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DEPARTMENT OF TRANSPORTATION

STATE OF GEORGIA

INTERDEPARTMENTAL CORRESPONDENCE

FILE MSL00-0004-00(086), Gwinnett Co.
SR 20 over SR 316
PI No. 0004086

OFFICE Materials and Research
Forest Park, Georgia

DATE September 17, 2010

FROM Georgene M. Geary, P.E., State Materials and Research Engineer

TO Bobby Hilliard, P.E., Office of Program Delivery
Attn: Hiral Patel

SUBJECT Final Acceptance of Consultant's Soil Survey Summary Report

As requested, we have reviewed the Soil Survey Report that was written on September 13, 2010 by Willmer Engineering of Atlanta, Georgia. This report is acceptable for use in design and during construction. Copies of this report should be forwarded to the appropriate DOT offices.

If additional information is needed, please contact Catherine Armstrong of the Geotechnical Engineering Bureau at 404-608-4727

GMG: CAA

Copy:

Willmer Engineering Inc.
3772 Pleasantdale Rd.
Suite 165
Atlanta, Georgia 30340-4270
Attn: Sujit Bhowmik

SOIL SURVEY REPORT
(Revised September 29, 2010)
Side Roads and Ramps
SR 316 from West of CR 104/Collins Hill Road
to CR 177/Hi-Hope Road
GDOT Project No. MSL00-0004-00(086)
PI No. 0004086
Gwinnett County, Georgia

WILLMER ENGINEERING INC.
Willmer Project No. ATL-171-3594

Prepared For

PBS&J
Atlanta, Georgia

Prepared By

WILLMER ENGINEERING INC.
3772 Pleasantdale Road
Suite 165
Atlanta, Georgia 30340-4270

770.939.0089

WILLMER ENGINEERING INC. | WE

September 29, 2010

VIA U.S. MAIL

Michael R. Moseley, Jr., PE
PBS&J
1600 River Edge Parkway NW
Suite 600
Atlanta, Georgia 30328

SUBJECT: **Soil Survey Report**
Side Roads and Ramps
SR 316 from West of CR 104/Collins Hill Road to CR 177/Hi-Hope Road
GDOT Project Nos. MSL00-0004-00(086), PI No. 0004086
Gwinnett County, Georgia
Willmer Project No. ATL-171-3594

Dear Mr. Moseley:

Willmer Engineering Inc. (Willmer) is pleased to provide this Soil Survey report for the proposed improvement of side roads and ramps associated with construction of SR 316 from West of CR 104/Collins Hill Road to CR 177/Hi-Hope Road in Gwinnett County, Georgia. The Soil Survey was performed based on a set of plans and cross sections received on March 19, 2010, provided to us by PBS&J. This work was performed in general accordance with Willmer Proposal No. P04-105B, dated November 4, 2009, and the GDOT guidance documents for Soil Survey for roadway design. The report was revised to incorporate GDOT review comments dated September 10, 2010.

The attached summary presents the site and subsurface conditions along the proposed alignment and our conclusions and recommendations related to project design and construction.

We appreciate the opportunity to be of service to you on this project. Please contact us if you have any questions concerning this report or require further assistance.

Sincerely,

WILLMER ENGINEERING INC.

Duhwan Kim, PhD
Project Engineer

Sujit K. Bhowmik, PhD, PE
Chief Engineer

James L. Willmer, PE
Executive Vice President/Principal Consultant

DK/SKB/JLW:lmh
P:\3594-SR 316 Colonial Pipeline Gas Easement\Report-SS\171-3594 SR 316 Collins Hill Road-SS Report (Rev 1).docx

GEORGIA REGISTERED No. 10750 PROFESSIONAL ENGINEER
9/29/2010

3772 Pleasantdale Road
Suite 165
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Attachments: **Soil Survey Summary**

Special Provision 881 – Fabrics

Figures

Figure 1 Project Location Map
Figure 2 Project Alignment Map

Appendix I

Removal Detail
Berm Detail for Fills over 35 Feet
Benching Detail
Filter Fabric Detail
Pipe Culvert Material Alternates

Appendix II

Boring Record Legend
Unified Soil Classification System Reference Sheet
Record of Soil Survey Borings (Pages 1 through 5)
Standard Penetration Test Boring Logs

Appendix III

Laboratory Data Summary (Sheets 1 through 6)
Results of Consolidation Test
Results of Organic Content Test on a Muck Sample
Results of Corrosion Series Tests on Water Samples

SOIL SURVEY SUMMARY
for
GDOT Project Nos. MSL00-0004-00(086), PI No. 0004086
Side Roads and Ramps
SR 316 from West of CR 104/Collins Hill Road to CR 177/Hi-Hope Road
Gwinnett County, Georgia

1. Location / Description

This project involves improvements of side roads and ramps associated with SR 316 from Collins Hill Road and 1,500 feet east of SR 20 (Buford Drive) in Gwinnett County, Georgia. The starting point of the project is located about 1.5 miles north of Lawrenceville, Georgia. The improvements consist of the new construction of two ramps and three side roads (Ramps 'V' and 'W', Park Access Drive, Reynolds Road Extension, and Lendon Connector).

The total length of this project is about 1.1 miles. A project location map is presented in Figure 1, and a project alignment map is presented in Figure 2. This project includes one box culvert located on Lendon Connector.

2. Geology

The project alignment is geologically sited within the Piedmont Physiographic Province of Georgia, and is underlain by mica schist and amphibolite.

3. Rock

None encountered.

4. Removal

A. Soils with High In-Place Moisture Content:

In some parts of the project alignment, the soils at/near the proposed grade were found to have in-place moisture contents far above the corresponding optimum moisture contents. This condition has the potential to cause pumping problems during subgrade and base construction. It is recommended that upon completion of any necessary excavation in these areas, 24-inches of subgrade soils from beneath the proposed pavement and shoulders be removed, and either dried out and replaced, or replaced with drier soils. The locations where high in-place moisture contents will likely be encountered are:

Station to Station	Location
610+50± to 611+10± (Ramp 'W')	Left & Right
54+94± to 61+50± (Reynolds Road Extension)	Left & Right

This work should be done under the direction of the Engineer, and may be eliminated if the subgrade soils are dry and stable at the time of construction.

(continued)

4. Removal (continued)

B. Class IV Soils – Muck with Organics:

Materials unsuitable for embankment construction (Class IV Soils - muck with organics) which requires removal were encountered in a lake at the locations and estimated minimum depths indicated below:

Station to Station	Location	Estimated Minimum Depth
23+00± to 25+75± (Lendon Connector)	Left & Right	2'
25+75± to 26+50± (Lendon Connector)	Left	2'

The lake should be dewatered prior to removal of the unsuitable materials, and the removed materials should be replaced with rock embankment. If there is standing water during replacement, the rock embankment should be placed to a height of 18 inches above the water elevation at the time of construction. We recommend that the rock embankment be choked off with fines prior to the placement of normal fill material. Removal and replacement should be in accordance with the "Removal Detail" presented in Appendix 1. The removed materials may be used in thin layers to flatten side slopes, or may be wasted outside the construction limits of the project.

5. Waste

None of the materials found on this project will require wasting.

6. Subgrade Materials

No additional subgrade materials will be required for this project.

7. Pavement Design

The pavement design for this project should include a minimum of 10 inches of graded aggregate base (GAB).

8. Pavement Design Values

The following values are recommended for use in the pavement design calculations for the entire length of the project:

Soil Support Value = 2.5
Regional Factor = 1.8
Subgrade Reaction Modulus, k = 130 pci

Graded aggregate base is the only base material recommended for use on this project.

9. Slopes

A. General Slopes:

Standard Penetration Test (SPT) borings and slope stability analyses were performed at the critical slope locations to evaluate the stability of the designed slopes. Logs of the SPT borings performed in high fill areas are included in Appendix II.

Based on the results of our stability analyses, it is recommended that a maximum slope of 2:1 be used in all areas.

B. Slopes Greater than 35 feet in Height:

Embankment slopes that are greater than 35 feet in height will require construction of an intermediate berm in accordance with the attached "Berm Detail" (see Appendix I) at the following location:

Station to Station	Location
23+25± to 26+00± (Lendon Connector)	Left
23+75± to 25+75± (Lendon Connector)	Right

10. Serrated Slopes

Serrated slopes will not be required on this project.

11. Bench Detail

Where new fills are to be placed on existing slopes steeper than 3:1, the existing slope should be benched in accordance with the "Benching Detail" presented in Appendix I.

12. Low Wet Areas

The project alignment crosses a number of low wet areas, which may remain inundated at the time of construction. Ditching will likely be required to drain any standing water prior to embankment construction. The low wet areas were at the following stations:

Station to Station	Location
4296+25± to 4298+00± (Ramp 'V')	Right

If there is standing water and it is not feasible to drain these areas during construction, a mat of rock embankment should be placed to a height of 18 inches above the water level prior to placing normal fills. We recommend that the rock embankment be choked off with fines prior to the placement of normal fill material.

(continued)

12. Low Wet Areas (continued)

If the ground surface is wet and unstable due to high ground water, we recommend that a layer of filter fabric be placed on top of the existing ground surface prior to placing the fills, as shown on the 'Filter Fabric Detail' in Appendix I. Placement of the fabric should be in accordance with Special Provision Section 881.

The requirement of any of these measures may be eliminated at the direction of the Engineer if the subgrade soils are dry and stable at the time of construction.

13. Shrinkage

We recommend an average shrinkage factor of 25% for use in the earthwork calculations for this project.

14. Culverts

We recommend that a 12-inch blanket of Type II Foundation Backfill material be placed under the barrel of all culverts and 48-inch diameter and larger cross-drains on this project with the exception of the culverts at the following locations where a 24-inch blanket of Type II Foundation Backfill is recommended:

Station	Culvert Size	Type II Foundation Backfill Required
24+50± (Lendon Connector)	7'x7' RCBC	24"

15. Corrosion

In selecting culvert material types, reference should be made to the attached (Appendix I) "Pipe Culvert Material Alternates" for materials allowable based on the laboratory corrosion tests.

Corrosion potential tests, consisting of electrical resistivity and pH tests, were performed on a water sample obtained from the culvert location on Lendon Connector. The test results are summarized in Table AIII-3, Appendix III.

16. Special Problems

A. Miscellaneous trash/debris consisting of wood, paint cans, roofing, flooring (possible asbestos), and other materials were found along the proposed alignment at the following locations:

Station to Station	Location
604+00± to 607+00± (Ramp 'W')	Left, Center & Right
67+00± to 69+00± (Reynolds Road Extension)	Left, Center & Right

(continued)

16. Special Problems (continued)

These materials should be removed prior to site grading/fill placement and disposed of in accordance with applicable regulatory requirements.

B. Several residences and businesses are located close to the construction limits of the project. Vibrations from construction may be of concern to the property owners. It is recommended that the Engineer contact the Geotechnical Engineering Bureau prior to construction to evaluate the need for crack surveys and vibration monitoring.

Reported By: Duhwan Kim, PhD / Sujit K. Bhowmik, PhD, PE

Reviewed By: James L. Willmer, PE

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

PROJECT NO. MSL00-0004-00(086), Gwinnett County
PI NO. 0004086

SECTION 881 – FABRICS

881.2.08 Filter Fabric for Embankment Stabilization

A. Requirements

1. Use woven filter fabric for embankment stabilization.
2. Sew fabric with a lock stitch using high strength polypropylene or nylon thread.
3. Obtain approval of the stitch and sewing method from the Engineer prior to use.
4. Use fabric that meets the following minimum tensile strength requirements:

Fabric Type	Tensile Strengths in lb./in. (kN/m) width			
	Warp Direction		Fill Direction	
	5% Strain	Ultimate	5% Strain	Ultimate
Polyester	100 (17.5)	250 (43.8)	100 (17.5)	250 (43.8)
Polypropylene	100 (17.5)	400 (70)	100 (17.5)	400 (70)

Minimum Seam Strength = 100 lb./in. (17.5 kN/m) width

a. Tensile strengths at 5% strain are based on reduction factors from the ultimate strengths of 0.4 for polyester and 0.25 for polypropylene fabrics.

b. Use of reduction factors other than those shown are allowed only if verified by laboratory tests acceptable to the Department.

5. Submit a certification from the manufacturer that shows the physical properties of the material used and how it meets this Specification. Submit the certificate according to Subsection 106.05, "Materials Certification."

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

Test according to the following:

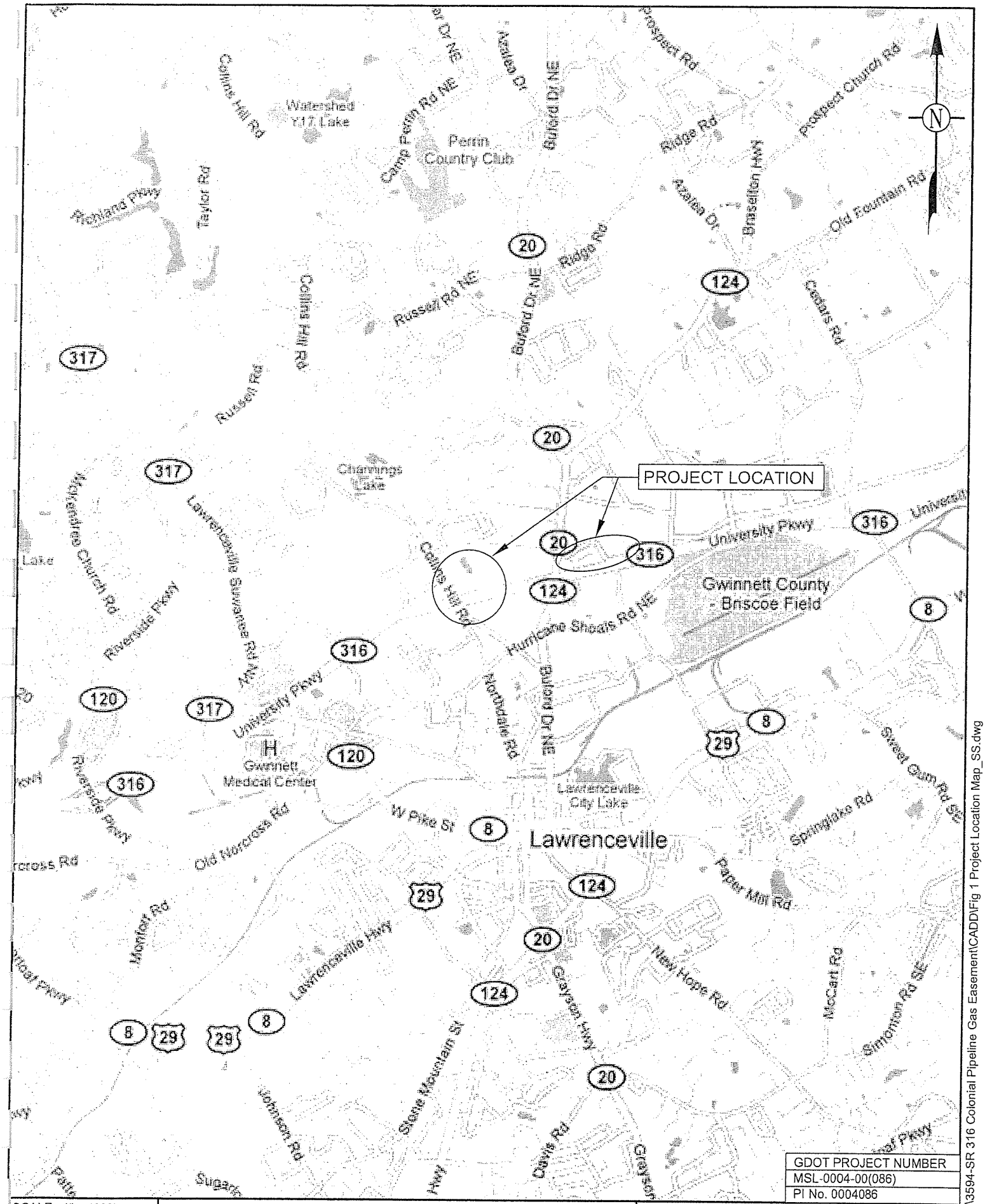
Test	Method
Tensile Strength, Elongation	ASTM D-4595 Wide Strip Test
Seam Strength	ASTM D-4884 Wide Strip Test

1. Run the tests at a strain rate of 10% per minute.
2. Use a pre-tensioning load of 10 pounds per inch (1.75 kN/m) or 3%, whichever is less.

D. Materials Warranty

General Provisions 101 through 150.

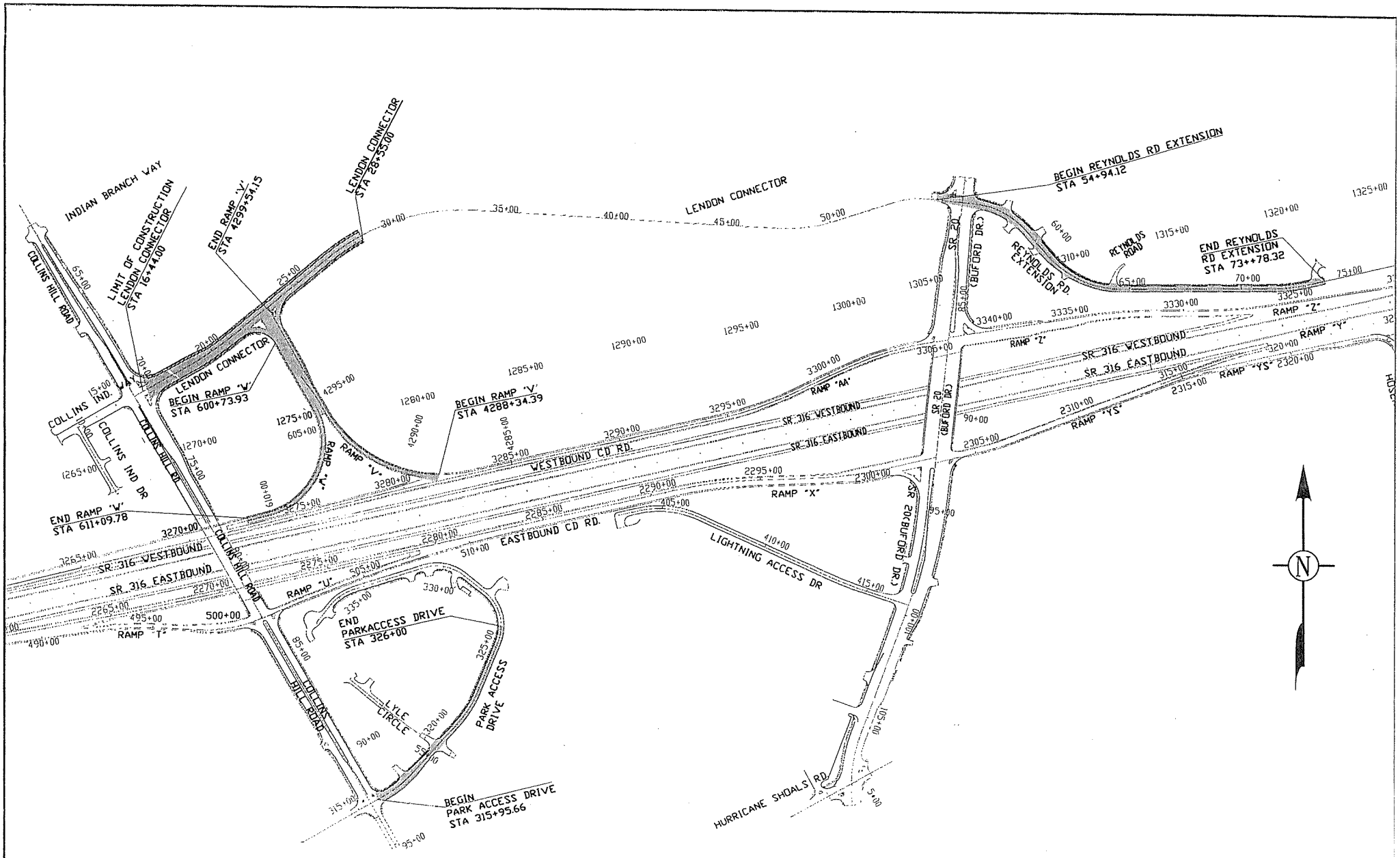
FIGURES



GDOT PROJECT NUMBER
MSL-0004-00(086)
PI No. 0004086

SCALE: 1" = 4000'			FIGURE 1 PROJECT LOCATION MAP SR 316 FROM WEST OF CR 104/COLLINS HILL ROAD TO CR 177/HI-HOPE ROAD GWINNETT COUNTY, GEORGIA WILLMER PROJECT No. ATL-171-3594
DATE: 5/26/2010	WILLMER ENGINEERING INC. WE	GEOTECHNICAL ENGINEERING CONSTRUCTION SERVICES ENVIRONMENTAL SERVICES AND ENGINEERING 3772 PLEASANTDALE ROAD - SUITE 165 ATLANTA, GA 30340-4270	
DRAWN BY: CDL			
REVIEWED BY: DK			

P:\3594-SR 316 Colonial Pipeline Gas Easement\CADD\Fig 1 Project Location Map_SS.dwg



GDOT PROJECT NUMBER
MSL00-0004-00(086)
PI No. 0004086

SCALE: 1" = 500'	WILLMER ENGINEERING INC.	WE	GEOTECHNICAL ENGINEERING ▫ CONSTRUCTION SERVICES ENVIRONMENTAL SERVICES AND ENGINEERING 3772 PLEASANTDALE ROAD - SUITE 165 ATLANTA, GA 30340-4270
DATE: 6/30/2010			FIGURE 2 PROJECT ALIGNMENT MAP SIDE ROADS AND RAMPS SR 316 FROM WEST OF CR 104/COLLINS HILL ROAD TO CR 177/HI-HOPE ROAD GWINNETT COUNTY, GEORGIA WILLMER PROJECT No. ATL-171-3594
DRAWN BY:CDL			
REVIEWED BY: DK			

APPENDIX I

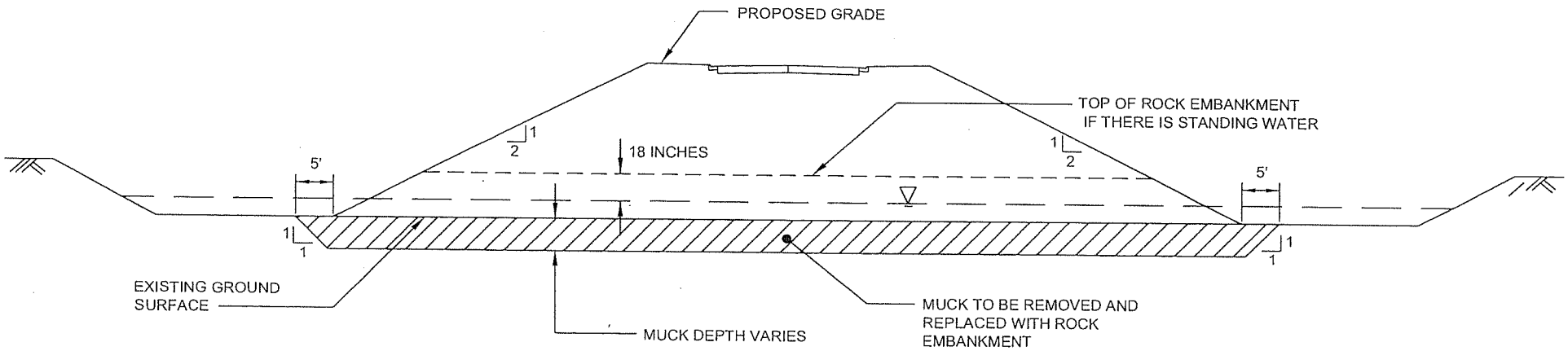
GENERAL NOTES:

1. DEWATER THE AREA AS NEEDED PRIOR TO MUCK REMOVAL. REMOVE MUCK TO DEPTHS AS DIRECTED BY THE ENGINEER.

2. PLACE ROCK EMBANKMENT MATERIAL IN THE EXCAVATED AREA IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.

3. IF THERE IS STANDING WATER AFTER MUCK REMOVAL, PLACE ROCK EMBANKMENT TO A HEIGHT OF 18 INCHES ABOVE THE WATER ELEVATION AT THE TIME OF CONSTRUCTION.

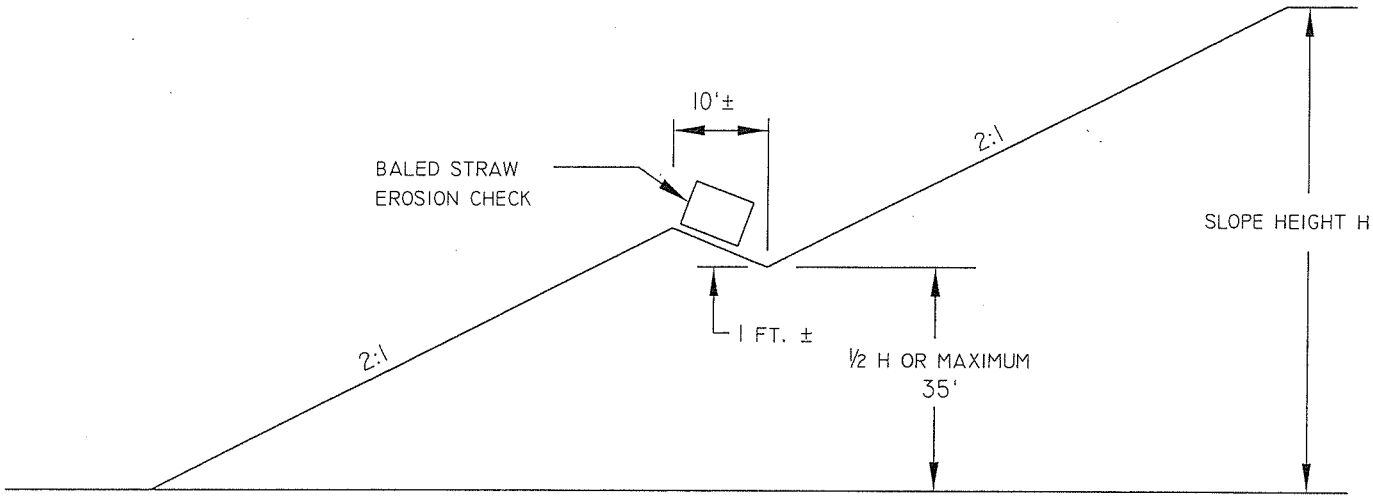
APPLIES TO STATION TO STATION	LOCATION	ESTIMATED MINIMUM DEPTH (FEET)
23+00± TO 27+75± (LENDON CONNECTOR)	LEFT AND RIGHT	2
25+75± TO 26+50± (LENDON CONNECTOR)	LEFT	2



REMOVAL DETAIL

GDOT PROJECT NUMBER
MSL00-0004-00(086)
PI No. 0004086

SCALE: NTS	WILLMER ENGINEERING INC. WE	GEOTECHNICAL ENGINEERING ▫ CONSTRUCTION SERVICES ENVIRONMENTAL SERVICES AND ENGINEERING 3772 PLEASANTDALE ROAD - SUITE 165 ATLANTA, GA 30340-4270	REMOVAL DETAIL SIDE ROADS AND RAMPS SR 316 FROM WEST OF CR 104/COLLINS HILL ROAD TO CR 177/HI-HOPE ROAD GWINNETT COUNTY, GEORGIA WILLMER PROJECT No. ATL-171-3594
DATE: 6/30/2010			
DRAWN BY: CDL			
REVIEWED BY: DK			



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.

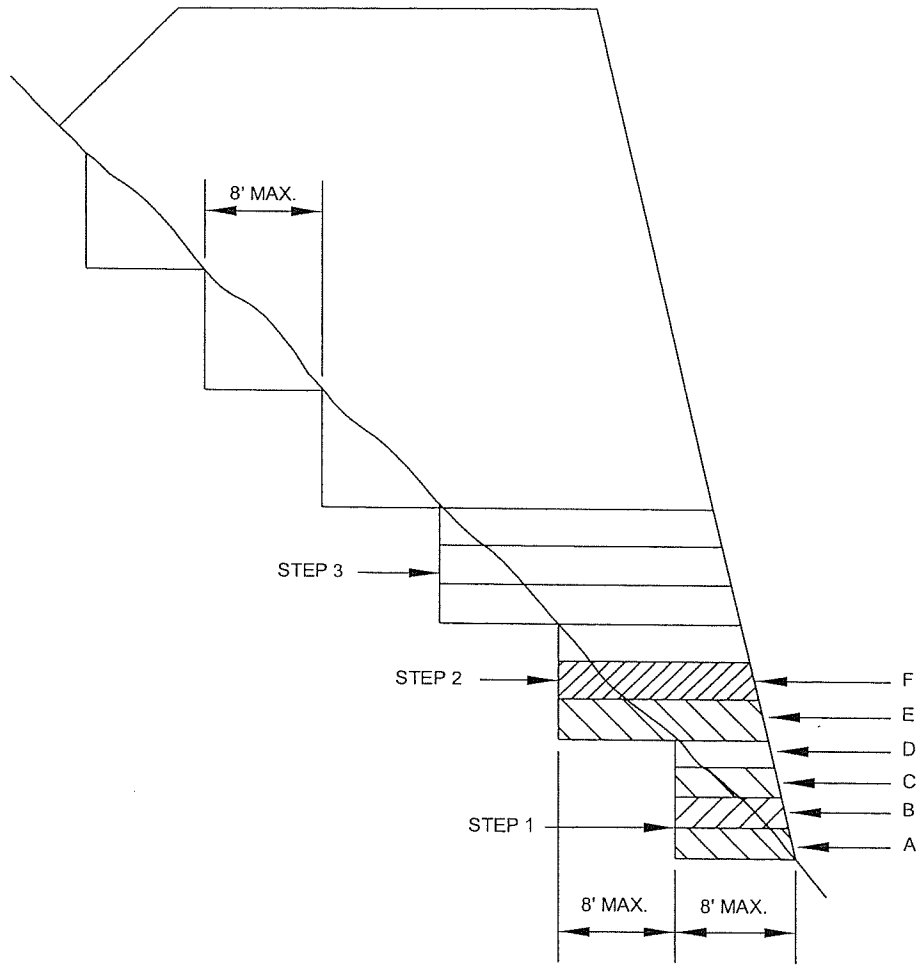
BERM DETAIL FOR FILLS OVER 35 FEET

GDOT PROJECT NUMBER
MSL-0004-00(086)
PI No. 0004086

SCALE: NTS			BERM DETAIL
DRAWN BY: CDL	5/20/2010	WILLMER ENGINEERING INC. WE GEOTECHNICAL ENGINEERING CONSTRUCTION SERVICES ENVIRONMENTAL SERVICES AND ENGINEERING 3772 PLEASANTDALE ROAD - SUITE 165 ATLANTA, GA 30340-4270	SR 316 FROM WEST OF CR 104/COLLINS HILL ROAD TO CR 177/HI-HOPE ROAD GWINNETT COUNTY, GEORGIA WILLMER PROJECT No. ATL-171-3594
REVIEWED BY: DK	5/20/2010		

P:\3594-SR 316 Colonial Pipeline Gas Easement\CADD\Fig Berm_Detail-SS.dwg

REVISED 9/29/2008



1. WHERE THE EMBANKMENT IS TO BE PLACED ON A HILLSIDE OR ANOTHER EXISTING EMBANKMENT HAVING A SLOPE OF 3 TO 1 OR STEEPER, THE FOUNDATION MUST BE BENCHED WHILE THE EMBANKMENT IS BEING CONSTRUCTED. (SEE DIAGRAM AT LEFT)

2. THE DIAGRAM SHOWS THAT BEFORE LAYER "A" IS PLACED, THE FIRST STEP (1) IS TO CUT INTO THE SLOPE A MAXIMUM DISTANCE OF ABOUT 8' (ABOUT 3/4 THE WIDTH OF THE TYPICAL D-8 BULLDOZER BLADE). SUCCESSIVE LAYERS B, C, AND D ARE THEN PLACED. BEFORE LAYER "E" IS PLACED, THE SECOND STEP IS TO CUT 8 FEET INTO THE SLOPE AND SUCCESSIVE LAYERS ARE AGAIN PLACED. IF IT IS ANTICIPATED THAT THE VERTICAL PART OF THE STEP WILL EXCEED 4' IF AN 8' HORIZONTAL CUT IS MADE, THEN THE ACTUAL CUT STOPS WHEN THE VERTICAL PART REACHES A MAXIMUM OF 4' ALLOWING THE HORIZONTAL DISTANCE TO VARY.

3. THE PROCESS OF BENCHING IS CONSIDERED INCIDENTAL TO THE ITEM OF UNCLASSIFIED EXCAVATION AND BORROW OR GRADING COMPLETE IN CONSTRUCTION OF THE EMBANKMENT AND NO ADDITIONAL MEASUREMENT OF QUANTITIY OR PAYMENT WILL BE MADE FOR BENCHING.

BENCHING DETAIL

GDOT PROJECT NUMBER
MSL00-0004-00(086)
PI No. 0004086

SCALE: NTS	
DRAWN BY: CDL	6/30/2010
REVIEWED BY: DK	6/30/2010

WILLMER ENGINEERING INC. WE

GEOTECHNICAL ENGINEERING ▫ CONSTRUCTION SERVICES
ENVIRONMENTAL SERVICES AND ENGINEERING
3772 PLEASANTDALE ROAD - SUITE 165
ATLANTA, GA 30340-4270

BENCHING DETAIL
SIDE ROADS AND RAMPS
SR 316 FROM WEST OF CR 104/COLLINS HILL ROAD TO CR 177/HI-HOPE ROAD
GWINNETT COUNTY, GEORGIA
WILLMER PROJECT No. ATL-171-3594

GENERAL NOTES:

1. FILTER FABRIC SHALL BE PLACED IN LOW WET AREAS WITHOUT ANY STANDING WATER, OR IF ANY STANDING WATER CAN BE DRAINED PRIOR TO FABRIC PLACEMENT.

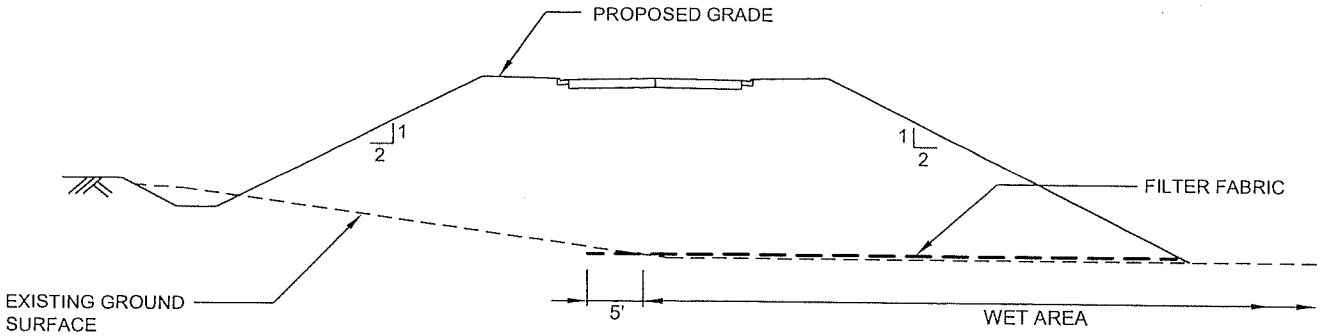
2. ALL TREES, DEBRIS AND OTHER ORGANIC MATTER SHALL BE REMOVED PRIOR TO FILTER FABRIC PLACEMENT.

3. FILTER FABRIC SHALL BE PLACED IN APPLICABLE PORTIONS OF THE AREAS LISTED ABOVE, AS DIRECTED BY THE ENGINEER.

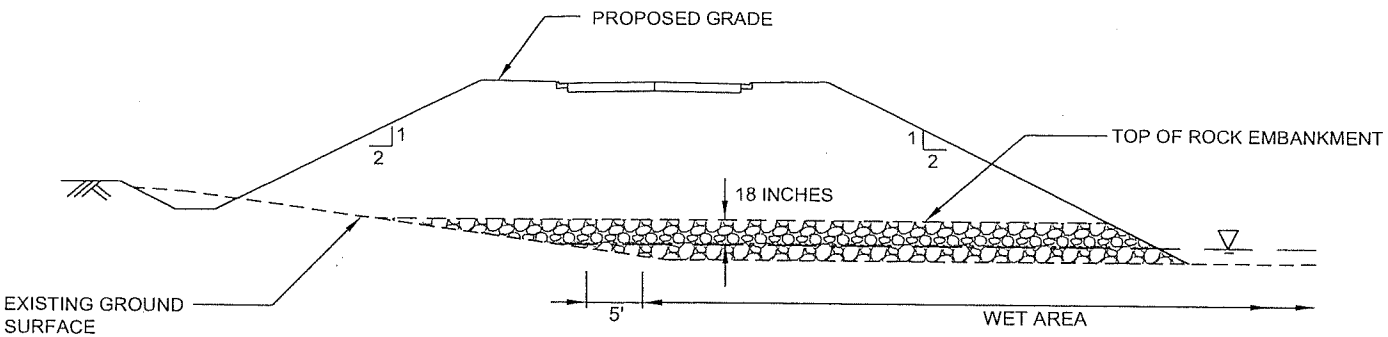
4. FILTER FABRIC SHALL BE BENCHED INTO THE EXISTING SLOPE A MINIMUM OF 5 FEET BEYOND THE WET AREA AS SHOWN.

5. IF THERE IS STANDING WATER, PLACE ROCK EMBANKMENT TO A HEIGHT OF 18 INCHES ABOVE THE WATER ELEVATION AT THE TIME OF CONSTRUCTION.

APPLIES TO STATION TO STATION	LOCATION
4296+25± TO 4298+00± (RAMP 'V')	RIGHT



FILTER FABRIC
(IF THERE IS NO STANDING WATER)



ROCK EMBANKMENT
(IF THERE IS STANDING WATER)

FILTER FABRIC/ROCK EMBANKMENT DETAIL

GDOT PROJECT NUMBER
MSL00-0004-00(086)
PI No. 0004086

SCALE: NTS	WILLMER ENGINEERING INC. WE	GEOTECHNICAL ENGINEERING ▫ CONSTRUCTION SERVICES ENVIRONMENTAL SERVICES AND ENGINEERING 3772 PLEASANTDALE ROAD - SUITE 165 ATLANTA, GA 30340-4270	FILTER FABRIC/ROCK EMBANKMENT DETAIL SIDE ROADS AND RAMPS SR 316 FROM WEST OF CR 104/COLLINS HILL ROAD TO CR 177/HI-HOPE ROAD GWINNETT COUNTY, GEORGIA WILLMER PROJECT No. ATL-171-3594
DATE: 9/29/2010			
DRAWN BY: CDL			
REVIEWED BY: DK			

pH 7.54
Resistivity 109407
Project No.: MSL00-0004-00(086) County: Gwinnett P.I. No.: 0004086

Pipe Culvert Material Alternates
For Piedmont/Blue Ridge Region

TYPE OF PIPE INSTALLATION				CONCRETE	CORRUGATED STEEL AASHTO M-36		CORRUGATED ALUMINUM AASHTO M-196	PLASTIC			
					ALUMINUM COATED (TYPE 2) CORR. STEEL	PLAIN ZINC COATED	PLAIN UNCOATED ALUMINUM	CORR. POLY-ETHYLENE AASHTO M-252	CORR. POLY-ETHYLENE SMOOTHED LINED AASHTO M-294 TYPE "S"	POLY VINYL CHLORIDE (PVC) PROFILE WALL AASHTO M-304	POLY VINYL CHLORIDE (PVC) CORRUGATED SMOOTH INTERIOR ASTM F-949
STORM DRAIN	LONGITUDINAL INTERSTATE AND TRAVEL BEARING			X							
STORM DRAIN	LONGITUDINAL NON-INTERSTATE AND NON-TRAVEL BEARING			X	X		X		X	X	X
STORM DRAIN	CROSS DRAIN	GRADE ≤ 10%	ADT < 250	X	X	X	X		X	X	X
STORM DRAIN	CROSS DRAIN	GRADE ≤ 10%	250 < ADT < 1,500	X	X*		X		X	X	X
STORM DRAIN	CROSS DRAIN	GRADE ≤ 10%	1,500 < ADT < 15,000	X					X	X	X
STORM DRAIN	CROSS DRAIN	GRADE ≤ 10%	ADT > 15,000	X							
STORM DRAIN	CROSS DRAIN	GRADE > 10%	ADT < 250		X	X	X		X	X	X
STORM DRAIN	CROSS DRAIN	GRADE > 10%	ADT > 250				X		X	X	X
SIDE DRAIN				X	X	X	X		X	X	X
PERMANENT SLOPE DRAIN					X	X	X		X	X	X
PERFORATED UNDERDRAIN					X	X	X	X	X		X

* This type pipe can be used if the addition of Type "B" Coating (AASHTO M-190, Half Bituminous Coated with Paved Invert) is utilized.

NOTES:

1 Allowable materials are indicated by an "X".

2 Structural requirements of storm drain pipe will be in accordance with Georgia Standard 1030-D or 1030-P, whichever is applicable, and the Standard Specifications.

3 Graded aggregate backfill shall be used in cross drain applications for all plastic pipes (AASHTO M-294, HDPE pipe; AASHTO M-304, PVC pipe; ASTM F-949, PVC pipe).

4 The Contractor shall provide additional storm sewer capacity calculations if a pipe material other than concrete is selected.

5 Pipe used under mechanically stabilized earth (MSE) walls, within MSE wall backfill, or within five feet of an MSE wall face shall be Class V Concrete Pipe.

6 Project specific pH and Resistivity values are entered into the respective boxes above to determine allowable pipe materials.

Rev. 03-22-10

APPENDIX II

WILLMER ENGINEERING INC. WE

BORING RECORD LEGEND

SM, CL, etc: - GROUP SYMBOL based on Unified Soil Classification System.
(Refer to ASTM D-2488 and Table 1 of D-2487)

N-VALUE: BLOWS PER FOOT- Standard Penetration Resistance (SPT) blow count , the sum of the second and third 6-inch increments of the SPT test.
(Refer to ASTM D-1586)

CONSISTENCY / RELATIVE DENSITY Correlated with SPT Blow Count, N:

SILTS AND CLAYS

N (blows per foot)	Consistency
0 - 2	Very Soft
3 - 4	Soft
5 - 8	Firm
9 - 15	Stiff
16 - 30	Very Stiff
31 - 50	Hard
> 50	Very Hard

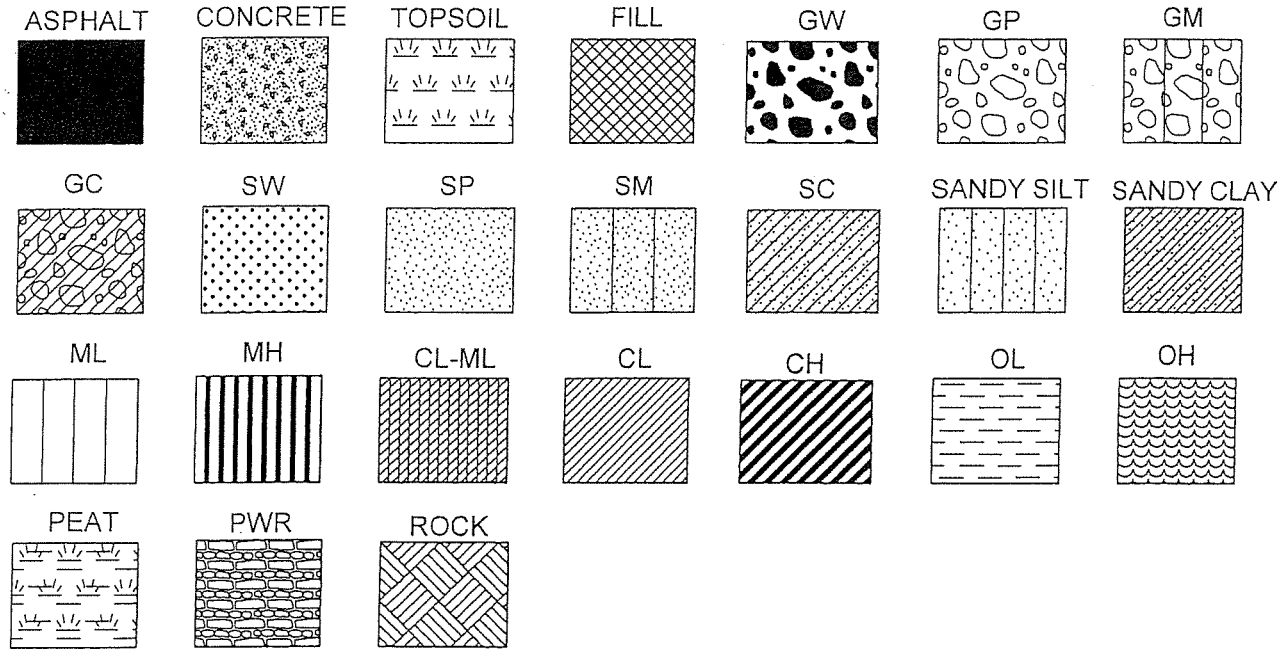
SANDS

N (blows per foot)	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

NOTES:

Groundwater Measurements:

- ▼ Water level at time of backfilling
- ▽ Water level at time of boring
- Caved level at 24 hours



WILLMER ENGINEERING INC. | WE

Willmer Engineering Inc.
3772 Pleasantdale Road, Suite 165
Atlanta, Georgia 30340

UNIFIED SOIL CLASSIFICATION SYSTEM REFERENCE SHEET

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN #200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED #4 SIEVE	CLEAN GRAVELS LITTLE OR NO FINES	(GW)	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			(GP)	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES APPRECIABLE AMOUNT OF FINES	(GM)	SILTY GRAVELS and GRAVEL-SAND-SILT MIXTURES
			(GC)	CLAYEY GRAVELS and GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING #4 SIEVE	CLEAN SAND LITTLE OR NO FINES	(SW)	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			(SP)	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES APPRECIABLE AMOUNT OF FINES	(SM)	SILTY SANDS and SAND-SILT MIXTURES
			(SC)	CLAYEY SANDS and SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN #200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		(ML)	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR VERY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			(CL)	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			(OL)	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		(MH)	INORGANIC ELASTIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
			(CH)	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			(OH)	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			(PT)	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

Record of Soil Survey Borings
Side Roads and Ramps
SR 316 from West of CR 104/Collins Hill Road to CR 177/Hi-Hope Road
GDOT Project No. MSL00-0004-00(086), PI No. 0004086
Willmer Engineering Project No. 171-3594

Station	Boring No.	Offset (feet)		Depth	Soil Description	Sample No.	Soil Class	Water Table Depth (feet)	Boring Term. Depth (feet)	Notes / Comments
		Left	Right							
Park Access Drive										
316+25	SS-1-RS		60	0-4'	Light brown silty medium to fine SAND	SS-1-RS	II B4	--	10	MC @ 6'
					(micaceous)					
				4'-10'	Reddish brown medium to fine sandy	--	II B4			Soil similar to SS-2-CL
					SILT					
320+00	SS-2-CL	0		0-2"	Topsoil			--	8	
				2"-8'	Reddish brown medium to fine sandy	SS-2-CL	II B4			MC @ 5'
					SILT					
322+00	SS-3-LL	10		0-3"	Topsoil			--	5	
				3"-5'	Tan silty medium to fine SAND	SS-3-LL	I A2			MC @ 3'
325+00	SS-4-CL	0		0-13'	Brown silty medium to fine SAND	SS-4-CL	I A2	--	13	MC @ 9'
					(micaceous)					SPT 8.5'-10' (11-12-16)
Ramp 'V'										
4289+00	SS-5-CL	0		0-1"	Topsoil			--	5	
				1"-5'	Brown silty medium to fine SAND	SS-5-CL	II B2			MC @ 1.5'

Notes:
(i) All offsets are from proposed construction centerline unless noted otherwise.
(ii) All depths are from existing ground surface unless noted otherwise.

Record of Soil Survey Borings
Side Roads and Ramps
SR 316 from West of CR 104/Collins Hill Road to CR 177/Hi-Hope Road
GDOT Project No. MSL00-0004-00(086), PI No. 0004086
Willmer Engineering Project No. 171-3594

Station	Boring No.	Offset (feet)		Depth	Soil Description	Sample No.	Soil Class	Water Table Depth (feet)	Boring Term. Depth (feet)	Notes / Comments
		Left	Right							
4292+00	SS-6-CL	0		0-1"	Topsoil			--	5	
				1"-2.5'	Reddish brown clayey medium to fine	SS-6-CL 1"-2.5'	II B4			MC @ 2'
					SAND					
				2.5'-5'	Dark brown silty medium to fine SAND	SS-6-CL 2.5'-5'	II B3			MC @ 4'
					with decayed wood					
4295+00	SS-7-CL	0		0-5'	Dark brown clayey medium to fine SAND	SS-7-CL	II B3	--	5	MC @ 1.5'
4295+00	SS-7-LL	40		0-4"	Topsoil			--	5	
				4"-5'	Orange-brown clayey medium to fine	--	II B3			Soil similar to SS-7-CL
					SAND with rock fragments at depth of 3'					
4298+00	SS-8-RL		10	0-3"	Topsoil			--	5	
				3"-2.5'	Brown clayey medium to fine SAND with	--	II B3			Soil similar to SS-7-CL
					coarse gravel					
				2.5'-5'	Gray clayey medium to fine SAND		II B3			Soil similar to SS-7-CL
4298+00	SS-8-LS	40			See SPT boring log			--	25	

Notes:
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(ii) All depths are from existing ground surface unless noted otherwise.

Record of Soil Survey Borings
Side Roads and Ramps
SR 316 from West of CR 104/Collins Hill Road to CR 177/Hi-Hope Road
GDOT Project No. MSL00-0004-00(086), PI No. 0004086
Willmer Engineering Project No. 171-3594

Station	Boring No.	Offset (feet)		Depth	Soil Description	Sample No.	Soil Class	Water Table Depth (feet)	Boring Term. Depth (feet)	Notes / Comments
		Left	Right							
Ramp 'W'										
605+00	SS-9-CL	0		0-3"	Topsoil			--	7	
				3"-7'	Brown silty medium to fine SAND	SS-9-CL	II B2			MC @ 2', Garbage in area
608+00	SS-10-CL	0		0-5'	Reddish brown clayey medium to fine	SS-10-CL	II B4	--	5	MC @ 1.5'
					SAND					
611+00	SS-11-RL		15	0-3'	Reddish brown fine sandy SILT	SS-11-RL 0-3'	II B4	--	7	MC @ 2'
				3'-7'	Tan and reddish brown silty medium to	SS-11-RL 3'-5'	II B4			MC @ 5'
					fine SAND					
Lendon Connector										
18+00	SS-12-CL	0		0-5'	Reddish brown medium to fine sandy	SS-12-CL	II B4	--	5	MC @ 2'
					CLAY (slightly micaceous)					
18+00	SS-12-RS		40	0-5'	Reddish brown clayey medium to fine	--	II B4	--	5	Subsoil similar to SS-12-CL
					SAND					
21+00	SS-13-CL	0		0-3"	Topsoil			--	5	
				3"-5'	Brown medium to fine sandy CLAY	SS-13-CL	II B4			

Notes:
(i) All offsets are from proposed construction centerline unless noted otherwise.
(ii) All depths are from existing ground surface unless noted otherwise.

Record of Soil Survey Borings
Side Roads and Ramps
SR 316 from West of CR 104/Collins Hill Road to CR 177/Hi-Hope Road
GDOT Project No. MSL00-0004-00(086), PI No. 0004086
Willmer Engineering Project No. 171-3594

Station	Boring No.	Offset (feet)		Depth	Soil Description	Sample No.	Soil Class	Water Table Depth (feet)	Boring Term. Depth (feet)	Notes / Comments
		Left	Right							
21+00	SS-13-RD		107	0-3"	Topsoil			--	9	
				3"-9'	Brown medium to fine sandy CLAY	--	II B4			Soil similar to SS-13-CL
										MC @ 3'
24+70	SS-14-LS	170			See SPT boring log					
23+05	SS-14-RS		80		See SPT boring log					
27+00	SS-15-CL	0		0-3"	Topsoil			--		
				3"-3'	Light brown silty medium to fine SAND	SS-15-CL	I A2		3	MC @ 2'
										Hand/power auger refusal at 3'
26+50	SS-15A-CL	0		0-5'	Tan and orange-bown silty medium to fine	--	I A2	--	5	Soil similar to SS-15-CL
					SAND					(Offset boring)
Reynolds Road Extension										
57+30	SS-16-LS	70		0-2"	Topsoil			--	7	
				2"-7'	Reddish brown medium to fine sandy SILT	SS-16-LS	II B4			MC @ 5'
60+10	SS-17-LL	40		0-7'	Reddish brown clayey medium to fine	SS-17-LL	II B3	--	7	MC @ 3'

Notes:
(i) All offsets are from proposed construction centerline unless noted otherwise.
(ii) All depths are from existing ground surface unless noted otherwise.

Record of Soil Survey Borings
Side Roads and Ramps
SR 316 from West of CR 104/Collins Hill Road to CR 177/Hi-Hope Road
GDOT Project No. MSL00-0004-00(086), PI No. 0004086
Willmer Engineering Project No. 171-3594

Station	Boring No.	Offset (feet)		Depth	Soil Description	Sample No.	Soil Class	Water Table Depth (feet)	Boring Term. Depth (feet)	Notes / Comments
		Left	Right							
					SAND with gravel (slightly micaceous)					
63+00	SS-18-CL	0		0-1'	Graded Aggregate Base					Gravel road
				1'-9'	Reddish brown silty medium to fine	SS-18-CL	II B4	--	9	MC @ 5'
					SAND					SPT 4.5'-6' (6-8-8)
66+00	SS-19-CL	0		0-3"	Topsoil			--	5	
				3"-5'	Brown silty medium to fine SAND	SS-19-CL	II B3			MC @ 2'
69+00	SS-20-CL	0		0-2"	Topsoil			--		
				2"-5'	Brown silty medium to fine SAND	SS-20-CL	II B3		7	MC @ 2'
					(slightly micaceous)					
				5'-7'	Reddish brown medium to fine sandy	--	II B4			Soil similar to SS-12-CL
					CLAY					
72+00	SS-21-LL	12		0'-11'	Reddish brown medium to fine sandy	SS-21-CL	II B4	--	11	MC @ 7.5'
					CLAY (micaceous)					

Notes:
(i) All offsets are from proposed construction centerline unless noted otherwise.
(ii) All depths are from existing ground surface unless noted otherwise.

WILLMER ENGINEERING INC. | WE

Project: SR 316 from West of CR 104/Collins Hill RD to CR 177/Hi-Hope RD	**HOLE No. SS-8-LS**
Location: Gwinnett County, Georgia	Sheet 1 of 1
Project Number: 171-3594 GDOT No. MSL00-0004-00(086), PI No. 0004086	Location: High Fill

Azimuth: -- Angle from Horizontal: 90 Surface Elevation (ft): 1018.00 Station: 4298+00, 40' Lt (Ramp 'V')

Drilling Equipment: CME 45 Drilling Method: HSA-Manual Hammer

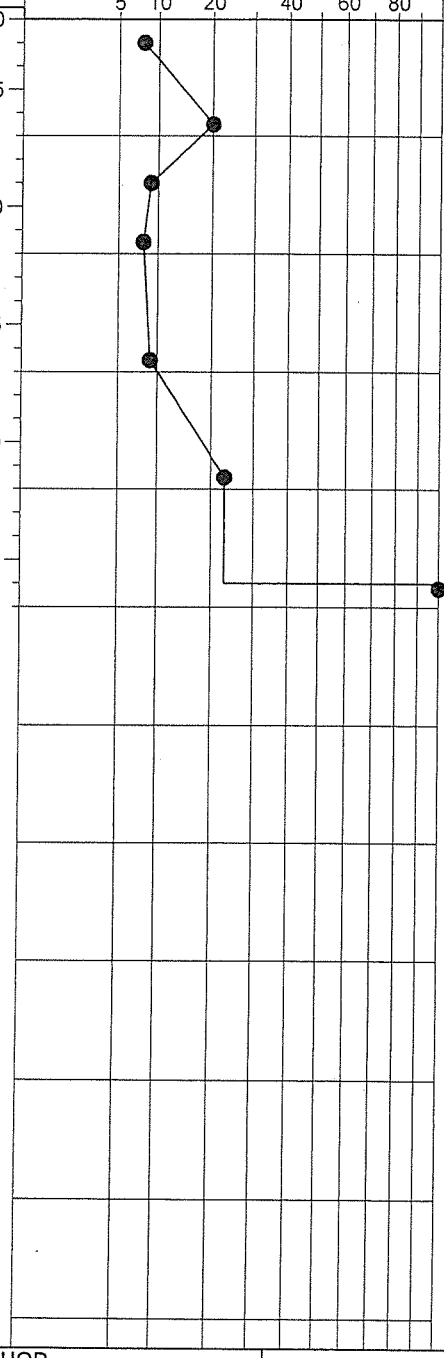
Core Boxes: NA Samples: 7 Overburden (ft): NA Rock (ft): NA Total Depth (ft): 25.0

Logged By: PT Date Drilled: 4/21/10

VERTICAL DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE	REC%	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST DATA (blows/foot)	N-VALUE
		SS			TOPSOIL = 2 inches	SM	1018.0		8
					RESIDUUM: Loose orange-brown silty medium to fine **SAND**	SC	1015		
5		SS			Medium dense orange and tan clayey medium to fine **SAND**				20
		SS			Loose gray silty medium to fine **SAND**	SM	1010		9
10		SS							8
					Loose orange-brown silty medium to fine **SAND**	SM	1005		
15		SS							9
					Medium dense light brown and orange silty medium to fine **SAND**	SM	1000		
20		SS							23
							995		
25		SS			PARTIALLY WEATHERED ROCK: Sampled as very dense orange-brown silty medium to fine **SAND**	PWR			50/5"

Boring was terminated at 25 feet below the existing ground surface.

Groundwater was encountered at 9 feet below the existing ground surface at the time of boring and at 7 feet 24 hours after boring completion.



SAMPLER TYPE		DRILLING METHOD		Hole No.
SS - Split Spoon	NX - Rock Core, 2-1/8"	HSA - Hollow Stem Auger	RW - Rotary Wash	SS-8-LS
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core	
NQ - Rock Core, 1-7/8"	CT - Continuous Tube	DC - Driving Casing		

WILLMER ENGINEERING INC. | WE

Project: SR 316 from West of CR 104/Collins Hill RD to CR 177/Hi-Hope RD	**HOLE No. SS-14-LS**
Location: Gwinnett County, Georgia	Sheet 1 of 1
Project Number: 171-3594 GDOT No. MSL00-0004-00(086), PI No. 0004086	Location: Box Culvert

Azimuth: -- Angle from Horizontal: 90 Surface Elevation (ft): 1022.00 Station: 24+70, 170' Lt (Lendon Connector)

Drilling Equipment: CME 45 Drilling Method: HSA-Manual Hammer

Core Boxes: NA Samples: 9 Overburden (ft): NA Rock (ft): NA Total Depth (ft): 30.0

Logged By: PT Date Drilled: 4/21/10

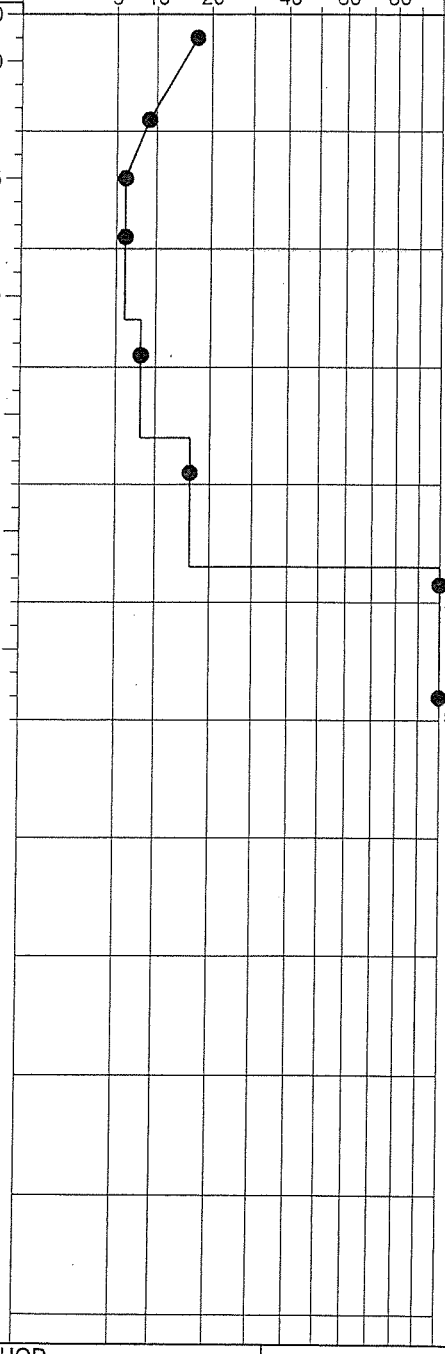
VERTICAL DEPTH (ft)	SAMPLE TYPE	REC%	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	N-VALUE
	SS			FILL: Medium dense tan and orange-brown silty medium to fine **SAND** with root and rock fragments	FILL	1022.0	17
5	SS			Loose gray, orange, and tan silty medium to fine **SAND** with clayey medium to fine sand pockets and rock and root fragments	FILL	1020	9
	SS					1015	6
10	SS			Loose gray and tan silty medium to fine **SAND** with trace decayed plant and wood fragments (micaceous)	FILL		6
15	ST SS			POSSIBLE ALLUVIUM: Firm brown medium to fine sandy lean **CLAY** with trace decayed wood fragments and rock fragments	CL	1010	8
20	SS			RESIDUUM: Medium dense brown silty medium to fine **SAND** (micaceous)	SM	1005	16
25	SS			PARTIALLY WEATHERED ROCK: Sampled as very dense gray silty medium to fine **SAND** (micaceous)	PWR	1000	50/6"
30	SS					995	50/1"

Boring was terminated at 30 feet below the existing ground surface.

Groundwater was encountered at 20 feet below the existing ground surface at the time of boring and at 14 feet 24 hours after boring completion.

The Shelby tube from 13 to 15 feet was obtained from an offset hole.

STANDARD PENETRATION TEST DATA (blows/foot)



SAMPLER TYPE		DRILLING METHOD		Hole No.
SS - Split Spoon	NX - Rock Core, 2-1/8"	HSA - Hollow Stem Auger	RW - Rotary Wash	SS-14-LS
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core	
NQ - Rock Core, 1-7/8"	CT - Continuous Tube	DC - Driving Casing		

WILLMER ENGINEERING INC. | WE

Project: SR 316 from West of CR 104/Collins Hill RD to CR 177/Hi-Hope RD	**HOLE No. SS-14-RS**
Location: Gwinnett County, Georgia	Sheet 1 of 1
Project Number: 171-3594 GDOT No. MSL00-0004-00(086), PI No. 0004086	Location: High Fill

Azimuth: -- Angle from Horizontal: 90 Surface Elevation (ft): 1014.00 Station: 23+05, 80' Rt (Lendon Connector); 4299+00, 10' Lt (Ramp 'V')

Drilling Equipment: CME 45 Drilling Method: HSA-Manual Hammer

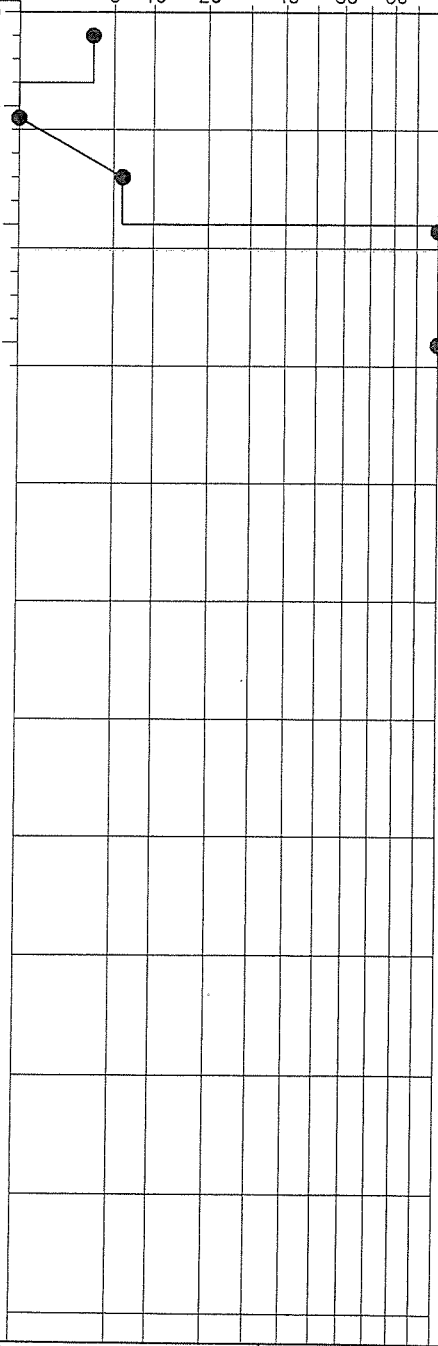
Core Boxes: NA Samples: 5 Overburden (ft): NA Rock (ft): NA Total Depth (ft): 15.0

Logged By: PT Date Drilled: 4/21/10

VERTICAL DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE	REC%	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST DATA (blows/foot)	N-VALUE
		SS			TOPSOIL = 3 inches	FILL	1014.0		3
					POSSIBLE FILL: Very loose gray and tan clayey medium to fine **SAND** with root fragments	SM			
5		SS					1010		WOH
		SS			POSSIBLE ALLUVIUM: Very loose to loose brown and gray silty medium to fine **SAND** with root and plant fragments				6
10		SS				PWR	1005		50/6"
					PARTIALLY WEATHERED ROCK: Sampled as very dense gray and orange-brown silty coarse to fine **SAND** (slightly micaceous)				
15		SS					1000		50/2"

Boring was terminated at 15 feet below the existing ground surface.

Groundwater was encountered at 7 feet below the existing ground surface at the time of boring and at 2 feet 24 hours after boring completion.



SAMPLER TYPE		DRILLING METHOD		Hole No.
SS - Split Spoon	NX - Rock Core, 2-1/8"	HSA - Hollow Stem Auger	RW - Rotary Wash	SS-14-RS
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core	
NQ - Rock Core, 1-7/8"	CT - Continuous Tube	DC - Driving Casing		

WILLMER ENGINEERING INC. | WE

Project: SR 316 from West of CR 104/Collins Hill RD to CR 177/Hi-Hope RD
Location: Gwinnett County, Georgia
Project Number: 171-3594 GDOT No. MSL00-0004-00(086), PI No. 0004086

HOLE No. WB-1

Sheet 1 of 1

Location: Retaining Wall

Azimuth: -- | Angle from Horizontal: 90 | Surface Elevation (ft): 1080.00 | Station: 71+00, 35' Rt (Reynolds RD EXT.)

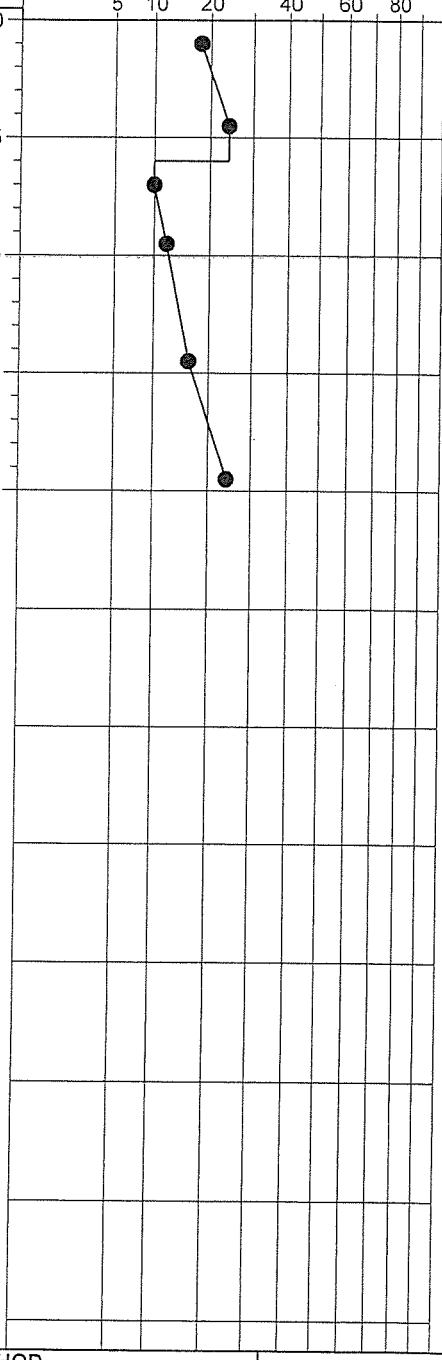
Drilling Equipment: CME 45 | Drilling Method: HSA-Manual Hammer

Core Boxes: NA | Samples: 6 | Overburden (ft): NA | Rock (ft): NA | Total Depth (ft): 20.0

Logged By: PT | Date Drilled: 4/21/10

VERTICAL DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE	REC%	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	N-VALUE
		SS			FILL: Medium dense brown silty medium to fine **SAND** with root and rock fragments	FILL	1080.0	18
5		SS			Medium dense reddish brown silty medium to fine **SAND** (micaceous)	FILL	1075	24
		SS			RESIDUUM: Loose to medium dense orange-brown, brown, and reddish brown silty medium to fine **SAND** with rock fragments (slightly micaceous)	SM		10
10		SS					1070	12
15		SS			Medium dense light orange, brown, reddish brown, and black silty medium to fine **SAND** (micaceous)	SM	1065	16
20		SS			Boring was terminated at 20 feet below the existing ground surface.		1060	24

Groundwater was not encountered at the time of boring completion.



SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
NQ - Rock Core, 1-7/8"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. WB-1

SPTN SR 316.GPJ 5/21/10

WILLMER ENGINEERING INC. | WE

Project: SR 316 from West of CR 104/Collins Hill RD to CR 177/Hi-Hope RD
Location: Gwinnett County, Georgia
Project Number: 171-3594 GDOT No. MSL00-0004-00(086), PI No. 0004086

HOLE No. WB-2

Sheet 1 of 1

Location: Retaining Wall

Azimuth: -- | Angle from Horizontal: 90 | Surface Elevation (ft): 1078.00 | Station: 72+00, 12' Rt (Reynolds RD EXT.)

Drilling Equipment: CME 45 | Drilling Method: HSA-Manual Hammer

Core Boxes: NA | Samples: 11 | Overburden (ft): NA | Rock (ft): NA | Total Depth (ft): 35.0

Logged By: PT | Date Drilled: 4/21/10

VERTICAL DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE	REC%	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST DATA (blows/foot)	N-VALUE
		SS			FILL: Medium dense tan and brown silty medium to fine **SAND** with root fragments	FILL	1078.0		19
						SM	1075		
5		SS			RESIDUUM: Medium dense orange-brown and reddish brown silty medium to fine **SAND** (slightly micaceous)				24
		SS					1070		12
		SS			Stiff brown medium to fine sandy **SILT**	ML			10
10		ST					1065		
		ST							
15		SS							14
							1060		
20		SS							13
							1055		
25		SS							11
							1050		
30		SS							10
							1045		
35		SS			- with rock fragments				20

Boring was terminated at 35 feet below the existing ground surface.

Groundwater was encountered at 24 feet below the existing ground surface at the time of boring and at 22 feet 24 hours after boring completion.

Shelby tubes were taken from offset boring at 10-12 feet and 12-14 feet.

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
NQ - Rock Core, 1-7/8"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. WB-2

WILLMER ENGINEERING INC. WE

Project: SR 316 from West of CR 104/Collins Hill RD to CR 177/Hi-Hope RD	**HOLE No. WB-3**
Location: Gwinnett County, Georgia	Sheet 1 of 1
Project Number: 171-3594 GDOT No. MSL00-0004-00(086), PI No. 0004086	Location: Retaining Wall

Azimuth: -- Angle from Horizontal: 90 Surface Elevation (ft): 1075.00 Station: 73+50, 11' Rt (Reynolds RD EXT.)

Drilling Equipment: CME 45 Drilling Method: HSA-Manual Hammer

Core Boxes: NA Samples: 10 Overburden (ft): NA Rock (ft): NA Total Depth (ft): 30.0

Logged By: PT Date Drilled: 4/21/10

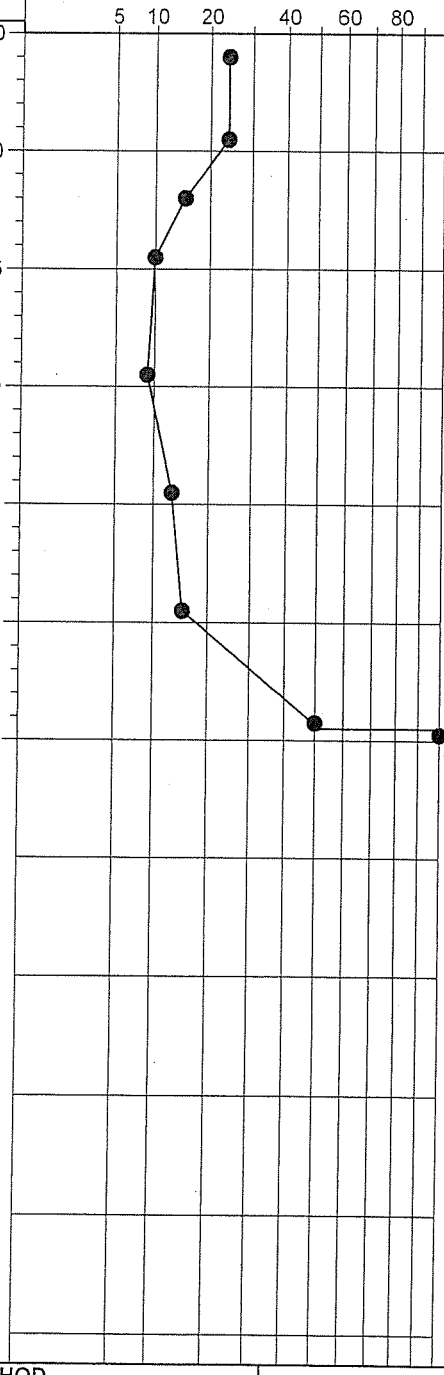
VERTICAL DEPTH (ft)	SAMPLE TYPE	REC%	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	N-VALUE
	SS			FILL: Medium dense reddish brown silty medium to fine **SAND** with root and wood fragments	FILL	1075.0	24
5	SS			RESIDUUM: Medium dense orange-brown silty medium to fine **SAND** with trace root fragments (slightly micaceous)	SM	1070	24
	SS						15
10	SS			Stiff brown medium to fine sandy **SILT**	ML	1065	10
	ST						
15	SS					1060	9
20	SS			- with rock fragments		1055	13
25	SS					1050	15
30	SS			- becomes dense			50
	SS			PARTIALLY WEATHERED ROCK: Sampled as very dense brown and orange silty medium to fine **SAND** (slightly micaceous)	PWR	1045	50/6"

Boring was terminated at 30 feet below the existing ground surface.

Groundwater was encountered at 22 feet below the existing ground surface at the time of boring and at 21 feet 24 hours after boring completion.

Shelby tube was taken from offset boring at 12-14 feet.

STANDARD PENETRATION TEST DATA (blows/foot)



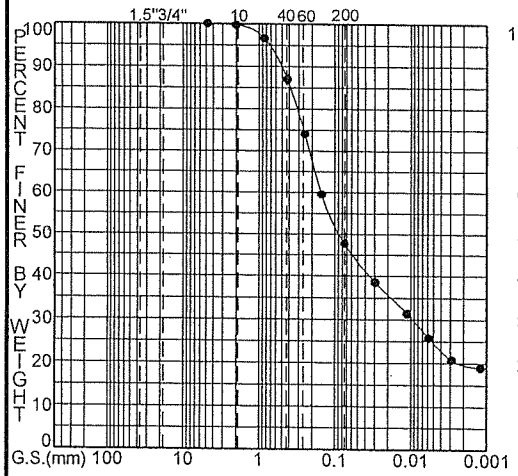
SAMPLER TYPE		DRILLING METHOD		Hole No.
SS - Split Spoon	NX - Rock Core, 2-1/8"	HSA - Hollow Stem Auger	RW - Rotary Wash	WB-3
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core	
NQ - Rock Core, 1-7/8"	CT - Continuous Tube	DC - Driving Casing		

APPENDIX III

WILLMER ENGINEERING INC.

Project: **Side Roads and Ramps, SR 316 from West of CR 104 to CR 177**
Location: **Gwinnett County, Georgia**
Supervisor: **MK**
Prime Consultant: **PBS&J**
Willmer Project No.: **171-3594**
GDOT Project No.: **MSL00-0004-00(086), PI No. 0004086**

Station: 316+25, 60 ft Right from CL	Station: 320+00, CL	Station: 322+00, 10 ft Left from CL	Station: 325+00, CL
Sample No.: SS-1-RS (5-8 ft)	Sample No.: SS-2-CL (3-6 ft)	Sample No.: SS-3-LL (0.25-3 ft)	Sample No.: SS-4-CL (8-11 ft)
Soil Desc.: Light brown silty medium to fine SAND (micaceous)	Soil Desc.: Reddish brown medium to fine sandy SILT (micaceous)	Soil Desc.: Tan silty medium to fine SAND	Soil Desc.: Brown silty medium to fine SAND (micaceous)
GDOT Soil Class: II B4	GDOT Soil Class: II B4	GDOT Soil Class: I A2	GDOT Soil Class: I A2

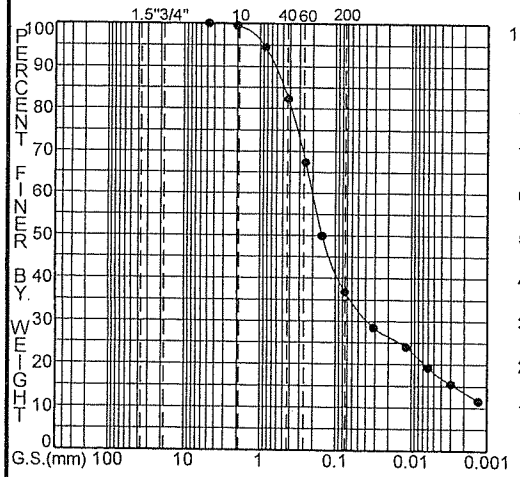


% Finer	Station 316+25	Station 320+00	Station 322+00	Station 325+00
1.5" Sieve	100.0	100.0	100.0	100.0
3/4" Sieve	100.0	100.0	100.0	100.0
No. 10 Sieve	99.7	99.8	98.6	99.6
No. 40 Sieve	87.0	90.2	77.3	68.0
No. 60 Sieve	74.1	81.4	60.2	53.5
No. 200 Sieve	47.8	57.1	26.7	29.4
Clay Content (%)	20.0	25.4	4.9	6.4
Total Volume Change (%)	7.8	7.6	6.7	11.8
Swell (%)	2.8	4.1	2.3	8.6
Shrinkage (%)	5.0	3.5	4.4	3.2
Maximum Dry Density (pcf)	100.3	99.6	100.0	107.0
Opt. Moisture Content (%)	19.5	20.0	19.8	16.0
Nat. Moisture Content (%)	22.9	23.8	8.5	12.6
Liquid Limit (%)	---	---	---	---
Plasticity Index (%)	---	---	---	---
Erosion Index	4.25	3.11	6.85	6.51
Soil Support Value	---	3.7	---	---

WILLMER ENGINEERING INC.

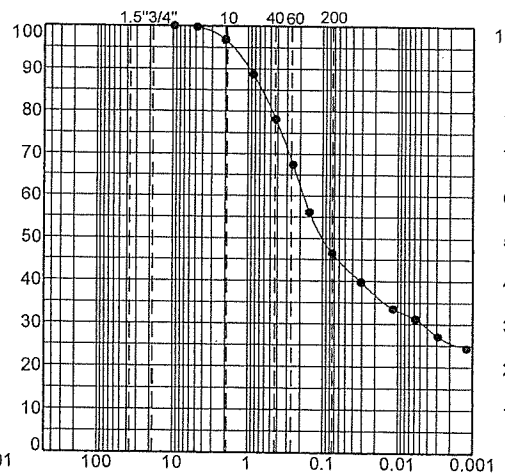
Project: **Side Roads and Ramps, SR 316 from West of CR 104 to CR 177**
Location: **Gwinnett County, Georgia**
Supervisor: **MK**
Prime Consultant: **PBS&J**
Willmer Project No.: **171-3594**
GDOT Project No.: **MSL00-0004-00(086), PI No. 0004086**

Station: **4289+00, CL**
Sample No.: **SS-5-CL (0.08-3 ft)**
Soil Desc.: **Brown silty medium to fine SAND**
GDOT Soil Class: **II B2**



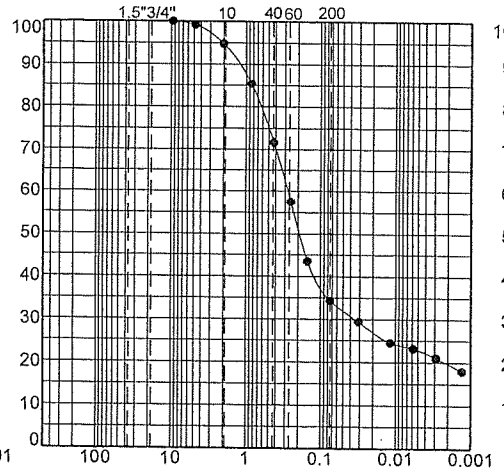
% Finer 1.5" Sieve	100.0
% Finer 3/4" Sieve	100.0
% Finer No. 10 Sieve	99.5
% Finer No. 40 Sieve	82.3
% Finer No. 60 Sieve	67.4
% Finer No. 200 Sieve	36.9
Clay Content (%)	13.5
Total Volume Change (%)	1.7
Swell (%)	0.5
Shrinkage (%)	1.2
Maximum Dry Density (pcf)	117.7
Opt. Moisture Content (%)	11.7
Nat. Moisture Content (%)	9.4
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	5.59
Soil Support Value	---

Station: **4292+00, CL**
Sample No.: **SS-6-CL (0.08-2 ft)**
Soil Desc.: **Reddish brown clayey medium to fine SAND**
GDOT Soil Class: **II B4**



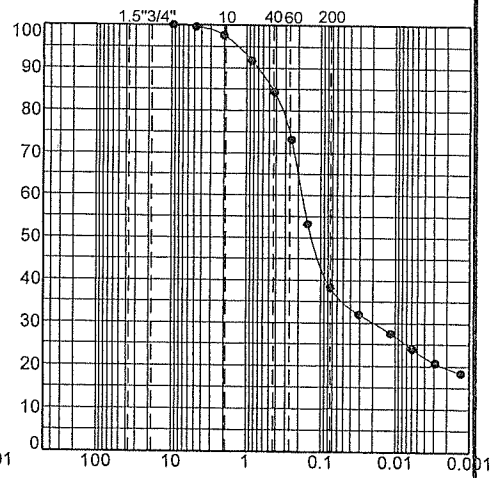
% Finer 1.5" Sieve	100.0
% Finer 3/4" Sieve	100.0
% Finer No. 10 Sieve	96.8
% Finer No. 40 Sieve	78.2
% Finer No. 60 Sieve	67.5
% Finer No. 200 Sieve	46.5
Clay Content (%)	25.9
Total Volume Change (%)	11.8
Swell (%)	7.2
Shrinkage (%)	4.6
Maximum Dry Density (pcf)	104.3
Opt. Moisture Content (%)	17.4
Nat. Moisture Content (%)	23.0
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	4.41
Soil Support Value	---

Station: **4295+00, CL**
Sample No.: **SS-7-CL (0-3 ft)**
Soil Desc.: **Dark brown clayey medium to fine SAND**
GDOT Soil Class: **II B3**



% Finer 1.5" Sieve	100.0
% Finer 3/4" Sieve	100.0
% Finer No. 10 Sieve	94.8
% Finer No. 40 Sieve	71.6
% Finer No. 60 Sieve	57.5
% Finer No. 200 Sieve	34.3
Clay Content (%)	19.6
Total Volume Change (%)	4.6
Swell (%)	0.8
Shrinkage (%)	3.8
Maximum Dry Density (pcf)	109.4
Opt. Moisture Content (%)	15.0
Nat. Moisture Content (%)	18.2
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	5.91
Soil Support Value	4.2

Station: **4298+00, 40 ft Left from CL**
Sample No.: **SS-8-LS (0.17-3 ft)**
Soil Desc.: **Dark brown clayey medium to fine SAND**
GDOT Soil Class: **II B3**

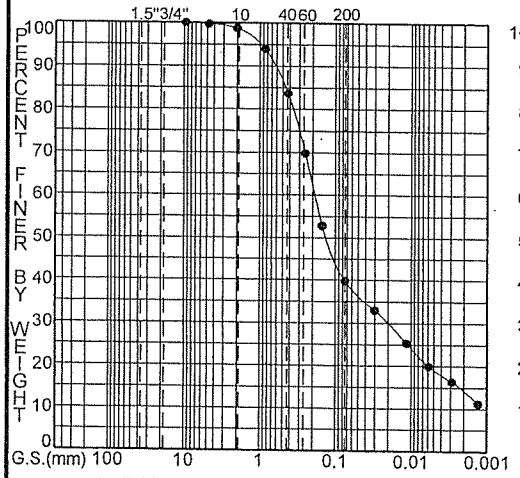


% Finer 1.5" Sieve	100.0
% Finer 3/4" Sieve	100.0
% Finer No. 10 Sieve	97.7
% Finer No. 40 Sieve	84.4
% Finer No. 60 Sieve	73.2
% Finer No. 200 Sieve	38.3
Clay Content (%)	19.6
Total Volume Change (%)	4.1
Swell (%)	1.0
Shrinkage (%)	3.1
Maximum Dry Density (pcf)	110.0
Opt. Moisture Content (%)	14.8
Nat. Moisture Content (%)	14.7
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	5.42
Soil Support Value	---

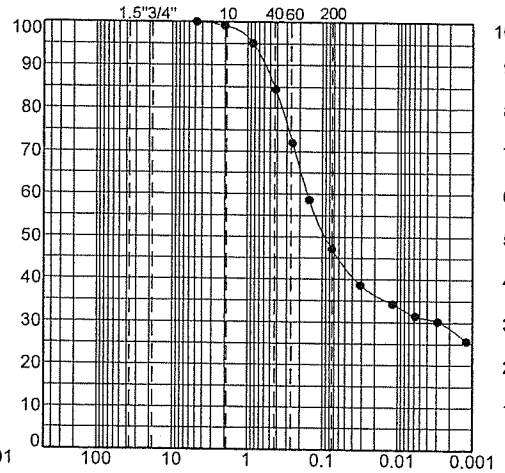
WILLMER ENGINEERING INC. | WE

Project: **Side Roads and Ramps, SR 316 from West of CR 104 to CR 177**
Location: **Gwinnett County, Georgia**
Supervisor: **MK**
Prime Consultant: **PBS&J**
Willmer Project No.: **171-3594**
GDOT Project No.: **MSL00-0004-00(086), PI No. 0004086**

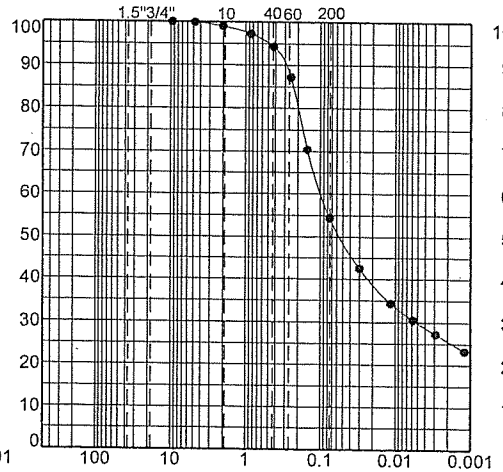
Station: 605+00, CL	Station: 608+00, CL	Station: 611+00, 15 ft Right from CL	Station: 18+00, CL
Sample No.: SS-9-CL (0.25-3 ft)	Sample No.: SS-10-CL (0-3 ft)	Sample No.: SS-11-RL (0-2.5 ft)	Sample No.: SS-12-CL (0-3 ft)
Soil Desc.: Brown silty medium to fine SAND	Soil Desc.: Reddish brown clayey medium to fine SAND	Soil Desc.: Reddish brown fine sandy SILT	Soil Desc.: Reddish brown medium to fine sandy CLAY (slightly micaceous)
GDOT Soil Class: II B2	GDOT Soil Class: II B4	GDOT Soil Class: II B4	GDOT Soil Class: II B4



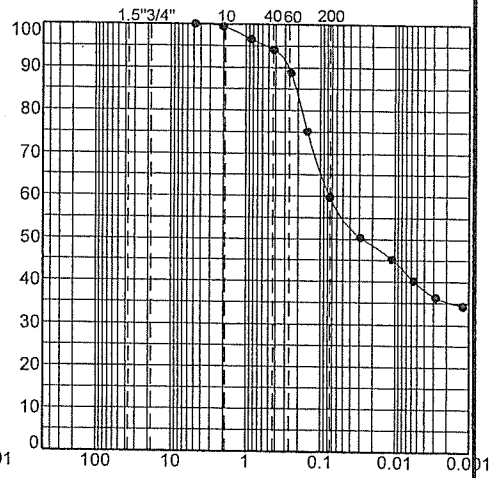
% Finer	
1.5" Sieve	100.0
3/4" Sieve	100.0
No. 10 Sieve	98.7
No. 40 Sieve	83.7
No. 60 Sieve	69.8
No. 200 Sieve	39.8
Clay Content (%)	14.0
Total Volume Change (%)	3.2
Swell (%)	1.9
Shrinkage (%)	1.3
Maximum Dry Density (pcf)	114.0
Opt. Moisture Content (%)	13.2
Nat. Moisture Content (%)	11.8
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	5.24
Soil Support Value	---



% Finer	
1.5" Sieve	100.0
3/4" Sieve	100.0
No. 10 Sieve	99.1
No. 40 Sieve	84.5
No. 60 Sieve	72.1
No. 200 Sieve	47.2
Clay Content (%)	28.3
Total Volume Change (%)	6.3
Swell (%)	2.6
Shrinkage (%)	3.7
Maximum Dry Density (pcf)	98.1
Opt. Moisture Content (%)	20.8
Nat. Moisture Content (%)	19.7
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	4.33
Soil Support Value	---



% Finer	
1.5" Sieve	100.0
3/4" Sieve	100.0
No. 10 Sieve	99.0
No. 40 Sieve	94.3
No. 60 Sieve	87.2
No. 200 Sieve	54.4
Clay Content (%)	25.6
Total Volume Change (%)	6.8
Swell (%)	2.2
Shrinkage (%)	4.6
Maximum Dry Density (pcf)	100.6
Opt. Moisture Content (%)	19.3
Nat. Moisture Content (%)	24.9
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	3.4
Soil Support Value	---

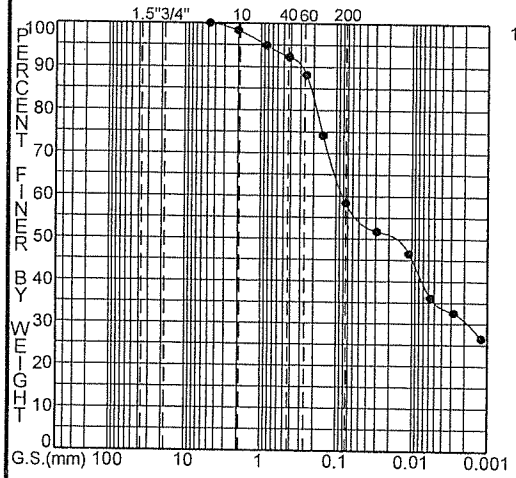


% Finer	
1.5" Sieve	100.0
3/4" Sieve	100.0
No. 10 Sieve	99.4
No. 40 Sieve	94.1
No. 60 Sieve	88.8
No. 200 Sieve	59.8
Clay Content (%)	35.5
Total Volume Change (%)	10.0
Swell (%)	2.3
Shrinkage (%)	7.7
Maximum Dry Density (pcf)	100.5
Opt. Moisture Content (%)	19.1
Nat. Moisture Content (%)	24.9
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	2.78
Soil Support Value	---

WILLMER ENGINEERING INC. | WE

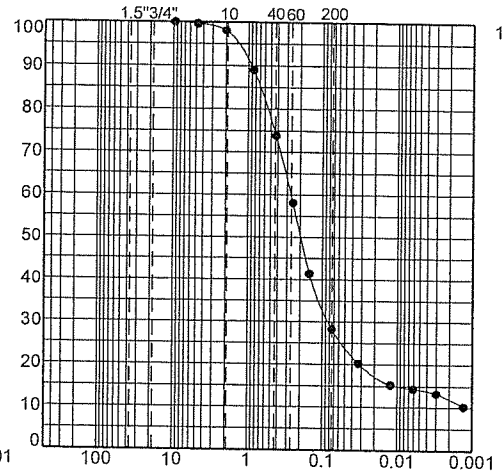
Project: **Side Roads and Ramps, SR 316 from West of CR 104 to CR 177**
Location: **Gwinnett County, Georgia**
Supervisor: **MK**
Prime Consultant: **PBS&J**
Willmer Project No.: **171-3594**
GDOT Project No.: **MSL00-0004-00(086), PI No. 0004086**

Station: **21+00, CL**
Sample No.: **SS-13-CL (0.25-3 ft)**
Soil Desc.: **Brown medium to fine sandy CLAY**
GDOT Soil Class: **II B4**



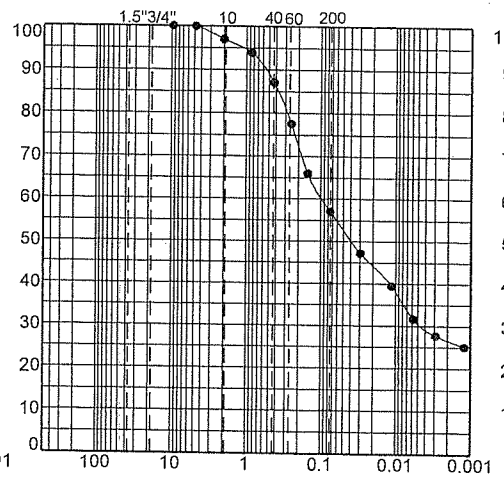
% Finer: 1.5" Sieve	100.0
3/4" Sieve	100.0
No. 10 Sieve	98.4
No. 40 Sieve	92.3
No. 60 Sieve	88.1
No. 200 Sieve	58.4
Clay Content (%)	30.1
Total Volume Change (%)	7.8
Swell (%)	1.6
Shrinkage (%)	6.2
Maximum Dry Density (pcf)	104.5
Opt. Moisture Content (%)	17.3
Nat. Moisture Content (%)	15.0
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	2.95
Soil Support Value	---

Station: **27+00, CL**
Sample No.: **SS-15-CL (0.25-3 ft)**
Soil Desc.: **Light brown silty medium to fine SAND**
GDOT Soil Class: **I A2**



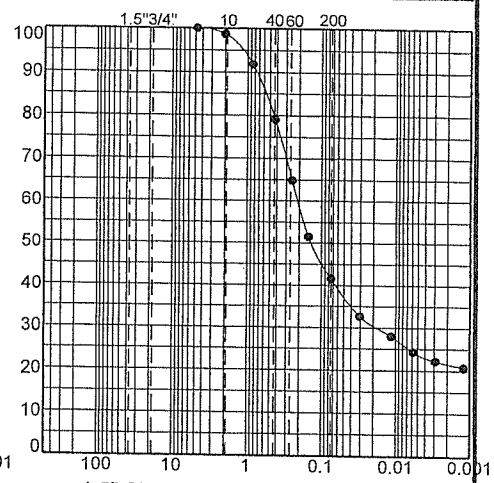
% Finer: 1.5" Sieve	100.0
3/4" Sieve	100.0
No. 10 Sieve	98.0
No. 40 Sieve	73.9
No. 60 Sieve	58.1
No. 200 Sieve	28.2
Clay Content (%)	11.8
Total Volume Change (%)	4.0
Swell (%)	2.4
Shrinkage (%)	1.6
Maximum Dry Density (pcf)	109.9
Opt. Moisture Content (%)	14.9
Nat. Moisture Content (%)	8.8
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	6.66
Soil Support Value	4.6

Station: **57+30, 70 ft Left from CL**
Sample No.: **SS-16-LS (2-5 ft)**
Soil Desc.: **Reddish brown medium to fine sandy SILT**
GDOT Soil Class: **II B4**



% Finer: 1.5" Sieve	100.0
3/4" Sieve	100.0
No. 10 Sieve	96.9
No. 40 Sieve	87.1
No. 60 Sieve	77.6
No. 200 Sieve	57.1
Clay Content (%)	26.6
Total Volume Change (%)	9.0
Swell (%)	1.3
Shrinkage (%)	7.7
Maximum Dry Density (pcf)	102.3
Opt. Moisture Content (%)	18.4
Nat. Moisture Content (%)	22.9
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	3.11
Soil Support Value	---

Station: **60+10, 40 ft Left from CL**
Sample No.: **SS-17-LL (2-5 ft)**
Soil Desc.: **Reddish brown clayey medium to fine SAND (slightly micaceous)**
GDOT Soil Class: **II B3**

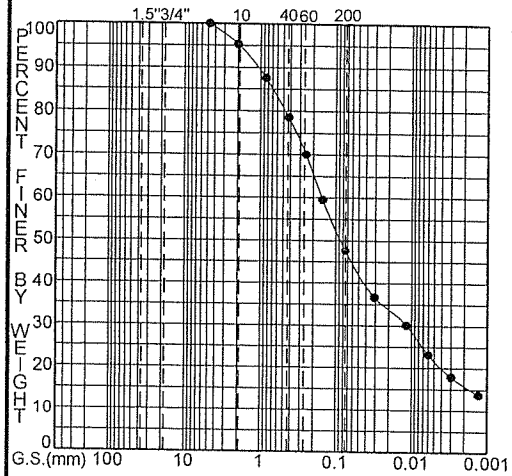


% Finer: 1.5" Sieve	100.0
3/4" Sieve	100.0
No. 10 Sieve	98.8
No. 40 Sieve	79.2
No. 60 Sieve	64.9
No. 200 Sieve	41.6
Clay Content (%)	21.6
Total Volume Change (%)	7.0
Swell (%)	0.3
Shrinkage (%)	6.7
Maximum Dry Density (pcf)	106.9
Opt. Moisture Content (%)	16.2
Nat. Moisture Content (%)	21.7
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	5.01
Soil Support Value	---

WILLMER ENGINEERING INC. | WE

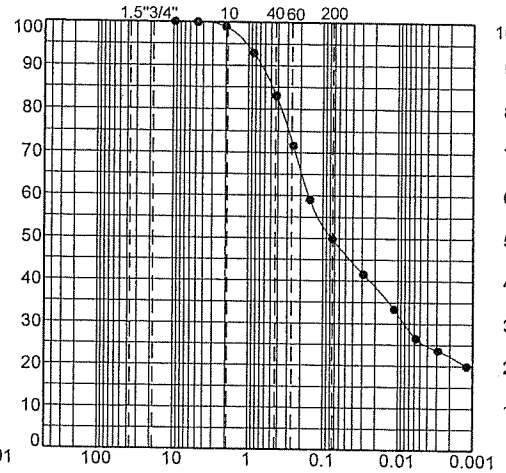
Project: **Side Roads and Ramps, SR 316 from West of CR 104 to CR 177**
Location: **Gwinnett County, Georgia**
Supervisor: **MK**
Prime Consultant: **PBS&J**
Willmer Project No.: **171-3594**
GDOT Project No.: **MSL00-0004-00(086), PI No. 0004086**

Station: **63+00, CL**
Sample No.: **SS-18-CL (4-7 ft)**
Soil Desc.: **Reddish brown silty medium to fine SAND (micaceous)**
GDOT Soil Class: **II B4**



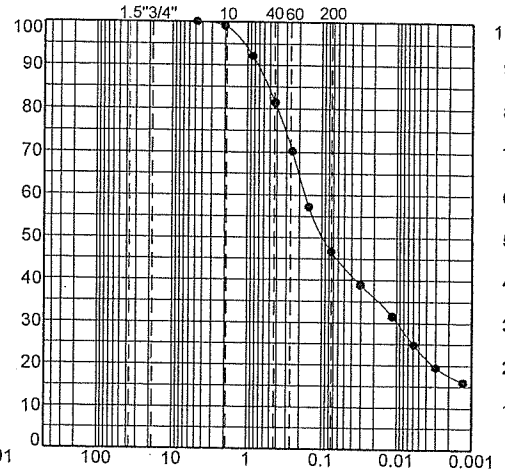
% Finer 1.5" Sieve	100.0
3/4" Sieve	100.0
No. 10 Sieve	95.3
No. 40 Sieve	78.5
No. 60 Sieve	70.1
No. 200 Sieve	47.6
Clay Content (%)	15.9
Total Volume Change (%)	12.3
Swell (%)	11.8
Shrinkage (%)	0.5
Maximum Dry Density (pcf)	103.0
Opt. Moisture Content (%)	18.0
Nat. Moisture Content (%)	21.6
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	4.28
Soil Support Value	3.7

Station: **66+00, CL**
Sample No.: **SS-19-CL (0.25-3 ft)**
Soil Desc.: **Brown silty medium to fine SAND**
GDOT Soil Class: **II B3**



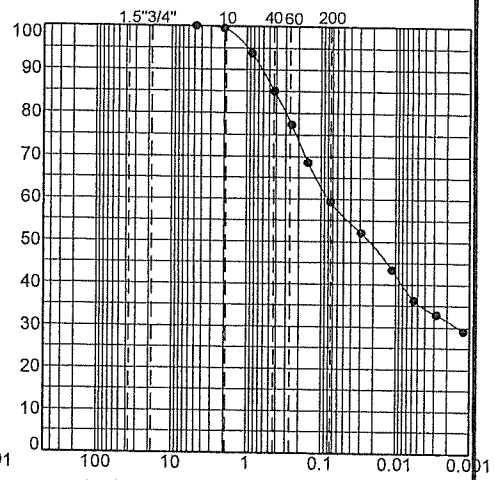
% Finer 1.5" Sieve	100.0
3/4" Sieve	100.0
No. 10 Sieve	98.9
No. 40 Sieve	83.1
No. 60 Sieve	71.6
No. 200 Sieve	49.8
Clay Content (%)	22.1
Total Volume Change (%)	13.4
Swell (%)	5.7
Shrinkage (%)	7.7
Maximum Dry Density (pcf)	110.6
Opt. Moisture Content (%)	14.6
Nat. Moisture Content (%)	11.1
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	4.01
Soil Support Value	---

Station: **69+00, CL**
Sample No.: **SS-20-CL (0.17-3 ft)**
Soil Desc.: **Brown silty medium to fine SAND (slightly micaceous)**
GDOT Soil Class: **II B3**



% Finer 1.5" Sieve	100.0
3/4" Sieve	100.0
No. 10 Sieve	99.1
No. 40 Sieve	81.4
No. 60 Sieve	70.3
No. 200 Sieve	46.7
Clay Content (%)	17.8
Total Volume Change (%)	9.5
Swell (%)	6.5
Shrinkage (%)	3.0
Maximum Dry Density (pcf)	109.7
Opt. Moisture Content (%)	15.0
Nat. Moisture Content (%)	18.0
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	4.39
Soil Support Value	---

Station: **72+00, 20 ft Right from CL**
Sample No.: **SS-21-CL (5-8 ft)**
Soil Desc.: **Reddish brown medium to fine sandy CLAY (micaceous)**
GDOT Soil Class: **II B4**



% Finer 1.5" Sieve	100.0
3/4" Sieve	100.0
No. 10 Sieve	99.5
No. 40 Sieve	85.0
No. 60 Sieve	77.4
No. 200 Sieve	59.4
Clay Content (%)	31.4
Total Volume Change (%)	12.6
Swell (%)	8.8
Shrinkage (%)	3.8
Maximum Dry Density (pcf)	98.1
Opt. Moisture Content (%)	20.8
Nat. Moisture Content (%)	22.4
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	2.82
Soil Support Value	3.6

WILLMER ENGINEERING INC.

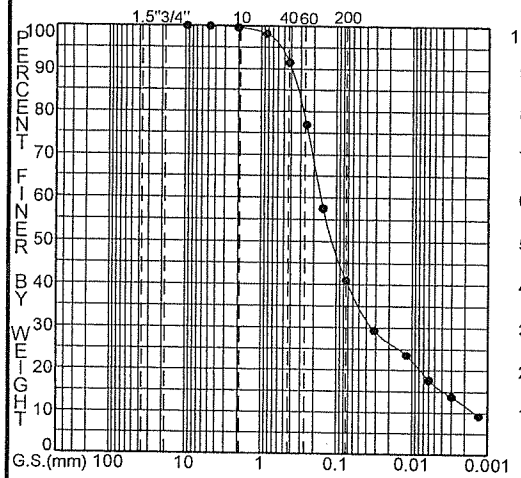
Project: **Side Roads and Ramps, SR 316 from West of CR 104 to CR 177**
Location: **Gwinnett County, Georgia**
Supervisor: **MK**
Prime Consultant: **PBS&J**
Willmer Project No.: **171-3594**
GDOT Project No.: **MSL00-0004-00(086), PI No. 0004086**

Station: **611+00, 15 ft Right from CL**

Sample No.: **SS-11-RL (2.5-5 ft)**

Soil Desc.: **Tan and reddish brown silty medium to fine SAND**

GDOT Soil Class: **II B4**



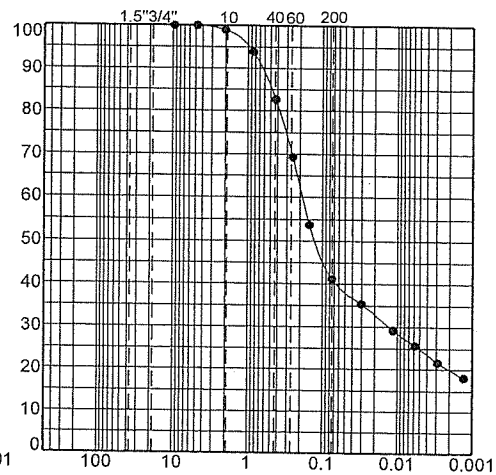
% Finer	
1.5" Sieve	100.0
3/4" Sieve	100.0
No. 10 Sieve	99.6
No. 40 Sieve	91.5
No. 60 Sieve	76.9
No. 200 Sieve	41.0
Clay Content (%)	11.5
Total Volume Change (%)	10.2
Swell (%)	7.8
Shrinkage (%)	2.4
Maximum Dry Density (pcf)	102.1
Opt. Moisture Content (%)	18.5
Nat. Moisture Content (%)	17.0
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	5.09
Soil Support Value	4.0

Station: **4292+00, CL**

Sample No.: **SS-6-CL (2-5 ft)**

Soil Desc.: **Dark brown silty medium to fine SAND**

GDOT Soil Class: **II B3**



% Finer	
1.5" Sieve	100.0
3/4" Sieve	100.0
No. 10 Sieve	98.9
No. 40 Sieve	82.7
No. 60 Sieve	69.3
No. 200 Sieve	41.2
Clay Content (%)	20.0
Total Volume Change (%)	8.9
Swell (%)	6.0
Shrinkage (%)	2.9
Maximum Dry Density (pcf)	110.0
Opt. Moisture Content (%)	14.4
Nat. Moisture Content (%)	18.1
Liquid Limit (%)	---
Plasticity Index (%)	---
Erosion Index	5.06
Soil Support Value	---

Table AIII-1

Results of Consolidation Test
Side Roads and Ramps
SR 316 from West of CR 104/Collins Hill Road to CR 177/Hi-Hope Road
GDOT Project No. MSL00-0004-00(086), PI No. 0004086
Willmer Engineering Project No. 171-3594

Station and Offset	Location	Boring No.	Sample Depth (feet)	Soil Description	Fine Content (%)	Natural Moisture Content (%)	LL (%)	PI (%)	Void Ratio	σ_p' (psf)	C_c	C_r	C_v (ft^2/day)
24+70 (170 feet Left of Centerline)	Lendon Connector	SS-14-LS	13-15	Brown medium to fine sandy lean CLAY	55.9	17.4	38	17	0.65	2700	0.12	0.02	2

Abbreviations:
σ_p' - Preconsolidation Pressure
C_c - Compression Index
C_r - Recompression Index
C_v - Coefficient of Consolidation
LL - Liquid Limit
PI – Plasticity Index

Table AIII-2

Results of Organic Content Test on a Muck Sample
Side Roads and Ramps
SR 316 from West of CR 104/Collins Hill Road to CR 177/Hi-Hope Road
GDOT Project No. MSL00-0004-00(086), PI No. 0004086
Willmer Engineering Project No. 171-3594

Station to Station	Sample No.	Soil (Muck) Description	Sample Depth (feet)	Natural Moisture Content (%)	Organic Content (%)	Liquid Limit (%)	Plasticity Index (%)
23+00± to 25+50± (Lendon Connector)	M-1	Brown sandy lean CLAY (CL)	0-2	42.4	3.4	48	21

Table AIII-3

Results of Corrosion Series Tests on Water Samples
Side Roads and Ramps
SR 316 from West of CR 104/Collins Hill Road to CR 177/Hi-Hope Road
GDOT Project No. MSL00-0004-00(086), PI No. 0004086
Willmer Engineering Project No. 171-3594

Station to Station	Location Description	Sample Type	pH	Resistivity (ohm-cm)
23+20, 110 feet Left of Centerline, Lendon Connector	Lake	Water	7.54	109,407