August 29, 2018

Office of the County Manager
215 N. Main Street
Waynesville, NC 28786

Attention: Mr. David B. Francis
Program Administrator

Subject: BORROW MATERIAL EVALUATION
Dennis Farm Road Property – Site A
Jonathan Creek Soil Reclamation Project
Waynesville, North Carolina
BLE Project No. J18-12047-01

Dear Mr. Francis:

Bunnell-Lammons Engineering, Inc. (BLE) is pleased to present this report for borrow material evaluation for the Jonathan Creek project. This report has been performed in general accordance with BLE Proposal No. P17-1060 dated April 30, 2018 and change order #2 dated April 30, 2018 and approved on July 20, 2018 by Mr. James W. Kirkpatrick, III. The purpose of this report was to provide information on the soil conditions at Site A that could be used as potential borrow material. Project information was provided to us by correspondence with Mr. David Francis with Haywood County and Andy Alexander, P.G., with BLE and a grading exhibit provided by McGill Associates, our previous exploration report dated April 5, 2018 and our site observations.

PROJECT INFORMATION
We understand that Haywood County is considering obtaining off-site fill soils to raise the Jonathan Creek site in Waynesville, North Carolina. The Dennis Farm Road property (Site A) in Waynesville, North Carolina is currently being considered as a source for potential fill materials. The proposed borrow site is a cow pasture across Highway 276 from the Johnathan Creek site and is approximately 4 acres in size. The site generally consists of sloping terrain that consist of grass covered ground with scattered underbrush along the edges of the pasture. BLE initially performed eight test pit excavations at the site along with laboratory testing of the soils potential for re-use as fill material. However, due to the limited reach of the provided track-hoe, the exploration was limited to depths of between 6 and 8 feet. Based on this limited data collected, soil test borings were requested to evaluate the deeper soils within the proposed borrow area.
SURFACE CONDITIONS
Site conditions were observed by Mr. Sam C. Interlicchia during a site reconnaissance on August 7, 2018. The site is currently being used for agricultural purposes and appears to be mostly used as pasture land for cattle. The site is a vacant, cleared, grassy field. The terrain in the vicinity of the borrow site generally slopes downward from the east to the west. There is approximately 70 feet of elevation relief across the property. There are two slight cross ridges and one valley/swale trending down the principal slope direction. The slope varies, having inclination between 3H:1V and 1½ H:1V. No springs or surface water was observed on the site at the time of our visit. However, the ground surface was noted to be soggy under foot traffic, which was most likely caused by recent precipitation.

FIELD EXPLORATION
The site was explored by performing eight (8) soil test borings at the approximate locations shown on the attached Boring Location Plan (reference Figure 1). The soil test borings were performed using a truck-mounted drill rig turning 2-1/4 inch I.D. hollow-stem augers. The soil test borings ranged in depth from 20 feet to 25 feet (boring termination) below the existing ground surface. Soil samples were obtained in accordance with ASTM D 1586 by driving a 1-3/8 inch I.D. split-spoon sampler with a 140-pound safety hammer. The boring locations were established in the field by BLE personnel using point coordinates developed for the provide drawing and a hand-held GPS unit with 3 to 5 meter accuracy. As such, the boring locations referenced in this report and shown on the figures and field records should be considered approximate. The Soil Test Boring Records and a description of our field procedures are attached to this report. Bulk samples were collected at selected depths for laboratory testing. The laboratory results are present in the Appendix.

SUBSURFACE CONDITIONS
The descriptions below provide a general summary of the subsurface conditions encountered. The appended test boring records contain detailed information recorded at each boring location. These represent our interpretation of subsurface conditions 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.

The surface materials on-site generally consist of an approximate 6-inch-thick layer of grass and organic-laden topsoil. Beneath this surface material, the soil test borings encountered residual soils. The residual soils were found to consist of loose to very firm residual soil typical of the Blue Ridge Physiographic Province. The residual soils predominantly consisted of sandy silt and silty sands. Standard penetration resistance (blow counts, N values) ranged from 8 to 31 blows per foot, typically becoming firmer with depth. All eight soil test borings were terminated in residual soil.

Groundwater was not encountered by the borings at the time of drilling or when the borings were backfilled. Because the borings were located in an area being currently used as a pasture, the borings were backfilled shortly after drilling, thus precluding 24-hour groundwater level measurements. Groundwater elevations at the site can be expected to fluctuate several feet with seasonal and rainfall variations and may fluctuate due to construction activity. Normally, the highest ground-water levels occur in late winter and spring and the lowest levels occur in late summer and fall. On completion of drilling and after checking for the presence of water, the boreholes were backfilled with auger cuttings, a hole plug inserted.
LABORATORY RESULTS

Soil samples were obtained from soil test boring B-2, B-4, B-6 and B-8 and were processed for laboratory testing at the BLE laboratory. Samples were collected from auger cuttings brought to the surface by augers. The laboratory testing performed on the selected soil samples is described below, the results of which are summarized in Table 1 below.

- Natural moisture content: 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 and was determined in accordance with ASTM D 2216.
- A moisture-density relationship test (standard Proctor) was performed to determine compaction characteristics, including the maximum dry density and optimum moisture content. The results are presented on the attached Moisture Density Relationship Test report in the Appendix.

The soil samples collected were generally classified as silty sands with low plasticity (SM), and were found to have natural moisture contents slightly above the laboratory determined optimum moisture content (see Table 1 below). 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.

Table 1 - Laboratory Test Results

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Boring No.</th>
<th>Sample Depth (feet)</th>
<th>Natural Moisture (%)</th>
<th>Maximum Dry Density (pcf)</th>
<th>Optimum Moisture Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-1</td>
<td>B-2</td>
<td>10 to 15</td>
<td>18.4</td>
<td>102.1</td>
<td>16.8</td>
</tr>
<tr>
<td>S-2</td>
<td>B-4</td>
<td>10 to 15</td>
<td>19.9</td>
<td>101.2</td>
<td>20.5</td>
</tr>
<tr>
<td>S-3</td>
<td>B-6</td>
<td>5 to 10</td>
<td>21.3</td>
<td>101.5</td>
<td>19.5</td>
</tr>
<tr>
<td>S-4</td>
<td>B-8</td>
<td>1 to 5</td>
<td>21.6</td>
<td>99.8</td>
<td>21.4</td>
</tr>
</tbody>
</table>

PRELIMINARY RECOMMENDATIONS

The primary geotechnical considerations for the proposed project were the suitability of the soils for re-use as fill and the potential to encounter rock during excavation. Based on the boring data, the soils encountered in the soil test borings should be excavatable using conventional earthmoving equipment. It was anticipated that the excavated soil would be used to raise the site grade for another nearby site. Based on the soil test boring data, the borrow soil is suitable for use as structural fill material. The laboratory data indicates that the soils are within plus or minus 3 percent of the optimum moisture content. However, it should be noted that moisture contents on a grading project will be dictated to some degree by the prevailing weather at the time of construction.

Engineered Soil Fill

Based upon our visual examination, limited laboratory testing and experience with similar soil types, the on-site residual soils appear to be generally suitable for use as structural fill. Fill should be spread and compacted in horizontal lifts that are 8 inches or less in thickness. Fill should be uniformly compacted in thin lifts to at least 95 percent of the standard Proctor (ASTM D-698) maximum dry density. In addition, the upper 18 inches of subgrade should be compacted to at least 98 percent of the maximum dry density. As a rule, the moisture content of the fill soils should be maintained within plus or minus 3 percent of the optimum moisture content as determined from the standard compaction test.
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 (MDD) of no less than 90 pounds per cubic foot (pcf). Fill soils should contain no more than 3 percent organic matter by weight.

LIMITATIONS
Our evaluation of borrow material 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 evaluation have been based on interpolation of the subsurface data between the widely spaced soil test borings. Subsurface conditions between the borings may differ. If the project information is incorrect or the borrow location has changed, please contact us so that our recommendations can be reviewed. The discovery of any site or subsurface conditions during excavation which deviate from the data obtained in this exploration should be reported to us for our evaluation. All excavations should be in accordance with OSHA regulations. The assessment of site environmental conditions for presence of pollutants in the soil, rock and ground water of the site was beyond the scope of this exploration.

CLOSING
We appreciate the opportunity to provide our professional services on this project. We look forward to providing additional services as the project progresses. If you have any questions regarding this report, please do not hesitate to call us.

Sincerely,
BUNNELL-LAMMONS ENGINEERING, INC.
Firm Registration No. C-1538

Sam C. Interlicchia
Project Manager

Jesse R. Jacobson, P.E.
Asheville Branch Manager
NC Registration No. 030948

APPENDIX:
Boring Location Plan
Soil Test Boring Records
Moisture Density Relationship Test Reports
Field Exploration Procedures
Key To Soil Symbols and Classification
**SOIL BORING NO. B-1**

**PROJECT:** Dennis Hall Property

**CLIENT:** Haywood County

**LOCATION:** Waynesville, NC

**DRILLER:** METRO DRILL, INC., Tim & Ryan

**DRILLING METHOD:** CME-45, 2 1/2" Hollow Stem Auger

**DEPTH TO WATER**

<table>
<thead>
<tr>
<th>ELEVATION/DEPTH (FT)</th>
<th>SOIL DESCRIPTION</th>
<th>SOIL TYPE</th>
<th>STANDARD PENETRATION RESULTS BLOWS/FOOT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Firm, light red, slightly micaceous, silty fine to medium SAND (SM) - (residuum)</td>
<td></td>
<td>2 5 10 20 30 40 50 70 90</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Firm to very firm, light red to dark red, micaceous to very micaceous, silty fine to medium SAND (SM)</td>
<td></td>
<td>2 5 10 20 30 40 50 70 90</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Boring terminated at 25 feet. No groundwater encountered at time of boring.</td>
<td></td>
<td>2 5 10 20 30 40 50 70 90</td>
</tr>
</tbody>
</table>

**PROJECT NO.:** J18-12047-01

**START:** 06/08/18 **END:** 06/08/18

**ELEVATION:**

**LOGGED BY:** S. Interlicchia

**AFTER 24 HOURS:**

**CAVING:**
**SOIL BORING NO. B-2**

**PROJECT:** Dennis Hall Property  
**CLIENT:** Haywood County  
**LOCATION:** Waynesville, NC  
**DRILLER:** METRO DRILL, INC., Tim & Ryan  
**DRILLING METHOD:** CME-45, 2 1/2" Hollow Stem Auger  
**DEPTH TO WATER:** INITIAL:  
AFTER 24 HOURS:  
**CAVING:**

<table>
<thead>
<tr>
<th>ELEVATION/DEPTH (FT)</th>
<th>SOIL DESCRIPTION</th>
<th>SOIL TYPE</th>
<th>STANDARD PENETRATION RESULTS BLOWS/FOOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Firm to very firm, light reddish brown, slightly micaceous, silty fine to medium SAND (SM) - (residuum)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Dense and very firm, dark purplish red, micaceous, silty fine to medium SAND (SM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 20                   | Boring terminated at 20 feet.  
No groundwater encountered at time of boring. |           |  |

**PROJECT NO.:** J18-12047-01  
**START:** 08/08/18  
**END:** 08/08/18  
**LOGGED BY:** S. Interlilchichi
SOIL BORING NO. B-3

PROJECT: Dennis Hall Property
CLIENT: Haywood County
LOCATION: Waynesville, NC
DRILLER: METRO DRILL, INC., Tim & Ryan
DRILLING METHOD: CME-45, 2 1/2" Hollow Stem Auger
DEPTH TO - WATER> INITIAL: ¥ AFTER 24 HOURS: ¥ CAVING>

ELEVATION/DEPTH (FT)

<table>
<thead>
<tr>
<th>Elevation/Depth (FT)</th>
<th>Soil Description</th>
<th>Soil Type</th>
<th>Standard Penetration Results Blisters/Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2 5 10 20 30 40 50 70 90</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Loose to firm, reddish brown, slightly micaceous, silty fine to medium SAND (SM) - (residuum)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Very firm, light tan, very micaceous, silty fine to medium SAND (SM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Boring terminated at 25 feet. No groundwater encountered at time of boring.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
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</tr>
</tbody>
</table>

SOIL BORING NO. B-3
Sheet 1 of 1
SOIL BORING NO. B-4

PROJECT: Dennis Hall Property
CLIENT: Haywood County
LOCATION: Waynesville, NC
DRILLER: METRO DRILL, INC., Tim & Ryan
DRILLING METHOD: CME-45, 2 1/2” Hollow Stem Auger
DEPTH TO - WATER: INITIAL: Y AFTER 24 HOURS: Y CAVING: XXXX

<table>
<thead>
<tr>
<th>ELEVATION/DEPTH (FT)</th>
<th>SOIL DESCRIPTION</th>
<th>SOIL TYPE</th>
<th>STANDARD PENETRATION RESULTS BLOWS/FOOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Firm, reddish brown, slightly micaceous to micaceous, silty fine to medium SAND (SM) (residuum)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Firm to very firm, light reddish brown, very micaceous, silty fine to medium SAND (SM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Boring terminated at 25 feet. No groundwater encountered at time of boring.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SOIL BORING NO. B-5

PROJECT: Dennis Hall Property
CLIENT: Haywood County
LOCATION: Waynesville, NC
DRILLER: METRO DRILL, INC., Tim & Ryan
DRILLING METHOD: CME-45, 2 1/2" Hollow Stem Auger
DEPTH TO WATER: INITIAL: After 24 Hours: Caving:

<table>
<thead>
<tr>
<th>ELEVATION/DEPTH (FT)</th>
<th>SOIL DESCRIPTION</th>
<th>SOIL TYPE</th>
<th>SAMPLES</th>
<th>STANDARD PENETRATION RESULTS BLOWS/FOOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Loose to very firm, reddish brown to dark red, micaceous to very micaceous, silty fine to medium SAND (SM) - (residuum)</td>
<td></td>
<td></td>
<td>2 5 10 20 30 40 50 70 90</td>
</tr>
<tr>
<td>-5</td>
<td></td>
<td>5 6 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-10</td>
<td></td>
<td>7 7 9</td>
<td></td>
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</tr>
<tr>
<td>-15</td>
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<td>8 9 11</td>
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</tr>
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<tr>
<td>-35</td>
<td></td>
<td>11 13 15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Boring terminated at 25 feet. No groundwater encountered at time of boring.
SOIL BORING NO. B-6

PROJECT: Dennis Hall Property
CLIENT: Haywood County
LOCATION: Waynesville, NC
DRILLER: METRO DRILL, INC., Tim & Ryan
DRILLING METHOD: CME-45, 2 1/2" Hollow Stem Auger
DEPTH TO WATER: INITIAL: \(\n\)
AFTER 24 HOURS: \(\n\)
CAVING: \(\n\)

<table>
<thead>
<tr>
<th>ELEVATION/DEPTH (FT)</th>
<th>SOIL DESCRIPTION</th>
<th>SOIL TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Firm, light reddish brown, slightly micaceous to micaceous, silty fine to medium SAND (SM) - (residuum)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Very firm, dark red, very micaceous, silty fine to medium SAND (SM)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Boring terminated at 25 feet. No groundwater encountered at time of boring.</td>
<td></td>
</tr>
</tbody>
</table>

STANDARD PENETRATION RESULTS

<table>
<thead>
<tr>
<th>SAMPLES</th>
<th>2</th>
<th>5</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>50</th>
<th>70</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 7 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 5 6</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td>6 6 7</td>
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<td>6 7 9</td>
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<td>7 9 9</td>
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<td>10 12 15</td>
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<td></td>
</tr>
</tbody>
</table>

SOIL BORING NO. B-6
Sheet 1 of 1
SOIL BORING NO. B-7

PROJECT: Dennis Hall Property
CLIENT: Haywood County
LOCATION: Waynesville, NC
DRILLER: METRO DRILL, INC., Tim & Ryan
DRILLING METHOD: CME-45, 2 1/2" Hollow Stem Auger
DEPTH TO WATER INITIAL: " " AFTER 24 HOURS: " " CAVING:

<table>
<thead>
<tr>
<th>ELEVATION/DEPTH (FT)</th>
<th>SOIL DESCRIPTION</th>
<th>SOIL TYPE</th>
<th>STANDARD PENETRATION RESULTS BLOWS/FOOT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Loose, brown, slightly clayey, silty fine to medium SAND (SM) - (residuum)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-5</td>
<td>Firm to very firm, reddish brown, very micaceous, silty fine to medium SAND (SM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boring terminated at 25 feet. No groundwater encountered at time of boring.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELEVATION/DEPTH (FT)</td>
<td>SOIL DESCRIPTION</td>
<td>SOIL TYPE</td>
<td>STANDARD PENETRATION RESULTS BLOWS/FOOT</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-----------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Firm, tan, brown, slightly micaceous, silty fine to medium SAND (SM) - (residuum)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Firm to very firm, reddish brown, very micaceous, silty fine to medium SAND (SM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>20</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
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</tr>
</tbody>
</table>

Boring terminated at 25 feet.
No groundwater encountered at time of boring.
MOISTURE DENSITY RELATIONSHIP TEST REPORT

Test specification: ASTM D 698-00a Method A Standard

<table>
<thead>
<tr>
<th>Elev/Depth</th>
<th>Classification</th>
<th>Nat. Moist.</th>
<th>Sp.G.</th>
<th>LL</th>
<th>PI</th>
<th>% &gt; #4</th>
<th>% &lt; No.200</th>
</tr>
</thead>
<tbody>
<tr>
<td>10' - 15'</td>
<td>SM</td>
<td>18.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test Results:

Maximum dry density = 102.1pcf

Optimum moisture = 16.8 %

Project No: J17-12047-01  Client: Haywood County
Project: Dennis Hall Property  Date: 08/17/18

Remarks:
Boring B-2

Source of Sample: On Site  Sample Number: S-1

BUNNELL-LAMMONS ENGINEERING, INC.

Asheville, North Carolina

Tested By: AD  Checked By: PY
MOISTURE DENSITY RELATIONSHIP TEST REPORT

Test specification: ASTM D 698-00a Method A Standard

<table>
<thead>
<tr>
<th>Elev/Depth</th>
<th>Classification</th>
<th>Nat. Moist.</th>
<th>Sp.G.</th>
<th>LL</th>
<th>PI</th>
<th>% &gt; #4</th>
<th>% &lt; No.200</th>
</tr>
</thead>
<tbody>
<tr>
<td>10' - 15'</td>
<td>SM</td>
<td>19.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TEST RESULTS**

Maximum dry density = 101.2 pcf

Optimum moisture = 20.5 %

**MATERIAL DESCRIPTION**

Reddish brown, silty fine to medium SAND (SM)

**Remarks:**

Boring B-4

**Source of Sample:** On Site

Sample Number: S-2

BUNNELL-LAMMONS ENGINEERING, INC.

Asheville, North Carolina

Tested By: AD

Checked By: PY
MOISTURE DENSITY RELATIONSHIP TEST REPORT

Test specification: ASTM D 698-00a Method A Standard

<table>
<thead>
<tr>
<th>Elev/Depth</th>
<th>Classification</th>
<th>Nat. Moist.</th>
<th>Sp.G.</th>
<th>LL</th>
<th>PI</th>
<th>% &gt; #4</th>
<th>% &lt; No.200</th>
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</thead>
<tbody>
<tr>
<td>15'-10'</td>
<td>USCS SM</td>
<td>21.3</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

TEST RESULTS

Maximum dry density = 101.5 pcf
Optimum moisture = 19.5 %

Project No. J17-12047-01  Client: Haywood County
Project: Dennis Hall Property

Date: 8/17/18
Remarks: Boring B-6

Source of Sample: On Site  Sample Number: S-3

BUNNELL-LAMMONS ENGINEERING, INC.
Asheville, North Carolina

Tested By: AD  Checked By: PY
### MOISTURE DENSITY RELATIONSHIP TEST REPORT

![Graph showing the relationship between water content and dry density.](image)

**Test specification:** ASTM D 698-00a Method A Standard

<table>
<thead>
<tr>
<th>Elev/Depth</th>
<th>Classification</th>
<th>Nat. Moist.</th>
<th>Sp.G.</th>
<th>LL</th>
<th>PI</th>
<th>% &gt; #4</th>
<th>% &lt; No.200</th>
</tr>
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<tr>
<td>1' - 5'</td>
<td>SM</td>
<td>21.6</td>
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</tbody>
</table>

#### TEST RESULTS

- **Maximum dry density:** 99.8 pcf
- **Optimum moisture:** 21.4%

#### MATERIAL DESCRIPTION

- **Description:** Tan brown, silty fine to medium SAND (SM)

#### Project Details

- **Project No.:** J17-12047-01
- **Client:** Haywood County
- **Project:** Dennis Hall Property
- **Date:** 8/17/18

#### Source and Sample Information

- **Source of Sample:** On Site
- **Sample Number:** S-4

#### BUNNELL-LAMMONS ENGINEERING, INC.

- **Location:** Asheville, North Carolina

**Tested By:** AD  
**Checked By:** PY
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 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, once 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 and visually classified. Soil Test Boring Records are attached showing the soil descriptions and penetration resistance.
KEY TO SOIL CLASSIFICATIONS AND CONSISTENCY DESCRIPTIONS
BUNNELL-LAMMONS ENGINEERING, INC.
ASHEVILLE, NORTH CAROLINA

Penetration Resistance* Blows per Foot
SANDS

0 to 4
5 to 10
11 to 20
21 to 30
data-nudge

over 50

Very Loose
Loose
Firm
Very Firm
Dense
Very Dense

Penetration Resistance* Consistency Blows per Foot
SILTS and CLAYS

0 to 2
3 to 4
5 to 8
9 to 15
16 to 30
31 to 50
over 50

Very Soft
Soft
Firm
Stiff
Very Stiff
Hard
Very Hard

*ASTM D 1586

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

12
15
16
Number of blows in first 6-inches
Number of blows in second 6-inches
Number of blows in third 6-inches

KEY TO DRILLING SYMBOLS

Grab Sample
Split Spoon Sample
Undisturbed Sample

Groundwater Table at Time of Drilling

Groundwater Table 24 Hours after Completion of Drilling

KEY TO SOIL CLASSIFICATIONS

Well-graded Gravel GW
Low Plasticity Clay CL
Clayey Silt MH
Silty Sand SM

Poorly-graded Gravel GP
Sandy Clay CLS
Sandy Silt MLS

Partially Weathered Rock BLDRCBBL
Silty Clay CL-ML
Sand SW
Bedrock BEDROCK

High Plasticity Clay CH
Silt ML
Clayey Sand SC
Concrete A5