BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL, ENVIRONMENTAL AND CONSTRUCTION MATERIALS CONSULTANTS

June 25, 2013

Mr. William G. Lapsley, P.E.
William G. Lapsley & Associates, PA
214 North King Street
Hendersonville, North Carolina 28792

Subject: **SUBSURFACE EXPLORATION REPORT**
Sig. Inv. Nos.: 14-1271 and 13-0820
NC 280 (Boyltson Highway) at SR 2277 (Old Fanning Bridge Road)
Henderson/Buncombe County, North Carolina
BLE Project No.: J13-8616-01

Dear Mr. Lapsley:

Bunnell-Lammons Engineering, Inc. (BLE) is pleased to provide this letter concerning the exploratory soil test borings performed for the above referenced project. Project information was obtained from a review of the provided Transmittal of Acceptable Traffic Signal Plan dated April 1, 2013 prepared by Zachary M. Little, P.E. with the Western Region Signals Project Engineer. This letter describes the work performed and presents the results obtained from our exploration.

Project Information

A new signalized intersection is being developed for the intersection of Boylston Highway and Old Fanning Bridge Road. Part of the signalization effort will be the construction of two new mast arm poles to support the street sign and the signals. Metal Pole #1 will be located in the northeast quadrant of the intersection, Metal Pole #2 in the southeast quadrant. Drilled piers will be used to support the poles. At the time of this exploration, loading information had not been made available, nor had the Case Number.

Exploration Program

The exploration consisted of performing two soil test borings to a depth of 27 ½ feet below existing grade at the requested pole locations (Figure 1). The soil test borings were performed using a truck mounted drill rig turning 2-1/4 inch I.D. hollow-stem augers. Soil samples were obtained in general accordance with ASTM D 1586 by driving a 1-3/8 inch I.D. split-spoon sampler with a 140-pound safety hammer. Standard penetration testing (SPT) was performed at depth of 1, 2.5, 5, 7.5, 10, 15, 20 and 26 feet as required by the Project Special Provisions (version 12.1) dated March 27, 2013. The boring locations were established by a professional land surveyor hired by others. The boring locations referenced in this report and shown on the attached figure should be considered approximate. The Soil Test Boring Records and a description of our field procedures are attached.

Subsurface Conditions

The borings encountered fill, residual soil, alluvial soil and partially weathered rock in order of increasing depth. The appended test boring records presented in the Appendix contain detailed information recorded at each boring location. The boring 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.

130 OVAL ROAD, SUITE 200
ARDEN, NORTH CAROLINA 28704
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Beneath a 3 inch thick layer of topsoil, fill soils comprised of very loose and very firm silty sand were encountered at both boring locations to depths of 5 and 7½ feet below the existing ground surface. A 7½-foot thick layer of alluvial soil (water deposited) was encountered directly below the fill material at boring location P-1. The alluvial soil consists of firm micaceous fine sand. Below the alluvial soil and fill soil in boring P-2, residual soils were encountered. The residual soil consisted of very loose and dense silty sand which typical became firmer with depth. Partially weathered rock (residual material that is transitional between soil and rock with standard penetration resistance of 100 blows per foot or more) was encountered underlying the residual soil in soil test borings P-1 at a depth of 26.5 feet below the ground surface. The PWR sampled as silty fine to medium sand. Both soil test borings were advanced to their assigned termination depths.

Ground water was encountered by both soil test borings at the time of drilling at a depth of 10 feet below the existing ground surface at the time of drilling. Because the borings were located in an area accessible by the public, the borings were backfilled shortly after drilling, thus precluding 24-hour ground water level measurements. We expect groundwater levels will fluctuate with seasonal and rainfall variations. Normally, the highest ground-water levels occur in late winter and spring and the lowest levels occur in late summer and fall.

Findings

Listed below is the Design N-value calculated from the soil test borings for use in the foundation design. The calculations were performed in accordance with the Project Special Provisions (Version 12.1) dated March 27, 2013 section 1.4.B titled "Soil Test and Foundation Determination". We understand a site specific foundation will be determined by the pole manufacturer based on these values.

- Pole No. 1 (Sig. No. 14-1271) **Design N-value 7**
- Pole No. 2 (Sig. No. 13-0820) **Design N-value 14**

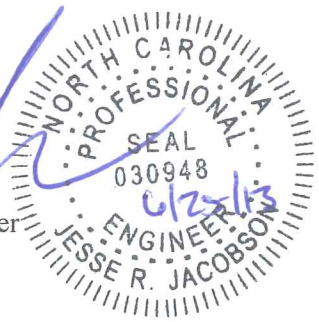
Closure

Thank you for the opportunity to provide our services during this phase of your project. Please contact us when we can be of further service or if you have any questions concerning this letter.

Sincerely,
BUNNELL-LAMMONS ENGINEERING, INC.

Sam C. Interlicchia
Project Manager

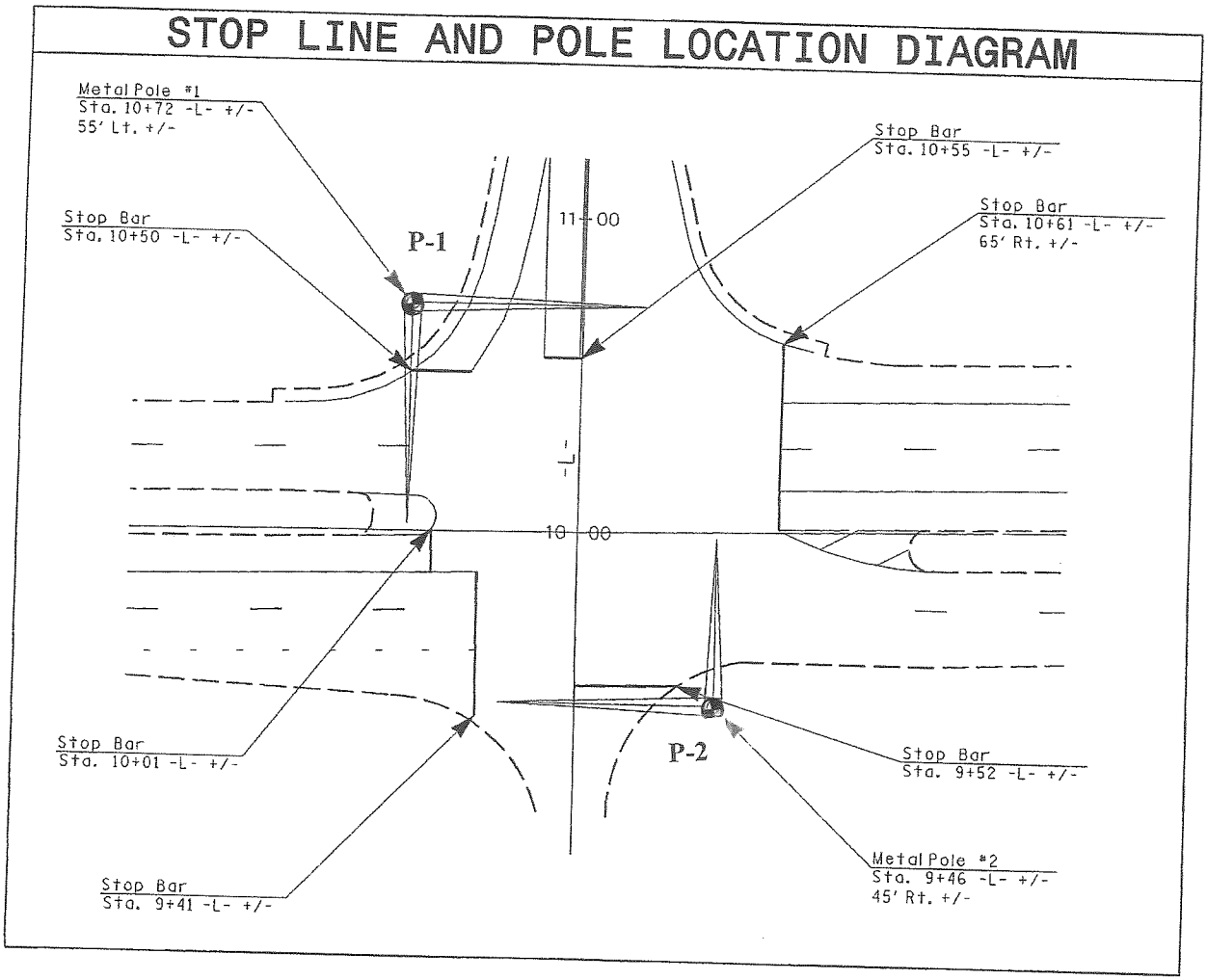
Jesse R. Jacobson, P.E.
Asheville Branch Manager
Registered, NC 30948



Attachments:

Boring Location Plan
Soil Test Boring Records
Key to Soil Symbols and Classifications
Field Exploration Procedures

STOP LINE AND POLE LOCATION DIAGRAM



LEGEND

⊕ APPROXIMATE LOCATION OF SOIL TEST BORING

DRAWING NOT TO SCALE

REFERENCE: Ramey Kemp Associates, Inc. March 2013

DRAWN: SCI	DATE: June 2013	BLE INC. BUNNELL-LAMMONS ENGINEERING, INC. 130 OVAL ROAD, SUITE 200 ARDEN, NORTH CAROLINA 28704 PHONE: (828)277-0100 FAX: (828)277-0110	SOIL TEST BORING LOCATION PLAN SIG. INV. NOS.: 14-1271 & 13-0820 NC 280 at SR 2277 HENDERSON/BUNCOMBE COUNTIES, NC
CHECKED: JRJ	CAD: TLP SN-BLP		FIGURE 1
APPROVED:	JOB NO: J13-7972-01		

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SOIL BORING NO. P-1 Pole #1 (Sig. No 14-1271)

PROJECT: Traffic Signal Poles — PROJECT NO.: 7972-01
CLIENT: William G. Lapsley and Associates, PA — START: 06/12/13 END: 06/12/13
LOCATION: Mills River, North Carolina — ELEVATION:
DRILLER: Metro Drill, Inc., Reid — LOGGED BY: S. Interlicchia
DRILLING METHOD: CME 45; 2 1/4" Hollow Stem Auger
DEPTH TO - WATER> INITIAL: ▽ 10 AFTER 24 HOURS: ▼ CAVING>

ELEVATION/ DEPTH (FT)	SOIL DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)
	3 inches of TOPSOIL/rootmat			
	Loose and very loose, brown and tan, silty, fine to medium SAND (SM) - (fill)		3 4 5	9
			3 5 4	9
5	Firm, dark brownish gray, very silty, fine to medium SAND (SM)		2 1 1	2
	Firm, wet, gray, micaceous, fine SAND (SM) - (alluvium)		5 5 6	11
10 ▽			5 5 6	11
15	Loose to dense, greenish brown, slightly micaceous to micaceous, very silty to silty, fine to medium SAND (SM) - (residuum)		4 4 5	9
20			10 15 17	32
25			30 50/5.5	50/5.5
	Partially weathered rock which sampled as light brown, very micaceous, silty, fine to medium SAND (SM)			
	Boring terminated at 27.5 feet. Groundwater encountered at 10 feet at time of drilling.			

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GEOT_NOWELL 7972-01.GPJ 6/25/13

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SOIL BORING NO. P-2 Pole #2 (Sig No. 13-0820)

PROJECT: Traffic Signal Poles — PROJECT NO.: 7972-01
CLIENT: William G. Lapsley and Associates, PA — START: 06/12/13 END: 06/12/13
LOCATION: Mills River, North Carolina — ELEVATION:
DRILLER: Metro Drill, Inc., Reid — LOGGED BY: S. Interlicchia
DRILLING METHOD: CME 45; 2 1/4" Hollow Stem Auger
DEPTH TO - WATER> INITIAL: 10 AFTER 24 HOURS: CAVING>

ELEVATION/ DEPTH (FT)	SOIL DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)
	3 inches of TOPSOIL/rootmat			
	Very firm, dark brown, slightly micaceous, silty, fine to medium SAND (SM) - (fill)		4 6 14	20
			9 12 13	25
5	Loose, greenish brown, slightly micaceous, very silty, fine to medium SAND (SM) - (residuum)		7 9 15	24
	Very loose, wet light grayish tan, slightly micaceous, very silty, fine to medium SAND (SM)		2 3 3	6
10 ▽			1 1 1	2
15	Dense to firm, dark reddish brown, micaceous, silty, fine to medium SAND (SM)		4 10 14	24
20			10 16 17	33
25			5 7 13	20
	Boring terminated at 27.5 feet. Groundwater encountered at 10 feet at time of drilling.			

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KEY TO SOIL CLASSIFICATIONS AND CONSISTENCY DESCRIPTIONS

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ASHEVILLE, NORTH CAROLINA

Penetration Resistance* Blows per Foot (SANDS)	Relative Density
0 to 4	Very Loose
5 to 10	Loose
11 to 20	Firm
21 to 30	Very Firm
31 to 50	Dense
over 50	Very Dense

Penetration Resistance* Blows per Foot (SILTS and CLAYS)	Consistency
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

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

KEY TO DRILLING SYMBOLS

Grab Sample

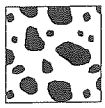
Split Spoon Sample

Undisturbed Sample

Groundwater Table at Time of Drilling

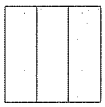
Groundwater Table 24 Hours after Completion of Drilling

KEY TO SOIL CLASSIFICATIONS


Well-graded Gravel
GW

Low Plasticity Clay
CL

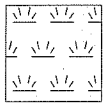
Clayey Silt
MH


Silty Sand
SM

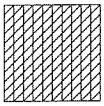
Poorly-graded Gravel
GP

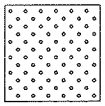
Sandy Clay
CLS

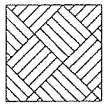
Sandy Silt
MLS


Topsoil
TOPSOIL

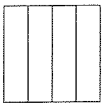
Partially Weathered Rock
BLDRCBBL

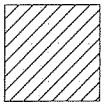

Silty Clay
CL-ML


Sand
SW


Bedrock
BEDROCK

High Plasticity Clay
CH


Silt
ML


Clayey Sand
SC

Concrete
A5

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.