PRELIMINARY GEOTECHNICAL EXPLORATION REPORT

ORCHARDS AT NAPLES ROAD APARTMENTS
399 & 333 NAPLES ROAD
HENDERSONVILLE, NORTH CAROLINA

Prepared For:
Orchards at Naples Road, LLC
3872 NW 126 Avenue
Coral Springs, Florida 33065

BLE Project Number 24-24544

March 31, 2025

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March 31, 2025

Orchards at Naples Road, LLC
3872 NW 126 Avenue
Coral Springs, Florida 33065

Attention: Mr. Luis Graef

Subject: **PRELIMINARY GEOTECHNICAL EXPLORATION REPORT**
Orchards at Naples Road
399 & 333 Naples Road
Hendersonville, North Carolina
BLE Project No. 24-24544

Dear Mr. Graef:

Bunnell-Lammons Engineering, Incorporated (BLE) is pleased to present this report of preliminary geotechnical exploration for the proposed Apartments to be located at the property with the addresses 399 and 333 Naples Road in Hendersonville, North Carolina. This exploration was performed generally as described in Bunnell-Lammons Engineering (BLE) Proposal No. P24-1738 dated November 18, 2024. The exploration was authorized on November 19, 2024, by the signature of Mr. Luis Graef on our Proposal Acceptance Sheet.

Sincerely,

BUNNELL LAMMONS ENGINEERING INC.
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Appendix

1.0 AUTHORIZATION

A preliminary geotechnical exploration has been performed for Orchards at Naples Road Apartments to be located at 333 and 399 Naples Road in Hendersonville, North Carolina. This exploration was performed generally as described in Bunnell-Lammons Engineering (BLE) Proposal No. P24-1738 dated November 18, 2024. The exploration was authorized on November 19, 2024, by the signature of Mr. Luis Graef on our Proposal Acceptance Sheet.

2.0 SCOPE OF EXPLORATION

This report details the findings of the preliminary geotechnical exploration performed for the proposed Orchards at Naples Road Apartments to be located at 333 and 399 Naples Road in Hendersonville, North Carolina (reference Figures in Appendix A). The intent of this exploration was to evaluate the subsurface soil and groundwater conditions at the site and provide geotechnical recommendations for design of the foundations, floor slabs and associated project elements. We have also included a discussion of secondary design considerations and provided geotechnical related construction recommendations.

3.0 PROJECT INFORMATION

The information in this report is based on an email request from Mr. Jared DeRiddler, P.E. of WGLA on November 11, 2024, to BLE representative, Mr. Garrett Pittman. BLE are also in receipt of the Site Civil Plan (Drawing C-200) dated November 11, 2024 and a 'Heat Map' dated February 5, 2025, showing the proposed cut and fill sections of the site.

Planning activities are underway for the Orchards at Naples Road Apartments to be located at 333 and 399 Naples Road in Hendersonville, North Carolina. The site under consideration is a 11.38-acre parcel and is identified by Henderson County Property PIN #9651679318.

The proposed development will consist of 7 apartment buildings in addition to a clubhouse, parking areas and driveways. The apartment buildings will be between 3 and 4 stories in height. Based on our previous experience with similar projects, these will likely be a cast-in-place concrete foundation with a wood-framed vertical structure.

Detailed structural or civil drawings were not provided at the time this report was written. We have assumed individual columns loads will not exceed 100 kips and that wall bearing footings will not exceed 5 kips per linear foot. Based on the provided 'Heat Map' from WGLA, proposed maximum cut and fill sections will be on the order of 30 and 21 feet respectively.

4.0 FIELD EXPLORATION

The site was explored by drilling sixteen (16) soil test borings (ASTM D1586) at the approximate locations shown on the attached Boring Location Plan. After the completion of the borings, an additional nine (9) test pits were completed using an excavator provided by Mr. John Hernandez of Forge Valley Builders. During the completion of the test pits, soil and groundwater conditions were observed and recorded by a geotechnical professional. The soil test borings and the test pits were performed at the approximate locations as shown on Figure 2 in Appendix A. The borings and test pits were located in the field by BLE representatives by referencing the provided site plan, identifiable site landmarks and cellular GPS-tracking. The boring/test pit locations shown in Appendix A should be considered approximate. A description of our field procedures is also included as Appendix B.

5.0 SITE GEOLOGY

The project site is in the Blue Ridge Physiographic Province. The bedrock in this region is a complex crystalline formation that has been faulted and contorted by past tectonic movements. The rock has weathered to residual soils which form the mantle for the hillsides and hilltops. The typical residual soil profile in areas not disturbed by erosion or human activities consists of silty and/or clayey soils near the surface where weathering is more advanced, underlain by sandy silts and silty sands.

The boundary between soil and rock is not sharply defined, and there often is a transitional zone, termed "partially weathered rock," overlying the parent bedrock. Partially weathered rock is defined, for engineering purposes, as residual material with standard penetration resistances in excess of 100 blows per foot (bpf). Weathering is facilitated by fractures, joints, and the presence of less resistant rock types. Consequently, the profile of the partially weathered rock and hard rock is quite irregular and erratic, even over short horizontal distances. Also, it is relatively common to find lenses and boulders of hard rock and/or zones of partially weathered rock within the soil mantle, well above the general bedrock level.

Areas near drainage features and in valleys often contain alluvial, or water-deposited, soils that have been deposited over geologic time by streams, past floods, and gradual erosion from higher elevations. This site, in particular, is bounded and crossed by tributary streams of Mud Creek, which, in BLE's experience lives up to it's name in regard to the alluvial soils. In mountainous areas, colluvial, or gravity-deposited, materials are commonly found on the sides and at the base of steep slopes, in swales, and along drainage features from past landslides and erosion.

6.0 SITE CONDITIONS

Site conditions were observed by Mr. Colm O'Doherty P.E., during several site visits. From our review of available online imagery, it appears that the central area of the site had been developed at some point in the past. There may have been a building in this location which was apparently demolished at some point between 1998 and 2004. There is an asphalt roadway which provided access to this building from Naples Road which is still at the site. This area is still relatively clear with gentle slopes.

There is a knoll in the northwest area of the site. This knoll is between 35 and 40 feet in vertical height and it steeply drops off to the north, west and south sides. From our review of historical aerial imagery, this knoll is formed from fill soil that was placed around 2002.

There are also two small creeks at the project site, the aforementioned tributaries to Mud Creek. The first runs along the northern site boundary in an easterly direction. The second runs along the western site boundary towards the north and joins the first creek in the northwest corner of the site. Water as observed in these creeks at the time of BLE's site visit.

7.0 SUBSURFACE CONDITIONS

Due to the varying soil conditions at the project site, BLE have broken the site into two sections.

7.1 Northwestern Knoll

Borings B-01 through B-06 were performed on top of the knoll in the northwestern section of the site. Test Pits TP-1 through TP-7 were also performed along the toe of this knoll as it slopes down to the tributary creek.

Fill
The knoll in the northwest section of the site is between 35 and 40 feet in vertical heigh. This is an intended cut section which was intended on bring used as engineered fill in other areas of the site. Soil test borings B-01 through B-05 and Test Pits TP-1 through TP-7 were performed in this area. This knoll appears to consist of previously placed fill material. The fill varied widely in soil type and consistency but it generally consisted of clayey sand (SC), silty sand (SM), sandy silt (ML), and sandy clay (CL). There was also a substantial quantity of construction debris such as concrete, asphalt, plastic, wood and gravel in these test pits and borings. From our review of online aerial imagery, it appears that this knoll was formed from placed fill material containing construction debris sometime around 2002. No compaction records are expected to exist for this fill. Borings B-01 through B-05 encountered premature refusal at depths of between of between 5 and 15 feet in the fill, most likely in obstructions such as concrete and/or asphalt. SPT N-values were measured as being between 4 blows per foot (bpf) to greater than 50 blows over six inches. The elevated blow counts were likely caused by obstructions within the fill.

Alluvium
Soil interpreted as alluvium was encountered in test pits TP-1, TP-3, TP-4, and TP-5, in addition to soil test boring B-06. Alluvium is soil that was transported to its current location by water. Alluvial soils are typically soft, wet, and compressible, having never been subject to loads in excess of their current overburden pressure. There are also two small creeks at the project site, which is the probable source of the alluvial soil. It appears that the area below the fill soil in the northwestern section of the site is alluvial soil. It was generally classified as clayey sand (SC), silty sand (SM) or clay (CL). The SPT N-value were measured as 4 bpf.

Residuum
Residual soil typical of the Blue Ridge Physiographic Province was encountered in boring B-06 at a depth of 5 feet, below the previously mentioned alluvial soil. The residual soils consisted of a sandy silt (ML). SPT N-values were measured as being between 4 and 12 bpf. All other borings in this section encountered obstructions in the fill which prevented extending through the fill and into the residuum.

7.2 Eastern and South Sections

Soil test borings B-07 through B-16 and Test Pits TP-8 and TP-9 were performed in the eastern and southern sections of the site.

Surface Cover
The surface cover at soil test borings B-10 and B-15 consisted of 2 inches of asphalt. These borings were located on old driveway associated with previous building(s) which have since been demolished. The surface cover at all other borings in this area consisted of a 4-inch organic layer (topsoil, leaves and roots). It's possible that this organic surface cover will vary across the site.

Fill
Soil interpreted as fill was encountered below the surface cover in soil test borings B-07 and B-16. The fill material extended to depths of 2.5 and 5.0 feet, respectively. The sampled fill material consisted of clayey

sand (SC) or sandy clay (CL) with traces of wood fragments and gravel. Standard Penetration Test (SPT) N-values ranged from 4 to 5 blows per foot (bpf).

Residuum

Residual soil typical of the Blue Ridge Physiographic Province was encountered in all borings in this section of the site except for boring B-16, where premature refusal was encountered at a depth of 5 feet within the fill. The residual soils were generally encountered below the surface cover or below the fill material. The residual soils were classified as silty sand (SM), silty clay (CL-ML), or sandy silt (ML) with varying amounts of mica. SPT N-values generally varied between 6 and 77 bpf, typically becoming firmer with depth.

The soil test boring data is summarized in Table 1 and the test pits data is summarized in Table 2.

Table 1: Boring Data Summary

Boring Number	**Depth to Residual Soil**	**Boring Depth (feet)**
B-01	> 8.0	8.0 (a)
B-02	> 15.0	15.0 (a)
B-03	> 5.0	5.0 (a)
B-04	> 8.0	8.0 (a)
B-05	> 8.5	8.5 (a)
B-06	5.0	15.0
B-07	2.5	25.0
B-08	0.3	15.0
B-09	0.3	25.0
B-10	0.2	25.0
B-11	0.3	15.0
B-12	0.3	25.0
B-13	0.3	30.0
B-14	0.3	30.0
B-15	0.2	15.0
B-16	> 5.0	5.0 (a)

(a) Boring encountered premature refusal at this depth

Table 2: Test Pit Data Summary

Boring Number	**Depth to Residual Soil**	**Test Pit Depth (feet)**
TP-1	> 6.0	6.0
TP-2	> 6.0	6.0
TP-3	> 4.0	4.0
TP-4	> 3.5	3.5
TP-5	> 5.0	5.0
TP-6	> 10.0	10.0
TP-7	> 10.0	10.0
TP-8	0.3	10.0
TP-9	0.3	10.0

Groundwater

Groundwater was encountered in the soil test borings and test pits as shown in Table 3. It should be noted that groundwater levels may fluctuate several feet with seasonal and rainfall variations and with changes in the water level in adjacent drainage features. Normally, the highest groundwater levels occur in late winter and spring and the lowest levels occur in late summer and fall. At this site encountered groundwater was not only associated with climatic variations but also with trapped or perched groundwater zones in the fill sections.

Table 3: Groundwater Summary

Boring Number	Time of Boring (feet)	End of Day (feet)
B-01	Dry	Dry
B-02	Dry	Dry
B-03	Dry	Dry
B-04	Dry	5.0
B-05	Dry	Dry
B-06	Dry	13.0
B-07	21.0	16.0
B-08	Dry	Not taken
B-09	19.0	12.0
B-10	Dry	Not taken
B-11	Dry	Dry
B-12	Dry	Not taken
B-13	Dry	Not taken
B-14	25.0	Not taken
B-15	Dry	Not taken
B-16	Dry	Not taken
TP-1	5.0	Not taken
TP-2	Dry	Not taken
TP-3	Dry	Not taken
TP-4	2.0	Not taken
TP-5	4.0	Not taken
TP-6	5.0	Not taken
TP-7	Dry	Not taken
TP-8	Dry	Not taken
TP-9	Dry	Not taken

The above descriptions provide a general summary of the subsurface conditions encountered. The letters in parentheses represent a visual classification of the soils in accordance with the Unified Soil Classification System. A key to symbols and classification is included as Appendix E. The Boring/Test Pit Logs included as Appendices C and D contain detailed information recorded at each boring/test pit location. The Boring/Test Pit Logs represent our interpretation of the field logs based on engineering examination of the field samples. The lines designating the interfaces between various strata represent approximate boundaries and the transition between strata may be gradual. It should be noted that the soil conditions will vary between boring locations.

8.0 LABORATORY TEST RESULTS

Soil samples processed for laboratory testing were obtained from soil test borings B-10 and B-13 and from test pits TP-8 and TP-9. One bulk sample was collected from each of these locations. See Table 4 for the depths where the bulk samples were collected. A Standard Proctor Test (ASTM D-698), a Grained Size Distribution Test (ASTM D6913), an Atterberg Limit Test (ASTM D4318) and a Natural Moisture Content Test (ASTM D2216) were run on each bulk sample. A California Bearing Ratio (CBR) Test (ASTM D1893) was also run on the bulk samples from B-10 and B-13. The laboratory test results are summarized in Table 4. See Appendix F for the laboratory test data.

Table 4: Laboratory Test Results

Sample No.	Sample Depth (feet)	Natural Moisture (%)	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	PI	USCS
B-10	5.0-10.0	26.9	100.7	22.0	28	CH
B-13	5.0-10.0	36.2	90.6	26.7	20	MH
TP-8	9.0-10.0	19.7	95.9	21.8	NP	ML
TP-9	9.0-10.0	21.7	97.1	20.9	NP	ML

9.0 ANALYSIS AND DESIGN RECOMMENDATIONS

A major aspect of site grading will be the re-use of the existing onsite soils as engineered fill in other areas of the site. There are two areas that are intended on being re-used as engineered fill: The northwestern knoll and the southeastern quadrant. Laboratory testing was performed from bulk samples that were collected from the southwestern quadrant. The laboratory testing indicates much of excavated materials from this area of the site can be re-used as structural fill, but some moisture adjustment will be needed. BLE also notes that several retaining walls are planned for this site. Some of the laboratory testing indicates that some of this soil may be fined grained (more than 50% passing the No. 200 sieve) which would not be suitable for re-use as backfill for Mechanically-Stabilized Earth retaining walls, if these are the intended retraining wall systems for this project site. The fills and alluvium may also be unsuitable for wall foundations; however, this should be analyzed during wall design.

It appears the northwestern knoll generally consists of previously placed fill material, which contains a high proportion of construction debris. Wood, concrete, asphalt, plastic and gravel were all encountered in the soil test borings/test pits performed in this area. This material should not be used as engineered fill in other areas of the site and it is not suitable for support of the proposed buildings, driveways or parking areas. The fill from the northwestern knoll should also be removed and wasted offsite or in areas of the site not intended for development.

Assuming that the building loads do not exceed that outlined in this report, the subsurface conditions at the site indicate that the site is adaptable to a shallow foundation approach. However, it is anticipated that a significant portion of the shallow foundation bearing soils, particularly in the northwestern knoll, will require remediation prior to concrete placement. The current grading plan shows that most of the poor quality fill containing construction debris will be removed from this area during mass grading, with the intended bearing surface being the alluvial soils below the fill. In this case the remedial repair would involve the excavation of the loose/soft alluvial/fill soil and then replacing these soils with crushed stone or approved and compacted structural fill. However, the presence of a high groundwater table may complicate this process. It may be more practical to remove the entirety of the poor quality fill, and establish a final shallow foundation bearing elevation such that a minimum depth of structural fill is maintained at each building pad location. Pending a review of site grading plans and foundation plans, BLE recommends that the thickness of improved soils between the bottom of the foundation and the top of the undercut subgrade should be at least twice the width of the footing foundations. If this option is followed, the subgrade may require stabilization (See Section 10.4 of this report), and structural fill be then placed in accordance with the requirements of engineered fill (See Section 10.7) until the desired subgrade elevation is achieved. Once the structural design is finalized, BLE should be contacted for more details for this process.

9.1 Shallow Foundations

Provided that the site is prepared with the recommendations of this report, we recommend an allowable bearing capacity of 2,500 psf be utilized when designing foundations. We recommend that the minimum widths for individual column and continuous wall footings be 24 and 18 inches, respectively. The minimum widths are considered advisable to provide a margin of safety against a local or punching shear failure of the foundation soils. Exterior/perimeter footings should bear at least 24 inches below final exterior grade for embedment needed to develop the recommended allowable design bearing pressure range and to provide frost protection.

The same protective embedment recommended for the interior and exterior footings should be used for the thickened perimeter and interior portions of a monolithic foundation slab, if such a slab is used in lieu of individual strip and spread footing foundations.

Exposure to the environment may weaken the soils at the bearing level if the foundation excavations remain open for long periods of time. Therefore, we recommend that, once the excavation is extended to final grade and the foundation bearing soils has been examined, the footing should be constructed as soon as possible thereafter to minimize the potential for damage to the bearing soils. The foundation bearing area should be level or benched and free of loose soil, ponded water, and debris. Foundation concrete should not be placed on soils that have been disturbed or softened. If the bearing soils are disturbed or softened by surface water intrusion, exposure and/or freezing, the disturbed or softened soils must be removed from the foundation excavation bottom prior to placement of concrete. If the excavation must remain open overnight or if rainfall becomes imminent while the bearing soils are exposed, we recommend placement of a 2 to 4-inch thick "mud-mat" of "lean" (2,000 psi) concrete on the bearing soils before the placement of reinforcing steel for protection against softening from exposure. We recommend that foundation excavations be observed and tested by an experienced engineering technician working under the direction of the BLE geotechnical engineer.

9.2 Lateral Earth Pressure

Retaining walls must be capable of resisting the lateral earth pressures that will be imposed on them. Walls which will be permitted to rotate at the top, such as cantilever retaining walls, may be designed to resist the active earth pressure. The active earth pressure coefficient is designated as Ka. Typically, a top rotation of about 1 inch per 10 feet height of wall is sufficient to develop active pressure conditions in soils similar to those encountered at the site.

Walls which will be prevented from rotating such as laterally braced retaining walls should be designed to resist the at rest lateral earth pressure. The at-rest earth pressure coefficient is designated as Ko.

The passive earth pressure may be considered as the pressure exerted on the side of a foundation which aids in resisting sliding of the foundation. The passive earth pressure coefficient is designated as Kp. Friction resistance along the base of the foundation may also be used to resist sliding. The coefficient of frictional resistance is designated as fs. Consideration should be given to dividing the passive earth pressure coefficient by a safety factor of 2 to limit the amount of lateral deformation required to mobilize the passive resistance. Published documentation indicates that very little horizontal compression (approximately 0.5 percent relative to wall height) is required to develop one-half of the available passive resistance, hence the suggested safety factor of 2. However, depending on soil type and relative density it may take 2 to 15 percent horizontal compression to develop the full passive resistance.

Table 5 provides a summary of the recommended earth pressure coefficients to be used in design. Also included are the unit weights to be used in the design. These values are based on our experience and testing of reasonably similar soils on other projects. The values presented in Table 5 assume the ground surface is level. Sloping backfill (or sloping soil surfaces in front of a footing when considering passive resistance) will dramatically influence the earth pressure coefficients. Bunnell-Lammons Engineering should be consulted concerning applicable earth pressure coefficients where sloping soil surfaces may be present.

Table 5: Lateral Loading Summary

Soil Type	Active - Ka	At Rest - Ko	Passive - Kp	Concrete/Soil Friction - Fs	Unit Weight
#57 Crushed Stone (1)	0.24	0.38	N/A	N/A	110 pcf
Structural Fill	0.33	0.50	3.00	0.4	130 pcf
Residuum	0.33	0.50	3.00	0.4	115 pcf

(1) In order for this coefficient to be used, the soil wedge within an angle of 45 degrees from the base of the wall to about 2 feet below the exterior grade should be excavated and replaced with stone.

The compacted mass unit weight of the backfill soil, which we estimate to be approximately 125 pcf, should be used with the earth pressure coefficients to calculate lateral earth pressures. Lateral pressure arising from surcharge loading, earthquake loading, and groundwater should be added to the above soil earth pressures to determine the total lateral pressures which the walls must resist. Where practical, we recommend that retaining walls and other below grade walls incorporate filtered gravity drainage systems to prevent the buildup of excess hydrostatic pressures behind the walls. In addition, transient loads imposed on the walls by construction equipment during backfilling should be taken into consideration during design and construction. Excessively heavy grading equipment should not be allowed within about 5 feet horizontally of the walls.

9.3 Grade Slabs

The grade slab may be soil-supported assuming that the site is prepared in accordance with the recommendations of this report. It is recommended that the slab on grade be uniformly supported on a layer of aggregate base course, as specified in the North Carolina Department of Transportation Standard Specifications for Roads and Structures, 2018 Edition. The aggregate base course layer should have a minimum thickness of at least 6 inches and be compacted to at least 98 percent of its standard Proctor maximum dry density. Based on previous experience with similar soils encountered at this site, a maximum modulus of subgrade reaction (k) equal to 100 pounds per cubic inch should be used for design of slabs on properly prepared subgrades supported by an adequate depth of base coarse. A vapor barrier should be included below the slab if vapor penetration is not acceptable. The need for a vapor barrier is also dependent on the floor covering type. Floor slabs supported on grade which will be carpeted, tiled, painted, or receive some other covering or sealant should incorporate a vapor barrier. The vapor barrier should be installed in accordance with the manufacturer's recommendations.

Completed slabs should be protected from excessive surface moisture prior to and during periods of prolonged, below-freezing temperatures to prevent subgrade freezing and resulting heave. The slab subgrade area should be evaluated by BLE prior to placement of crushed stone.

The grade slab should be jointed around columns and along footing supported walls so that the slab and foundations can settle differentially without damage. This jointing is not required when slabs and foundations are cast as a single unit (i.e. thickened edge foundations). If slab thickness permits, joints containing dowels or keys may be used in the slab to permit movement between parts of the slab without cracking or sharp vertical displacements.

9.4 Pavement

A site-specific pavement design requires detailed information about projected traffic frequency and intensity, acceptable service limits, life expectancy and other factors which are not currently available. It also requires site specific laboratory testing which was not part of the scope of this exploration. However, Table 2 shows recommended pavement sections based on our experience on similar projects in this region. These pavement sections have demonstrated acceptable performance with subsurface conditions similar to this site.

Assuming the site is prepared with the recommendations of this report, the pavement sections presented below could be expected to provide adequate performance considering a 15 to 20-year service life. For the purpose of this report, light duty pavement is considered to be subject to automobile traffic, such as a car parking lot. Medium duty pavement is considered to be subject to a heavy concentration of automobiles, and occasional loaded trucks, such as drive lanes.

Table 6: Recommended Pavement Sections

Pavement Type	**Layers**	**Material**	**Thickness (Inches)**	
			Light-Duty	**Medium Duty**
Flexible	a.	Asphaltic concrete surface course	2.5	3
	b.	Aggregate base course	8	10
Rigid	a.	Concrete	6	6

The asphalt surface course should conform to the North Carolina Department of Transportation (NCDOT) Standard Specification, Section 610, for Type S-9.5 Superpave mixture. The base course material should be Aggregate Base Course (ABC Stone) conforming to NCDOT Standard Specification, Section 520, for Type B aggregate. The base course should be compacted to 100 percent of the standard Proctor (ASTM D-698) maximum dry density. All materials and workmanship should meet the North Carolina Department of Transportation Standard Specifications for Roads and Structures, current edition.

The concrete for rigid pavement should be air-entrained and have a minimum flexural strength (third point loading) of 550 psi which could likely be achieved by a concrete mix having a compressive strength of at least 4,000 psi at 28 days. Recommended air contents from the Portland Cement Association (PCA) are as follows:

Maximum Aggregate Size	Percent Air
1½ inches	5 percent plus or minus 1½ percent
¾ to 1-inch	6 percent plus or minus 1½ percent

In addition, we recommend a maximum slump of 4 inches.

Joint spacing for this concrete thickness should be on the order of 12 to 15 feet. Control joints should be sawed as soon as the cut can be made, without raveling (aggregate pulling out of the concrete matrix) or cracks forming ahead of the saw blade. Joints should be sawed consecutively so that the joints commence working together. The American Association of State Highway and Transportation Officials (AASHTO) suggests that transverse contraction joints should be one quarter of the slab thickness and longitudinal joints should be one third of the slab thickness. All joints should be filled with flexible joint filler.

Curing of the concrete slab should begin as soon as the slab has been finished and the joints sawed. Moist curing by fog spray nozzles or wet burlap is the most dependable curing procedure. Other methods of curing could consist of spray applied curing compounds or covering the slab with waterproof paper or heavy plastic. If paper or plastic is used for curing, the edges of the cover should be anchored and joints between sheets should be taped or sealed.

Related civil design factors such as subgrade drainage, shoulder support, cross-sectional configurations, surface elevations, and environmental factors which will significantly affect the service life must be included in the preparation of the construction drawings and specifications. Normal periodic maintenance will be required.

9.5 Secondary Design Considerations

The following items are presented for your consideration. These items are known to generally enhance performance of structural and pavement systems.

- Roof drainage should be collected by a system of gutters and downspouts and directed away from all structures.
- Sidewalks should be sloped so that water drains away from the structures.
- Site grading and paving should result in positive drainage away from the structures. Water should not be allowed to pond around the structures or in such locations that would lead to saturation of pavement subgrade materials. A minimum slope of approximately ¼ to ½-inch per foot should provide adequate drainage.
- Backfill for utility lines should be placed in accordance with the requirements for engineered fill to minimize the potential for differential settlement.

10.0 CONSTRUCTION RECOMMENDATIONS

10.1 Clearing and Grubbing

Site preparation should include the removal of all unsuitable surface materials (asphalt, trees, surface vegetation, surface soils containing organic matter or other deleterious materials) from within the proposed building and pavement areas. Deleterious materials should be disposed of offsite or in areas of the site that will not be developed. Topsoil and organic soils may be stockpiled for later use in areas to be landscaped. The fill from the northwestern knoll should also be removed of offsite or in areas of the site not intended for development.

10.2 Drainage

Groundwater was encountered in the borings and test pits as noted in Table 4. It should be noted that groundwater levels may fluctuate several feet with seasonal and rainfall variations and with changes in the water level in adjacent drainage features. Normally, the highest groundwater levels occur in late winter and spring and the lowest levels occur in late summer and fall.

The contractor should be prepared to promptly remove any surface water or encountered groundwater from the construction area. This has been done effectively on past jobs by means of gravity ditches and pumping from filtered sumps. BLE should be consulted, if higher than anticipated groundwater levels are encountered.

10.3 Areas Around Drainage Features

These areas may require over-excavation of the soft soils and the placement of a network of wrapped rock drains. The wrapped rock drain should consist of needle-punched, non-woven, geotextile filter fabric placed along the stream/creek beds or within an excavated trench, with sufficient length to cover the entire bottom, sides and top with a minimum of 12 inches of overlap. Once the filter fabric has been placed, clean-washed crushed stone, such as No. 57 stone or approved equivalent should be placed. Once the drain component has been completed, the filter fabric should be overlapped over the washed stone. Due to the extent of the existing tributaries/wetlands, the wrapped rock drain may consist of trunk lines with feeder lines as necessary to reach necessary areas of dewatering while generally following the existing meandering path of the features. Drains should be extended to allow for "daylighting" of the drain beyond the structural limits of the fill areas. The water level should be held 3 feet below the placement of any soil fill.

10.4 Proofrolling

After stripping and rough excavation grading, we recommend that areas to provide support for the foundations, floor slab, engineered fill and pavement be carefully inspected for soft surficial soils and proofrolled with a 25 to 35-ton, four-wheeled, rubber-tired roller or similar approved equipment. The proofroller should make at least four passes over each location, with the last two passes perpendicular to the first two where practical.

Any areas which wave, rut, or deflect excessively and continue to do so after several passes of the proofroller should be excavated to firmer soils or stabilized in accordance with section 10.5 of this report. The excavated areas should be backfilled in thin lifts with engineered fill. The proofrolling and excavating operations should be carefully monitored by an experienced engineering technician working under the direction of the geotechnical engineer. Proofrolling should not be performed when the ground is frozen or wet from recent precipitation.

10.5 Subgrade Stabilization

Based on the geotechnical data collected as part of this geotechnical exploration, it's likely that some areas of soft/loose soil may be encountered. Therefore, it is likely that some portions of the subgrade will be unstable after the proofroll and remedial activities will be necessary. Such remedial activities may include partial undercutting and replacement, or stabilization with geo-synthetics and crushed stone, chemical stabilization, or a combination of these methods. Appropriate recommendations may be provided at the time of construction by BLE. Stabilization measures will vary with location and will also be dependent on the weather conditions during construction.

10.6 Excavation

Based on the borings and our experience, the existing fill, alluvial and residual soil should be excavatable using conventional earthmoving equipment. It's likely that construction debris will be encountered within the northwestern knoll. There was also some shotrock at the ground surface close to boring B-8. Some of this shotrock and construction debris may be very large and will be difficult to handle and remove from the site. It may be more practical to break it into smaller pieces using mechanical breakers before removal and disposal.

10.7 Engineered Fill

All fill placed during the grading of the site should be uniformly compacted in 8-inch loose lifts to at least 95 percent of the standard Proctor maximum dry density (ASTM D 698). Beneath floor slabs and on-grade parking, the compaction requirement should be raised to 98 percent in the upper 12 inches. The soils to be used in the engineered fill should contain no more than 3 percent organic matter by weight and should be free of roots, limbs, other deleterious material and should generally preclude rocks larger than 6 inches in diameter. In addition, the moisture content of the compacted soil fill should be maintained to within plus or minus 3 percent of the optimum moisture content as determined from the standard Proctor compaction test during placement and compaction. This provision may require the contractor to dry soils during periods of wet weather or to wet soils during dry periods. The fill soils should have a Plasticity Index (PI) of less than 30, and a standard Proctor maximum dry density of no less than 90 pounds per cubic foot (pcf).

10.8 Assessment of Onsite Materials for use as Engineered Fill

It appears the northwestern knoll generally consists of previously placed fill material, which is likely to contain a high proportion of construction debris. Wood, concrete, asphalt, plastic and rock fragments were all encountered in the soil test borings/test pits performed in this area. This material should not be used as engineered fill in other areas of the site. This material should be disposed of offsite or in non-structural areas of the site.

Laboratory testing carried out on soil samples obtained from the onsite residual soils in the southeast quadrant were found to have natural moisture contents of between 9.5 wet to 2.4 percent dry of the Optimum Moisture Content (OMC), as determined by the laboratory test results. These soils may require some drying before re-use as structural fill. It should be noted that moisture contents on a large grading project will be dictated to some degree by the prevailing weather at the time of construction. The dry unit weights of the bulk samples were tested as 100.7 pcf, 90.6 pcf, 95.9 pcf, 114.5 pcf, and 97.1 pcf, respectively, which are above the recommended dry unit weight of 90 pcf.

10.9 Fill Placement over Sloping Ground

Where the existing ground is steeper than 6:1 (horizontal to vertical), newly placed fill should be "benched" into the existing ground to reduce the potential for a preferential shearing plane at the fill/ground surface interface. This can be accomplished by benching or stepping into the natural ground. The height of each bench should not exceed 2 feet, and all fill should be compacted on a level plane.

10.10 Subgrade Protection During Construction

The surface of compacted subgrade soils can deteriorate and lose its support capabilities when exposed to environmental changes and construction activity. Deterioration can occur in the form of freezing, formation of erosion gullies, extreme drying, exposure for a long period of time or rutting by construction traffic. We recommend that the surfaces of floor slab subgrades that have deteriorated or softened be recompacted prior to construction of the floor slab. Additionally, any excavations through the subgrade soils (such as utility trenches) should be properly backfilled in compacted lifts. Recompaction of subgrade surfaces and compaction of backfill should be checked with a sufficient number of field density tests to determine if adequate compaction is being achieved.

10.11 Building Area Fill Settlement Monitoring

Some areas of the site may be raised with significant embankments of fill. The mass weight of this fill will cause the residual soils and lower parts of the fill to undergo compression and consolidation settlement. We expect that most of the settlement will take place during grading and in a short period thereafter. However, good design and construction practice requires that this settlement be monitored and verified to be substantially complete prior to construction of the structure foundations.

Instrumentation such as settlement plates can be embedded at the bottom of the fill and extended and monitored as the fill is built up. Our experience indicates that while these provide valuable data and insight on how the settlement is progressing, they require a commitment by the contractor to accommodate the monitoring and avoid damaging the instrumentation. Settlement monitoring hubs should be established on the fill surface as soon as the mass fill placement is substantially complete. Survey measurements (level measurements to the nearest 0.001-foot) should be made on a regular basis, with the surveying being performed relatively frequently in the beginning (2 times per week) and then less frequently (1 time per week) as time passes. This information should be furnished to the Geotechnical Engineer for review. We suggest that a minimum 4-to 6-week delay period be programmed into the construction schedule between the time mass grading is substantially complete and the time construction of the foundations or superstructure begins in the deeper fill areas. As discussed in the recommendations section, further soil testing to help evaluate the anticipated settlement and the time rate of ground strengthening is recommended.

10.12 Slopes

Fill slopes should initially be constructed beyond the design slope edge due to the difficulty of compacting the edge of slopes. The fill could then be cut back leaving the exposed face well compacted. Fill slopes should be adequately compacted in accordance with the recommendations of this report. Fill embankment slopes are typically designed to have an inclination of 2H:1V (horizontal to vertical). Typically, we suggest that fill slopes be constructed at 3H:1V or flatter. As such, these steeper slopes will be more susceptible to erosion and shallow sloughing than those built at a flatter inclination. Nevertheless, either inclination is considered stable at this site. We recommend that the face of slopes and embankments be protected by establishing vegetation as soon as practical after grading.

Any disturbed soil located on the existing slope faces should be removed. Once removed and prior to fill placement, the exposed subgrade should be inspected for soft soils. Fill material should be constructed in horizontal stages starting at the base of the existing slope. Prior to each stage of fill placement, the sloped area should be benched into the existing soils with a level pad. The level pad will allow for better compaction of the fill materials. The resulting series of level benches will also serve to break the potential slip plane between the compacted fill layers.

Cut slopes made in residual soil should generally remain stable at inclinations made no steeper than 2H:1V. To reduce repairs and maintenance and to make the establishment of vegetation easier, flatter inclinations should be considered where practical. Steeper inclinations of up to 1.5H:1V are often used for cut slopes, but the risk of slope instability increases as the steepness increases beyond 2H:1V. Steeper slopes should only be considered in areas that can tolerate occasional sloughing of material from the slope face, and where a potential failure of that slope would not impact buildings or other critical facilities. The surface of cut slopes should be vegetated to control erosion. Slopes that are over 30 feet in height should have a bench at 20 to 30–foot height intervals to help slow the flow of water down the face of the slope. The benches should be sloped slightly to drain water.

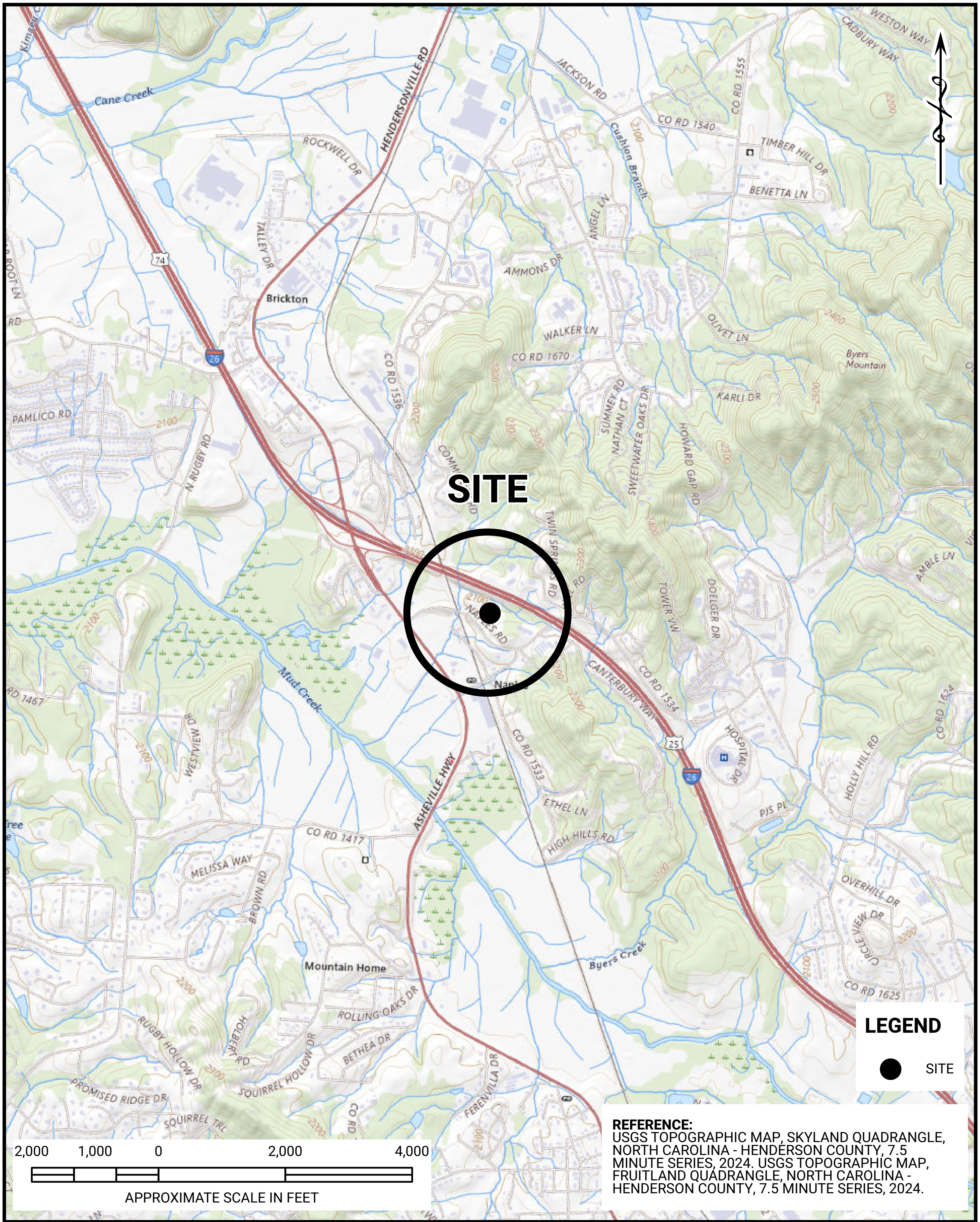
11.0 SPECIFICATIONS REVIEW

It is recommended that Bunnell-Lammons Engineering be retained to make a general review of the foundation and earthwork plans and specifications prepared from the recommendations presented in this report. We would then suggest any modifications so that our recommendations are properly interpreted and implemented.

12.0 BASIS OF RECOMMENDATIONS

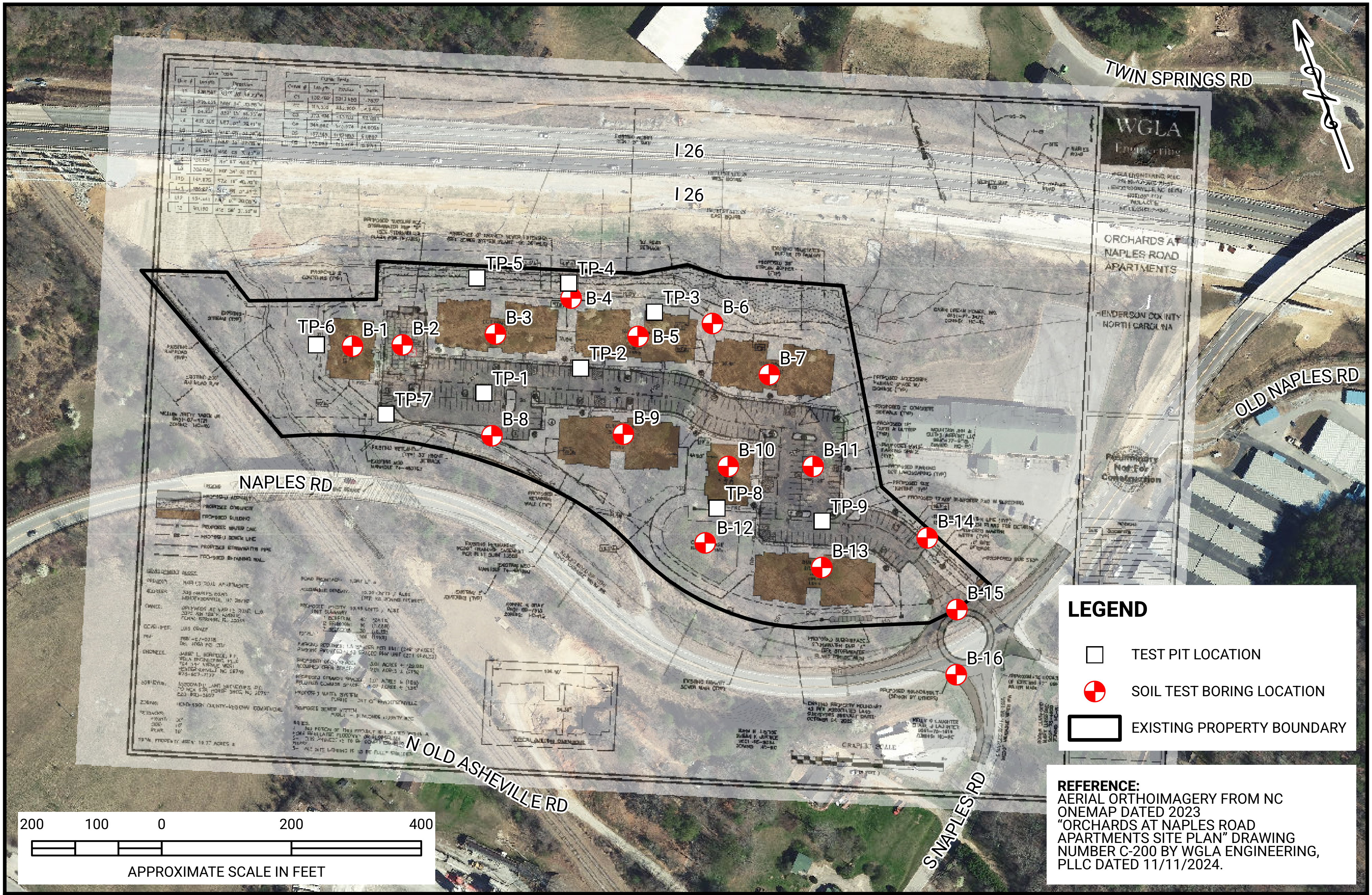
Our evaluation of foundation support conditions has been based on our understanding of the project information and data obtained in our exploration as well as our experience on similar projects. The general subsurface conditions utilized in our foundation evaluation have been based on interpolation of the subsurface data between the widely spaced borings/test pits. Subsurface conditions between the borings/test pits may differ. If the project information is incorrect or the structure location (horizontal or vertical) and/or dimensions are changed, please contact us so that our recommendations can be reviewed. The discovery of any site or subsurface conditions during construction which deviate from the data obtained in this exploration should be reported to us for our evaluation. The assessment of site environmental conditions for presence of pollutants in the soil, rock and groundwater of the site was beyond the scope of this exploration. Soil cuttings used as backfill in boreholes will settle over time resulting in a depression at the surface. It is beyond the scope of our services to return to the site to repair boreholes that have exhibited settlement of the backfill soils.

APPENDIX A
Figures



REFERENCE:
USGS TOPOGRAPHIC MAP, SKYLAND QUADRANGLE, NORTH CAROLINA - HENDERSON COUNTY, 7.5 MINUTE SERIES, 2024. USGS TOPOGRAPHIC MAP, FRUITLAND QUADRANGLE, NORTH CAROLINA - HENDERSON COUNTY, 7.5 MINUTE SERIES, 2024.

DRAWN BY: AES	DATE: 3/13/2025	BUNNELL LAMMONS ENGINEERING	**SITE LOCATION MAP** PROPOSED RESIDENTIAL DEVELOPMENT 399 NAPLES ROAD HENDERSONVILLE, NORTH CAROLINA	FIGURE 1
CHECKED BY: COD	FILE: FIG1_399NAPLES			
APPROVED BY: COD	JOB NO: 24-24544			



LEGEND

☐	TEST PIT LOCATION
●	SOIL TEST BORING LOCATION
▭	EXISTING PROPERTY BOUNDARY

REFERENCE:
AERIAL ORTHOIMAGERY FROM NC ONEMAP DATED 2023
"ORCHARDS AT NAPLES ROAD APARTMENTS SITE PLAN" DRAWING NUMBER C-200 BY WGLA ENGINEERING, PLLC DATED 11/11/2024.

DRAWN BY: AES	DATE: 3/13/2025	BUNNELL LAMMONS ENGINEERING	**BORING LOCATION PLAN** PROPOSED RESIDENTIAL DEVELOPMENT 399 NAPLES ROAD HENDERSONVILLE, NORTH CAROLINA
CHECKED BY: COD	FILE NAME: FIG1_399NAPLES		FIGURE 2
APPROVED BY: COD	JOB NO: 24-24544		

APPENDIX B
Field Exploration Procedures

Field Exploration Procedures

Soil Test Borings

The borings were made by mechanically twisting a continuous flight steel auger into the soil. Soil sampling and penetration testing were performed in general accordance with ASTM D 1586. At assigned intervals, soil samples were obtained with a standard 1.4-inch I. D., 2-inch O. D., split-tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings, and then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final 12 inches was recorded and is designated the "standard penetration resistance." The penetration resistance, when properly evaluated, is an index to the strength of the soil and foundation supporting capability.

Representative portions of the soil samples, thus obtained, were placed in glass jars and transported to the laboratory. In the laboratory, the samples were examined by a geotechnical engineer to verify the field classifications of the driller. Test Boring Records are attached, showing the soil descriptions and penetration resistance.

Test Pits

The test pits were performed with a track-mounted excavator. The soils encountered were identified, in the field, from excavated soils brought to the surface by the bucket of the excavator.

APPENDIX C
Boring Logs

BUNNELL
LAMMONS
ENGINEERING

BUNNELL-LAMMONS ENGINEERING, INC.

Geotechncal And Environmental Consultants

BORING NO. B-01

PROJECT: Orchards at Naples Road

PROJECT NO.: 24-24544

CLIENT: Orchards at Naples Road, LLC

START: 02/03/2025

END:

LOCATION: 399 Naples Road, Hendersonville, NC, USA

ELEVATION: 0

DRILLER: Baker Jordan Environmental, LLC, Baker Jordan

LOGGED BY: COD

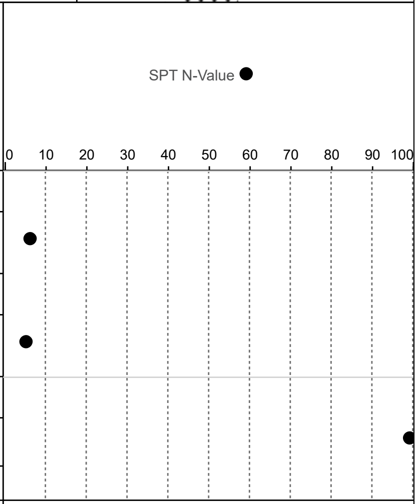
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586

DEPTH TO - WATER> INITIAL: ∇ N/A

AFTER 24 HOURS: ▼ N/A

CAVING: ▨ N/A

Depth (ft)	Description	Graphic Log	SPT Testing
	4" topsoil/roots- (TOPSOIL)		
	Loose, brown, moist, clayey SAND (SC) with rock and asphalt fragments: (FILL)	▨	2, 3, 4
		▨	3, 3, 3
5		▨	
		▨	2, 2, 50/2in



B-01 refusal at 8ft (Auger encountered refusal before penetrating fill. Refusal likely caused by obstructions within the fill. No groundwater encountered at time of drilling or end of day.)

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNCAL AND ENVIRONMENTAL CONSULTANTS

BORING NO. B-02

PROJECT: Orchards at Naples Road

PROJECT NO.: 24-24544

CLIENT: Orchards at Naples Road, LLC

START: 02/04/2025

END:

LOCATION: 399 Naples Road, Hendersonville, NC, USA

ELEVATION: 0

DRILLER: Baker Jordan Environmental, LLC, Baker Jordan

LOGGED BY: COD

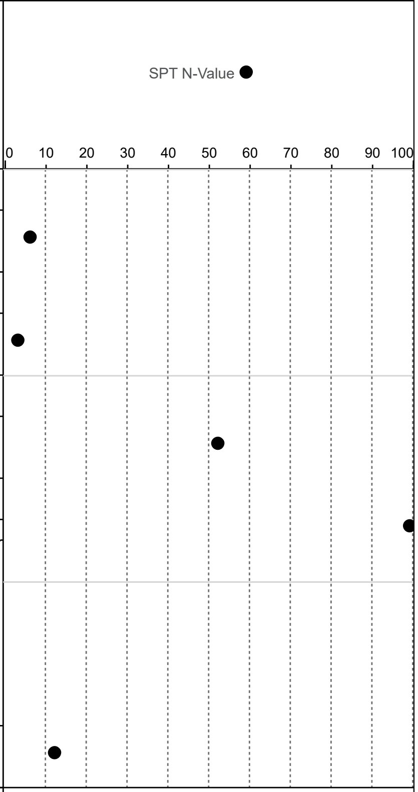
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586

DEPTH TO - WATER> INITIAL: ▽ N/A

AFTER 24 HOURS: ▼ N/A

CAVING: ▨ N/A

Depth (ft)	Description	Graphic Log	SPT Testing
	4" topsoil/roots- (TOPSOIL)		
	Very loose to loose, brown, wet to moist, silty, fine SAND (SM): with some rock fragments and trace mica- (FILL)	▨	4, 3, 4 3, 2, 2
5	**Asphalt with some clay - (ASPHALT)**	■	3, 3, 50 50
10	**Stiff, gray to brown, sandy CLAY (SC) with some gravel and wood fragments - (FILL)**	▨	6, 5, 8



B-02 refusal at 15ft (Auger encountered refusal before penetrating fill. Refusal likely caused by obstructions within the fill. No groundwater encountered at time of drilling or end of day.)

BUNNELL-LAMMONS ENGINEERING, INC.

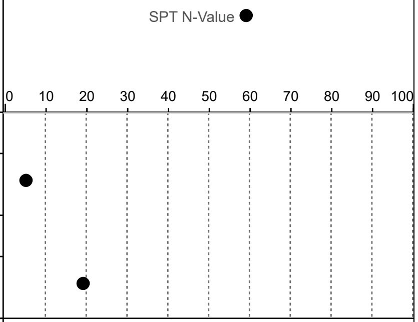
GEOTECHNCAL AND ENVIRONMENTAL CONSULTANTS

BORING NO. B-03

PROJECT: Orchards at Naples Road	PROJECT NO.: 24-24544
CLIENT: Orchards at Naples Road, LLC	START: 02/04/2025 END:
LOCATION: 399 Naples Road, Hendersonville, NC, USA	ELEVATION: 0
DRILLER: Baker Jordan Environmental, LLC, Baker Jordan	LOGGED BY: COD
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586	

DEPTH TO - WATER> INITIAL: ▽ N/A AFTER 24 HOURS: ▼ N/A CAVING: ▨ N/A

Depth (ft)	Description	Graphic Log	SPT Testing
	4" topsoil/roots- (TOPSOIL)		
	Firm, gray to brown, sandy SILT (ML) with some rock fragments and trace mica: (FILL)	▨	3, 2, 4
		▨	3, 10, 10



B-03 refusal at 5ft (Auger encountered refusal before penetrating fill. Two auger offsets were attempted. Both encountered refusal at 5 feet. No groundwater encountered at time or drilling or end of day.)

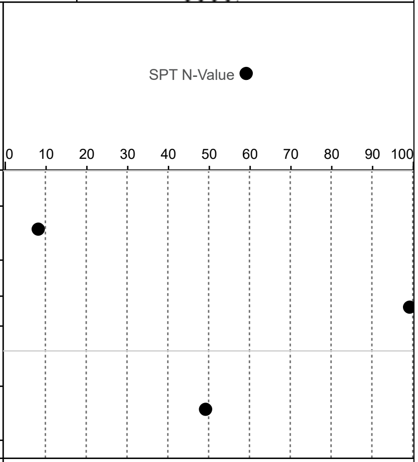
BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNCAL AND ENVIRONMENTAL CONSULTANTS

BORING NO. B-04

PROJECT: Orchards at Naples Road	**PROJECT NO.: 24-24544**
CLIENT: Orchards at Naples Road, LLC	**START: 02/04/2025** **END:**
LOCATION: 399 Naples Road, Hendersonville, NC, USA	**ELEVATION: 0**
DRILLER: Baker Jordan Environmental, LLC, Baker Jordan	**LOGGED BY: COD**
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586	
DEPTH TO - WATER> INITIAL: ▽ 5 **AFTER 24 HOURS: ▼ N/A**	**CAVING: ▨ N/A**

Depth (ft)	Water	Description	Graphic Log	SPT Testing
		4" topsoil/roots- (TOPSOIL)		
		Stiff, brown, moist, sandy CLAY (CL) with many rock and asphalt fragments: (FILL)	▨	3, 4, 5 6, 50/4in
5	▽ Initial	**Loose, brown to gray, silty, fine to medium SAND (SM): with rock fragments and many plastic fragments : (FILL)**	▨	9, 17, 33



B-04 refusal at 8ft (Auger encountered refusal before penetrating fill. Refusal likely caused by construction debris. Groundwater encountered at 5 feet at time of drilling and end of day.)

BUNNELL LAMMONS ENGINEERING

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNCAL AND ENVIRONMENTAL CONSULTANTS

BORING NO. B-05

PROJECT: Orchards at Naples Road

PROJECT NO.: 24-24544

CLIENT: Orchards at Naples Road, LLC

START: 02/04/2025

END:

LOCATION: 399 Naples Road, Hendersonville, NC, USA

ELEVATION: 0

DRILLER: Baker Jordan Environmental, LLC, Baker Jordan

LOGGED BY: COD

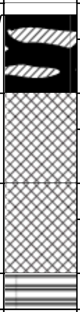
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586

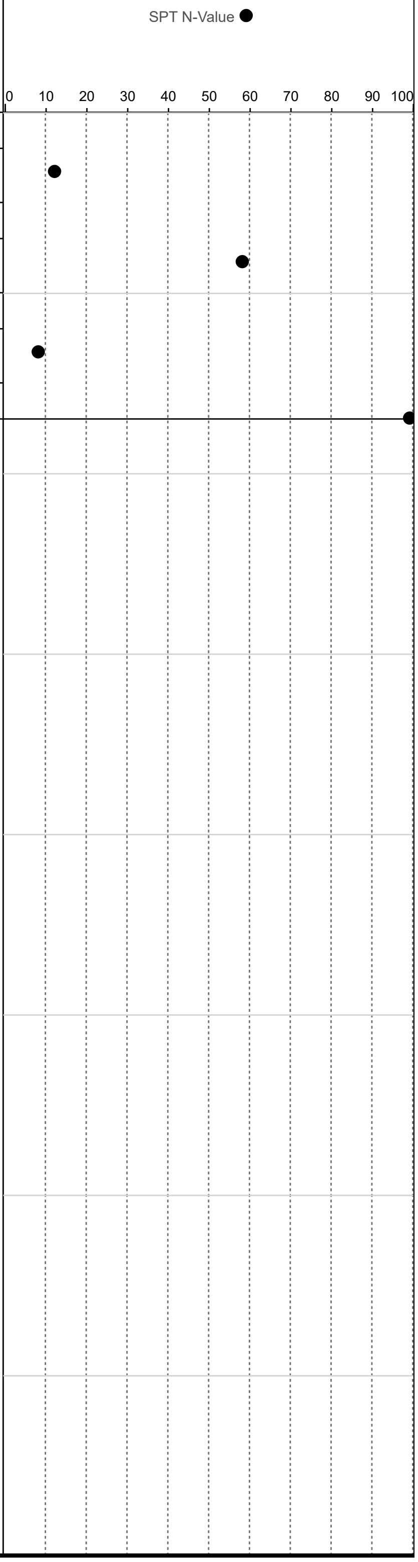
DEPTH TO - WATER> INITIAL: ▽ N/A

AFTER 24 HOURS: ▼ N/A

CAVING: ▨ N/A

Depth (ft)	Water	Description	Graphic Log	SPT Testing
		4" topsoil/roots- (TOPSOIL)		
		Asphalt with some brown, moist, silty, fine to medium sand (ASPHALT)		5, 9, 4
		Brown to gray, sandy CLAY (CL) with gravel and concrete fragments: (FILL)		3, 9, 50
5		**Stiff, brown, moist, sandy CLAY (CL) with wood and gravel : (FILL)**		4, 4, 5
		(CONCRETE)		50/2in





B-05 refusal at 8.5ft (Auger encountered refusal before penetrating fill. Refusal likely caused by construction debris. Auger was offset 5 feet from original location. Auger also encountered refusal at 8.5 feet. No groundwater encountered at time of drilling or end of day.)

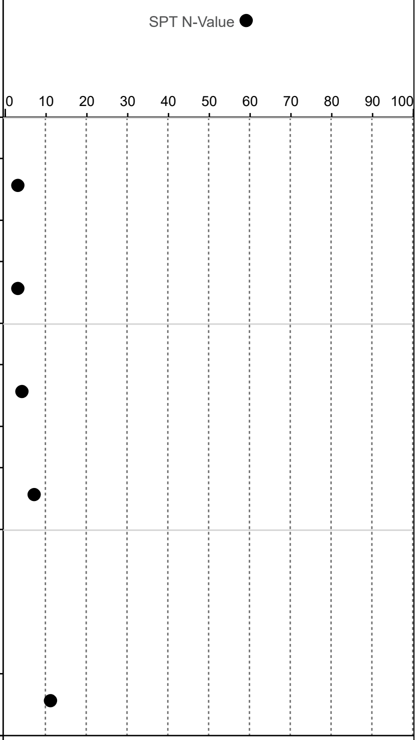
BUNNELL-LAMMONS ENGINEERING, INC.

Geotechncal And Environmental Consultants

BORING NO. B-06

PROJECT: Orchards at Naples Road
PROJECT NO.: 24-24544
CLIENT: Orchards at Naples Road, LLC
START: 02/04/2025
END:
LOCATION: 399 Naples Road, Hendersonville, NC, USA
ELEVATION: 0
DRILLER: Baker Jordan Environmental, LLC, Baker Jordan
LOGGED BY: COD
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586
DEPTH TO - WATER> INITIAL: ▽ 13
AFTER 24 HOURS: ▼ N/A
CAVING: ▨ N/A

Depth (ft)	Description	Graphic Log	SPT Testing
	4" topsoil/roots- (TOPSOIL)		
	Soft, tan to gray, CLAY (CL) with trace fine grained sand: (ALLUVIUM)	▨	2, 2, 2
		▨	2, 1, 3
5	Firm to stiff, grey to purple, moist, sandy SILT (ML): (RESIDUUM)	▨	1, 2, 3
		▨	4, 4, 4
10		▨	
		▨	5, 6, 6



B-06 refusal at 15ft (Boring terminated at 15 feet. Groundwater encountered at 13 feet at time of drilling and end of day. Boring caved at 13 feet at time of drilling.)

BUNNELL-LAMMONS ENGINEERING, INC.

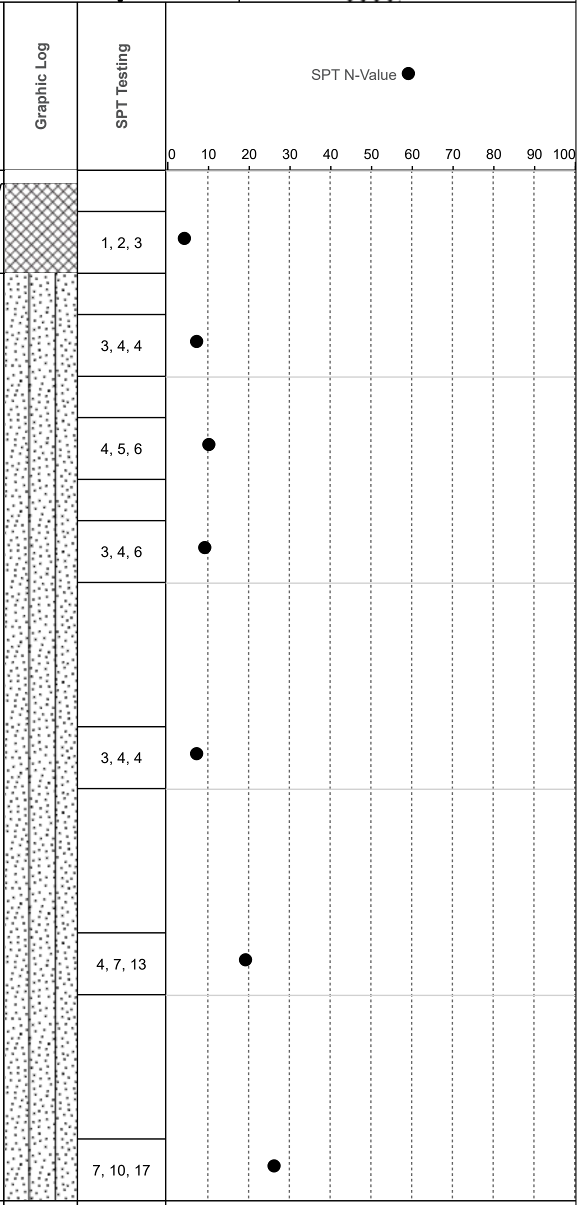
GEOTECHNCAL AND ENVIRONMENTAL CONSULTANTS

BORING NO. B-07

PROJECT: Orchards at Naples Road	PROJECT NO.: 24-24544
CLIENT: Orchards at Naples Road, LLC	START: 02/04/2025 END:
LOCATION: 399 Naples Road, Hendersonville, NC, USA	ELEVATION: 0
DRILLER: Baker Jordan Environmental, LLC, Baker Jordan	LOGGED BY: COD
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586	

DEPTH TO - WATER> INITIAL: ∇ 21 AFTER 24 HOURS: ▼ N/A CAVING: ▨ N/A

Depth (ft)	Description	SPT Testing
	4" topsoil/roots- (TOPSOIL)	
	Firm to stiff, brown, moist, Sandy CLAY (CL) with wood fragments- (FILL)	1, 2, 3
	Loose to medium dense, orange to gray, moist, silty SAND (SM): (RESIDUUM)	3, 4, 4
5		4, 5, 6
		3, 4, 6
10		
		3, 4, 4
15		
		4, 7, 13
20		
		7, 10, 17



B-07 Terminated at 25ft (Boring terminated at 25 feet. Groundwater encountered at 21 feet at time of drilling and 16 feet at the end of day. Boring caved at 16 feet at time of drilling.)

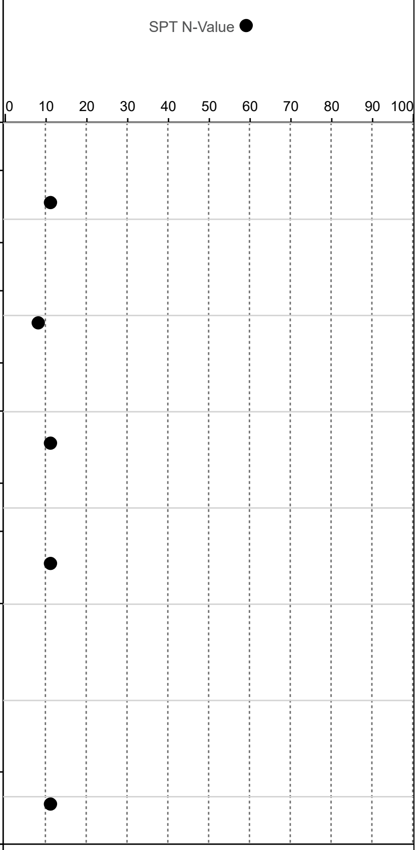
BORING NO. B-08

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNCAL AND ENVIRONMENTAL CONSULTANTS

PROJECT: Orchards at Naples Road
PROJECT NO.: 24-24544
CLIENT: Orchards at Naples Road, LLC
START: 02/04/2025
END: 02/04/2025
LOCATION: 399 Naples Road, Hendersonville, NC, USA
ELEVATION: 0
DRILLER: Baker Jordan Environmental, LLC, Baker Jordan
LOGGED BY: COD
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586
DEPTH TO - WATER> INITIAL: ∇ N/A
AFTER 24 HOURS: ▼ N/A
CAVING: ▨ N/A

Depth (ft)	Description	Graphic Log	SPT Testing
	4" topsoil/roots- (TOPSOIL)		
	Loose to medium dense, gray, silty, fine SAND: (RESIDUUM)		2, 5, 7
			2, 4, 5
5			
			6, 6, 6
	Silty Clay (CL-ML): stiff, brown, slightly moist, (RESIDUUM)		4, 6, 6
10			
			4, 5, 7



B-08 Terminate at 15ft (Boring terminated at 15 feet. No groundwater encountered at time of drilling. Boring caved at 13 feet at time of drilling.)

BUNNELL LAMMONS ENGINEERING

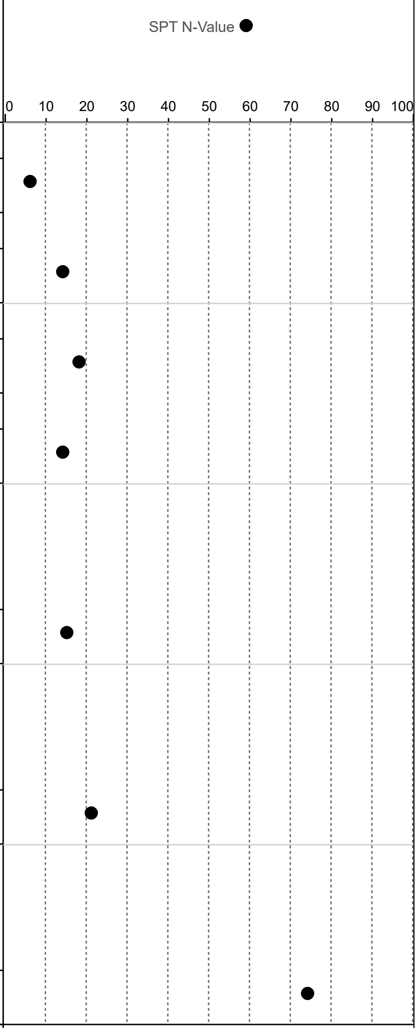
BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNCAL AND ENVIRONMENTAL CONSULTANTS

BORING NO. B-09

PROJECT: Orchards at Naples Road
PROJECT NO.: 24-24544
CLIENT: Orchards at Naples Road, LLC
START: 02/04/2025
END: 02/04/2025
LOCATION: 399 Naples Road, Hendersonville, NC, USA
ELEVATION: 0
DRILLER: Baker Jordan Environmental, LLC, Baker Jordan
LOGGED BY: COD
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586
DEPTH TO - WATER> INITIAL: ∇ N/A
AFTER 24 HOURS: ▼ N/A
CAVING: ▨ N/A

Depth (ft)	Water	Description	Graphic Log	SPT Testing
		4" topsoil/roots- (TOPSOIL)		
		Loose to medium dense, tan to gray, slightly moist, silty, fine SAND (SM): (RESIDUUM)		2, 2, 5
5				5, 7, 8
				5, 10, 9
10				3, 6, 9
15				4, 6, 10
20				6, 10, 12
		Very dense, gray, slightly moist, silty, fine SAND (SM): (RESIDUUM)		10, 30, 45



B-09 Terminate at 25ft (Boring terminated at 25 feet. Groundwater encountered at 19 feet at time of drilling. Boring caved at 20 feet at time of drilling.)

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNCAL AND ENVIRONMENTAL CONSULTANTS

BORING NO. B-10

PROJECT: Orchards at Naples Road

PROJECT NO.: 24-24544

CLIENT: Orchards at Naples Road, LLC

START: 02/04/2025

END: 02/04/2025

LOCATION: 399 Naples Road, Hendersonville, NC, USA

ELEVATION: 0

DRILLER: Baker Jordan Environmental, LLC, Baker Jordan

LOGGED BY: COD

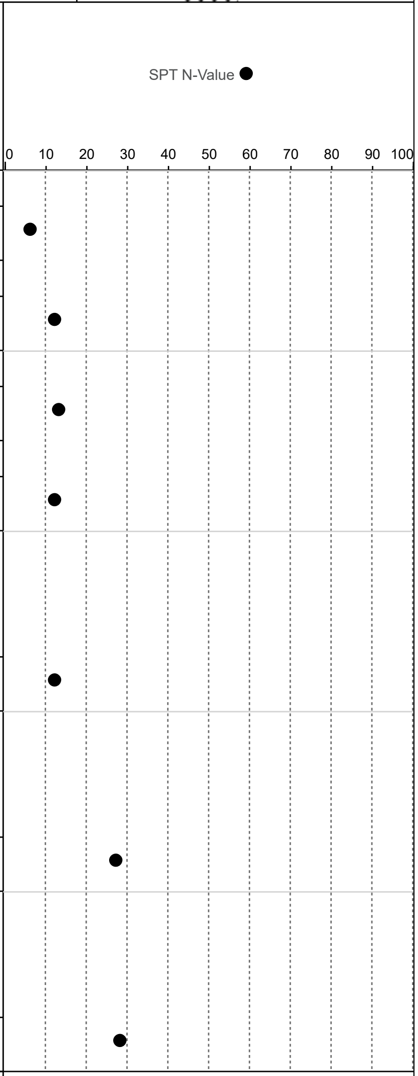
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586

DEPTH TO - WATER> INITIAL: ∇ N/A

AFTER 24 HOURS: ▼ N/A

CAVING: ▨ N/A

Depth (ft)	Water	Description	Graphic Log	SPT Testing
		2" asphalt- (ASPHALT)		
5		**Firm to stiff, brown silty CLAY (CL-ML) - (RESIDUUM)**	▨	3, 3, 4 5, 5, 8 4, 6, 8 4, 5, 8
10 15 20		**Stiff to very stiff, tan to gray, slightly moist, sandy SILT (ML) - (RESIDUUM)**	▥	3, 5, 8 6, 12, 16 10, 14, 15
		B-10 Terminate at 25ft (Boring terminated at 25 feet. No groundwater encountered at time of drilling. Boring caved at 20.5 feet at time of drilling.)		



BUNNELL LAMMONS ENGINEERING

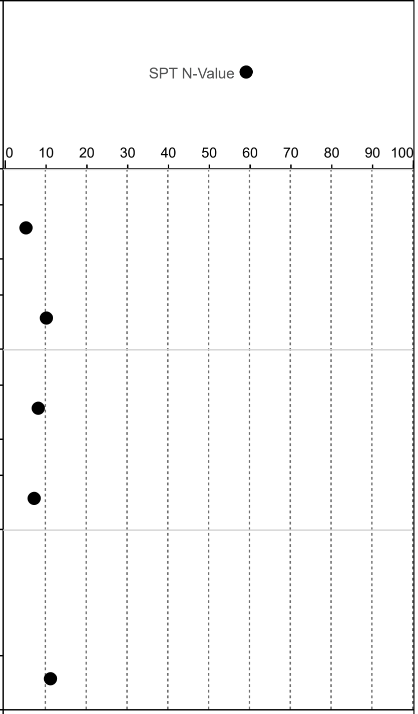
BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNCAL AND ENVIRONMENTAL CONSULTANTS

BORING NO. B-11

PROJECT: Orchards at Naples Road	PROJECT NO.: 24-24544	
CLIENT: Orchards at Naples Road, LLC	START: 02/04/2025	END: 02/04/2025
LOCATION: 399 Naples Road, Hendersonville, NC, USA	ELEVATION: 0	
DRILLER: Baker Jordan Environmental, LLC, Baker Jordan	LOGGED BY: COD	
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586		
DEPTH TO - WATER> INITIAL: ▽ N/A	AFTER 24 HOURS: ▼ N/A	CAVING: ▨ N/A

Depth (ft)	Water	Description	Graphic Log	SPT Testing
		4" topsoil/leaves- (TOPSOIL)		
		Firm to stiff, brown, silty CLAY (CL-ML): (RESIDUUM)	▨	3, 2, 4
			▨	3, 4, 7
5		Loose to medium dense, moist, brown to white, silty, fine to medium SAND (SM) - (RESIDUUM)	░	2, 4, 5
			░	3, 4, 4
10			░	
			░	4, 5, 7



B-11 Terminate at 15ft (Boring terminated at 15 feet. No groundwater encountered at time of drilling or end of day. Boring caved at 12 feet at time of drilling.)

BUNNELL-LAMMONS ENGINEERING, INC.

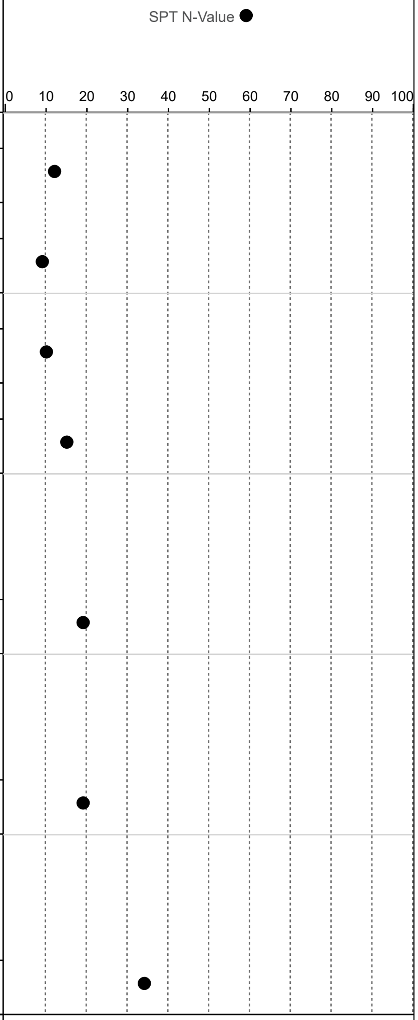
GEOTECHNCAL AND ENVIRONMENTAL CONSULTANTS

BORING NO. B-12

PROJECT: Orchards at Naples Road	PROJECT NO.: 24-24544
CLIENT: Orchards at Naples Road, LLC	START: 02/04/2025 END: 02/04/2025
LOCATION: 399 Naples Road, Hendersonville, NC, USA	ELEVATION: 0
DRILLER: Baker Jordan Environmental, LLC, Baker Jordan	LOGGED BY: COD
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586	

DEPTH TO - WATER> INITIAL: ▽ N/A AFTER 24 HOURS: ▼ N/A CAVING: ▨ N/A

Depth (ft)	Water	Description	SPT Testing
		4" topsoil/leaves- (TOPSOIL)	
		Medium dense, brown, silty, fine to medium SAND (SM) - (RESIDUUM)	4, 6, 7
			5, 5, 5
5		Stiff, gray to tan, sandy SILT (ML): (RESIDUUM)	5, 5, 6
			7, 7, 9
10		Very stiff to hard, white to gray, micaceous, sandy SILT (ML) - (RESIDUUM)	
15			6, 9, 11
20			6, 9, 11
			15, 18, 17



B-12 Terminate at 25ft (Boring terminated at 25 feet. No groundwater encountered at time of drilling. Boring caved at 20.5 feet at time of drilling.)

BUNNELL LAMMONS ENGINEERING

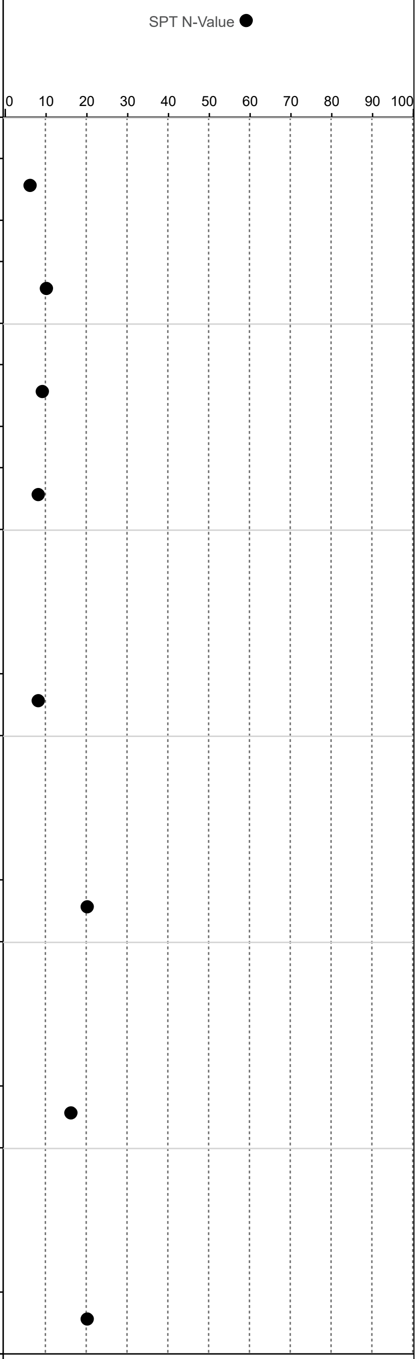
BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNCAL AND ENVIRONMENTAL CONSULTANTS

BORING NO. B-13

PROJECT: Orchards at Naples Road	PROJECT NO.: 24-24544	
CLIENT: Orchards at Naples Road, LLC	START: 02/04/2025	END: 02/04/2025
LOCATION: 399 Naples Road, Hendersonville, NC, USA	ELEVATION: 0	
DRILLER: Baker Jordan Environmental, LLC, Baker Jordan	LOGGED BY: COD	
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586		
DEPTH TO - WATER> INITIAL: ▽ N/A	AFTER 24 HOURS: ▼ N/A	CAVING: ▨ N/A

Depth (ft)	Description	Graphic Log	SPT Testing
	4" topsoil/leaves- (TOPSOIL)		
	Firm, moist, brown, slightly sandy SILT (ML): (RESIDUUM)	▨	3, 3, 4
	Stiff to very stiff, moist, orange to gray, sandy SILT (ML): (RESIDUUM)		6, 5, 6
5			4, 4, 6
			2, 4, 5
10			
			3, 4, 5
15			
			6, 10, 11
20			
			5, 7, 10
25			
			1, 10, 11



B-13 Terminate at 30ft (Boring terminated at 30 feet. No groundwater encountered at time of drilling. Boring caved at 25 feet at time of drilling.)

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNCAL AND ENVIRONMENTAL CONSULTANTS

BORING NO. B-14

PROJECT: Orchards at Naples Road

PROJECT NO.: 24-24544

CLIENT: Orchards at Naples Road, LLC

START: 02/04/2025

END: 02/04/2025

LOCATION: 399 Naples Road, Hendersonville, NC, USA

ELEVATION: 0

DRILLER: Baker Jordan Environmental, LLC, Baker Jordan

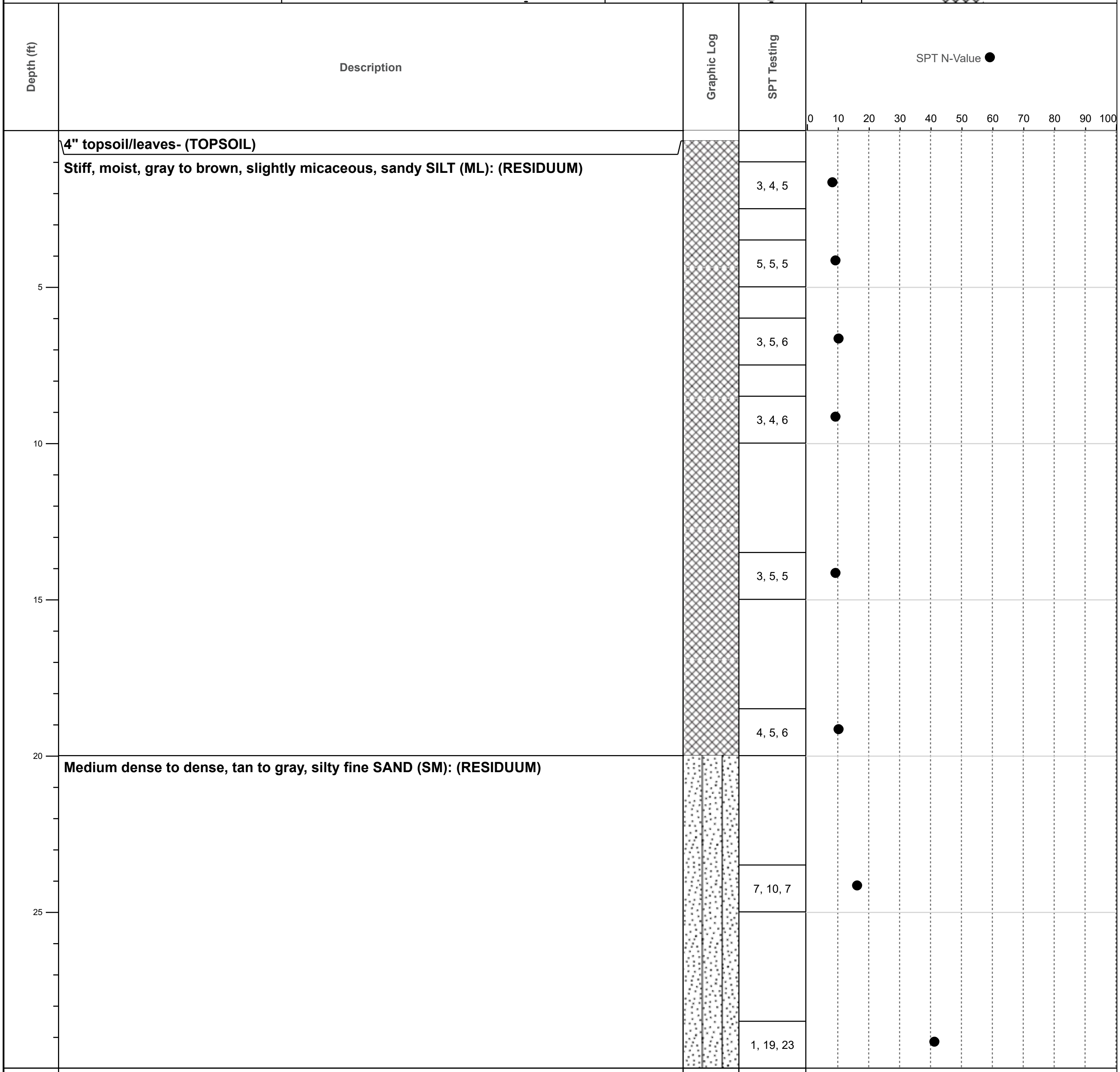
LOGGED BY: COD

DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586

DEPTH TO - WATER> INITIAL: ∇ N/A

AFTER 24 HOURS: ▼ N/A

CAVING: ▨ N/A



4" topsoil/leaves- (TOPSOIL)

Stiff, moist, gray to brown, slightly micaceous, sandy SILT (ML): (RESIDUUM)

3, 4, 5

5, 5, 5

3, 5, 6

3, 4, 6

3, 5, 5

4, 5, 6

Medium dense to dense, tan to gray, silty fine SAND (SM): (RESIDUUM)

7, 10, 7

1, 19, 23

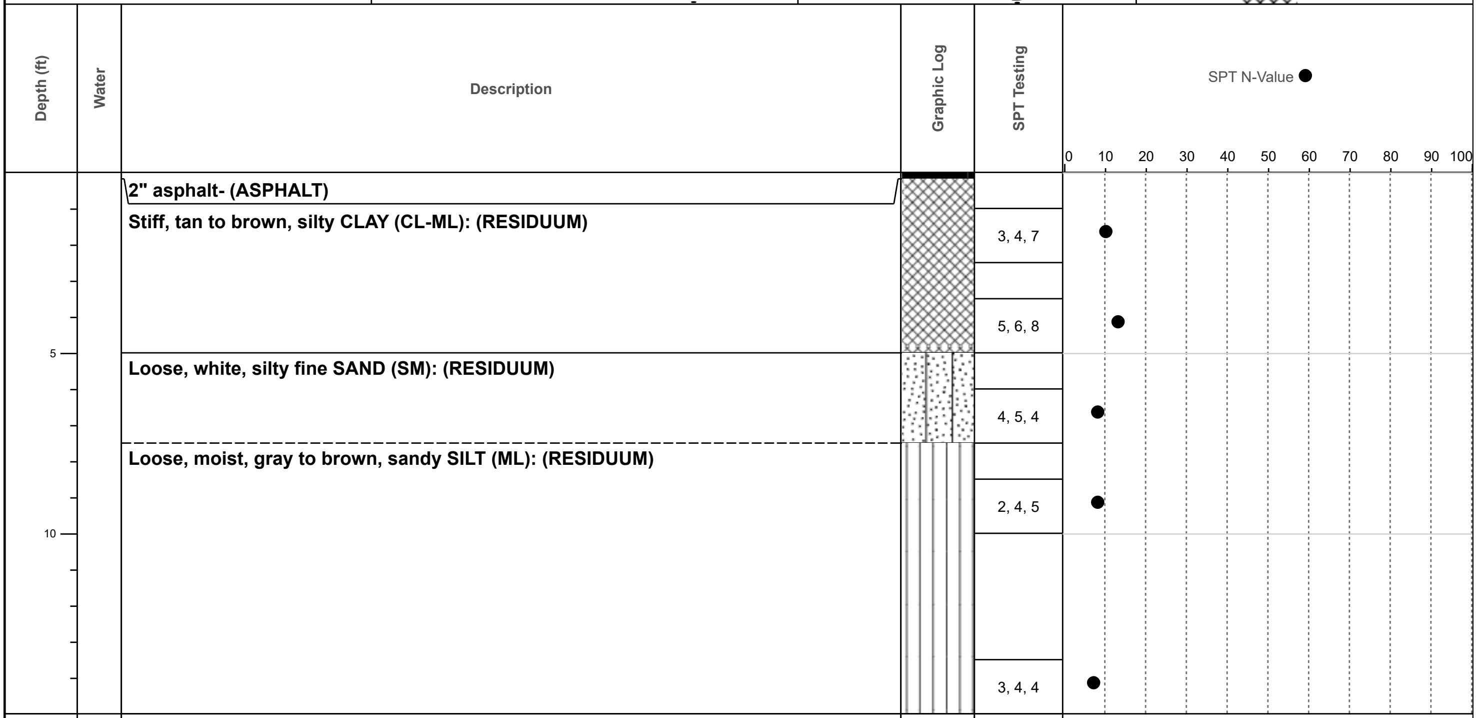
B-14 Terminate at 30ft (Boring terminated at 30 feet. Groundwater encountered at 25 feet at time of drilling. Boring caved at 25 feet at time of drilling.)

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNCAL AND ENVIRONMENTAL CONSULTANTS

BORING NO. B-15

PROJECT: Orchards at Naples Road	**PROJECT NO.: 24-24544**
CLIENT: Orchards at Naples Road, LLC	**START: 02/04/2025** **END: 02/04/2025**
LOCATION: 399 Naples Road, Hendersonville, NC, USA	**ELEVATION: 0**
DRILLER: Baker Jordan Environmental, LLC, Baker Jordan	**LOGGED BY: COD**
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586	
DEPTH TO - WATER> INITIAL: ▽ N/A **AFTER 24 HOURS: ▼ N/A**	**CAVING: ▨ N/A**



Description	SPT Testing
2" asphalt- (ASPHALT)	
Stiff, tan to brown, silty CLAY (CL-ML): (RESIDUUM)	3, 4, 7 5, 6, 8
Loose, white, silty fine SAND (SM): (RESIDUUM)	4, 5, 4
Loose, moist, gray to brown, sandy SILT (ML): (RESIDUUM)	2, 4, 5 3, 4, 4

B-15 Terminate at 15ft (Boring terminated at 15 feet. No groundwater encountered at time of drilling. Boring caved at 12.5 feet at time of drilling.)

BUNNELL-LAMMONS ENGINEERING, INC.

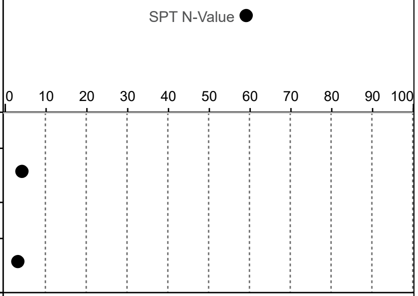
GEOTECHNCAL AND ENVIRONMENTAL CONSULTANTS

BORING NO. B-16

PROJECT: Orchards at Naples Road	**PROJECT NO.: 24-24544**
CLIENT: Orchards at Naples Road, LLC	**START: 02/04/2025** **END: 02/04/2025**
LOCATION: 399 Naples Road, Hendersonville, NC, USA	**ELEVATION: 0**
DRILLER: Baker Jordan Environmental, LLC, Baker Jordan	**LOGGED BY: COD**
DRILLING METHOD: Diedrich D50 Turbo / ASTM D 1586	

DEPTH TO - WATER> INITIAL: ▽ N/A **AFTER 24 HOURS: ▼ N/A** **CAVING: ▨ N/A**

Depth (ft)	Water	Description	Graphic Log	SPT Testing
		(TS): (4" TOPSOIL)	▨	
		Loose, moist, brown to gray, clayey, fine to medium SAND (SM) with gravel: (FILL)	▨	2, 1, 4
			▨	
			▨	3, 2, 2



B-16 refusal at 5ft (Auger encountered refusal at 5 feet. No auger offset was attempted because of nearby utilities. No groundwater encountered at time of drilling.)

APPENDIX D
Test Pit Logs

TEST PIT LOG

Job Name: Orchards at Naples		**Location**: TP-1		
Job Number: 24-24544		**Date Logged**: 2/17/2025		
Approximate Elevation:		**Logged By**: Tanner Whitesell		
Depth (Feet)		**Stratum Description**	**DCP DATA**	
From	**To**		**Depth**	**Blows**
0’	4”	Topsoil/Roots	-	-
4”	2’	Bricks, concrete etc. – (Fill)	-	-
2’	6’	Tan and gray, moist, clayey sand (SC) – (Alluvium)	-	-

Remarks and Notes:
Test pit terminated at 6 feet.
Measured at the toe of the slope
Groundwater was encountered 5 feet from the uphill side of the test pit.
Test pit backfilled with excavated material.

TEST PIT LOG

Job Name: Orchards at Naples		**Location**: TP-2		
Job Number: 24-24544		**Date Logged**: 2/17/2025		
Approximate Elevation:		**Logged By**: Tanner Whitesell		
Depth (Feet)		**Stratum Description**	**DCP DATA**	
From	**To**		**Depth**	**Blows**
0’	3”	Topsoil/Roots	-	-
3”	3’	Brown, moist, silty sand (SM) with construction debris – (Fill)	-	-
3’	6’	Gray, wet, sandy silt (ML) with construction debris – (Fill)	-	-

Remarks and Notes:
Test pit terminated at 6 feet.
Surface water was observed under the root mat.
Groundwater was not encountered at the time of test pits.
Test pit backfilled with excavated material.

TEST PIT LOG

Job Name: Orchards at Naples	**Location**: TP-3
Job Number: 24-24544	**Date Logged**: 2/17/2025
Approximate Elevation:	**Logged By**: Tanner Whitesell

Depth (Feet)		**Stratum Description**	**DCP DATA**	
From	**To**		**Depth**	**Blows**
0’	1’	Topsoil/Roots	-	-
1’	2’	Dark brown, moist, clayey silty sand (SM) with brick and asphalt observed – (Fill)	-	-
2’	4’	Blue and grey, clayey sand (SC) – (alluvium)	-	-

Remarks and Notes:
Test pit terminated at 4 feet.
Groundwater was not encountered at the time of test pits.
Measurements taken at the toe of slope.
Test pit backfilled with excavated material.

TEST PIT LOG

Job Name: Orchards at Naples	**Location**: TP-4
Job Number: 24-24544	**Date Logged**: 2/17/2025
Approximate Elevation:	**Logged By**: Tanner Whitesell

Depth (Feet)		**Stratum Description**	**DCP DATA**	
From	**To**		**Depth**	**Blows**
0’	6”	Topsoil/Roots	-	-
6”	1.5’	Dark brown, moist, clayey sand (SC) with construction debris and trash observed – (Fill)	-	-
1.5’	3.5’	Grey silty sand (SM) – (Alluvium)	-	-

Remarks and Notes:
Test pit terminated at 3.5 feet.
Groundwater was encountered at 2 feet at time of excavation.
Measurements taken at the toe of slope.
Test pit backfilled with excavated material.

TEST PIT LOG

Job Name: Orchards at Naples		**Location**: TP-5		
Job Number: 24-24544		**Date Logged**: 2/17/2025		
Approximate Elevation:		**Logged By**: Tanner Whitesell		
Depth (Feet)		**Stratum Description**	**DCP DATA**	
From	**To**		**Depth**	**Blows**
0’	6”	Topsoil/Roots	-	-
6”	4’	Dark brown, moist, clayey silty sand (SC) with construction debris and trash observed (Fill)	-	-
4’	5’	Grey silty sand (SM) – (Alluvium)	-	-

Remarks and Notes:
Test pit terminated at 5 feet.
Groundwater was encountered at 4 feet at the time of excavation.
Measurements taken at the toe of slope.
Test pit backfilled with excavated material.

TEST PIT LOG

Job Name: Orchards at Naples

Location: TP-6

Job Number: 24-24544

Date Logged: 2/17/2025

Approximate Elevation:

Logged By: Tanner Whitesell

Depth (Feet)		Stratum Description	DCP DATA	
From	To		Depth	Blows
0’	4”	Topsoil/Roots	-	-
4”	10’	Brown clayey silty sand (SM) with construction debris and concrete - (Fill)	-	-

Remarks and Notes:
Test pit terminated at 10 feet.
Groundwater was encountered at 5 feet at the time of excavation.
Measurements taken at the toe of slope.
Test pit backfilled with excavated material.

TEST PIT LOG

Job Name: Orchards at Naples

Location: TP-7

Job Number: 24-24544

Date Logged: 2/17/2025

Approximate Elevation:

Logged By: Tanner Whitesell

Depth (Feet)		**Stratum Description**	**DCP DATA**	
From	**To**		**Depth**	**Blows**
0’	4”	Topsoil/Roots	-	-
4”	10’	Brown clayey silty sand (SM) with construction debris and concrete - (Fill)	-	-
Remarks and Notes: Test pit terminated at 10 feet. No groundwater was encountered at the time of excavation. Test pit backfilled with excavated material.				

TEST PIT LOG

Job Name: Orchards at Naples		**Location**: TP-8	
Job Number: 24-24544		**Date Logged**: 3/4/25	
Approximate Elevation:		**Logged By**: Colm O'Doherty	

Depth (Feet)		**Stratum Description**	**DCP DATA**	
From	**To**		**Depth**	**Blows**
0'	3"	Topsoil/Leaves	-	-
3"	10'	Tan to gray, slightly moist, sandy, silt (ML) – (Residuum)	-	-
Remarks and Notes: Test pit terminated at 10 feet. No groundwater was encountered at the time of excavation. Test pit backfilled with excavated material.				

TEST PIT LOG

Job Name: Orchards at Naples
Location: TP-9
Job Number: 24-24544
Date Logged: 3/4/25
Approximate Elevation:
Logged By: Colm O'Doherty

Depth (Feet)		Stratum Description	DCP DATA	
From	To		Depth	Blows
0'	3"	Topsoil/Leaves	-	-
3"	10.5'	Tan to gray, slightly moist, sandy, SILT (ML) – (Residuum)	-	-

Remarks and Notes:
Test pit terminated at 10.5 feet.
No groundwater was encountered at the time of excavation.
Test pit backfilled with excavated material.

APPENDIX E
A Key to Soil Classification

KEY TO SOIL CLASSIFICATIONS AND CONSISTENCY DESCRIPTIONS

BUNNELL-LAMMONS ENGINEERING, INC.

Penetration Resistance* Blows per Foot	Relative Density
SANDS	
0 to 4	Very Loose
5 to 10	Loose
11 to 30	Medium-Dense
31 to 50	Dense
over 50	Very Dense

Particle Size Identification

Boulder:	Greater than 300 mm
Cobble:	75 to 300 mm
Gravel:	Coarse - 19 to 75 mm
	Fine - 4.75 to 19 mm
Sand:	Coarse - 2 to 4.75 mm
	Medium - 0.425 to 2 mm
	Fine - 0.075 to 0.425 mm
Silt & Clay:	Less than 0.075 mm

Penetration Resistance* Blows per Foot	Consistency
SILTS AND CLAYS	
0 to 2	Very Soft
3 to 4	Soft
5 to 8	Firm
9 to 15	Stiff
16 to 30	Very Stiff
31 to 50	Hard
over 50	Very Hard

*ASTM D 1586

KEY TO DRILLING SYMBOLS

✋	Bulk Sample	▽	Groundwater Table at Time of Drilling
☒	Split Spoon Sample	▼	Groundwater Table 24 Hours After Completion of Drilling
▮	Undisturbed Sample	▩	Cave-in Depth

KEY TO SOIL CLASSIFICATION

⁘	Well-graded Gravel GW	▨	Fat Clay CH	▥	Elastic Silt MH	⁙	Well Graded Sand SW
⁘	Poorly-graded Gravel GP	▤	Lean Clay CL	▥	Silt ML	⁙	Poorly Graded Sand SP
⁘	Partially Weathered Rock PWR	▤	Sandy Clay CL	▥	Sandy Silt ML	▨	Clayey Sand SC
▩	Fill FILL	▤	Silty Clay CL-ML	⁂	Topsoil TOPSOIL	⁙	Silty Sand SM

APPENDIX F
Laboratory Test Results

Laboratory Procedures

Compaction

Representative samples of potential borrow soils from the project site were collected, placed in cloth sacks, and transported to the laboratory for compaction testing. Standard Proctor compaction tests (ASTM D 698) were performed on selected samples to determine their compaction characteristics, including their maximum dry density and optimum moisture content. Test results are presented on the attached Compaction Test sheets.

Soil Plasticity

Representative samples of the upper clayey soils were selected for Atterberg Limits testing to determine their soil plasticity characteristics. The soil's Plasticity Index (PI) is representative of this characteristic and is bracketed by the Liquid Limit (LL) and the Plastic Limit (PL). These characteristics are determined in accordance with ASTM D 4318. The LL is the moisture content at which the soil will flow as a heavy viscous fluid. The PL is the moisture content at which the soil begins to lose its plasticity. The data obtained are presented on the attached Summary of Laboratory Test Data.

Grain Size Distribution

Grain size tests were performed on representative soil samples to determine the particle size distribution of these materials. After initial drying, the samples were washed over a U. S. Standard No. 200 sieve to remove the fines (particles finer than a No. 200 mesh sieve). The samples were then dried and sieved through a standard set of nested sieves. This test was performed in a manner similar to that described by ASTM D 422. The results are presented as percent finer by weight versus particle size curves on the attached Grain Size Distribution sheets

Natural Moisture Content

The natural moisture content of selected samples was determined in accordance with ASTM D 2216. The moisture content of the soil is the ratio, expressed as a percentage, of the weight of water in a given mass of soil to the weight of the soil particles. The results are presented in the attached Summary of Laboratory Test Data.

Laboratory Procedures

Compaction

Representative samples of potential borrow soils from the project site were collected, placed in cloth sacks, and transported to the laboratory for compaction testing. Standard Proctor compaction tests (ASTM D 698) were performed on selected samples to determine their compaction characteristics, including their maximum dry density and optimum moisture content. Test results are presented on the attached Compaction Test sheets.

Soil Plasticity

Representative samples of the upper clayey soils were selected for Atterberg Limits testing to determine their soil plasticity characteristics. The soil's Plasticity Index (PI) is representative of this characteristic and is bracketed by the Liquid Limit (LL) and the Plastic Limit (PL). These characteristics are determined in accordance with ASTM D 4318. The LL is the moisture content at which the soil will flow as a heavy viscous fluid. The PL is the moisture content at which the soil begins to lose its plasticity. The data obtained are presented on the attached Summary of Laboratory Test Data.

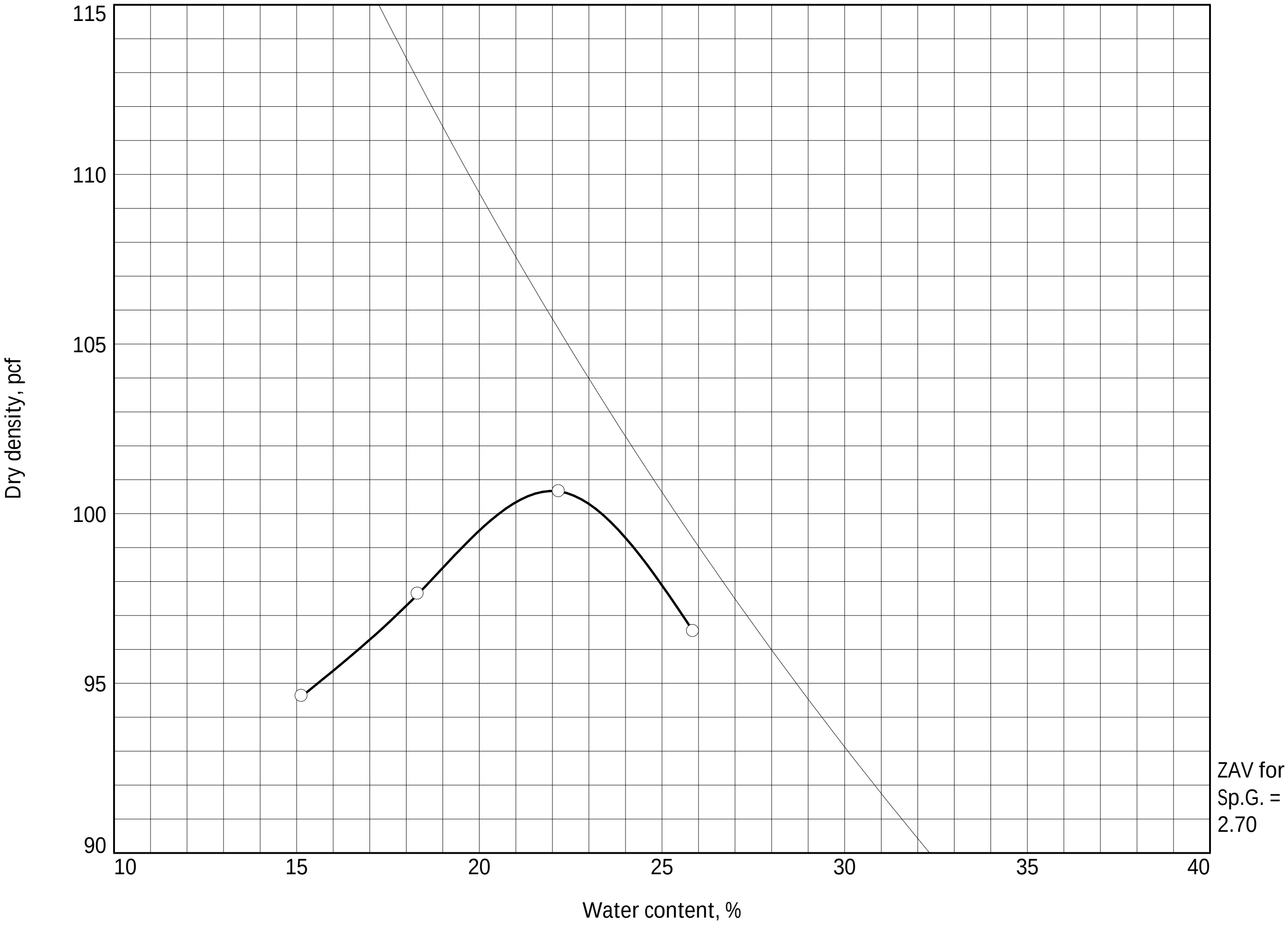
Grain Size Distribution

Grain size tests were performed on representative soil samples to determine the particle size distribution of these materials. After initial drying, the samples were washed over a U. S. Standard No. 200 sieve to remove the fines (particles finer than a No. 200 mesh sieve). The samples were then dried and sieved through a standard set of nested sieves. This test was performed in a manner similar to that described by ASTM D 422. The results are presented as percent finer by weight versus particle size curves on the attached Grain Size Distribution sheets

Natural Moisture Content

The natural moisture content of selected samples was determined in accordance with ASTM D 2216. The moisture content of the soil is the ratio, expressed as a percentage, of the weight of water in a given mass of soil to the weight of the soil particles. The results are presented in the attached Summary of Laboratory Test Data.

COMPACTION TEST REPORT



Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
5-10	CH	A-7-6(24)	26.9	2.7	55	28	0.0	79.8

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 100.7 pcf Optimum moisture = 22.0 %	Brown, Fat clay with sand

Project No. 24544 Client:

Project: Orchards at Naples Road

Date:

○ Source of Sample: B Sample Number: B-10

Bunnell Lammons Engineering, Inc.

Greenville, SC

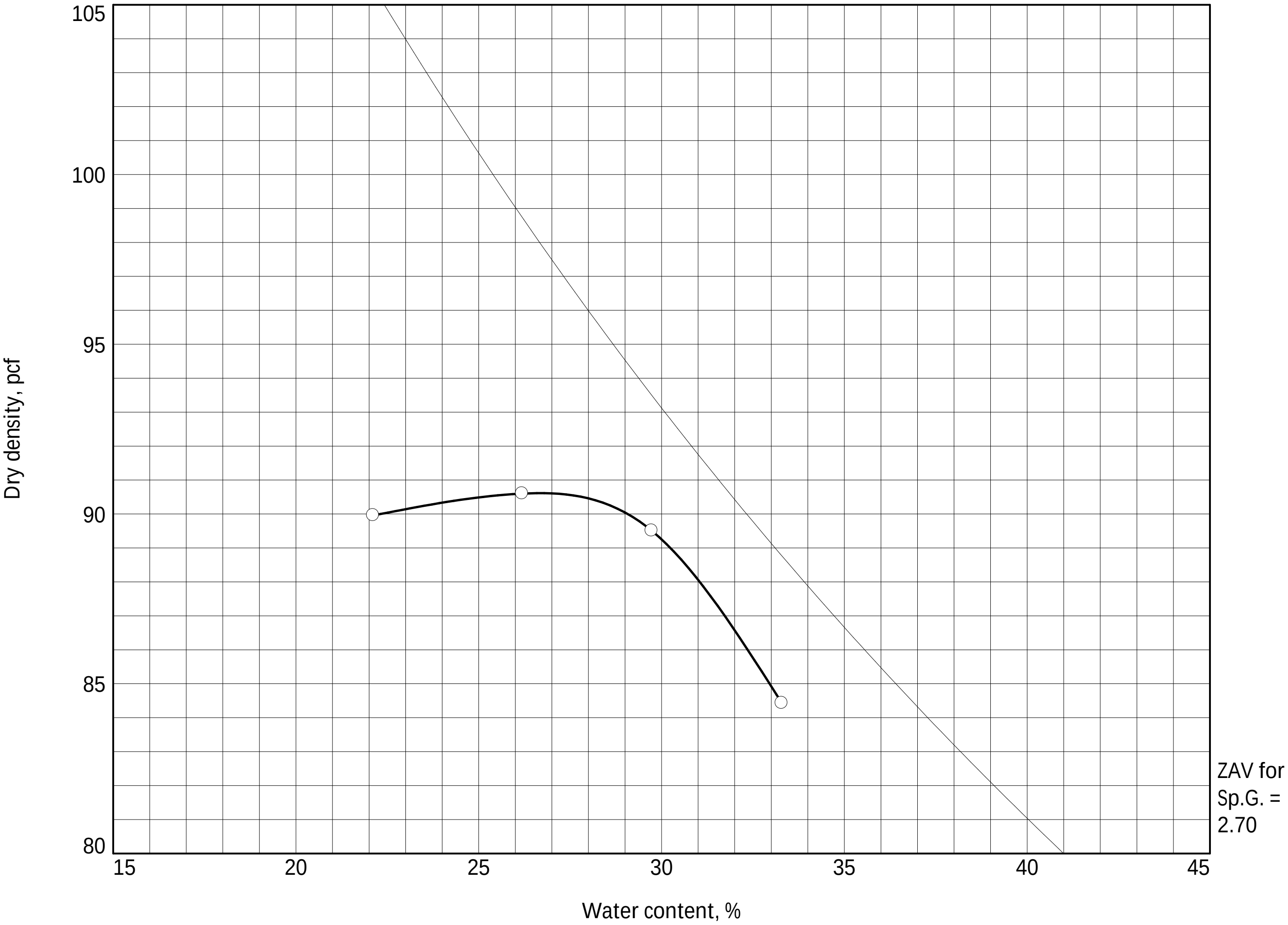
Remarks:

Figure

Tested By: LM

Checked By: ML

COMPACTION TEST REPORT



Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
5-10	MH	A-7-5(20)	36.2	2.7	58	20	0.0	82.1

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 90.6 pcf Optimum moisture = 26.7 %	Light brown, Elastic silt with sand

Project No. 24544 Client:

Project: Orchards at Naples Road

Date:

○ Source of Sample: B Sample Number: B-13

Bunnell Lammons Engineering, Inc.

Greenville, SC

Remarks:

Figure

Tested By: LM Checked By: ML

Standard proctor (ASTM D698 / AASHTO T99)

Report #: 001-L1

Client: Orchards at Naples Road, LLC
Project: Orchards at Naples Road Apartments
Location: 399 Naples Road, Hendersonville, NC 28792

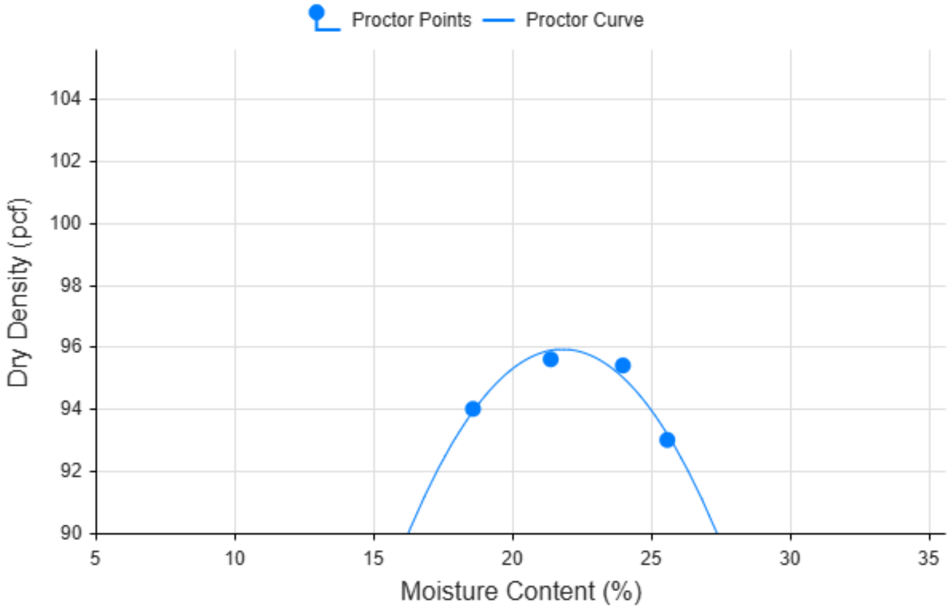
Report Date: 03/10/2025 **Sample Date:** 03/10/2025
Project #: 24-24544

SAMPLE AND PROCTOR / SATURATION CURVE (MOISTURE DENSITY)

Sample No: TP-8
Proctor #: 001-L1
Sample Source / Location:TP-8 (10')
Sample Description / Visual Classification:

Test Procedure: Standard Proctor (ASTM D698) (Method A)
Preparation Method: Air Dried
Hammer Type: Manual
Max Dry Density (pcf): 95.9
Optimum Moisture (%): 21.8 %

Saturation Results
Specific Gravity: 0
% Retained **Rock Correction:**
3/4" Sieve: 0 **3/8" Sieve:** 0
No. 4: 0



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Lab Representative: BLEAE Labtech

Standard proctor (ASTM D698 / AASHTO T99)

Report #: 002-L1

Client: Orchards at Naples Road, LLC
Project: Orchards at Naples Road Apartments
Location: 399 Naples Road, Hendersonville, NC 28792

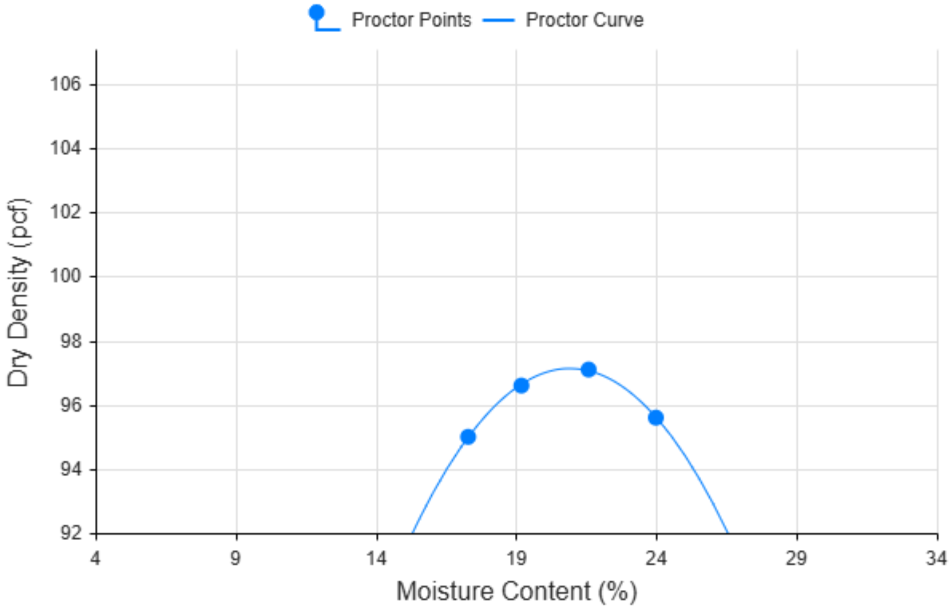
Report Date: 03/10/2025 **Sample Date:** 03/10/2025
Project #: 24-24544

SAMPLE AND PROCTOR / SATURATION CURVE (MOISTURE DENSITY)

Sample No: TP-9 **Proctor #:** 002-L1
Sample Source / Location:TP-9 (10')
Sample Description / Visual Classification:

Test Procedure: Standard Proctor (ASTM D698) (Method A)
Preparation Method: Air Dried
Hammer Type: Manual
Max Dry Density (pcf): 97.1
Optimum Moisture (%): 20.9 %

Saturation Results
Specific Gravity: 0
% Retained **Rock Correction:**
3/4" Sieve: 0 **3/8" Sieve:** 0
No. 4: 0



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Lab Representative: BLEAE Labtech

Notes: The results above apply only to the specific samples noted using the aforementioned test method(s) and do not represent any other sample. Reports may not be reproduced except in full without permission.

Particle-Size Distribution of Soils (ASTM D6913)

Report #: 001-L2

Client: Orchards at Naples Road, LLC
Project: Orchards at Naples Road Apartments
Location: 399 Naples Road, Hendersonville, NC 28792

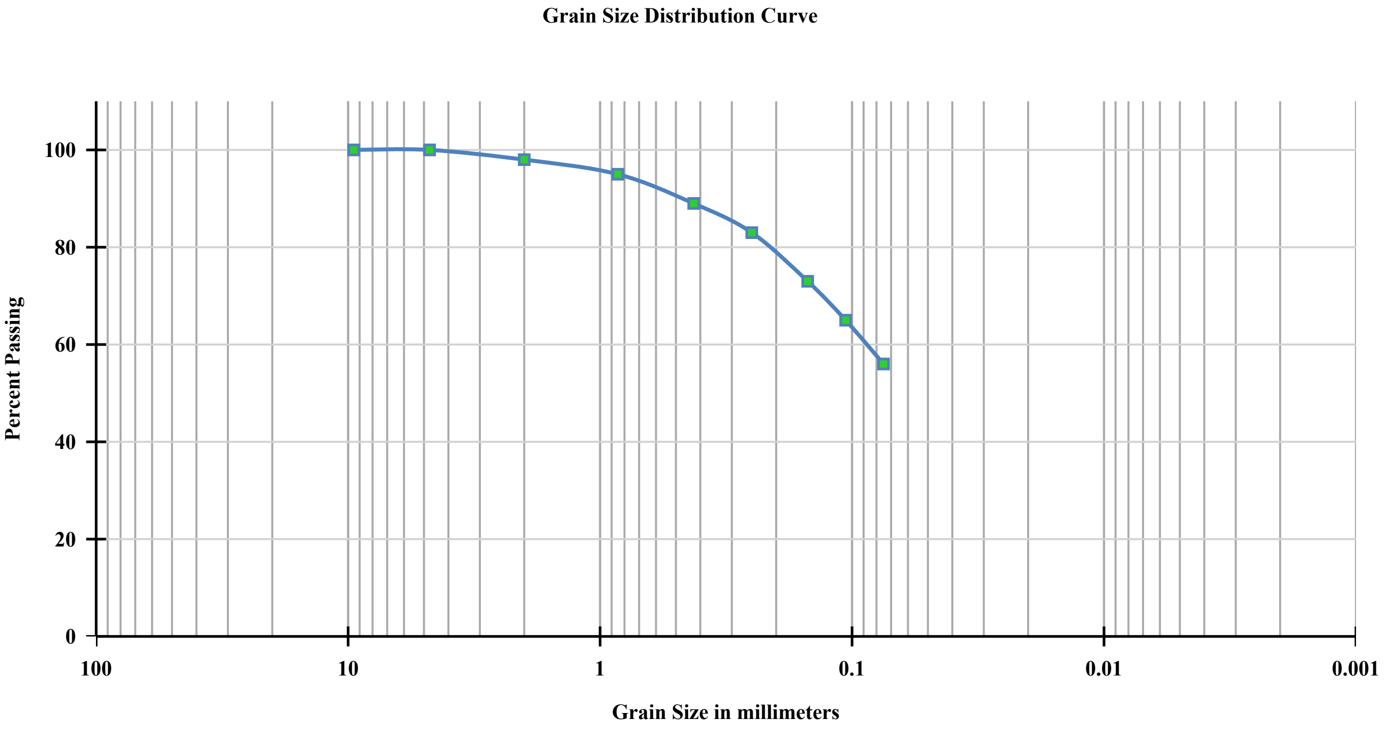
Report Date: 03/10/2025 **Sample Date:** 03/10/2025
Project #: 24-24544

SAMPLE DATA

Test Procedure: ASTM D6913 (Sieve)
Depth (ft): 10'
Sample No: TP-8
Sample Source / Location:TP-8 (10')
Sample Description / Classification:

SIEVE ANALYSIS AND TEST RESULTS

Tare Wt (g)	329.9	**Tare #**		**Moisture Content (%)**	19	**Dry Wt.+ Tare (g)**	679.4
Water Wt	66.4	**Wet Wt.+ Tare (g)**	745.8	**Dry Wt (g)**	349.5		



Sieve Sizes	Wt. Retained (g)	% Retained	% Passing	Spec Limits
3/8 in (9.5mm)		0.0	100.0	
#4 (4.75mm)	1.5	0.4	99.6	
#10 (2mm)	5.9	1.7	98.3	
#20 (0.85mm)	18.4	5.3	94.7	
#40 (0.425mm)	37.2	10.6	89.4	
#60 (0.25mm)	59.2	16.9	83.1	
#100 (0.15mm)	94.6	27.1	72.9	
#140 (0.106mm)	123.6	35.4	64.6	
#200 (0.075mm)	152.3	43.6	56.4	
PAN	167.3	47.9	52.1	

Material

% Gravel	% Sand	% Fines
0.4	43.2	56.4

Atterberg Limits Non Plastic

PL = 36 **LL =** 35 **PI =** -1

Coefficients

D_{60} = 0.09 **D_{10} =** **Cc =**
D_{30} = **Cu =**

Soil Classification

USCS	AASHTO
USCS (ASTM D2487) : ML	A-4 (-5)

Sandy silt

Particle-Size Distribution of Soils (ASTM D6913)

Report #: 002-L2

Client: Orchards at Naples Road, LLC
Project: Orchards at Naples Road Apartments
Location: 399 Naples Road, Hendersonville, NC 28792

Report Date: 03/10/2025 **Sample Date:** 03/10/2025
Project #: 24-24544

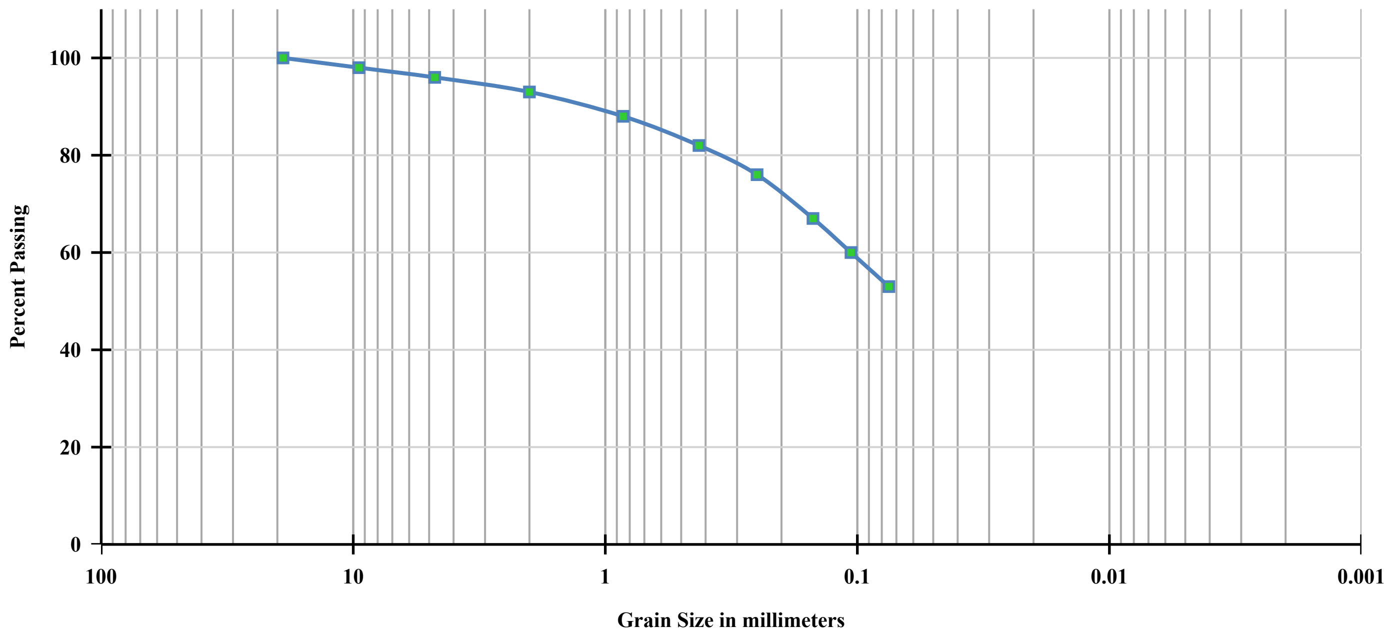
SAMPLE DATA

Test Procedure: ASTM D6913 (Sieve)
Depth (ft): 10'
Sample No: TP-9
Sample Source / Location:TP-9 (10')
Sample Description / Classification:

SIEVE ANALYSIS AND TEST RESULTS

Tare Wt (g)	329.5	**Tare #**		**Moisture Content (%)**	20.44	**Dry Wt.+ Tare (g)**	676.3
Water Wt	70.9	**Wet Wt.+ Tare (g)**	747.2	**Dry Wt (g)**	346.8		

Grain Size Distribution Curve



Sieve Sizes	Wt. Retained (g)	% Retained	% Passing	Spec Limits
3/4 in (19mm)		0.0	100.0	
3/8 in (9.5mm)	6.8	2.0	98.0	
#4 (4.75mm)	14.1	4.1	95.9	
#10 (2mm)	23.8	6.9	93.1	
#20 (0.85mm)	41.9	12.1	87.9	
#40 (0.425mm)	62.4	18.0	82.0	
#60 (0.25mm)	82.6	23.8	76.2	
#100 (0.15mm)	113.1	32.6	67.4	
#140 (0.106mm)	138.9	40.1	59.9	
#200 (0.075mm)	163.1	47.0	53.0	
PAN	173.9	50.1	49.9	

Material

% Gravel	% Sand	% Fines
4.1	42.9	53.0

Atterberg Limits Non Plastic

PL = 37 **LL =** 37 **PI =** 1

Coefficients

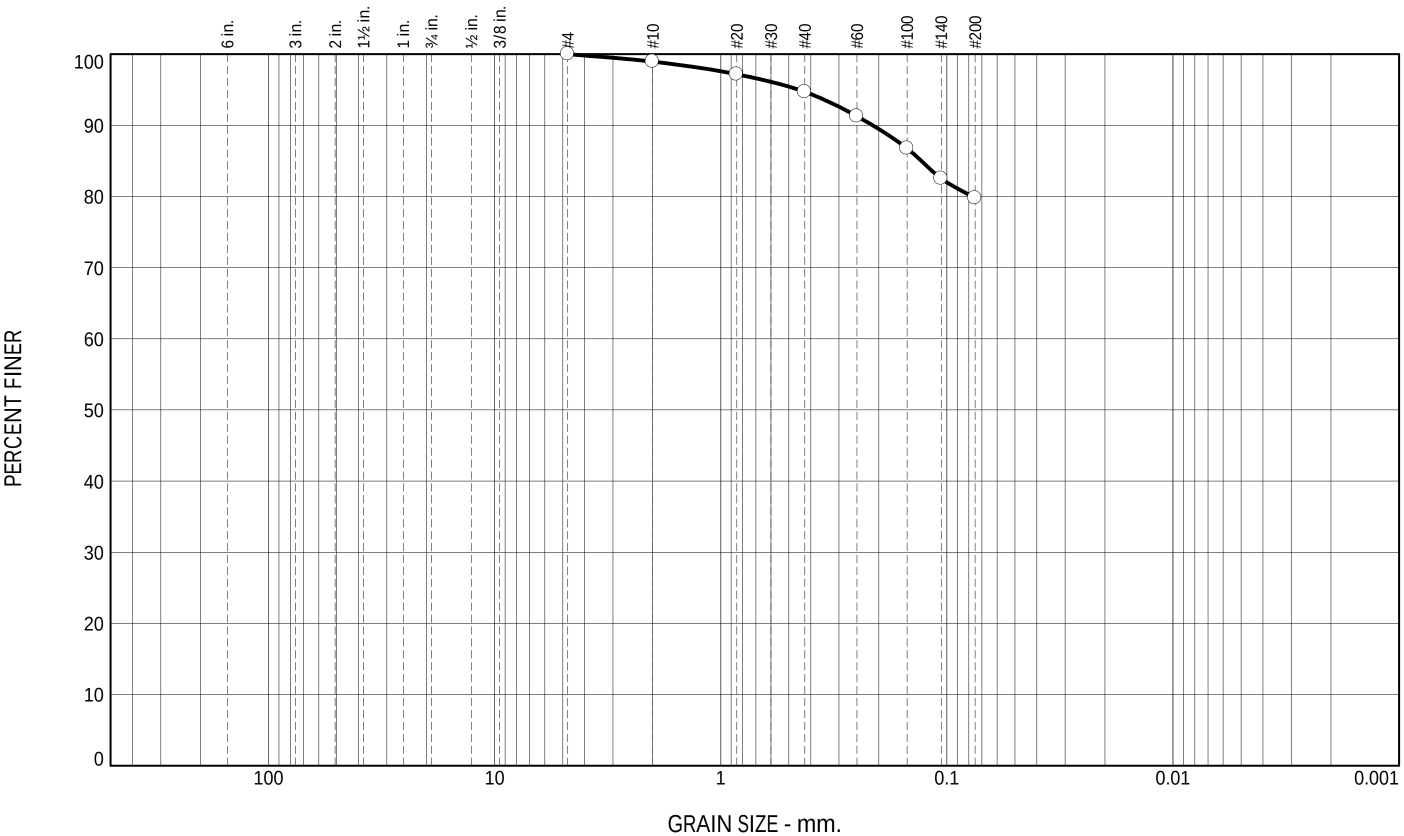
D_{60} = 0.11 **D_{10} =** **Cc =**
D_{30} = **Cu =**

Soil Classification

USCS: USCS (ASTM D2487) : ML
AASHTO: A-4 (-4)

Sandy silt

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.0	4.3	14.9	79.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.0		
#20	97.2		
#40	94.7		
#60	91.3		
#100	86.8		
#140	82.5		
#200	79.8		

* (no specification provided)

Soil Description

Brown, Fat clay with sand

Atterberg Limits

PL= 27 LL= 55 PI= 28

Coefficients

D_{90}= 0.2127 D_{85}= 0.1298 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(24)

Remarks

Source of Sample: B Depth: 5-10
Sample Number: B-10
Date:

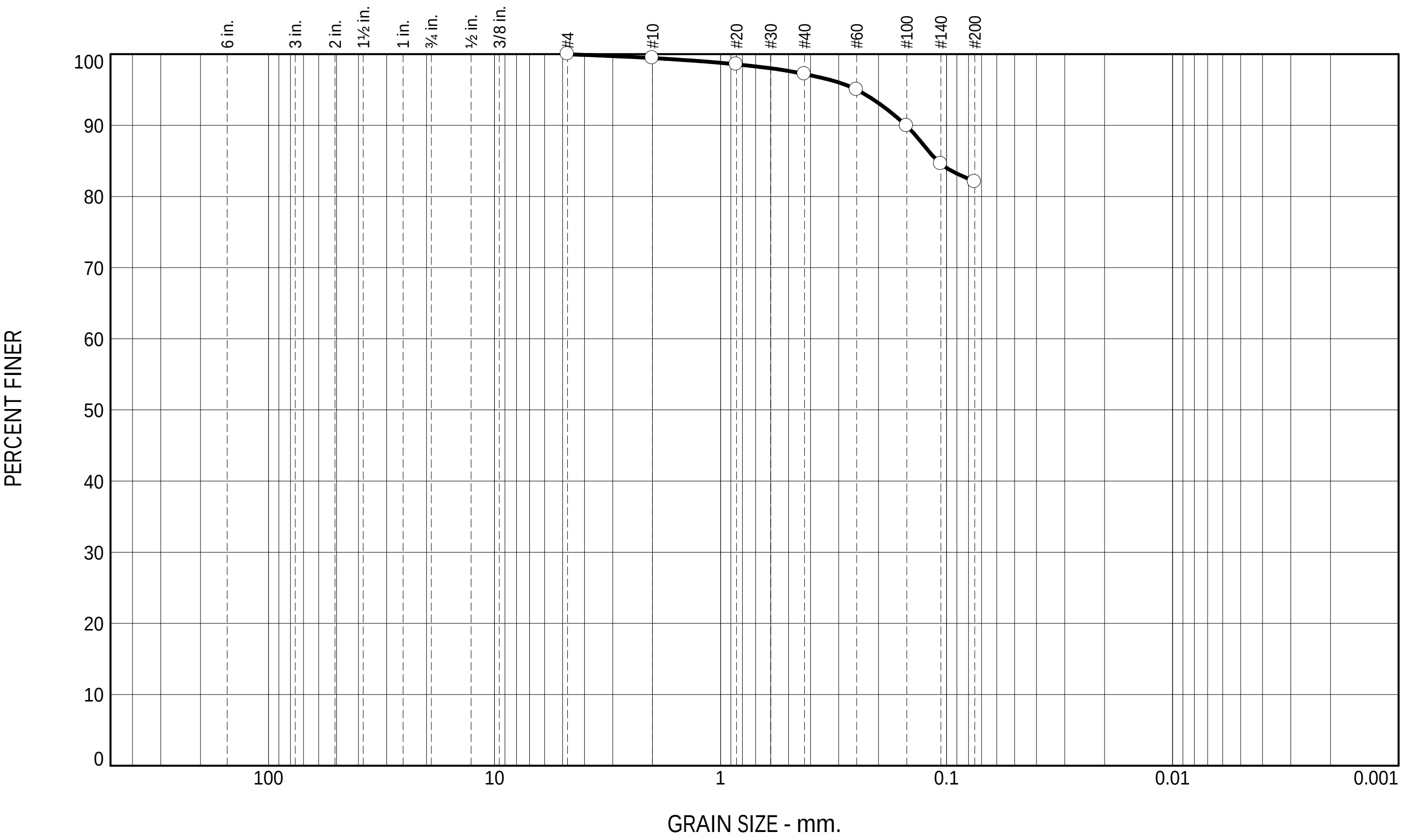
Bunnell Lammons Engineering, Inc.

Greenville, SC

Client:
Project: Orchards at Naples Road
Project No: 24544 Figure

Tested By: MW Checked By: ML

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.6	2.2	15.1	82.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.4		
#20	98.6		
#40	97.2		
#60	95.0		
#100	89.9		
#140	84.6		
#200	82.1		

* (no specification provided)

Soil Description

Light brown, Elastic silt with sand

Atterberg Limits

PL= 38 LL= 58 PI= 20

Coefficients

D_{90}= 0.1510 D_{85}= 0.1097 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= MH AASHTO= A-7-5(20)

Remarks

Source of Sample: B Depth: 5-10
Sample Number: B-13

Date:

Bunnell Lammons Engineering, Inc.

Greenville, SC

Client:
Project: Orchards at Naples Road

Project No: 24544

Figure

Tested By: MW

Checked By: ML

Atterberg Limit (ASTM D4318 / AASHTO T89 & 90)

Report #: 001-L3

Client: Orchards at Naples Road, LLC
Project: Orchards at Naples Road Apartments
Location: 399 Naples Road, Hendersonville, NC 28792

Report Date: 03/28/2025 **Sample Date:** 03/10/2025
Project #: 24-24544

SAMPLE DATA

Sample No: TP-8
Boring No:
Sample Source / Location:TP-8 (10')
Sample Description / Visual Classification:
Intended Use:
Soil Description: Sandy silt

Test Procedure: ASTM D4318
Depth (ft): 10'

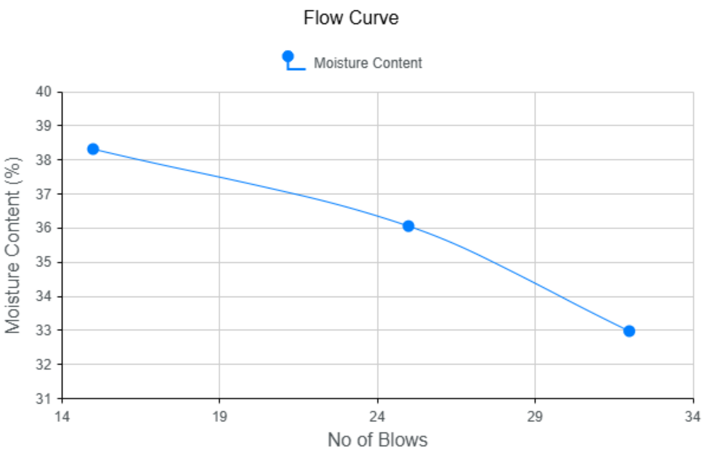
ASTM D4318 / AASHTO T89 & 90

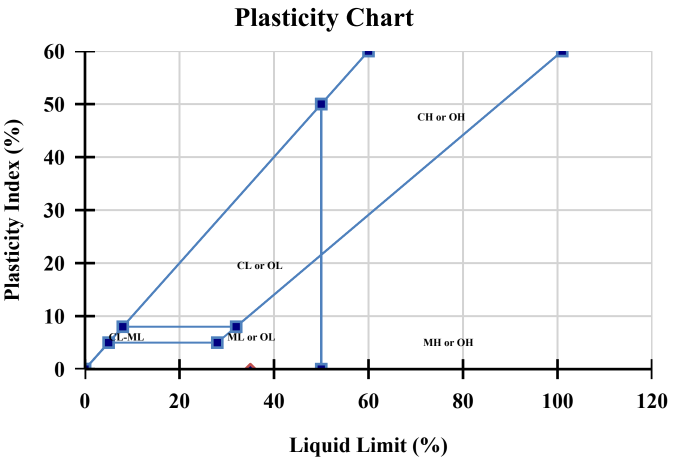
	Liquid Limit (s)			
	Trial 1	**Trial 2**	**Trial 3**	**Trial 4**
Number of Blows	15	25	32	
Tare No.				
Tare Mass (g)	22.8	22.8	22.8	
Tare + Wet Soil (g)	81.3	76.4	70.8	
Tare + Dry Soil (g)	65.1	62.2	58.9	
Mass of Dry Soil (g)	42.30	39.40	36.10	
Mass of Water (g)	16.20	14.20	11.90	
Moisture Content (%)	38.3	36.04	32.96	0

Liquid Limit (LL): 35
Plastic Limit (PL): 35
Plasticity Index (PI):
Non-Plastic: ☐ Yes ☒ No
Retained #40 Sieve (Estimate)(%):

Soil Classification:

USCS (ASTM D2487) : ML AASHTO: A-4 (-5)





Report Copied to: Colm ODoherty

Atterberg Limit (ASTM D4318 / AASHTO T89 & 90)

Report #: 002-L3

Client: Orchards at Naples Road, LLC
Project: Orchards at Naples Road Apartments
Location: 399 Naples Road, Hendersonville, NC 28792

Report Date: 03/28/2025 **Sample Date:** 03/10/2025
Project #: 24-24544

SAMPLE DATA

Sample No: TP-9
Boring No:
Sample Source / Location:TP-9 (10')
Sample Description / Visual Classification:
Intended Use:
Soil Description:

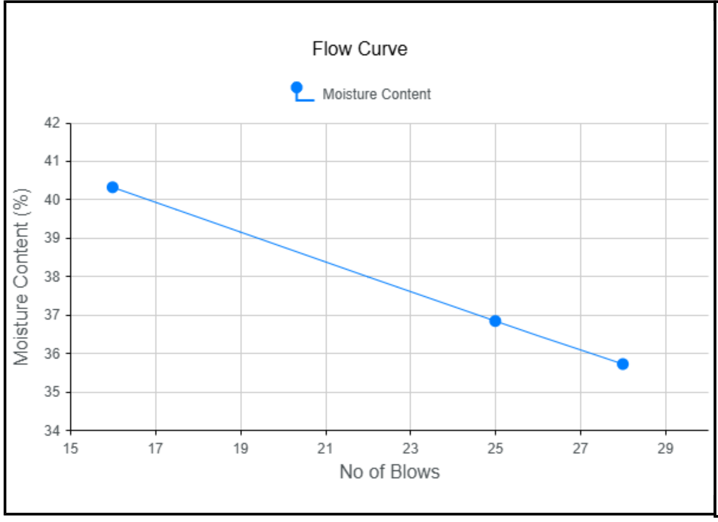
Test Procedure: ASTM D4318
Depth (ft): 10'

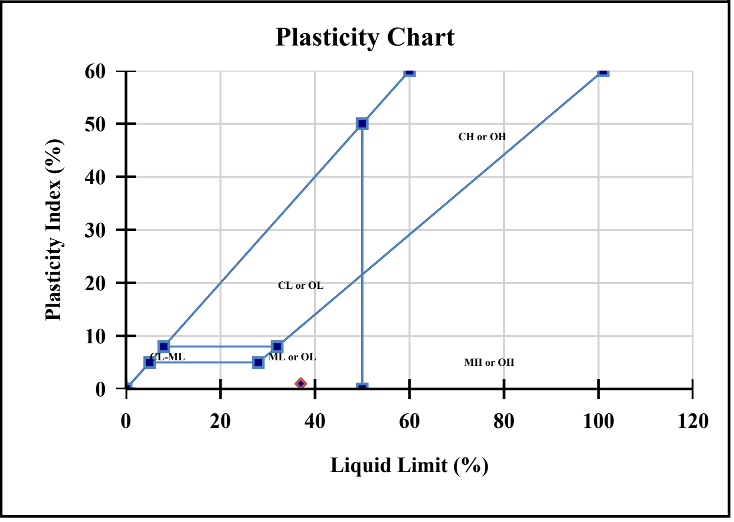
ASTM D4318 / AASHTO T89 & 90

	Liquid Limit (s)			
	Trial 1	**Trial 2**	**Trial 3**	**Trial 4**
Number of Blows	16	25	28	
Tare No.				
Tare Mass (g)	22.8	22.8	22.8	
Tare + Wet Soil (g)	77.1	78.9	79.8	
Tare + Dry Soil (g)	61.5	63.8	64.8	
Mass of Dry Soil (g)	38.70	41.00	42.00	
Mass of Water (g)	15.60	15.10	15.00	
Moisture Content (%)	40.31	36.83	35.71	0

Liquid Limit (LL): 37
Plastic Limit (PL): 36
Plasticity Index (PI): 1
Non-Plastic: ☐ Yes ☒ No
Retained #40 Sieve (Estimate)(%):

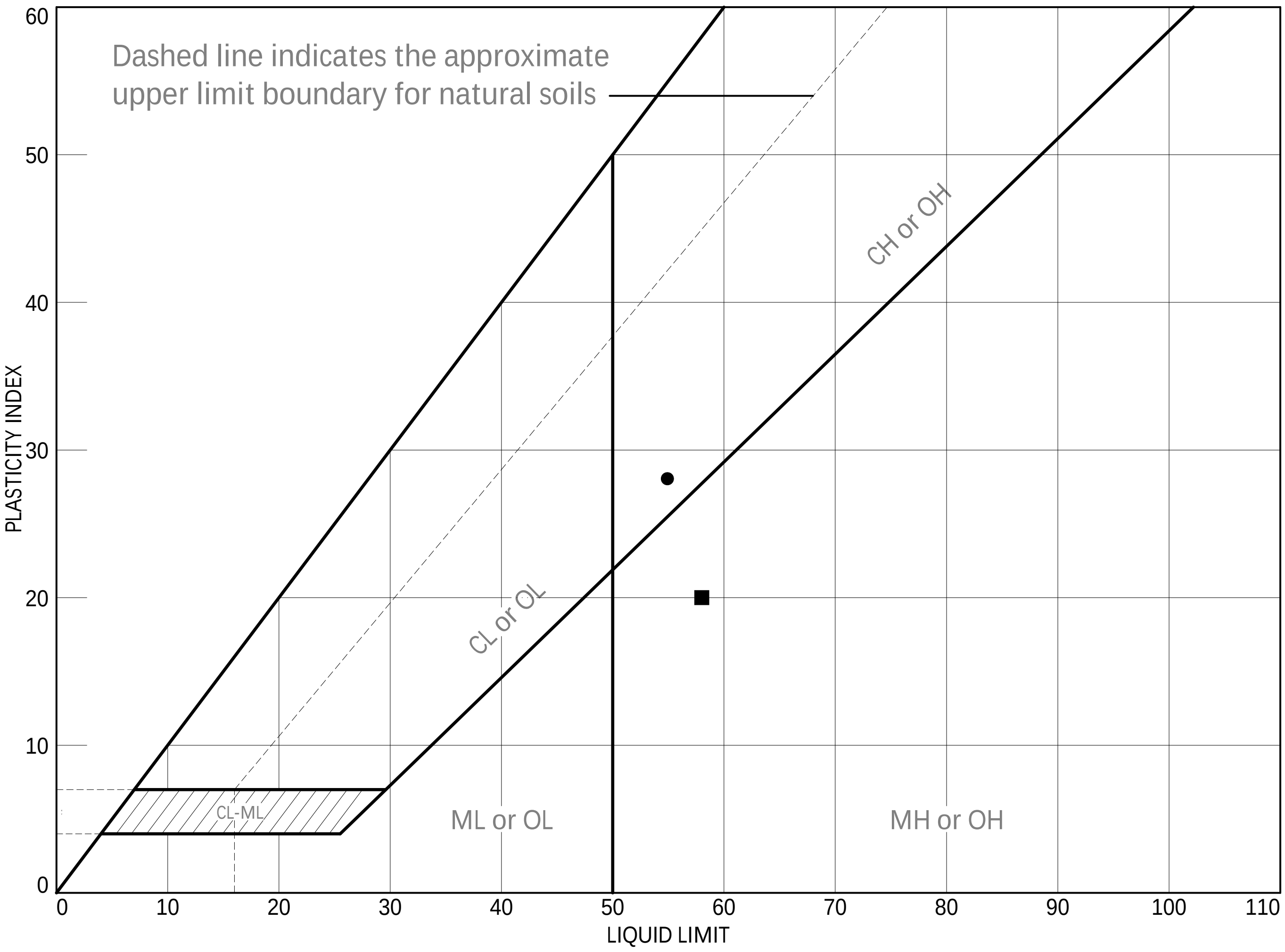
Soil Classification:





Report Copied to: Colm ODoherty

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B	B-10	5-10	26.9	27	55	28	CH
■	B	B-13	5-10	36.2	38	58	20	MH

Bunnell Lammons Engineering, Inc.

Greenville, SC

Client:
Project: Orchards at Naples Road

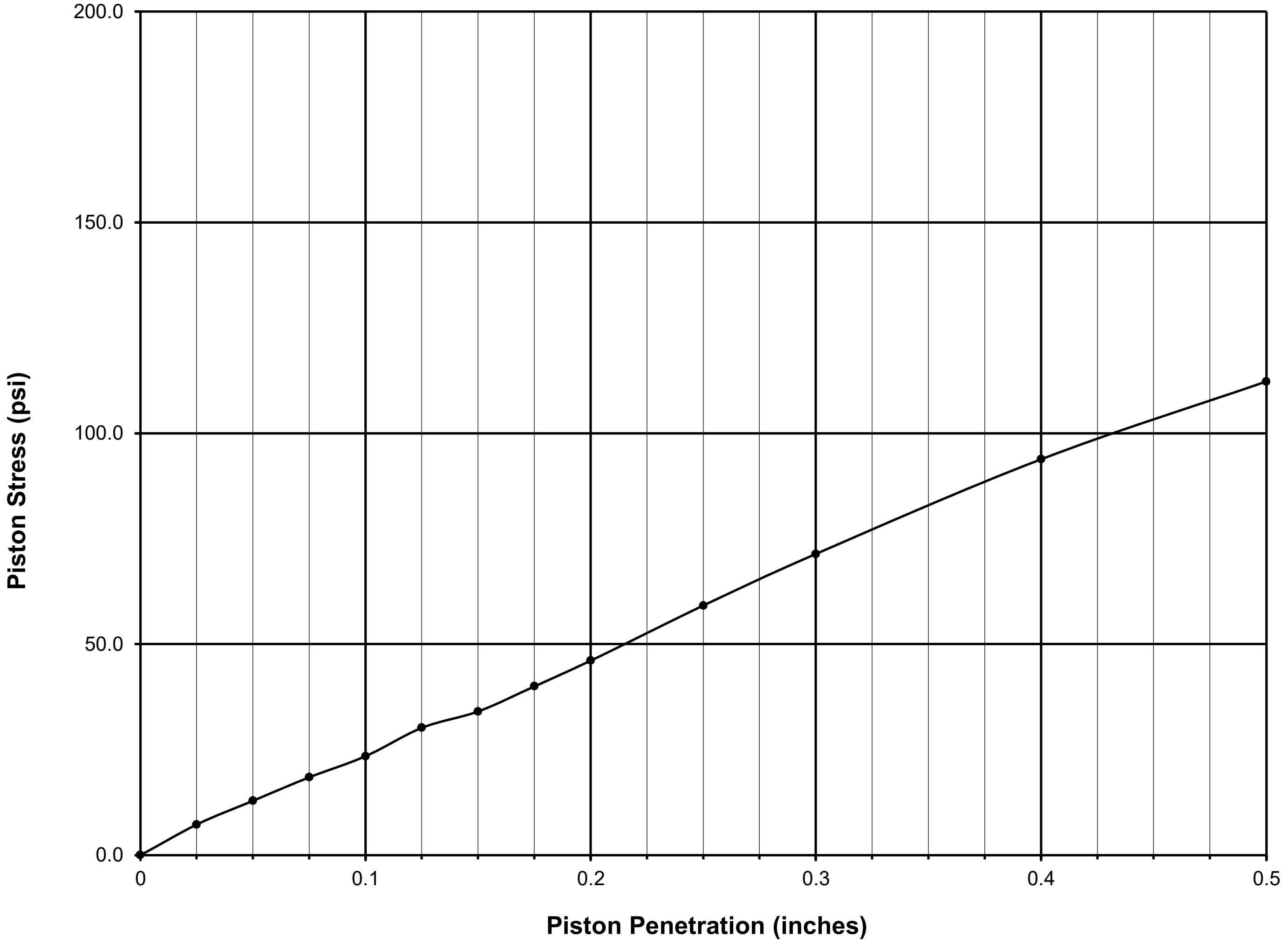
Project No.: 24544 Figure

Tested By: JM Checked By: ML

CALIFORNIA BEARING RATIO TEST REPORT
(ASTM D-1883)

Project Name: Orchards at Naples Road
Project No: 24544
Tested By: Matthew Firman-Watkins
Reviewed By: Matthew Lewis
Date Tested: 2/17/2025

Sample ID: B-10
Depth/Elevation: 10-May
Sample Type: Remolded
Soaked or Unsoaked: Soaked
Compaction Method: ASTM D698



Proctor Values		Surcharge	Corrected CBR		Soil Index Properties				
Max DD. (pcf)	Opt. MC (%)	(lbs)	0.1 inch	0.2 inch	LL	PL	PI	% Fines	USCS
100.7	22.0	10	2.3	3.1	55	27	28	79.8	CH

	Initial Properties (Before Soaking)	Soaked Properties
Compaction (%):	95	
Dry Density (pcf):	95.7	
Water Content (%):	25	25.3
Swell (%):		0.0

CALIFORNIA BEARING RATIO TEST REPORT

(ASTM D-1883)

Project Name: Orchards at Naples Road

Project No: 24544

Tested By: Matthew Firman-Watkins

Reviewed By: Matthew Lewis

Date Tested: 2/17/2025

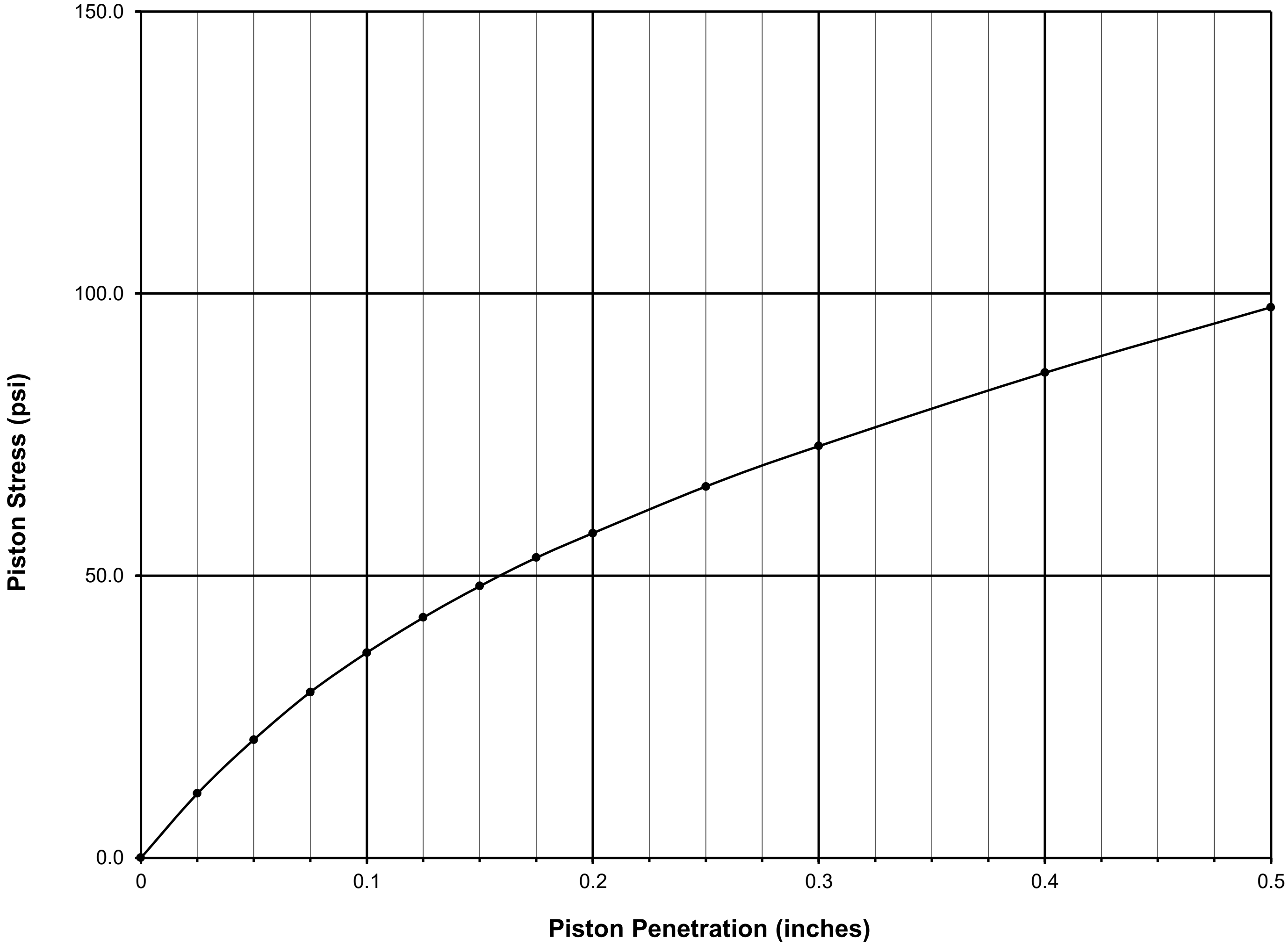
Sample ID: B-13

Depth/Elevation: 10-May

Sample Type: Remolded

Soaked or Unsoaked: Soaked

Compaction Method: ASTM D698



Proctor Values		Surcharge	Corrected CBR		Soil Index Properties				
Max DD. (pcf)	Opt. MC (%)	(lbs)	0.1 inch	0.2 inch	LL	PL	PI	% Fines	USCS
90.6	26.7	10	3.6	3.8	58	38	20	82.1	MH

	Initial Properties (Before Soaking)	Soaked Properties
Compaction (%):	95	
Dry Density (pcf):	86.1	
Water Content (%):	29.7	33.5
Swell (%):		0.0

APPENDIX G
Important Information about
This Geotechnical Engineering Report

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.

Bunnell-Lammons Engineering, Inc. (BLE) has prepared this advisory to help you 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 their development, which 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, reach to your BLE contact.

Understand the Geotechnical-Engineering Services Provided for this Report

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

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

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

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

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

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

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

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

Read this Report in Full

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

You Need to Inform Your Geotechnical Engineer About Change

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

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

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

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

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment 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 judgment 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, b*ut 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***.