REPORT

Geotechnical Exploration

Morgan Falls Road Improvements
Sandy Springs
Fulton County, Georgia

Project Number
2011.2530.01

October 28, 2011

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Mr. Garrin M. Coleman, P.E., L.S.I.T
Capital Programs Manager, Public Works
City of Sandy Springs
7840 Roswell Road
Building 500
Sandy Spring, Georgia 30350

Via Email: ***gcoleman@sandyspringsga.gov***

RE: Report of Geotechnical Exploration
Proposed Retaining Walls
Morgan Falls Road Improvements
Sandy Springs, Georgia
Project No. **2011.2530.01**

Dear Mr. Coleman:

United Consulting is pleased to submit this report of our geotechnical exploration for the above-referenced project. We appreciate the opportunity to assist you with this project and look forward to working with you on future projects. Please contact us if you have any questions or if we can be of further assistance.

Sincerely,

UNITED CONSULTING

GEORGIA REGISTERED No. 20064 PROFESSIONAL ENGINEER SANTANU SINHAROY

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

SITE AND PROJECT DESCRIPTION 2
PURPOSE 2
SCOPE 3
SUBSURFACE CONDITIONS 3
LABORATORY TEST PROGRAM 4
DISCUSSION AND RECOMMENDATIONS 6
- Retaining Wall System 6
- MSE Wall 7
- MSE Wall Settlement Prediction 8
- Soil Nails with Shotcrete or Gunite Facing 8
- Soil Parameters 9
- Global Stability 9
- Site and Wall Subgrade Preparation 9
- Difficult Excavation 10
- Groundwater 11
- Earthwork 11
- General Slopes Recommendations 12
- Benching 12
- Berm 12
- Caving Considerations 12
- Fill Placement 13

LIMITATIONS 13

APPENDIX A
Figure A – Site Location Plan
Figure 1 – Legend
Figure 2 through 9 – Boring Location Plan and Profile
General Notes/Narrative of Drilling Operations
Boring Logs (26)
Exploration Procedures
Berm Detail

APPENDIX B – Laboratory Test Results
Particle Size Distribution Test Reports (12)
Liquid and Plastic Limits, and Natural Water Content Test Report (2 pages, 12 Tests)
Standard Proctor Test Reports (3)
Tri-axial Shear Test Reports (3)-Undisturbed Samples
Tri-axial Shear Test Reports (3)-Remolded Bulk Samples
Laboratory Testing Procedures

APPENDIX C
Site Photographs (20 Photos)
PWR and Rock Photographs (6 Photos)

EXECUTIVE SUMMARY

United Consulting has completed a Geotechnical Exploration on proposed retaining walls associated with Morgan Falls Road Improvements. The results from this exploration are briefly summarized below. The text of the report should be reviewed for a discussion of these items.

1. A complete geotechnical engineering service is performed through the Observational Method as an indivisible two-phase process. The first phase provides advice about project specific risks and represents our firm's opinion of subsurface conditions with recommendations. Field observation during construction comprises the second phase of our service and provides us the opportunity to assess the reliability of the subsurface data and the appropriateness of our recommendations. Actual conditions often differ from those encountered in the exploration phase.

2. Many of the borings encountered PWR or rock at depths varying from surface to 35 feet. The presence of some exposed rock exist along the cut slope of Morgan Falls Road from Sta. 123+70± to Sta. 123+95± Left, Sta. 125+50± to Sta. 126+50± Left and Sta. 127+00± to Sta. 129+15± Right. Significant ripping and blasting should be expected to achieve the planned grades in this area. Elsewhere some localized difficult excavation conditions associated with PWR or rock should be expected.

3. Based on the laboratory testing program, majority of the soils on the site should generally be suitable for use as Select Engineered Fill in the area of the proposed MSE wall.

4. Provided the site is prepared as recommended, the proposed Wall foundations could be designed for an allowable soil bearing pressure of up to 3,000 psf.

5. Groundwater was not encountered at the time of drilling or after 24-hours. Therefore, we do not anticipate groundwater will significantly impact construction activities at the project site. However, due to presence of shallow PWR and rock, the site may be susceptible to formation of perched water.

SITE AND PROJECT DESCRIPTION

The project is for the roadway improvement associated with Morgan Falls Road. The project is located along the north and south side of Morgan Falls Road beginning at Morgan Falls Park at station 119+54.33 and extends eastward 3,117.51 feet to station 150+71.84, in Sandy Springs, Fulton County, Georgia.

At the time of the subsurface exploration, Morgan Falls Park and its facilities were present north of the west end of Morgan Falls Road. A residential property exists at the southwest corner. The immediate areas to the north of Morgan Falls Road were mostly hilly, wooded with some steep slopes covered with large trees, bushes and tall grass. 'Laurels at Morgan Falls' apartment exists beyond the steep hill along eastern half of the subject section of Morgan Falls Road. An existing MSE wall runs along the boundary of the apartment complex on top of the slope nearly parallel to the road. A golf course and a metal fence were present at south side of existing road from about project midpoint to the end of the project alignment. In addition, three major exposed rock slope faces exist intermittently both to the north and south of the road. It appeared that the rock planes slope towards the road on the north side whereas away from the road to the south side. More specifically, these locations were from Sta. 123+70± to Sta. 123+95± Left, Sta. 125+50± to Sta. 126+50± Left and Sta. 127+00± to Sta. 129+15± Right. Georgia Power easements cross centerline of the existing road at stations 128+56± and 138+38±. Overall topography generally sloped down from north to the south.

The improvements will consist of widening the existing roadway, the addition of curbs and gutters and the addition of a 5-foot wide sidewalk. The typical new roadway section including shoulders will be 44 feet wide, which is about 20 feet wider than the existing roadway section. The finished grade for the new roadway will be same as the existing roadway. The additional widening will occur primarily to the north of the existing roadway, and will primarily be a cut section. To achieve finish grades along the south shoulder, some shallow filling will be required. In order to reduce the disturbance limits of the adjacent properties due to existing steep slopes, fourteen new retaining walls will be required to accommodate the wider section.

The height of the walls will range from approximately 2 to 13 feet. However, several of the walls are tiered along the north side of the road with maximum cuts in the 20 to 30 feet range.

PURPOSE

The purpose of this geotechnical exploration was to assess the general type and condition of the subsurface materials present at the project site and to provide recommendations to guide in site development, wall design, difficult excavation associated with PWR and rock, earthwork and other geotechnical engineering related issues.

SCOPE

The scope of our Geotechnical Exploration has included the following items:

1. A visual reconnaissance of the site from a geotechnical standpoint;

2. Drilling twenty six (26) standard penetration test (SPT) to determine the nature and condition of the subsurface soils;

3. A visual evaluation of soil samples obtained during our field exploration program for further identification and classification;

4. Obtaining five (5) bulk samples and three (3) undisturbed Shelby tube samples for laboratory testing;

5. Analyzing the existing soil conditions with respect to the proposed construction;

6. Performing twelve (12) natural moisture content tests, twelve (12) Atterberg limits tests, twelve (12) particle-size analysis without Hydrometer tests, three (3) standard Proctor tests, three (3) in-situ Triaxial Shear test and three (3) remolded Triaxial Shear tests;

7. Preparing this report to document the results of our field exploration program, subsurface findings, laboratory results, engineering analysis and to provide recommendations for wall construction.

SUBSURFACE CONDITIONS

The site is located in the Piedmont Physiographic Province of Georgia. The virgin, "residual" soils (or residuum) native to this region have been formed by the in-place weathering of the parent crystalline rock. A typical residual soil profile consists of a clayey zone from the ground surface, underlain by sandy silts and silty sands. These silts and sands often exhibit the banded appearance of the parent rock. Seams of partially weathered rock are often encountered with depth until the sound, relatively unaltered parent rock is encountered. Partially weathered rock (PWR) is a term for the residuum that can be penetrated by soil drilling techniques and has standard penetration test resistance values in excess of 100 blows per foot. According to the Geologic Map of Georgia, the site is underlain by Powers Ferry and Factory Shoals Formations. Powers Ferry formation consists of undifferentiated biotite-quartz-plagioclase gneiss, mica schist and amphibolite. Factory Shoal Formation consists of intercalated light-gray, lustrous, garnet-biotite-oligoclase or muscovite-biotite-plagioclase metagraywacke, kyanite-quartz schist, and staurolite-muscovite quartz schist.

Below the initial topsoil/grass layer, borings encountered fill to depth of about 6 feet in borings 121+00, 13’ R and 122+03, 23’ L. The fill soils generally consisted of firm to medium dense sand with some amounts of silt, trace amounts of clay, mica and rock fragments with standard

penetration resistances (N-values) in the fill encountered ranging from 10 to 21 blows per foot (bpf).

Below the existing ground surface, road pavement, fill and occasional lenses of Partially Weathered Rock (PWR), residual soils were encountered in the borings. The residual soils encountered generally consisted of loose to very dense sand with varying amounts of silt and mica, trace amounts of clay and occasional trace amounts of rock fragments. The N-values within the residual soils encountered ranged from 5 to 79 bpf.

Partially weathered rock was encountered in seventeen borings at depths varying from 4 feet to auger refusal depth at 35 feet. Seven of the borings encountered lenses of PWR. Auger refusal occurred in thirteen borings at depths varying from 6 feet to 35 feet.

Groundwater was not encountered at the time of drilling in the borings drilled. Groundwater should be anticipated to fluctuate with the change of season or due to changes in watershed upstream from the site. For a more precise description of the conditions encountered within the borings, please refer to the Boring Logs provided in the Appendix.

LABORATORY TEST PROGRAM

Laboratory testing for this project included natural moisture content tests, in-situ and remolded Triaxial Shear tests, standard Proctor maximum dry density tests, particle-size analyses without Hydrometer tests and Atterberg limits tests. The results of laboratory testing are summarized in the following table. The results of natural moisture content tests from split spoon samples and Shelby tubes are included in the boring logs at the respective sample locations

TABLE 1: SUMMARY OF LABORATORY TEST RESULTS

Boring No.	Sample No.	Depth (feet)	Natural Moist. Content (%)	Atterberg Limits (%)			Particle-Size Analysis (%)			USCS
				LL	PL	PI	Gravel	Sand	Fines Silt & Clay	
126+65, 55' L	UD 1	14-16	8.1	NP	NP	NP	11.8	61.0	27.2	SM
144+00, 35' L	UD 2	11.5-13.5	4.9	NP	NP	NP	13.2	80.6	6.2	SW-SM
148+45, 50' L	UD 3	10-12	7.7	NP	NP	NP	0.4	90.4	9.2	SW-SM
126+64, 55' L	Bulk 1	12-22	5.7	NP	NP	NP	6.6	74.5	18.9	SM
134+37, 32' L	Bulk 5	2-8	9.7	NP	NP	NP	2.7	72.9	24.4	SM
141+88, 35' L	Bulk 4	3-11	6.5	NP	NP	NP	2.6	78.6	18.8	SM
144+00, 35' L	Bulk 2	6-13	5.8	NP	NP	NP	0.2	84.1	15.7	SM
148+45, 50' L 148+15, 45' L	*Bulk 3	6-15 13-20	6.3	NP	NP	NP	2.4	73.0	24.6	SM
123+72, 14' R	JAR 1	6-7.5	9.1	NP	NP	NP	0.0	83.7	16.3	SM
137+13, 12' R	JAR 2	11-12.5	7.2	NP	NP	NP	0.8	90.8	8.4	SW-SM
140+12, 35' L	JAR 3	16-17.5	8.7	NP	NP	NP	13.2	77.6	9.2	SW-SM
145+74, 9' R	JAR 4	8.5-10	6.7	NP	NP	NP	0.3	82.5	17.2	SM

TABLE 2: SUMMARY OF LABORATORY TEST RESULTS (CONT'D)

Boring No.	Sample No.	Depth (feet)	Standard Proctor Compaction		Tri-axial Shear Test (Consolidated Undrained with Pore Water Pressure)			
					Total		Effective	
			Υ_{dry} (pcf)	OMC (%)	c ksf	φ Deg	c' ksf	φ ' Deg
126+65, 55' L	UD 1	14-16	NC	NC	0.187	17.7	0.058	33.2
144+00, 35' L	UD 2	11.5-13.5	NC	NC	0.317	25.5	0.158	34.5
148+45, 50' L	UD 3	10-12	NC	NC	0.149	25.53	0.150	36.63
126+64, 55' L	Bulk 1	12-22	103.4	16.9	1.393	28.95	0.108	35.15
134+37, 32' L	Bulk 5	2-8	NC	NC	NC	NC	NC	NC
141+88, 35' L	Bulk 4	3-11	NC	NC	NC	NC	NC	NC
144+00, 35' L	Bulk 2	6-13	103.0	15.8	0.875	23.55	0	35.39
148+45, 50' L 148+15, 45' L	*Bulk 3	6-15 13-20	106.7	17.1	2.892	23.41	0	35.93
123+72, 14' R	JAR 1	6-7.5	NC	NC	NC	NC	NC	NC
137+13, 12' R	JAR 2	11-12.5	NC	NC	NC	NC	NC	NC
140+12, 35' L	JAR 3	16-17.5	NC	NC	NC	NC	NC	NC
145+74, 9' R	JAR 4	8.5-10	NC	NC	NC	NC	NC	NC

UD = Undisturbed Sample
Bulk = Bulk Sample
*Bulk 3 = Bulk Sample prepared from a mixture of samples from 148+45, 50' L and 148+15, 45'L
JAR = Split Spoon Sample

LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
NP = Non-Plastic
NC = Not Conducted
USCS = Unified Soil Classification System

Υ_{dry} = Maximum Dry Density
OMC = Optimum Moisture Content

φ = Angle of Internal Friction (Total)
c = Cohesion (Total)
φ′ = Angle of Internal Friction (Effective)
c′ = Cohesion (Effective)

DISCUSSION AND RECOMMENDATIONS

The following recommendations are based on our understanding of the proposed construction, the data obtained in our soil test borings, a site reconnaissance, and our experience with subsurface conditions similar to those encountered at the project site.

We also recommend that United Consulting be consulted during construction to conduct Geotechnical Evaluations as described elsewhere in this report. The purpose is to verify the similarity of the actual subsurface conditions versus conditions anticipated by the designers.

Retaining Wall System

Based on our review of the available project information and our conversation with Mr. Chad Epple with Southeastern Engineering, we understand that the types of the proposed earth retaining structures for various wall sections have not been finalized although provided cross-sections indicate primarily gravity wall and single or multi-tiered geogrid reinforced Mechanically Stabilized Earth (MSE) retaining wall. We have discussed with Mr. Epple regarding keeping the wall option open as it could potentially save City of Sandy Springs in both construction cost and schedule including reduced right-of-way limits if subsurface conditions in certain wall sections indicate possibility of a third option as Soil Nail Wall with shotcrete or gunite facing. This will allow the project to be bid as 'Design-Build' and will allow the contractor to propose the low cost alternative. A specification shall need to be prepared to cover design parameters for any wall options. We subsequently understood that the City would like to pursue the 'Design-Build' approach. Based on the subsurface data, our engineering judgment and our experience, we have summarized various wall system options along each wall in the following table below:

TABLE 3: ALTERNATE WALL SYSTEM

Wall No.	Station to Station	Type of Construction			
		Gravity Wall	MSE	Soil Nail	Slope (H:V)
1	120+05.46 to 126+57.31 (Right)	Y	Y	-	-
2	121+36.56 to 122+02.77 (Left)	Y	Y	-	-
3	122+09.81 to 122+40.81 (Left)	Y	Y	-	-
4	122+53.10 to 123+70± (Left)	-	Y	Y	2 : 1(1)
	123+70± to 123+95± (Left)	-	Y(2)	Y	1 : 1(3)
4, 4A & 4B	123+95± to 125+50± (Left)	-	Y	Y	2 : 1(1)
	125+50± to 126+50± (Left)	-	Y(2)	Y	1 : 1(3) ½ : 1(4)
	126+50± to 129+13.19 (Left)	-	Y	Y	2 : 1(1)

Wall No.	Station to Station	Type of Construction			
		Gravity Wall	MSE	Soil Nail	Slope (H:V)
5	132+11.97 to 133+71.70 (Right)	Y	Y	-	-
5A	134+78.25 to 135+96.32 (Right)	Y	Y	-	-
6	133+33.62 to 135+38.88 (Left)	-	Y	Y	2 : 1
7	136+66.42 to 139+68.38 (Right)	Y	Y	-	-
8	136+68.73 to 137+85.42 (Left)	-	Y	-	2 : 1
9	139+42.19 to 141+00.42 (Left)	-	Y	Y	2 : 1(1)
9 & 9A	141+00.42 to 142+30.40 (Left)	-	Y(2)	Y	1 : 1(3)
10	141+13.34 to 141+76.40 (Right)	Y	Y	-	-
11	141+86.40 to 143+33.61 (Right)	Y	Y	-	-
12	142+44.36 to 142+94.23 (Left)	Y	Y	-	2 : 1
13, 13A & 13B	143+01.74 to 148+81.09 (Left)	-	Y	Y	2 : 1(1)
14	145+17.49 to 147+42.42 (Right)	Y	Y	-	-

Y= Recommended

(1)= 2H:1V slope alone at these locations will require significant earthwork and need for increased right-of-way due to steep slopes and required wall heights; therefore not recommended.

(2) =MSE at these locations will require considerable PWR/Rock Excavation.

(3) = on PWR;

(4) = on Rock

MSE Wall

Soil parameters for the MSE wall design will depend, primarily, on the quality of the backfill use behind the wall, as well as the foundation materials below the wall face and the geogrid reinforced backfill.

For MSE wall backfill, United Consulting recommends the use of select backfill consisting of free draining soils (sandy gravel, sand or silty sand with minor clay fraction) with less than 35% passing the #200 sieve, have a PI of 20 or less, and no organics; an angle of internal friction (phi) of at least 30 degrees, and a moist unit weight of 110 pcf. Based on the laboratory testing program, nearly all of the soil samples tested are classified as SM and therefore should generally be suitable for use as Select Engineered Fill in the area of the proposed MSE wall.

For MSE wall construction, if the area below the toe of the wall face is to be on sloping ground, United Consulting recommends a minimum setback of at least 5 feet of relatively level ground between the wall and the crest of the slope.

We note that the wall foundation soil includes not only the area below the wall facing but also the entire area below the geogrid-reinforced zone behind the wall. Provided the site is prepared/ constructed as recommended, the wall foundation soils at the site should be suitable to support reinforced earth walls, if selected. An allowable soil bearing pressure of up to 3,000 psf could be considered for wall foundation design.

At the Geotechnical Engineer of Record, United Consulting must monitor MSE wall construction on a full-time basis. Sufficient density tests, as determined by the geotechnical engineer must be performed on each lift of soil between the geogrid reinforcement layers. Additionally, our representative must evaluate the entire wall foundation area prior to wall construction. The conditions observed should be compared to test boring data and design requirements. It is frequently necessary to make some field adjustments on wall types and their limits based on exposed subsurface materials during construction.

Surface water control should be maintained to prevent accumulation of water in exposed wall bearing footprint. Standing water in the wall footprint should be removed promptly. Soil softened by the water should be removed, and the Geotechnical Engineer or his representative should re-examine the area.

MSE Wall Settlement Prediction

Based on the provided information on existing grade, proposed top and bottom wall elevations, subsurface data from the borings and laboratory tests, a total estimated settlement of up to approximately 3 to 4 inches was calculated for proposed MSE walls. Our experience indicates that the MSE walls can easily tolerate settlements of this magnitude however, this should be verified by the wall designer. We note that majority of the settlement will occur during fill placement.

Soil Nails with Shotcrete or Gunite Facing

Soil nailing is an in-situ reinforcing of the soil. An array of soil nails which are passive inclusions, are typically installed in a grid pattern that functions to create a stable mass of soil. This mass of reinforced soil functions to retain the less stable material behind it. This method of wall construction that would greatly reduce the amount of excavation required as they are generally top-down construction. The holes are typically drilled at an angle of 15 degrees from horizontal and extend well into the cut to a predetermined depth beyond the active wedge where suitable soils are located. Once drilling of holes is completed, steel bars are inserted into the full length of the holes and the holes are filled with grout. After completion of each row of nails, some reinforcing steel and drainage fabric is placed on the face of the slope. The area is then covered with a shotcrete or gunite facing, thus creating a roughly vertical concrete wall that is held to the soil nails. The process is then repeated as needed until the full height of the wall excavation/

construction is completed. Installing soil nails in the cut areas containing PWR and moderately dense to dense soils are very useful in limiting excavation.

Soil Parameters

Based on our laboratory test results, soil boring data and our experience, we recommend the following soil parameters be used in design of MSE walls and soil nails.

TABLE 4: SOIL PARAMETERS FOR MSE WALL AND SOIL NAIL

Design Parameters	Reinforced Backfill			Retained Backfill	Foundation Material
	Soil	#57	GAB		
Moist Unit Weigh of the soil, γ (pcf)	110	105	135	110	120
Cohesion, c (psf)	0	0	0	100	50
Angle of internal friction, φ (degrees)	30	36	36	32	32
Modulus of Elasticity, E (ksf)	200	2,000	2,500	250	250
Poisson's Ratio, ν	0.33	0.35	0.25	0.30	0.30

The following soil design parameters are recommended for use for Gravity walls:

TABLE 5: SOIL PARAMETERS FOR GRAVITY WALL

Design Parameters	
Cohesion	C = 0 psf
Soil Unit Weight	γ = 110 pcf
Angle of Internal Friction	ϕ = 30°
Coefficient of Sliding Friction	= 0.38 (includes FS=1.5)
Maximum Allowable Bearing Pressure	= 3,000 psf

Global Stability

Drainage through the wall shall be included as part of the design and construction for all walls. The wall designer shall be responsible for global stability analysis to ensure the external stability of the wall system regardless of the wall type.

Site and Wall Subgrade Preparation

All vegetation, root mats, topsoils etc., and any other deleterious material should be removed from the areas of the proposed construction.

After clearing, stripping, and removal of topsoil, the subgrade in the proposed wall (primarily MSE and Gravity Wall) foundation areas and areas to receive fill should be proofrolled.

Proofrolling should be accomplished with a fully loaded tandem dump truck or its equivalent, where practical. Due to the steep slopes, it may be necessary to use the suitable available construction equipment including possible hand auger boring and probing for subgrade evaluation. Proofrolling should be performed under the observation of the Geotechnical Engineer or his representative so that if necessary, he can determine the most effective and suitable means of stabilizing any soft or wet areas that are discovered. This method may consist of undercutting and backfilling with a suitable compacted fill material, replacing with surge stone and a layer of crusher run, or some other method that he deems suitable.

Based on boring logs, no major undercutting is anticipated along the proposed wall alignments to prepare the foundation area for wall construction. This is because soft soils were not encountered in our borings. However, minor undercutting shall be anticipated in between or away from our borings in isolated areas particularly along fill wall on the slope.

Difficult Excavation

Many of the borings encountered PWR or rock at depths varying from surface to 35 feet. The presence of some exposed rock along the slope at Morgan Falls Road (from Sta. 123+70± to Sta. 123+95± Left, Sta. 125+50± to Sta. 126+50± Left and Sta. 127+00± to Sta. 129+15± Right) and the variable auger refusal depths in some adjacent borings likely indicate subsurface boulders or localized lenses of PWR or rock within the natural residual soils. Some of the auger refusals could be due to pinnacles or lenses of PWR or boulders. Additionally shallow PWR or rock could be present between or away from the areas explored.

We envision that the most significant areas where PWR or rock will be encountered are in the areas mentioned above. Significant ripping and blasting should be expected to achieve the planned grades in this area. Some localized difficult excavation conditions should be expected elsewhere, particularly if trench excavations for utility lines are planned.

Conventional scrapers and loaders can generally excavate soils. PWR typically requires loosening by ripping with large dozers pulling single tooth rippers in mass excavation and the use of jackhammers or light blasting in confined (trench) excavation. Relatively sound, massive, rock typically requires blasting for removal in mass or trench excavation.

Excavation techniques will vary based on the weathering of the materials, fracturing and jointing in the rock, and the overall stratigraphy of the feature. Actual field conditions usually display a gradual weathering progression with poorly defined and uneven boundaries between layers of different materials. We recommend that the following definitions for rock in earthwork excavation be included in bid documents:

1. General Excavation: Any material occupying an original volume of more than 1 cubic yard which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rating of not less than 80,000 lbs. usable pull (Caterpillar D-8 or larger).

2. Trench Excavation: Any material occupying an original volume of more than 1/2 cubic yard which cannot be excavated with a backhoe having a bucket curling force rated at not less than 40,000 lbs., using a rock bucket and rock teeth (John Deere 790 or larger).

Removal of rock by blasting can be very expensive. The costs of excavation vary with the type of material encountered and the quantities to be excavated. Hence, control of quantities is important. You may consider exposing the rock surface prior to blasting so the rock quantities can be more accurately estimated using surveying methods. Leaving soil overburden in place during blasting may result in difficulties in determination of blast rock quantities resulting in greater rock excavation costs. Also, residual soil overburden may increase the confining pressure of the rock and reduce the effectiveness of blast charges. Loose fill or blasting mats can be placed over the blast area to control fly-rock.

Ripped PWR and/or blasted rock fragments can be re-used and mixed into engineered fill provided that they are suitably pulverized and mixed with soil in order to fill voids between the rock pieces. A heavy compactor (Caterpillar 815 or larger) may be required to pulverized excavated blocks of dense soil or PWR.

Heavy blasting can dislodge loose rock from adjacent slopes. To minimize the raveling of adjacent slopes during blast excavation on the new cut slope, the seismic peak particle velocity at adjacent slopes of concern should be monitored by the placement of seismic monitoring instruments during construction particularly adjacent to the existing structures to reduce City's exposure to potential lawsuits.

Groundwater

Groundwater was not encountered at the time of drilling and/or at least 24-hours after drilling. Several of the boreholes caved-in at depths varying from 3 to 25 feet below grade, which may indicate possible presence of groundwater. We note that the natural moisture content tests of in-situ soil samples tested ranged from 5% to 9%. This may indicate that the cave-in depths are probably due to presence of drier soils in the boreholes when left open overnight for 24-hour groundwater reading. Therefore, we do not anticipate groundwater will significantly impact construction activities at the project site. However, due to presence of shallow PWR and rock, the site may be susceptible to formation of perched water. The contractor should be prepared to remove perched water as needed.

Earthwork

Majority of the soils encountered on the project site should generally be suitable for re-use as engineered fill. The geotechnical engineer must evaluate excavated soils to assess their suitability for reuse as engineered fill. Typical restrictions on suitable fill are no organics, plasticity index less than 20, and maximum particle size of four inches, with not more than 30 percent greater than $^{3}/_{4}$-inch. Additional requirements for MSE wall backfill is stated under 'MSE Wall' section above. These restrictions should also be applied to the imported borrow soils if needed.

Positive drainage should be maintained at all times to prevent saturation of exposed soils in case of sudden rains. Rolling the surface of disturbed soils will also improve runoff and reduce the potential for construction delays due to undercutting and/or stabilization of saturated soils. The degree of soil stability problems will also be dependent upon the precautions taken by the contractor to help protect these moisture sensitive soils.

General Slopes Recommendations

All slopes should be protected from erosion during construction and provided with appropriate permanent vegetation or other cover after construction. Slopes should be protected from concentrated run-off flow by means of berms and drainage ditches to direct runoff around slopes or through concrete channels. Appropriate vegetative cover should consist of fast growing grasses that will rapidly create a dense root mat over the entire slope. Landscaping consisting of isolated shrubs and pine straw will not provide adequate slope protection.

A minimum building or existing structure setback (from the nearest edge of existing or proposed foundations) of at least 10 feet from the crest of slopes is recommended. We note that during our fieldwork, we have noted an existing MSE wall behind proposed Wall 13A. We recommend care shall be exercised to perform any excavation in front of the wall both during the design and construction stage such as not to undermine the existing wall. Detailed stability analyses shall be performed to ensure the integrity of the existing wall. As an added precaution, we recommend both pre-and post-construction survey of the wall with supporting documentation of the area to reduce the City's potential liabilities. A minimum setback of 5 feet is recommended for all walls from the edge of pavement, curbs, etc., as applicable.

Benching

For portions of the walls that will be constructed on sloping terrain we recommend that the areas be prepared by creating level benches or steps for the wall, so the wall facing and the backfill behind the walls is placed on a relatively level surface, and, to reduce the potential for the fill mass sliding down the hills. The designer must consider downward sloping toe in stability analyses under such condition.

Berm

Embankment and cut slopes that are greater than 35 feet high will require construction of a berm in accordance with the attached detail. (See Berm Details in Appendix A)

Caving Considerations

Due to the presence of low-cohesive soils, some caving of excavations should be expected. Flattening of the excavation sidewalls and/or the use of bracing may be needed to maintain stability. All excavations should be performed in accordance with OSHA standards.

Fill Placement

Moisture-density determinations should be performed for each soil type used, to provide data necessary for quality assurance testing. The natural moisture content at the time of compaction should be within moisture content limits, which will allow the required compaction to be obtained. The contractor should be prepared to increase or decrease soil water content.

The fill should be placed in thin lifts (not to exceed 8 inches loose thickness) and compacted. We recommend that fill be compacted to at least 98% of Standard Proctor (ASTM D 698) maximum dry density within two feet below pavement subgrade and at least 95% of the Standard Proctor maximum dry density elsewhere.

A Geotechnical Engineer on a full-time basis should observe all grading operations. In-place density tests taken by that individual will assess the degree of compaction being obtained. The frequency of the testing should be determined by the Geotechnical Engineer.

LIMITATIONS

This report is for the exclusive use of **City of Sandy Springs** and the designers of the project described herein, and may only be applied to this specific project. Our conclusions and recommendations have been prepared using generally accepted standards of Geotechnical Engineering practice in the State of Georgia. No other warranty is expressed or implied. Our firm is not responsible for conclusions, opinions or recommendations of others.

The right to rely upon this report and the data within may not be assigned without UNITED CONSULTING'S written permission.

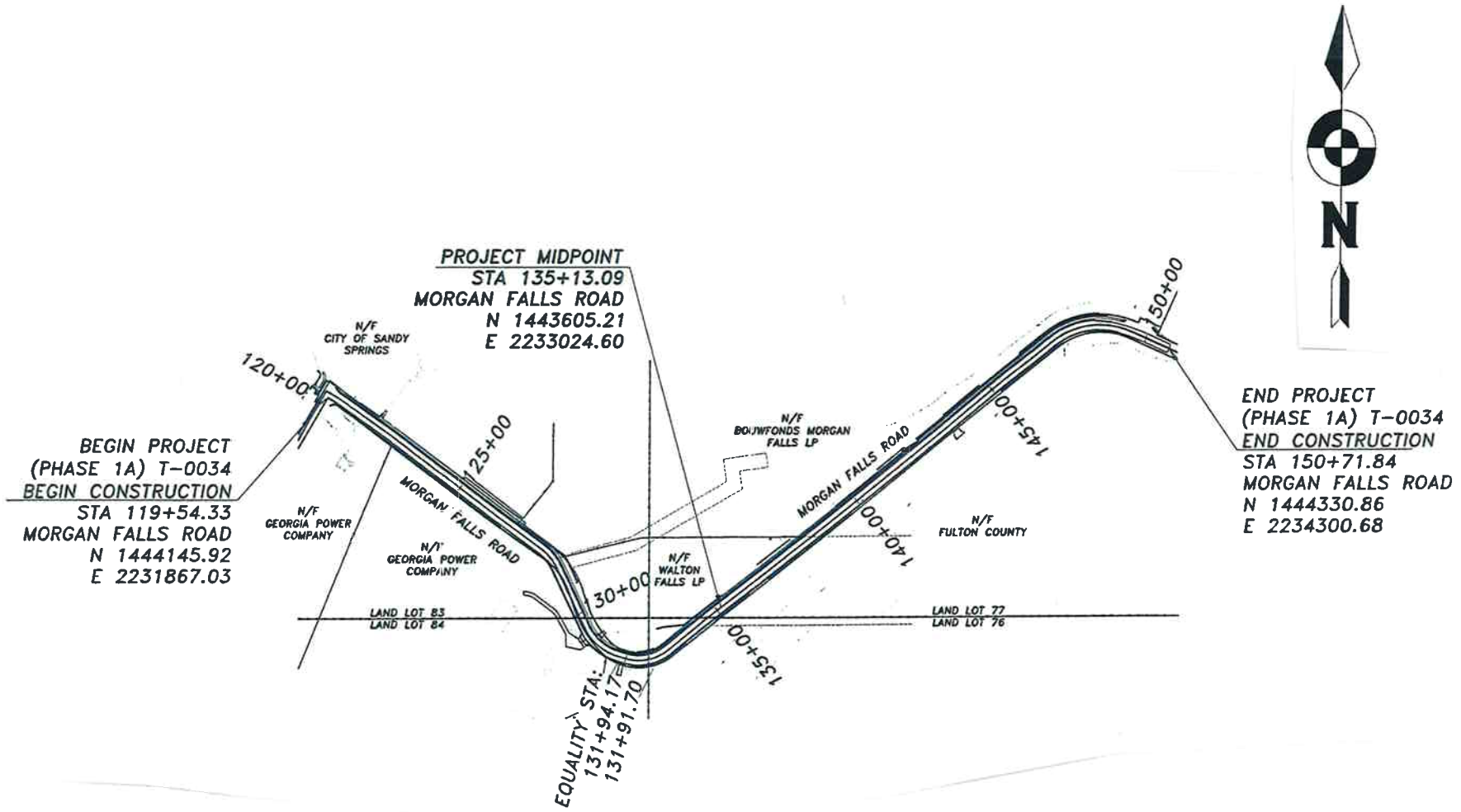
The scope of this evaluation was limited to an evaluation of the load-carrying capabilities and stability of the subsoils. Oil, hazardous waste, radioactivity, irritants, pollutants, molds, or other dangerous substance and conditions were not the subject of this study. Their presence and/or absence are not implied or suggested by this report, and should not be inferred.

Our conclusions and recommendations are based upon design information furnished us, data obtained from the previously described exploration and testing program and our past experience. They do not reflect variations in subsurface conditions that may exist intermediate of our borings and in unexplored areas of the site. Should such variations become apparent during construction, it will be necessary to re-evaluate our conclusions and recommendations based upon "on-site" observations of the conditions.

If the design or location of the project is changed, the recommendations contained herein, must be considered invalid unless our firm reviews the changes and our recommendations are either verified or modified in writing. When design is complete, we should be given the opportunity to review the foundation plan, grading plan, and applicable portions of the specifications to see if they are consistent with the intent of our recommendations.

APPENDIX A

Figure A – Site Location Plan
Figure 1 – Legend
Figure 2 through 9 – Boring Location Plan and Profile
General Notes/Narrative of Drilling Operations
Boring Logs (26)
Exploration Procedures
Berm Detail



SCALE: NTS	DATE: 10/25/2011	PROJECT NO: 2011.2530.01	TITLE: **SITE LOCATION MAP**	**FIG. A**
PREPARED: AW	CHECKED:	REVISIONS:	MORGAN FALLS ROAD IMPROVEMENTS SANDY SPRINGS, FULTON COUNTY, GEORGIA	
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LEGEND	
⊕	BORING LOCATION
▽	GROUNDWATER AT TIME OF BORING
▼	STABILIZED GROUNDWATER
NGWE	NO GROUNDWATER ENCOUNTERED
B.T.	BORING TERMINATED
A.R.	AUGER REFUSAL
FILL	FILL SOIL
ALLUV	ALLUVIAL SOIL
RES	RESIDUAL SOIL
PWR	PARTIALLY WEATHERED ROCK
— — — —	TOP OF ALLUVIAL
- - - - - -	TOP OF RESIDUAL
—·—·—	TOP OF PWR
—··—··—	TOP OF ROCK

UNIFIED SOIL CLASSIFICATION	
(GW)	WELL-GRADED GRAVEL
(GP)	POORLY-GRADED GRAVEL
(GM)	SILTY GRAVEL
(GC)	CLAYEY GRAVEL
(SW)	WELL-GRADED SAND
(SP)	POORLY-GRADED SAND
(SM)	SILTY SAND
(SC)	CLAYEY SAND
(CL)	LEAN CLAY
(ML)	SILT
(OL)	ORGANIC CLAY OR SILT
(CH)	FAT CLAY
(MH)	ELASTIC SILT
(PT)	PEAT

SCALE: NONE	DATE: 10-19-11	PROJECT NO: 2011.2530.01	TITLE: LEGEND MORGAN FALLS ROAD IMPROVEMENTS SANDY SPRINGS, FULTON COUNTY, GEORGIA
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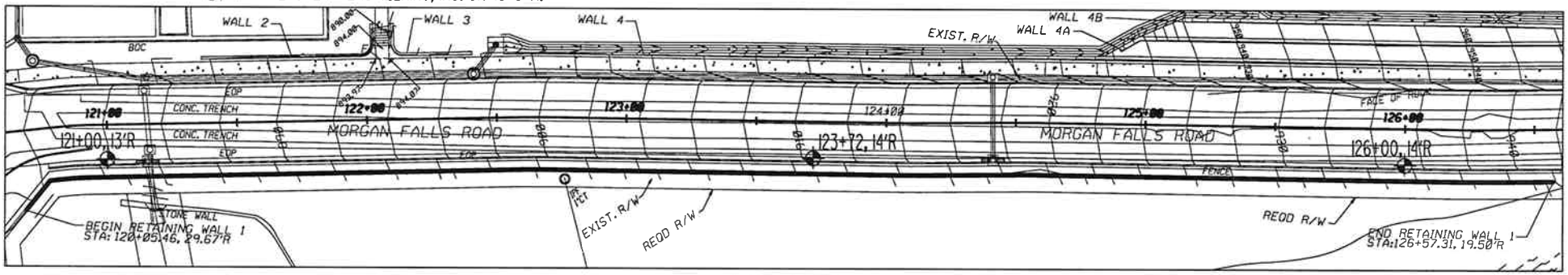
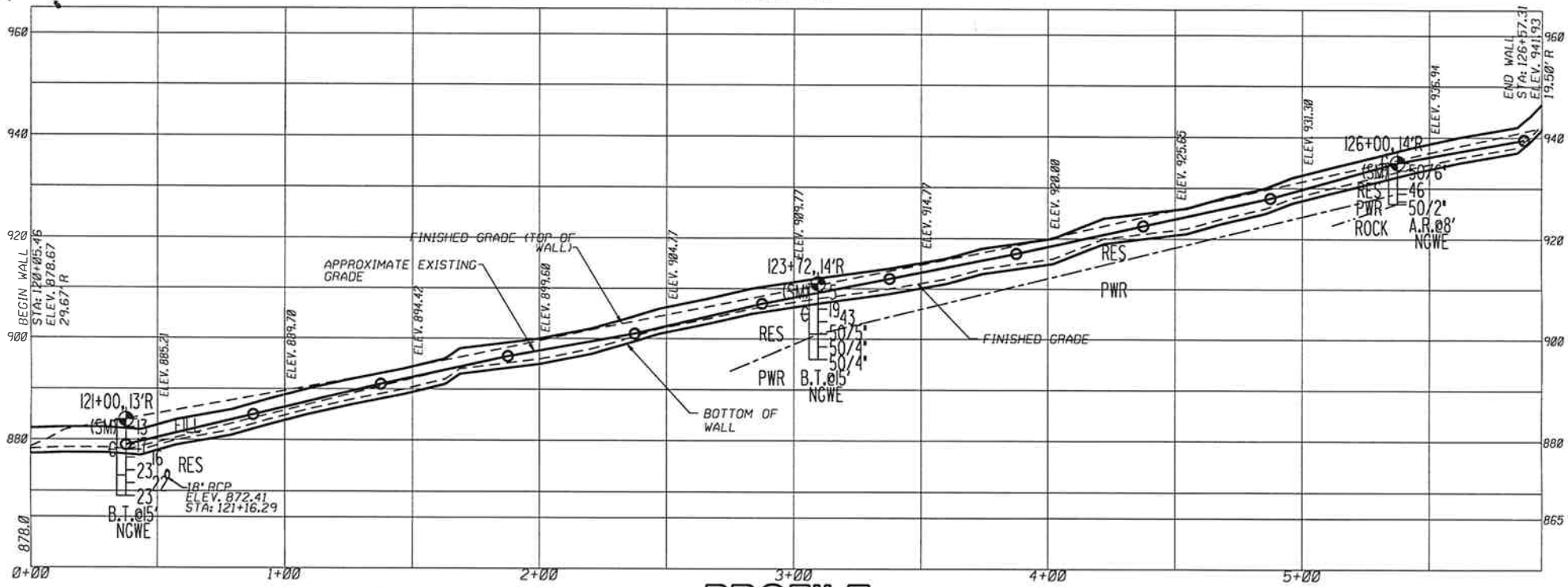
FIG. 1

REFERENCE: BASE PLAN PROVIDED BY SOUTHEASTERN ENGINEERING, INC. ON 10-6-11.



PLAN

SCALE: 1" = 60'



PROFILE

SCALE: (H) 1" = 60' / (V) 1" = 30'

SCALE: AS NOTED	DATE: 10-19-11	PROJECT NO: 2011.2530.01	TITLE: BORING LOCATION PLAN & PROFILE WALL 1 MORGAN FALLS ROAD IMPROVEMENTS SANDY SPRINGS, FULTON COUNTY, GEORGIA
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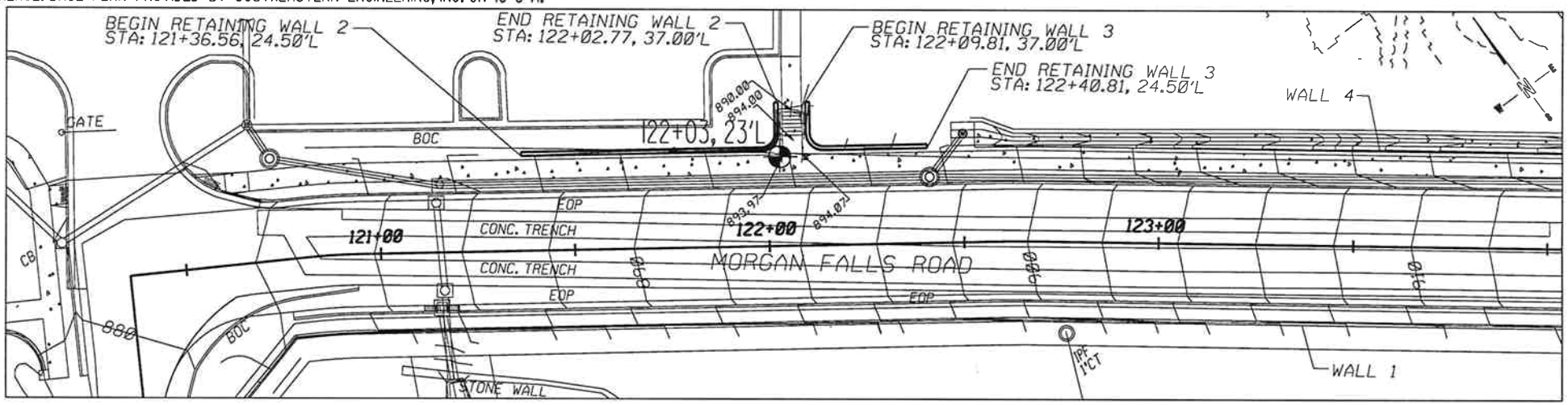
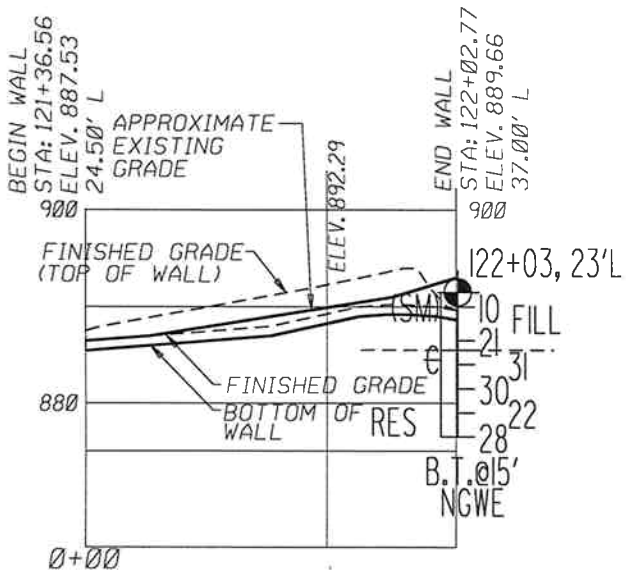
FIG. 2

REFERENCE: BASE PLAN PROVIDED BY SOUTHEASTERN ENGINEERING, INC. ON 10-6-11.



PLAN

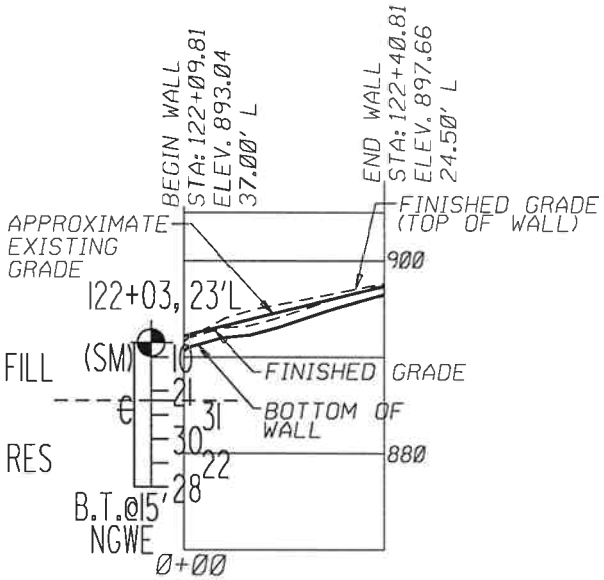
SCALE: 1" = 40'



WALL NO. 2

PROFILE

SCALE: (H) 1" = 40' / (V) 1" = 20'



WALL NO. 3

SCALE: AS NOTED	DATE: 10-19-11	PROJECT NO: 2011.2530.01	TITLE: BORING LOCATION PLAN & PROFILE WALLS 2 & 3 MORGAN FALLS ROAD IMPROVEMENTS SANDY SPRINGS, FULTON COUNTY, GEORGIA
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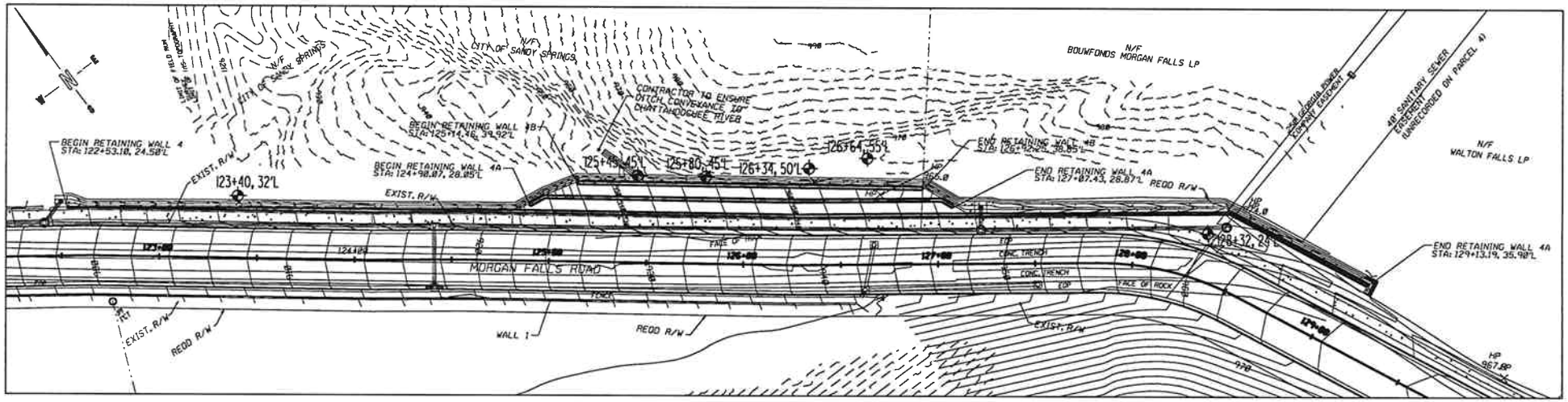
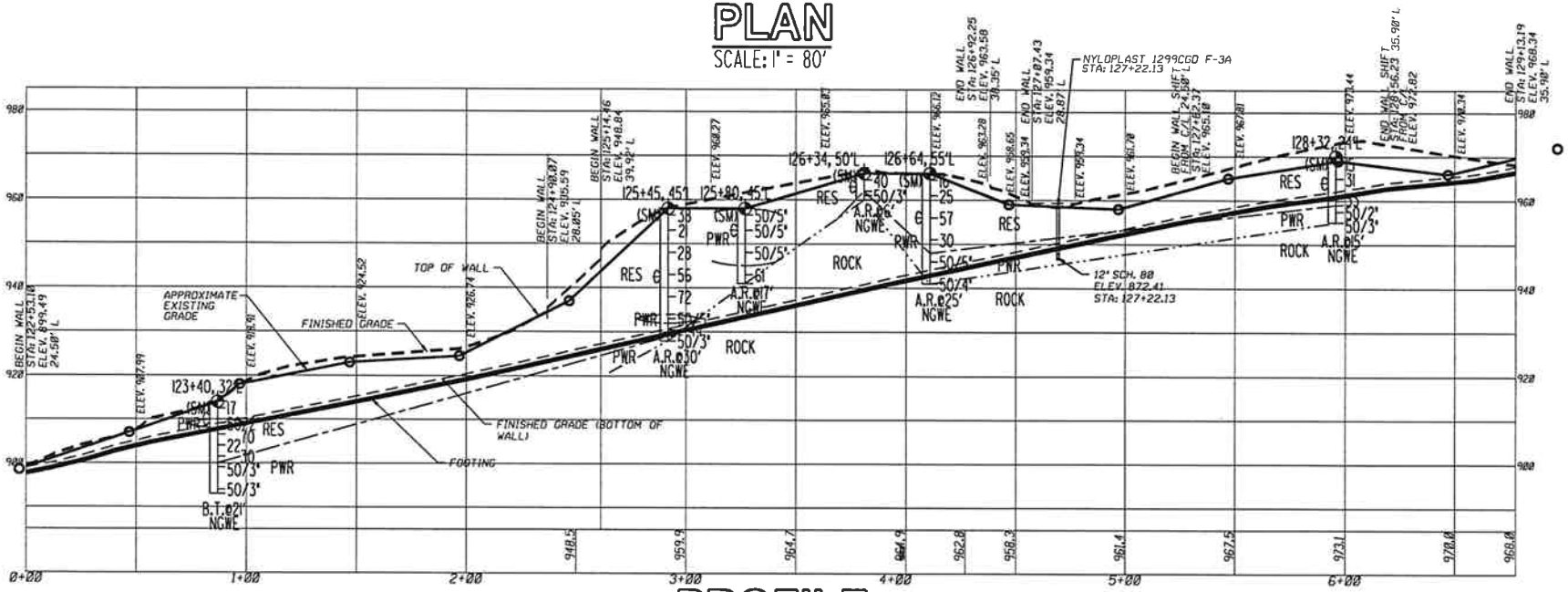
FIG. 3

REFERENCE: BASE PLAN PROVIDED BY SOUTHEASTERN ENGINEERING, INC. ON 10-6-11.



PLAN

SCALE: 1" = 80'



PROFILE

SCALE: (H) 1" = 80' / (V) 1" = 40'

SCALE: AS NOTED	DATE: 10-19-11	PROJECT NO: 2011.2530.01	TITLE: BORING LOCATION PLAN & PROFILE WALL 4, 4A & 4B MORGAN FALLS ROAD IMPROVEMENTS SANDY SPRINGS, FULTON COUNTY, GEORGIA
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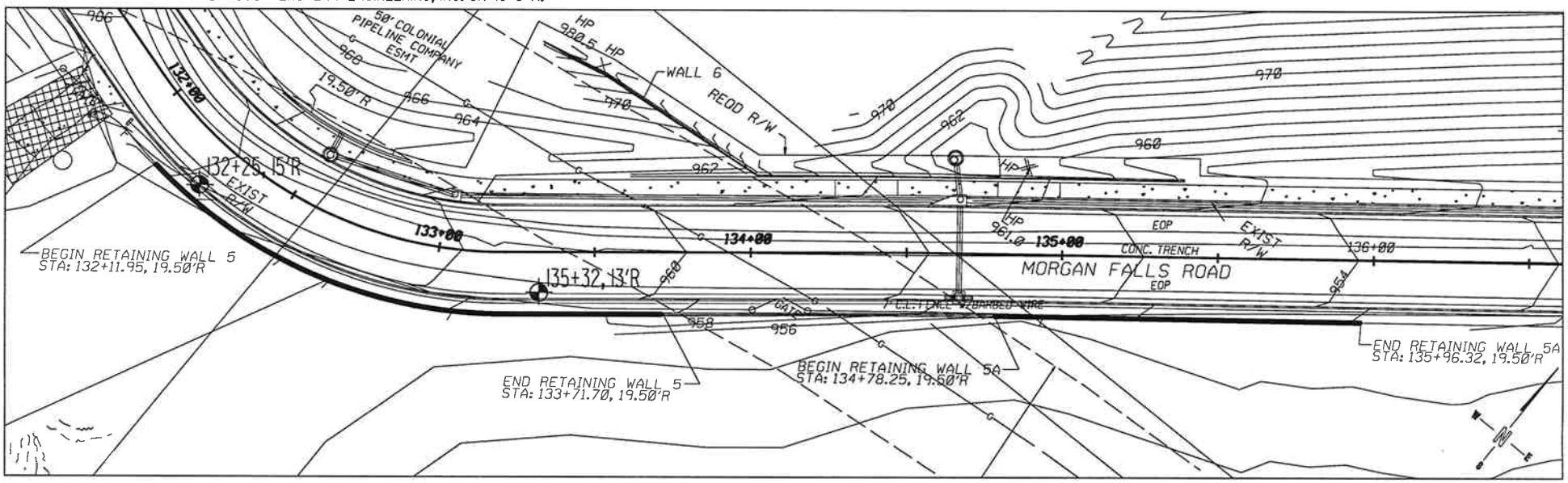
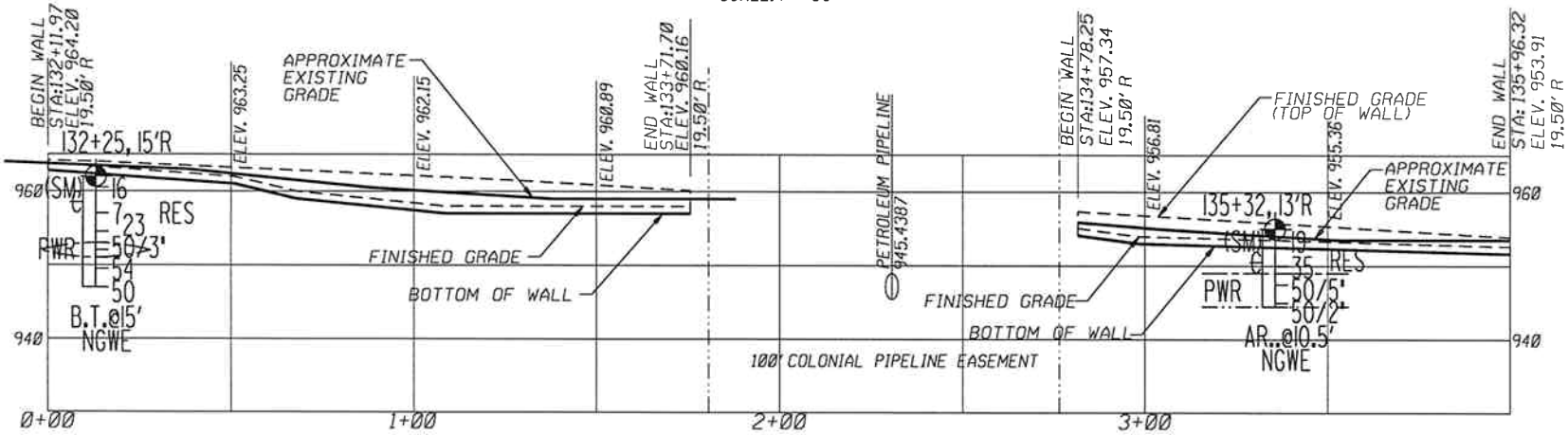
FIG. 4

REFERENCE: BASE PLAN PROVIDED BY SOUTHEASTERN ENGINEERING, INC. ON 10-6-11.



PLAN

SCALE: 1" = 50'



PROFILE

SCALE: (H) 1" = 50' / (V) 1" = 25'

SCALE: AS NOTED	DATE: 10-19-11	PROJECT NO: 2011.2530.01	TITLE: BORING LOCATION PLAN & PROFILE WALLS 5 & 5A MORGAN FALLS ROAD IMPROVEMENTS SANDY SPRINGS, FULTON COUNTY, GEORGIA
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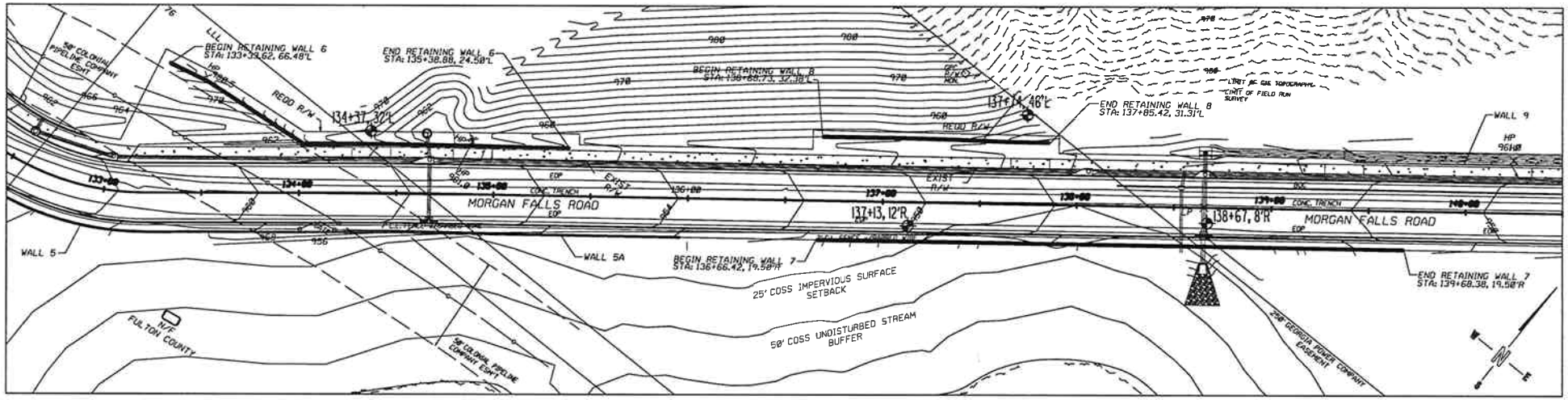
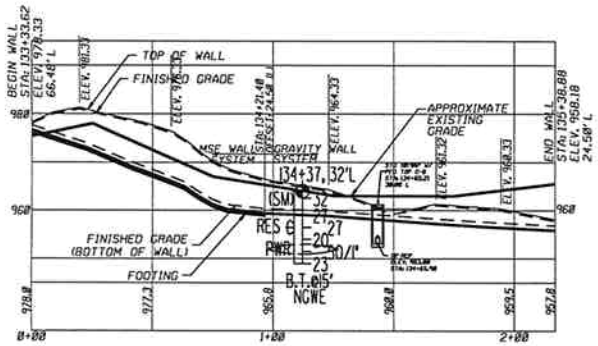
FIG. 5

REFERENCE: BASE PLAN PROVIDED BY SOUTHEASTERN ENGINEERING, INC. ON 10-6-11.

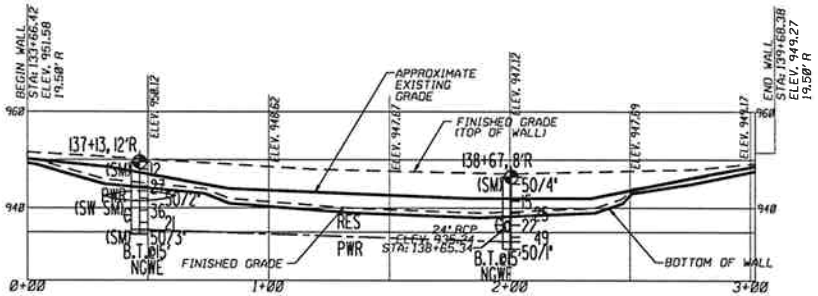


PLAN

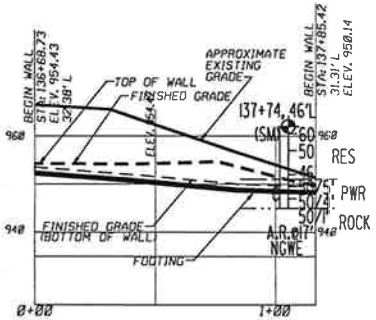
SCALE: 1" = 80'



WALL NO. 6



WALL NO. 7



WALL NO. 8

PROFILE

SCALE: (H) 1" = 80' / (V) 1" = 40'

SCALE: AS NOTED	DATE: 10-19-11	PROJECT NO: 2011.2530.01	TITLE: BORING LOCATION PLAN & PROFILE WALLS 6, 7 & 8 MORGAN FALLS ROAD IMPROVEMENTS SANDY SPRINGS, FULTON COUNTY, GEORGIA
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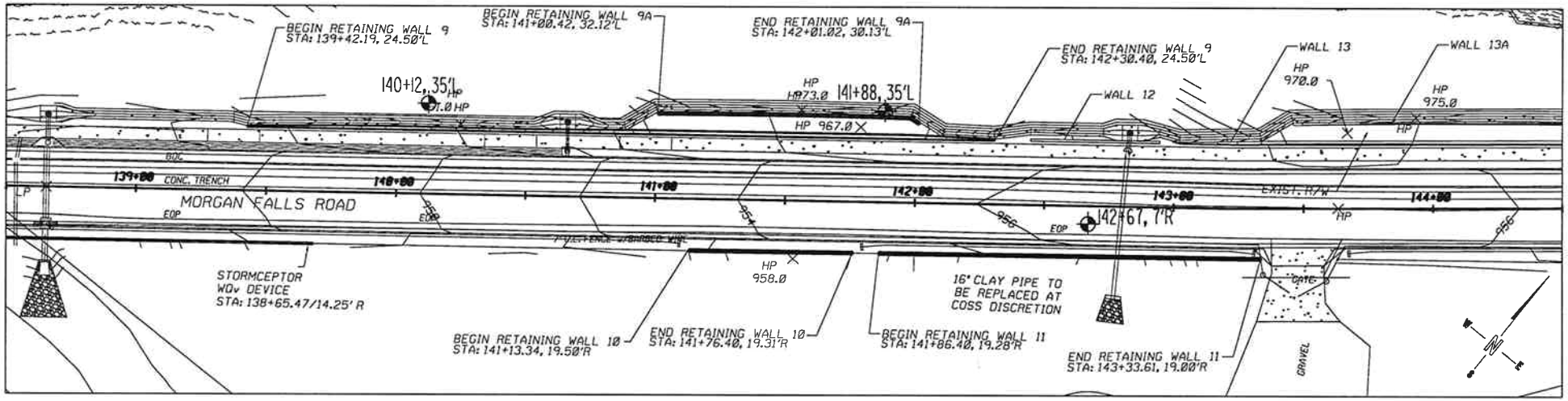
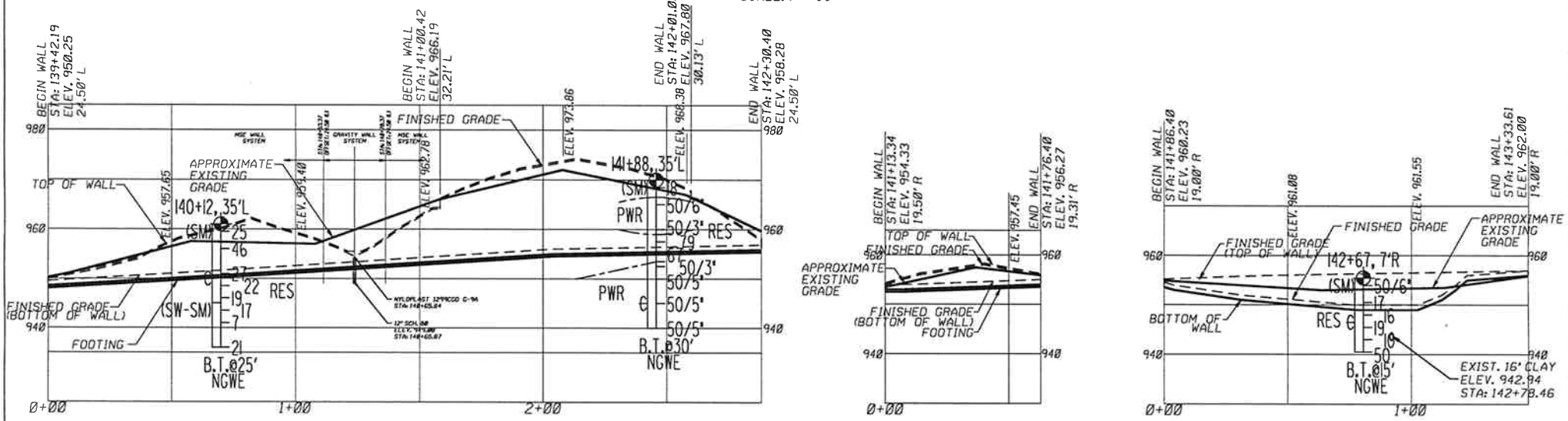
FIG. 6



PLAN

SCALE: 1" = 60'



WALL NO. 9 WALL NO. 10 WALL NO. 11

PROFILE

SCALE: (H) 1" = 60' / (V) 1" = 30'

SCALE: AS NOTED	DATE: 10-19-11	PROJECT NO: 2011.2530.01	TITLE: BORING LOCATION PLAN & PROFILE WALLS 9, 9A, 10 & 11 MORGAN FALLS ROAD IMPROVEMENTS SANDY SPRINGS, FULTON COUNTY, GEORGIA
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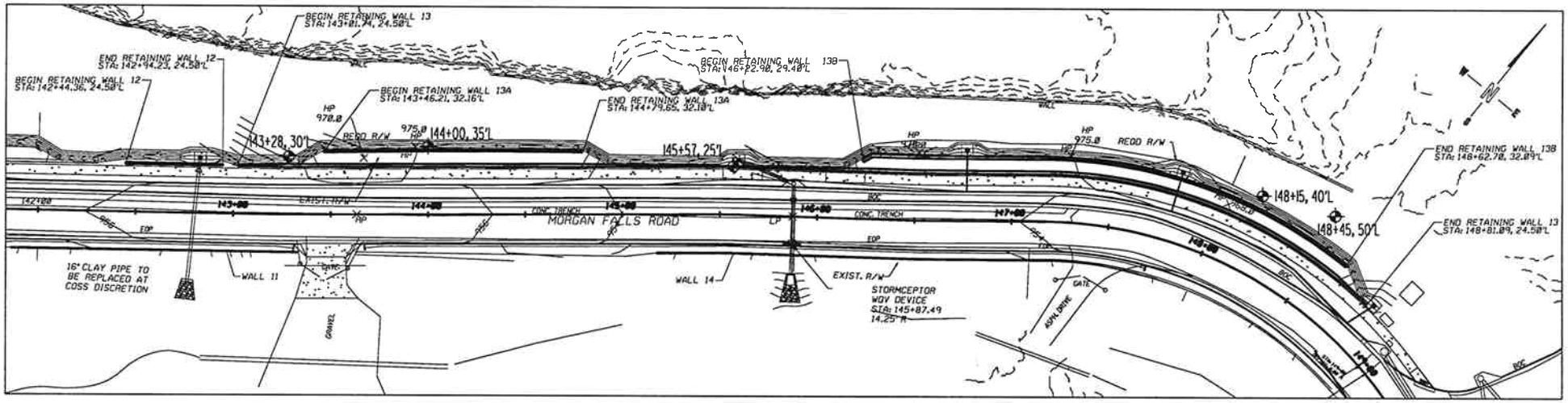
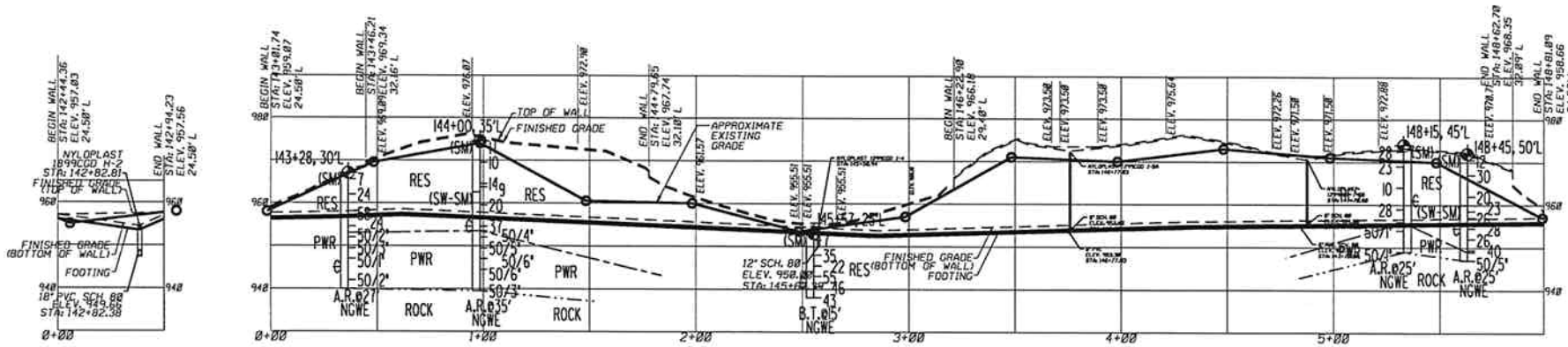
FIG. 7

REFERENCE: BASE PLAN PROVIDED BY SOUTHEASTERN ENGINEERING, INC. ON 10-6-11.



PLAN

SCALE: 1" = 80'



WALL NO. 12

WALL NO. 13

PROFILE

SCALE: (H) 1" = 80' / (V) 1" = 40'

SCALE: AS NOTED	DATE: 10-19-11	PROJECT NO: 2011.2530.01	TITLE: BORING LOCATION PLAN & PROFILE WALLS 12, 13, 13A & 13B MORGAN FALLS ROAD IMPROVEMENTS SANDY SPRINGS, FULTON COUNTY, GEORGIA
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FIG. 8

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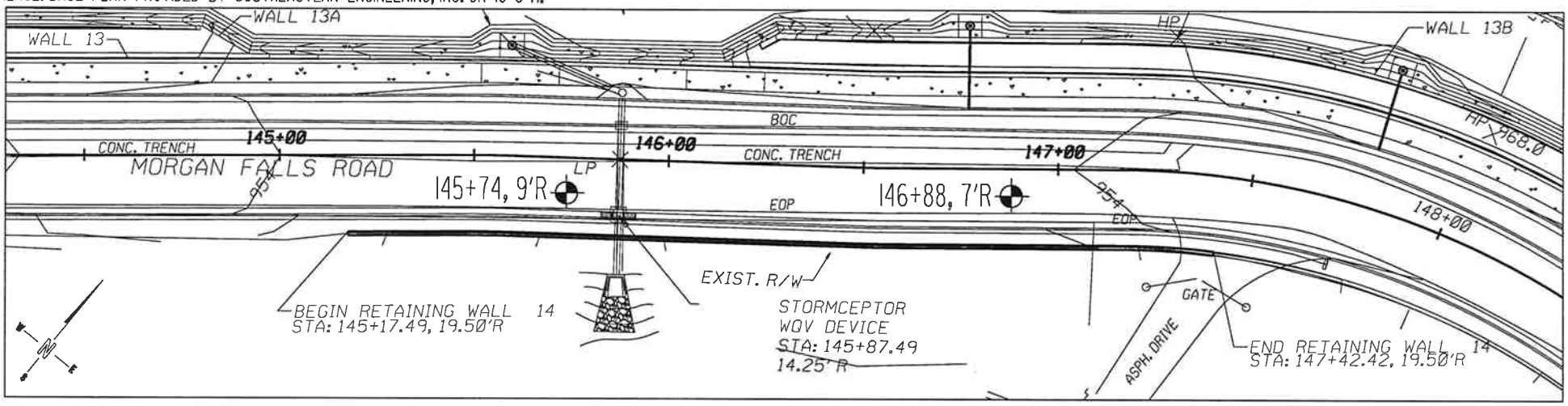
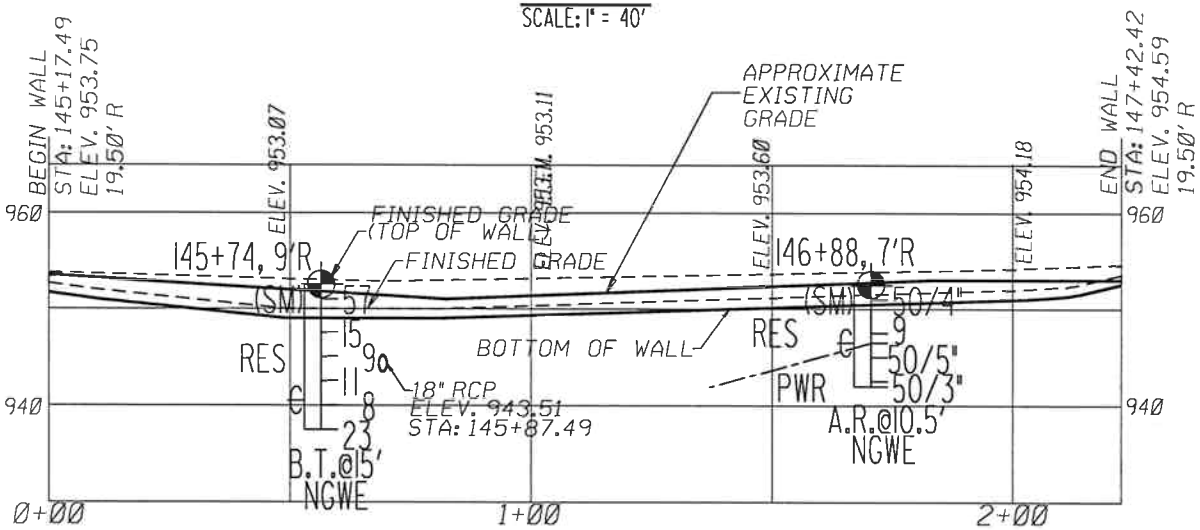


PLAN

SCALE: 1" = 40'



PROFILE

SCALE: (H) 1" = 40' / (V) 1" = 20'

SCALE: AS NOTED	DATE: 10-19-11	PROJECT NO: 2011.2530.01	TITLE: BORING LOCATION PLAN & PROFILE WALL 14 MORGAN FALLS ROAD IMPROVEMENTS SANDY SPRINGS, FULTON COUNTY, GEORGIA
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FIG. 9

GENERAL NOTES

The soil classifications noted on the Boring Logs are visual classifications unless otherwise noted. Minor constituents of a soil sample are termed as follows:

Trace	0 - 10%
Some	11 - 35%
Suffix "y" or "ey"	36 - 49%

LEGEND

Split Spoon Sample obtained during Standard Penetration Testing

Relatively Undisturbed Shelby Tube Sample

Groundwater Level at Time of Boring Completion

Groundwater Level at 24 hours (or as noted) after Termination of Boring

w	Natural Moisture Content	
LL	Liquid Limit	
PL	Plastic Limit	Atterberg Limits
PI	Plasticity Index	
PF	Percent Fines (Percent Passing #200 Sieve)	
γ_d	Dry Unit Weight (Pounds per Cubic Foot or PCF	
γ_m	Moist or In-Situ Unit Weight (PCF)	
γ_{sat}	Saturated Unit Weight (PCF)	

BORING LOG DATA AND NARRATIVE OF DRILLING OPERATIONS

The test borings were made by mechanically advancing helical hollow stem augers into the ground. Samples were covered at regular intervals in each of the borings following established procedures for performing the Standard Penetration Test in accordance with ASTM Specification D-1586. Soil samples were obtained with a standard 1.4" I.D. x 2.0" O.D. split barrel sampler. The sampler is first seated 6" to penetrate any loose cuttings and then driven an additional foot with the blows of a 140 pound hammer freely falling a distance of 30." The number of blows required to drive the sampler each six inches is recorded on the Boring Logs. The total number of blows required to drive the sampler the final foot is designated the "standard penetration resistance." This driving resistance, known as the "N" value, is a measure of the relative density of granular soils and is an indication of the consistency of cohesive deposits.

The following table describes soil consistencies and relative densities based on standard-penetration resistance values (N) determined by the Standard Penetration Test.

	"N"	Consistency
	0-2	Very Soft
	3-4	Soft
	5-8	Firm
Clay and Silt	9-15	Stiff
	16-30	Very Stiff
	Over 31	Hard

	"N"	Relative Density
	0-4	Very Loose
	5-10	Loose
	10-19	Firm
Sand	20-29	Medium Dense
	30-49	Dense
	50+	Very Dense

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 121+00, 13' R
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 09/28/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
885	2" TOPSOIL	0						Wall 1
	Sand-some silt, trace clay and rock fragments; firm; brown (Fill) (SM)		1		3-5-8	10		
880		5	2		7-7-10	10		No groundwater encountered at time of boring, Borehole caved-in at 6'
BoW= 877.0	Sand-some silt, trace clay and mica; firm; brown (Residual) (SM)		3		11-7-9	14		
875	-medium dense	10	4		16-11-12	12		
			5		8-10-12	18		
870	-red-brown	15	6		8-10-13	18		
	BORING TERMINATED AT 15'							
865		20						
860		25						
855		30						
850		35						
845		40						BoW= Approximate Bottom of Wall

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 123+72, 14' R
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 09/29/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	2" TOPSOIL	0						Wall 1
910	Sand-micaceous, some silt, trace clay and rock fragments; loose; tan-brown (Residual) (SM)		1		4-2-3	10		
BoW= 907.0	-trace mica; firm; red-brown	5	2		5-7-12	10		No groundwater encountered at time of boring, Borehole caved-in at 6'
905	-micaceous, no rock fragments; dense; brown	C	3		12-21-22	14	9.1	
	Partially Weathered Rock sampled as Sand-micaceous, trace silt and clay; very dense; brown (SM)	10	4		13-50/5	10		
900	-tan-brown		5		27-50/4	10		
		15	6		25-50/4	10		
895	BORING TERMINATED AT 15'							
		20						
890								
		25						
885								
		30						
880								
		35						
875								BoW= Approximate Bottom of Wall
		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 126+00, 14' R
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 09/29/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	2" TOPSOIL	0						Wall 1
935	Sand-some silt, trace mica, clay and rock fragments; very dense; brown (Residual) (SM)	C	1		6-50/6	6		N-value amplified due to rock fragments
BoW= 932.0	-some mica, no rock fragemnts; dense	5	2		18-22-24	12		No groundwater encountered at time of boring, Borehole caved-in at 1'
930	Partially Weathered Rock sampled as Sand-some mica, trace silt, clay and rock fragments; very dense; tan (SM)		3		50/2	2		
	AUGER REFUSAL AT 8'	10						
925								
		15						
920								
		20						
915								
		25						
910								
		30						
905								
		35						
900								BoW= Approximate Bottom of Wall
		40						
895								

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 122+03, 23' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 09/28/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	2" TOPSOIL/GRASS	0						Wall 2
890	Sand-some silt and clay; firm; brown (Fill) (SM)		1		6-6-4	14		
BoW= 888.5								
	-trace clay, rock fragments and mica; medium dense	5	2		9-11-10	14		No groundwater encountered at time of boring, Borehole caved-in at 7'
885	Sand-some silt, trace clay and mica; dense; brown (Residual) (SM)		3		10-14-17	18		
		10	4		10-13-17	18		
880	-medium dense		5		7-9-13	18		
		15	6		10-13-15	18		
	BORING TERMINATED AT 15'							
875		20						
870		25						
865		30						
860		35						
855		40						BoW= Approximate Bottom of Wall

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 123+40, 32' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 09/29/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
915	2" TOPSOIL/GRASS	0						Wall 4
	Sand-micaceous, trace silt and clay; firm; tan-brown (Residual) (SM)		1		2-3-14	18		No groundwater encountered at time of boring, Borehole caved-in at 4'
910		C 5	2		19-30-50/2	10		
BoF= 907.5	Partially Weathered Rock sampled as Sand-micaceous, trace silt and clay; very dense; tan-brown (SM)		3		12-44-26	18		
905	Sand-micaceous, trace silt and clay; very dense; tan-brown (Residual) (SM) -medium dense; red-orange	10	4		11-9-13	16		
	-dense		5		10-12-18	18		
900		15	6		11-38-50/3	14		
	Partially Weathered Rock sampled as Sand-micaceous, trace silt and clay; very dense; tan-brown (SM)							
895		20	7		11-14-50/3	14		
	BORING TERMINATED AT 21'							
890		25						
885		30						
880		35						
875		40						BoF= Approximate Bottom of Footing

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 125+45, 45' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 09/30/11
JOB NO.: 2011.2530.01 DRILLER: DUSTIN RIG: CME 55 LOGGED BY: AW

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	2" TOPSOIL	0						Walls 4, 4A and 4B
	Sand-some silt and mica, trace clay; dense; gray (Residual) (SM)		1		12-16-22	18		
955								
	- micaceous; medium dense; brown	5	2		4-9-12	18		
950								
	- trace rock fragments	10	3		9-11-17	18		
945								No groundwater encountered at time of boring and after 24 hours Borehole caved-in at 15.5'
	- very dense	15	4		13-17-39	18		
940								
		20	5		27-33-39	18		
935								
		25	6		13-23-50/5	17		
	Partially Weathered Rock sampled as Sand-micaceous, some silt, trace clay; very dense; gray (SM)		7		12-9-35	18		
930	Sand-micaceous, some silt, trace clay; dense; gray (Residual) (SM)							
BoF= 929.0	Partially Weathered Rock sampled as Sand-micaceous, some silt, trace clay ; very dense; gray-brown (SM)	30	8		32-50/3	18		Hard drilling from 29' to 30' (130 seconds)
	AUGER REFUSAL AT 30'							
925								
		35						
920								BoF= Approximate Bottom of Footing
		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 125+80, 45' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 09/30/11
JOB NO.: 2011.2530.01 DRILLER: DUSTIN RIG: CME 55 LOGGED BY: AW

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	1" TOPSOIL	0						Walls 4, 4A and 4B
	Partially Weathered Rock sampled as Sand-some silt and mica, trace clay; very dense; orange, brown, gray (SM)		1		22-50/5	11		Hard drilling from 1' to 3.5' (130 seconds)
955								Hard drilling from 3.5' to 6' (80 seconds)
		5	2		30-50/5	10		No groundwater encountered at time of boring and after 24 hours Borehole caved-in at 5'
950								
		10	3		28-50/5	10		Hard drilling from 8'- 10' (90 seconds)
945								
	Sand-some silt and mica, trace clay; very dense; gray (Residual) (SM)	15	4		10-13-48	18		
	AUGER REFUSAL AT 17'							
940								
		20						
935								
BoF= 933.0		25						
930								
		30						
925								
		35						
920								BoF= Approximate Bottom of Footing
		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 126+34, 50' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 09/30/11
JOB NO.: 2011.2530.01 DRILLER: DUSTIN RIG: CME 55 LOGGED BY: AW

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	1" TOPSOIL	0						Walls 4, 4A and 4B
965	Sand-some silt, trace mica and clay; dense; gray, brown (Residual) (SM)		1		12-14-26	18		
		C						No groundwater encountered at time of boring Borehole caved-in at 3'
	Partially Weathered Rock sampled as Sand-some silt and mica, trace clay; very dense; red-brown (SM)	5	2		40-50/3	9		
960	AUGER REFUSAL AT 6'							
		10						
955								
		15						
950								
		20						
945								
		25						
940								
BoF= 939.0								
		30						
935								
		35						
930								
								BoF= Approximate Bottom of Footing
		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 126+64, 55' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 09/30/11
JOB NO.: 2011.2530.01 DRILLER: DUSTIN RIG: CME 55 LOGGED BY: AW

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	2" TOPSOIL	0						Walls 4, 4A and 4B
965	Sand-micaceous, some silt, trace clay; firm; gray, brown (Residual) (SM)		1		4-7-9	18		
	-medium dense	5	2		10-12-13	18		
960								No groundwater encountered at time of boring and after 24 hours Borehole caved-in at 10'
	-very dense; gray	10	3		17-27-30	18		
955								Bulk Sample taken from 12' to 22'
	-dense; gray, brown	15	4		11-13-17	18		
950								
		20	5		17-25-50/5	17		
945	Partially Weathered Rock sampled as Sand-some silt and mica, trace clay; very dense; gray-brown (SM)							
BoF= 942.5		25	6		30-50/4	10		
940	AUGER REFUSAL AT 25'							* Undisturbed sample taken at Sta. 126+65, 55' Lt (14'-16') Straight Auger to 14' USCS= SM Moisture Content= 8.1%
		30						
935		35						
930								BoF= Approximate Bottom of Footing
		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 128+32, 24' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 09/30/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	2" TOPSOIL/GRASS	0						Wall 4
970	Sand-trace silt, clay, rock fragments and roothairs; firm; brown (Residual) (SM)		1		4-7-8	12		
	-trace mica; dense; red-brown	5	2		7-13-18	8		No groundwater encountered at time of boring, Borehole caved-in at 6'
965								
BoF= 960.5	-no roothairs; brown	10	3		7-15-18	18		
960								
	Partially Weathered Rock sampled as Sand-trace silt, clay, rock fragments and mica; very dense; red-brown (SM)		4		31-50/2	4		
		15	3		50/3	3		
955	-micaceous, no rock fragments							
	AUGER REFUSAL AT 15'							
950		20						
945		25						
940		30						
935		35						BoF= Approximate Bottom of Footing
930		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 132+25, 15' R
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 09/29/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
BoW= 962.0	2" TOPSOIL/GRASS	0						Wall 5
	Sand-trace silt, clay, rock fragments and roothairs; firm; brown (Residual) (SM)		1		11-9-7	6		No groundwater encountered at time of boring, Borehole caved-in at 3.5'
960		C						
	-loose	5	2		4-3-4	0		No recovery
	-trace mica, no roothairs; medium dense		3		5-9-14	12		
955								
	Partially Weathered Rock sampled as Sand-some mica, trace silt, clay and rock fragments; very dense; brown (SM)	10	4		21-50/3	8		
950			5		11-28-26	18		
	Sand-micaceous, trace silt and clay; very dense; tan-brown (Residual) (SM)		6		17-24-26	18		
	-some mica	15						
	BORING TERMINATED AT 15'							
945								
		20						
940								
		25						
935								
		30						
930								
		35						
925								BoW= Approximate Bottom of Wall
		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 135+32, 13' R
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 09/29/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 55 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	1" TOPSOIL	0						Wall 5A
955	Sand-some mica, trace silt, clay and rock fragments; firm; brown (Residual) (SM)		1		2-6-13	18		
BoW= 952.5								No groundwater encountered at time of boring
	-dense	5	2		13-11-24	18		Borehole caved-in at 4.5'
950								
	Partially Weathered Rock sampled as Sand-some mica, trace silt and clay; very dense; gray (SM)		3		50/5	5		
	-trace rock fragments							Hard drilling from 7.5' to 10.5' (3 minutes)
		10	4		50/2	2		
945	AUGER REFUSAL AT 10.5'							
		15						
940								
		20						
935								
		25						
930								
		30						
925								
		35						
920								
								BoW= Approximate Bottom of Wall
		40						
915								

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 134+37, 32' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 10/03/11
JOB NO.: 2011.2530.01 DRILLER: DUSTIN RIG: CME 550 LOGGED BY: AW

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
965	2" TOPSOIL	0						Wall 6
	Sand-some silt and mica, trace clay; dense; red-brown (Residual) (SM)		1		10-19-13	18		Bulk Sample taken from 2' to 8'
960	-medium dense	5	2		7-13-14	18		No groundwater encountered at time of boring and after 24 hours Borehole caved-in at 7.5'
BoW= 959.0	-micaceous, trace rock fragments; gray		3		16-14-13	18		
955	-gray-brown	10	4		11-12-8	18		
	Partially Weathered Rock sampled as Sand-some mica, trace silt, clay and rock fragments; very dense; brown (SM)		5		30-50/1	7		Hard drilling from 11' to 12' (15 seconds)
950		15	6		9-11-12	18		Hard drilling from 12.5' to 13.5' (30 seconds)
	Sand-some silt, trace clay and mica; medium dense; gray, brown, white (Residual) (SM)							
	BORING TERMINATED AT 15'							
945		20						
940		25						
935		30						
930		35						BoW= Approximate Bottom of Wall
925		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 137+13, 12' R
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 09/30/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
950	NO TOPSOIL	0						Wall 7
	Sand-some silt, clay and mica; firm; orange-brown (Residual) (SM)		1		6-5-7	18		
	-trace rock fragments; medium dense							
945		5	2		14-10-17	18		
BoW= 944.0								
			3		13-34-50/2	12		
	Partially Weathered Rock sampled as Sand-micaceous, trace silt; very dense; gray (SM)							
940		10	4		12-15-21	18		No groundwater encountered at time of boring
	Sand-micaceous, trace silt; dense; gray (Residual) (SW-SM)							Borehole caved-in at 11'
	-medium dense; brown		5		3-9-12	18	7.2	
935		15	6		13-34-50/3	15		
	Partially Weathered Rock sampled as Sand-micaceous, trace silt; very dense; gray (SM)							
	BORING TERMINATED AT 15'							
930		20						
925		25						
920		30						
915		35						
								BoW= Approximate Bottom of Wall
910		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 138+67, 8' R
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 09/30/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	2" ASPHALT, 18" CONCRETE	0						Wall 7
945	Sand-some rock fragments, trace silt, mica and clay; very dense; tan (Residual) (SM)		1		28-50/4	6		N-value amplified due to rock fragments
	-no rock fragments; firm; red- brown	5	2		8-8-7	12		
940	-medium dense; brown		3		12-11-14	8		
BoW= 938.0	-some silt; red	10	4		6-9-13	16		No groundwater encountered at time of boring and after 24 hours Borehole caved-in at 10'
935	-dense; brown		5		18-22-27	8		
	Partially Weathered Rock sampled as Sand-some silt and mica, trace clay; very dense (SM)	15	6		50/1	1		Hard drilling from 13.5' to 15' (115 seconds)
	BORING TERMINATED AT 15'							
930								
		20						
925								
		25						
920								
		30						
915								
		35						
910								BoW= Approximate Bottom of Wall
		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 137+74, 46' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 10/03/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	NO TOPSOIL	0						Wall 8
	Sand-some mica, trace silt and clay; very dense; orange-brown (Residual) (SM)		1		12-24-36	12		
960								
	-gray	5	2		12-18-32	18		
955								
	-micaceous; dense; light orange	10	3		18-21-25	18		No groundwater encountered at time of boring and after 24 hours Borehole caved-in at 14'
950			4		10-26-50/5	16		
	Partially Weathered Rock sampled as Sand-micaceous, trace silt and clay; very dense; gray (SM)							
BoF= 948.0		C 15	5		50/4	0		No recovery Hard drilling from 13.5' to 17' (5 minutes)
			6		50/1	0		No recovery
945	AUGER REFUSAL AT 17'							
		20						
940								
		25						
935								
		30						
930								
		35						
925								BoF= Approximate Bottom of Footing
		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 140+12, 35' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 10/03/11
JOB NO.: 2011.2530.01 DRILLER: DUSTIN RIG: CME 550 LOGGED BY: AW

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	2" TOPSOIL	0						Wall 9
960	Sand-some silt, trace clay and mica; medium dense; red-brown (Residual) (SM)		1		9-12-13	18		
	-trace rock fragments; dense	5	2		13-21-25	18		
955								Hard drilling from 5' to 8' (150 seconds)
	-no rock fragments; medium dense	10	3		8-12-15	18		
BoF= 950.0 950			4		6-10-12	18		No groundwater encountered at time of boring and after 24 hours Borehole caved-in at 14'
	-trace rock fragments; firm	15	5		6-8-11	18		
945	-micaceous, trace silt; light red-brown (SW-SM)		6		4-8-9	18	8.7	Hard drilling from 15' to 16' (110 seconds)
	-loose	20	7		4-3-4	18		
940								
	-medium dense; gray	25	8		6-11-10	18		
935	BORING TERMINATED AT 25'							
		30						
930								
		35						
925								BoF= Approximate Bottom of Footing
		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 141+88, 35' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 10/04/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
970	NO TOPSOIL	0						Walls 9 and 9A
	Sand-some silt, trace mica, clay and roothairs; firm; red-brown (Residual) (SM)		1		5-5-13	18		
			2		20-50/6	12		Bulk Sample taken from 3' to 11'
965	Partially Weathered Rock sampled as Sand-some silt and mica, trace clay; very dense; orange, brown (SM)	5						
	-micaceous		3		17-34-50/3	15		
960		10						
	Sand-micaceous, trace silt and clay; very dense; dark gray (Residual) (SM)		4		22-42-37	18		
	-brown		5		31-33-34	18		
BoF= 955.0 955		15						
	Partially Weathered Rock sampled as Sand-micaceous, trace silt and clay; very dense; tan-brown (SM)		6		22-50/3	8		
			7		17-50/5	10		
950		20						
								No groundwater encountered at time of boring and after 24 hours Borehole caved-in at 25'
		25	8		50/5	5		
945								Hard drilling from 24' to 28.5' (3.5 minutes)
			9		50/5	5		
940		30						
	BORING TERMINATED AT 30'							
935		35						
								BoF= Approximate Bottom of Footing
930		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 142+67, 7' R
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 10/03/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	3" ASPHALT, 6" CONCRETE	0						Wall 11
955	Sand-trace silt, rock fragments, mica and clay; very dense; tan-brown (Residual) (SM)		1		27-50/6	10		N-value amplified due to rock fragments
	-some mica, no rock fragments; firm	5	2		7-8-9	12		
950								
BoW= 949.0			3		6-7-9	18		No groundwater encountered at time of boring and after 24 hours Borehole caved-in at 9'
	-micaceous	10	4		13-10-9	18		
945								
			5		5-6-10	10		
	-trace rock fragments; very dense	15	6		13-25-25	8		
940	BORING TERMINATED AT 15'							
		20						
935								
		25						
930								
		30						
925								
		35						
920								BoW= Approximate Bottom of Wall
		40						
915								

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 143+28, 30' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 10/04/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	NO TOPSOIL	0						Wall 13
	Sand-some silt and mica, trace clay and roothairs; loose; brown (Residual) (SM)		1		1-3-4	18		
965								
	-medium dense; red-brown	5	2		7-11-13	18		
960								
	-micaceous, no roothairs; very dense; orange-brown	10	3		13-26-32	18		
BoF=956.5								
	-trace silt; medium dense		4		14-12-12	18		
955								
		15	5		17-38-50/2	12		
	Partially Weathered Rock sampled as Sand-micaceous, trace silt and clay; very dense; tan-brown (SM) -trace rock fragments							
950			6		50/3	3		
		20	7		30-50/1	6		No groundwater encountered at time of boring and after 24 hours Borehole caved-in at 22'
945								
	-no rock fragments; dark gray	25	8		50/2	2		Hard drilling from 24' to 27' (3.75 minutes)
940	AUGER REFUSAL AT 27'							
		30						
935								
		35						
930								BoF= Approximate Bottom of Footing
		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 144+00, 35' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 10/03/11
JOB NO.: 2011.2530.01 DRILLER: DUSTIN RIG: CME 55 LOGGED BY: AW

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
975	2" TOPSOIL	0						Walls 13 and 13A
	Sand- some silt and mica, trace clay; firm; brown (Residual) (SM)		1		4-5-6	18		
970		5	2		4-5-5	18		
	-gray-brown		3		5-7-7	6		Bulk sample taken from 6' to 13'
965	-loose	10	4		4-4-5	18		
	-micaceous, trace silt; gray (SW-SM)						4.9	Undisturbed sample taken from 11.5' to 13.5'
960	-medium dense	15	5		18-13-7	18		
BoF= 956.0	-dense							No groundwater encountered at time of boring
955		20	6		13-19-18	18		Borehole caved-in at 20'
	Partially Weathered Rock sampled as Sand-some silt and mica, trace clay; very dense; gray (SM)		7		24-50/4	10		
950		25	8		50/5	5		
			9		15-50/6	12		
945		30	10		50/6	6		
940		35	p		50/3	3		Hard drilling from 33. 5' to 35' (180 seconds)
	AUGER REFUSAL AT 35'							BoF= Approximate Bottom of Footing
935		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 145+57, 25' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 10/03/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
BoF= 953.0	4" TOPSOIL/GRASS	0						Wall 13
	Sand-trace silt, mica, clay and roothairs; loose; brown (Residual) (SM)		1		2-2-5	18		
950								
	-micaceous, no roothairs; dense	5	2		12-14-21	18		
	-medium dense		3		8-10-12	18		
945								
	-very dense	10	4		8-21-34	18		No groundwater encountered at time of boring and after 24 hours Borehole caved-in at 11.5'
	-dense	C	5		10-21-25	18		
940								
		15	6		11-18-25	18		
	BORING TERMINATED AT 15'							
935								
		20						
930								
		25						
925								
		30						
920								
		35						
915								BoF= Approximate Bottom of Footing
		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 148+15, 45' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 10/04/11
JOB NO.: 2011.2530.01 DRILLER: DUSTIN RIG: CME 55 LOGGED BY: AW

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
975	2" TOPSOIL	0						Walls 13 and 13B
	Sand-micaceous, some silt, trace clay; medium dense; brown, gray (Residual) (SM)		1		10-12-16	18		
970		5	2		12-11-12	18		
965	-firm	10	3		3-4-6	18		
		C						No groundwater encountered at time of boring Borehole caved-in at 13'
960	- some mica; medium dense; gray, brown	15	4		10-9-19	18		Bulk sample taken from 13' to 20'
								Hard drilling from 17' to 18' (60 seconds)
BoF= 955.0 955	Partially Weathered Rock sampled as Sand-some silt, trace clay and mica; very dense; gray (SM)	20	5		48-50/1	7		Hard drilling from 18' to 22' (130 seconds)
950		25	6		50/1	1		
	AUGER REFUSAL AT 25'							
945		30						
940		35						
								BoF= Approximate Bottom of Footing-
935		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 148+45, 50' L
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 10/04/11
JOB NO.: 2011.2530.01 DRILLER: DUSTIN RIG: CME 55 LOGGED BY: AW

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	2" TOPSOIL	0						Walls 13 and 13B
	Sand-some silt and mica, trace clay; firm; brown (Residual) (SM)		1		4-5-7	18		
970								
	-dense	5	2		13-14-16	18		
965								Bulk sample taken from 6' to 15'
	-medium dense	10	3		8-9-11	18		
	-micaceous, trace silt; tan, red-brown (SW-SM)						7.7	Undisturbed sample taken from 10' to 12'
960	-gray-brown		4		9-10-13	18		
		15	5		9-11-15	18		
								No groundwater encountered at time of boring
BoF= 955.0 955		C	6		5-12-16	18		Borehole caved-in at 17.5'
	-some silt, trace mica; gray, white	20	7		5-13-13	18		
950	-dense		8		6-15-25	18		
	Partially Weathered Rock sampled as Sand-some silt and mica; trace clay; very dense; gray, brown, white (SM)	25	9		50/5	3		
945	AUGER REFUSAL AT 25'							
		30						
940								
		35						
935								BoF= Approximate Bottom of Footing
		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 145+74, 9' R
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 10/03/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	3" ASPHALT/ 6" CONCRETE	0						Wall 14
	Sand-trace silt, clay , mica and rock fragments; very dense; brown (Residual) (SM)		1		17-30-27	12		N-value amplified due to rock fragments
950								
BoW= 949.0	-firm	5	2		8-7-8	0		No recovery
	-some mica; loose		3		3-4-5	10		
945								
	-micaceous, some silt, no rock fragments; firm	10	4		5-6-5	12	6.7	No groundwater encountered at time of boring and after 24 hours Borehole caved-in at 12'
	-loose		5		3-3-5	16		
940								
	-medium dense	15	6		11-10-13	18		
	BORING TERMINATED AT 15'							
935								
		20						
930								
		25						
925								
		30						
920								
		35						
915								BoW= Approximate Bottom of Wall
		40						

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BORING LOG

CONTRACTED WITH: CITY OF SANDY SPRINGS
BORING NO.: 146+88, 7' R
PROJECT NAME: MORGAN FALLS ROAD IMPROVEMENTS
DATE: 10/03/11
JOB NO.: 2011.2530.01 DRILLER: ANTHONY RIG: CME 550 LOGGED BY: SA

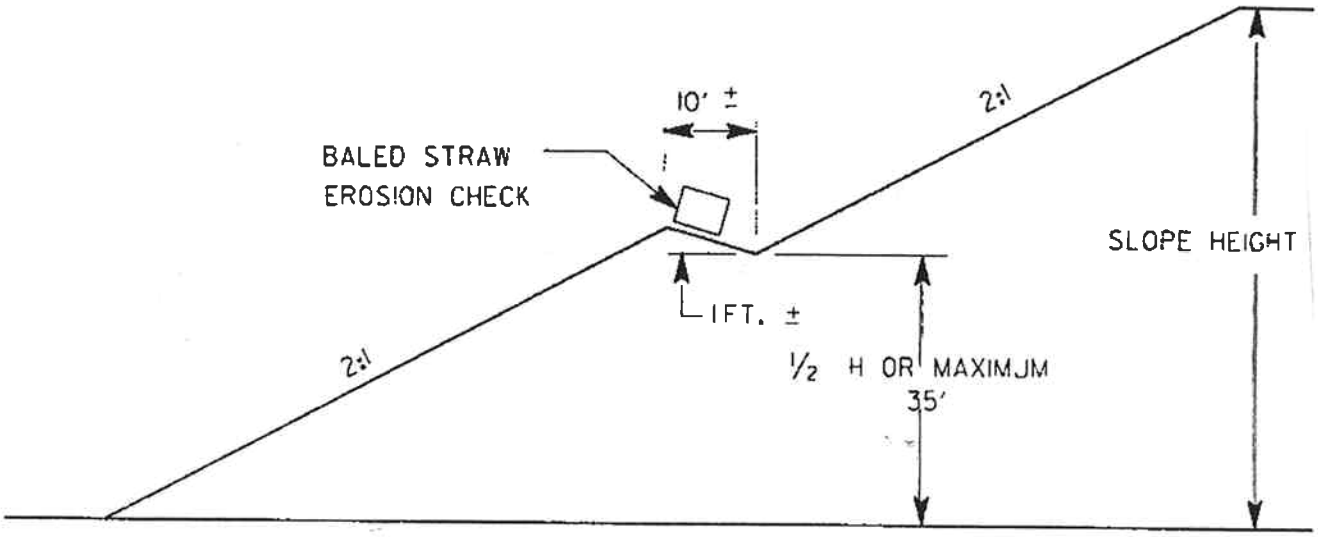
ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	3" ASPHALT/ 6" CONCRETE	0						Wall 14
	Sand-trace silt, mica, rock fragments and clay; very dense; tan (Residual) (SM)		1		20-50/4	8		N-value amplified due to rock fragments
BoW= 950.5								
950								
	-loose		2		3-4-5	0		No recovery
		5						
		C						No groundwater encountered at time of boring
			3		13-25-50/5	16		Borehole caved-in at 6'
945	Partially Weathered Rock sampled as Sand-micaceous, trace silt and clay; very dense; tan (SM)							
		10	4		50/3	3		
	AUGER REFUSAL AT 10.5'							
940								
		15						
935								
		20						
930								
		25						
925								
		30						
920								
		35						
915								BoW= Approximate Bottom of Wall
		40						

EXPLORATION PROCEDURES

Twenty six (26) Standard Penetration Test (SPT) borings were drilled at the approximate locations shown on the attached Boring Location Plan & Profile (Figure 2 through 9). The depths of borings ranged from 6 to 35 feet below the existing grades. Soil samples obtained using the split spoon sampler were evaluated by the Geotechnical Engineer and classified according to the visual-manual procedure described in ASTM D 2488-00. Soil test borings were performed in general accordance with ASTM D 1586. A narrative of field operations is included in the Appendix.

A track-mounted John Deere 555 dozer was utilized to clear access paths to some of the boring locations throughout the wall alignment. A United Consulting engineer supervised the clearing operations to reduce disturbance to the existing trees.

Boring locations were determined in the field by the Geotechnical Engineer who measured distances and estimated angles with the aid of a hand held compass, a measuring tape and existing site features. Ground elevations indicated on the boring logs are obtained by interpolation of the contours provided in site plan and cross section. Therefore, the boring locations shown on the attached boring location plan and the ground elevations on the boring logs should be considered approximate.



NOTES:

1. FOR SLOPE HEIGHTS LESS THAN 70 FT. BUT GREATER THAN 35 FT., A BERM SHOULD BE CONSTRUCTED AT APPROX. ½ THE SLOPE HEIGHT. FOR SLOPE HEIGHTS GREATER THAN 70 FT., CONSTRUCT A BERM EVERY 35 FT.
2. THE BERM SHOULD BE SLOPED TO DRAIN AND SHOULD BE CONNECTED TO CONCRETE FLUMES TO REMOVE WATER FROM SLOPE.
3. A DRAINAGE DITCH SHOULD BE CONSTRUCTED AT THE TOP OF CUT SLOPES WHERE WATER DRAINS TOWARDS SLOPE.

BERM DETAIL FOR CUTS OR FILLS OVER 35 FEET

NO SCALE