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PROJECT: 32574 REFERENCE: A-0011C

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STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 GEOTECHNICAL ENGINEERING UNIT

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY CLAY
 PROJECT DESCRIPTION NC 69 FROM GEORGIA STATE
LINE TO US 64

SITE DESCRIPTION CULVERT ON -L- (NC 69)
STATION 186+81 OVER UNNAMED TRIBUTARY
TO SOUTH BLAIR CREEK

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	A-0011C	1	5

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

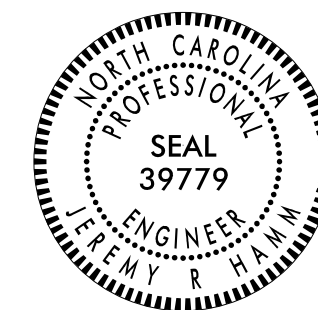
THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

- NOTES:
- THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
 - BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

TRIGON
GOODNIGHT, D. J.
WEIS, J. M.

INVESTIGATED BY FALCON ENG.
 DRAWN BY HILL, M. J.
 CHECKED BY HUNSBERGER, W. S.
 SUBMITTED BY FALCON ENG.
 DATE MAY 2019



DocuSigned by:
Jeremy R Hamm 5/15/2019
 ED7938089E22487...
 SIGNATURE DATE

**DOCUMENT NOT CONSIDERED FINAL
 UNLESS ALL SIGNATURES COMPLETED**

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SUBSURFACE INVESTIGATION
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

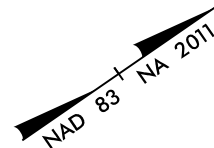
SOIL DESCRIPTION SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>										GRADATION WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.										ROCK DESCRIPTION HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED, AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:										TERMS AND DEFINITIONS ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.									
SOIL LEGEND AND AASHTO CLASSIFICATION																																							
GENERAL CLASS. GRANULAR MATERIALS (≤ 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										MINERALOGICAL COMPOSITION MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.										WEATHERING FRESH - ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. VERY SLIGHT (IV SLI.) - ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE. SLIGHT (SLI.) - ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. MODERATE (MOD.) - SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK. MODERATELY SEVERE (MOD. SEV.) - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i> SEVERE (SEV.) - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF</i> VERY SEVERE (IV SEV.) - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</i> COMPLETE - ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.																			
COMPRESSIBILITY SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50										PERCENTAGE OF MATERIAL ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10% LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35% HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE										GROUND WATER WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING STATIC WATER LEVEL AFTER 24 HOURS PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA SPRING OR SEEP																			
CONSISTENCY OR DENSENESS										MISCELLANEOUS SYMBOLS										RECOMMENDATION SYMBOLS																			
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION DIP & DIP DIRECTION OF ROCK STRUCTURES SOIL SYMBOL SPT TEST BORING ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT AUGER BORING INFERRED SOIL BOUNDARY CORE BORING INFERRED ROCK LINE MONITORING WELL ALLUVIAL SOIL BOUNDARY PIEZOMETER INSTALLATION SPT N-VALUE										UNDERCUT UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK																			
TEXTURE OR GRAIN SIZE										ABBREVIATIONS										ROCK HARDNESS																			
U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.75 2.00 0.42 0.25 0.075 0.053										AR - AUGER REFUSAL MED. - MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA - MICACEOUS WEA. - WEATHERED CL. - CLAY MOD. - MODERATELY UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC DRY - DRY UNIT WEIGHT CSE. - COARSE ORG. - ORGANIC PMT - PRESSUREMETER TEST SAMPLE ABBREVIATIONS DMT - DILATOMETER TEST SAP. - SAPROLITIC S - BULK DPT - DYNAMIC PENETRATION TEST SD. - SAND, SANDY SS - SPLIT SPOON e - VOID RATIO SL. - SILTY, SILTY ST - SHELBY TUBE F - FINE FOSS. - FOSSILIFEROUS SLI. - SLIGHTLY RS - ROCK FRAC. - FRACTURED, FRACTURES TCR - TRICONE REFUSAL RT - RECOMPACTED TRIAXIAL FRAGS. - FRAGMENTS w - MOISTURE CONTENT CBR - CALIFORNIA BEARING RATIO HI. - HIGHLY V - VERY										VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. MODERATELY HARD CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. MEDIUM HARD CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. SOFT CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE. VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.																			
SOIL MOISTURE - CORRELATION OF TERMS																																							
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION										EQUIPMENT USED ON SUBJECT PROJECT										FRACTURE SPACING																			
LL - LIQUID LIMIT PL - PLASTIC LIMIT OM - OPTIMUM MOISTURE SHRINKAGE LIMIT										DRILL UNITS: CME-45C, CME-55, CME-550, VANE SHEAR TEST, PORTABLE HOIST, MOBILE B-57 ADVANCING TOOLS: CLAY BITS, 6" CONTINUOUS FLIGHT AUGER, 8" HOLLOW AUGERS, HARD FACED FINGER BITS, TUNG-CARBIDE INSERTS, CASING w/ ADVANCER, TRICONE * STEEL TEETH, TRICONE * TUNG-CARB., CORE BIT HAMMER TYPE: AUTOMATIC, MANUAL CORE SIZE: B, H, N HAND TOOLS: POST HOLE DIGGER, HAND AUGER, SOUNDING ROD, VANE SHEAR TEST										TERM SPACING: VERY WIDE MORE THAN 10 FEET, WIDE 3 TO 10 FEET, MODERATELY CLOSE 1 TO 3 FEET, CLOSE 0.16 TO 1 FOOT, VERY CLOSE LESS THAN 0.16 FEET																			
PLASTICITY										INDURATION										BEDDING																			
NON PLASTIC 0-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT MODERATELY PLASTIC 16-25 MEDIUM HIGHLY PLASTIC 26 OR MORE HIGH										FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.										TERM THICKNESS: VERY THICKLY BEDDED 4 FEET, THICKLY BEDDED 1.5 - 4 FEET, THINLY BEDDED 0.16 - 1.5 FEET, VERY THINLY BEDDED 0.03 - 0.16 FEET, THICKLY LAMINATED 0.008 - 0.03 FEET, THINLY LAMINATED < 0.008 FEET																			
COLOR DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-BROWN). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.																																							
FRACURE SPACING										INDURATION										BEDDING																			
TERM SPACING: VERY WIDE MORE THAN 10 FEET, WIDE 3 TO 10 FEET, MODERATELY CLOSE 1 TO 3 FEET, CLOSE 0.16 TO 1 FOOT, VERY CLOSE LESS THAN 0.16 FEET										FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.										TERM THICKNESS: VERY THICKLY BEDDED 4 FEET, THICKLY BEDDED 1.5 - 4 FEET, THINLY BEDDED 0.16 - 1.5 FEET, VERY THINLY BEDDED 0.03 - 0.16 FEET, THICKLY LAMINATED 0.008 - 0.03 FEET, THINLY LAMINATED < 0.008 FEET																			
FRACURE SPACING																																							
INDURATION																																							
BEDDING																																							
BENCH MARK: BORING ELEVATIONS TAKEN FROM a0011c_ls_tin.tin DATED 09/06/17 ELEVATION: FEET																																							
NOTES: FIAD - FILLED IMMEDIATELY AFTER DRILLING																																							

28 FOR -L- PROFILE

RADII ARE 10' UNLESS HERWISE.

SEE SHEET 28 FOR -L- PROFILE

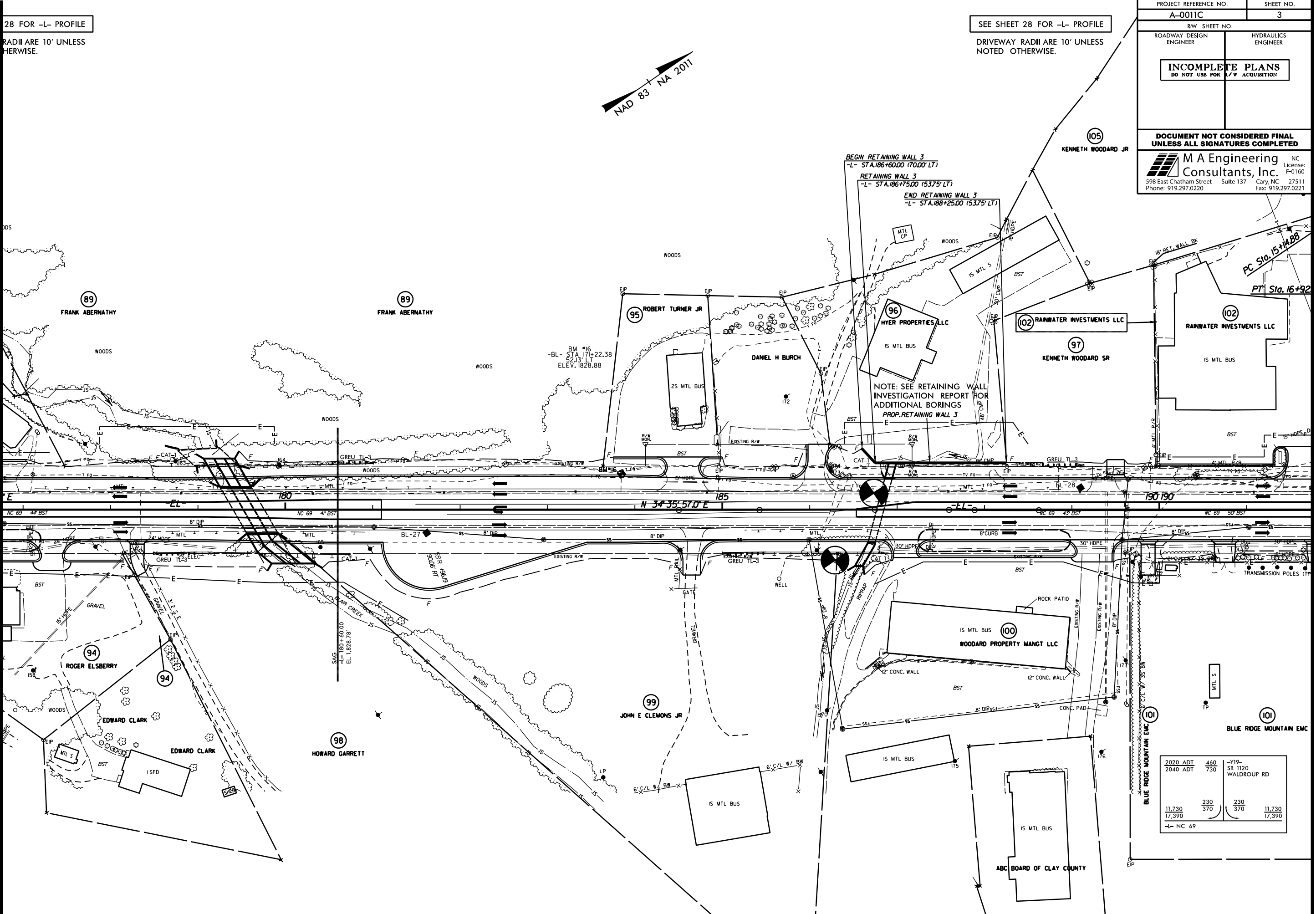
DRIVEWAY RADII ARE 10' UNLESS NOTED OTHERWISE.



PROJECT REFERENCE NO. A-0011C	SHEET NO. 3
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR A/W ACQUISITION	
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	
 M A Engineering Consultants, Inc.	
<small>598 East Chatham Street Suite 137 Cary, NC 27511 Phone: 919.297.0220 Fax: 919.297.0221</small>	

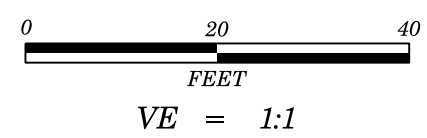
REVISIONS

15-MAY-2019 10:45T
I:\Projects\2016\16_016005.00 A-0011C NC 69 W/imping Clay County\A0011C.GEO.RDWY.CADD.GEOTECH\Site&Sub\A0011C_GEO_psh3_CULV3.dgn



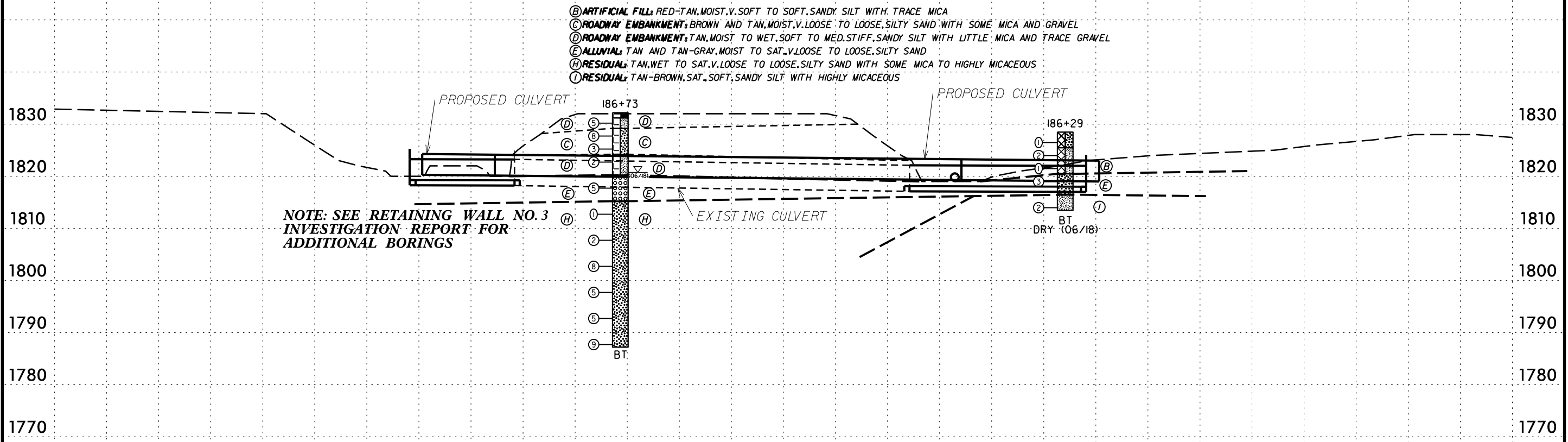
NOTE: SEE RETAINING WALL INVESTIGATION REPORT FOR ADDITIONAL BORINGS PROP. RETAINING WALL 3

2020 ADT	460	-Y19-	
2040 ADT	730	SR 1120	
		WALDRUP RD	
11,730	230	230	11,730
17,390	370	370	17,390
-L- NC 69			



PROJECT REFERENCE NO.	SHEET NO.
A-0011C	4
PROFILE OF CULVERT AT -L- STATION 186+81	

-L- 186+81



- ⓑ ARTIFICIAL FILL: RED-TAN, MOIST, V. SOFT TO SOFT, SANDY SILT WITH TRACE MICA
- ⓒ ROADWAY EMBANKMENT: BROWN AND TAN, MOIST, V. LOOSE TO LOOSE, SILTY SAND WITH SOME MICA AND GRAVEL
- ⓓ ROADWAY EMBANKMENT: TAN, MOIST TO WET, SOFT TO MED. STIFF, SANDY SILT WITH LITTLE MICA AND TRACE GRAVEL
- ⓔ ALLUVIAL: TAN AND TAN-GRAY, MOIST TO SAT., V. LOOSE TO LOOSE, SILTY SAND
- ⓗ RESIDUAL: TAN, WET TO SAT., V. LOOSE TO LOOSE, SILTY SAND WITH SOME MICA TO HIGHLY MICACEOUS
- ⓓ RESIDUAL: TAN-BROWN, SAT., SOFT, SANDY SILT WITH HIGHLY MICACEOUS

NOTE: SEE RETAINING WALL NO. 3
INVESTIGATION REPORT FOR
ADDITIONAL BORINGS

NOTES:
 GROUNDLINE PROFILE ALONG CULVERT CENTERLINE DRAWN
 FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES
 RECEIVED FROM MA ENGINEERING DATED SEPTEMBER 2017.
 CULVERT SKEW: 105 DEGREES

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 32574.1.FD7		TIP A-0011C		COUNTY CLAY		GEOLOGIST Goodnight, D.										
SITE DESCRIPTION NC 69 ROAD WIDENING FROM GA STATE LINE TO US 64 (HAYESVILLE BYPASS)							GROUND WTR (ft)									
BORING NO. B-087		STATION 186+29		OFFSET 58 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 1,828.5 ft		TOTAL DEPTH 15.0 ft		NORTHING 500,659		EASTING 556,308										
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 95% 03/19/2018		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic												
DRILLER Estep, J. E.		START DATE 06/14/18		COMP. DATE 06/14/18		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
1830														1,828.5	0.0	0.3' TOPSOIL
	1,827.5	1.0												1,828.5		ARTIFICIAL FILL TAN, SILTY FINE SAND (A-2-4) WITH TRACE GRAVEL
1825	1,825.0	3.5	1	1	1									1,825.5	3.0	RED-TAN, FINE SANDY SILT (A-4) WITH TRACE MICA
	1,822.5	6.0												1,820.5	8.0	ALLUVIAL TAN-GRAY, SILTY SAND (A-2-4)
1820	1,820.0	8.5	2	1	2									1,816.5	12.0	RESIDUAL TAN-BROWN, SANDY SILT (A-4) HIGHLY MICACEOUS
1815	1,815.0	13.5	1	1	1									1,813.5	15.0	Boring Terminated at Elevation 1,813.5 ft IN RESIDUAL: SANDY SILT

WBS 32574.1.FD7		TIP A-0011C		COUNTY CLAY		GEOLOGIST Goodnight, D.										
SITE DESCRIPTION NC 69 ROAD WIDENING FROM GA STATE LINE TO US 64 (HAYESVILLE BYPASS)							GROUND WTR (ft)									
BORING NO. RW3-1		STATION 186+73		OFFSET 19 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 1,832.2 ft		TOTAL DEPTH 45.0 ft		NORTHING 500,739		EASTING 556,270										
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 95% 03/19/2018		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic												
DRILLER Estep, J. E.		START DATE 06/13/18		COMP. DATE 06/13/18		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
1835														1,832.2	0.0	GROUND SURFACE
	1,831.2	1.0												1,831.2	1.0	0.5' BITUMINOUS CONCRETE 0.5' AGGREGATE BASE COURSE
1830	1,828.7	3.5	4	2	3									1,829.2	3.0	ROADWAY EMBANKMENT TAN, SANDY SILT (A-4) WITH LITTLE MICA
	1,826.2	6.0												1,824.2	8.0	BROWN AND TAN, SILTY SAND (A-2-4) WITH SOME MICA AND GRAVEL
1825	1,823.7	8.5	2	1	2									1,820.2	12.0	TAN, SANDY SILT (A-4) WITH LITTLE MICA AND TRACE GRAVEL
	1,818.7	13.5												1,815.2	17.0	ALLUVIAL TAN, FINE TO COARSE SAND (A-1-b)
1815	1,813.7	18.5	1	WOH	1											RESIDUAL TAN, SILTY FINE SAND (A-2-4) WITH SOME MICA, SAPROLITIC, AND HIGHLY MICACEOUS
1810	1,808.7	23.5	1		1											
1805	1,803.7	28.5	2	3	5											
1800	1,798.7	33.5	2	2	3											
1795	1,793.7	38.5	2	3	2											
1790	1,788.7	43.5	2	3	6									1,787.2	45.0	Boring Terminated at Elevation 1,787.2 ft IN RESIDUAL: SILTY SAND

NCDOT BORE DOUBLE A011C_GEO_RDWY_GINT.GPJ NC_DOT.GDT 5/8/19



July 25, 2019

Robert J. Porter, Jr. PE
MA Engineering Consultants, Inc.
598 East Chatham St, Suite 137
Cary, NC 27511

TIP No.: A-0011C
County: Clay
Project Description: NC 69 from Georgia State Line to US 64
Site Description: Culvert on -L- at Station 186+81 over Unnamed Tributary to South Blair Creek
Subject: Culvert Foundation Recommendations

Dear Mr. Porter:

As authorized, Falcon Engineering Inc. (Falcon) has completed the Culvert Foundation Recommendations for the above referenced project based on current NCDOT LRFD bridge design policy and procedures.

Foundation recommendations and notes on plans are presented in the attachments. These recommendations are based on subsurface data obtained by Falcon as presented in the Subsurface Investigation Report submitted under separate cover. Culvert geometry and scour data used in our analysis were obtained from the Culvert Scour Report (CSR) provided to us by MA Engineering.

Falcon appreciates the opportunity to have provided Stantec with geotechnical engineering services. If you have any questions concerning the contents of this report or need additional information, please do not hesitate to contact our office.

Respectfully submitted:

FALCON ENGINEERING, INC.

A handwritten signature in blue ink that reads "Stephen C. Crockett".

Stephen C. Crockett, PE
Geotechnical Engineer

A handwritten signature in blue ink that reads "Jeremy R. Hamm".

Jeremy R. Hamm, PE
Geotechnical Engineering Manager

Attachments: Foundation Recommendations and Notes on Plans

FOUNDATION RECOMMENDATIONS

WBS # 32574.1.FD7

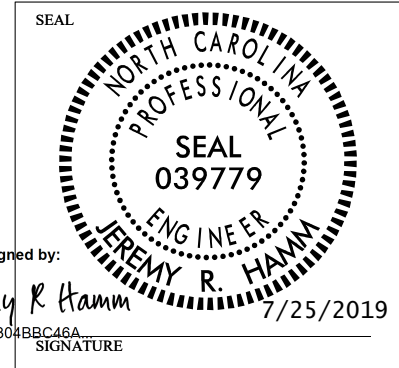
T.I.P. NO. A-0011C

COUNTY Clay

STATION 186+81 -L-

DESCRIPTION Culvert on -L- at Station 186+81 over
Unnamed Tributary to South Blair Creek

	INITIALS	DATE
DESIGN	JRH	05/07/19
CHECK	SCC	05/08/19
APPROVAL		



CULVERT SIZE	STATION	FOUNDATION TYPE	EXCAVATION DEPTH	MISCELLANEOUS DETAILS
8' x 5' Reinforced Concrete Box Culvert	-L- 186+81	36" Class VI Foundation Conditioning Material	3.0 foot below bottom of culvert	Approximate Culvert Extension = 20 ft upstream, 34 ft downstream Culvert Skew = 105 degrees Exist. Culvert Invert Elevation = 1817.67 ft Slope = 0.3% upstream and downstream

FOUNDATION RECOMMENDATION SPECIAL NOTES ON PLANS

- EXCAVATE FOUNDATION A MINIMUM OF 3.0 FEET BELOW CULVERT BEARING ELEVATION.
- INSTALL GEOTEXTILE FOR SOIL STABILIZATION, TYPE 4, TO A MINIMUM DISTANCE OF 1.5 FEET BEYOND THE EXTENTS OF THE CULVERT FOUNDATION IN ACCORDANCE WITH SECTION 270 OF THE STANDARD SPECIFICATIONS.
- PLACE 3.0 FEET OF CLASS VI FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH SECTION 414 OF THE STANDARD SPECIFICATIONS.
- OVEREXCAVATE LOOSE/SOFT MATERIAL IF PRESENT TO SUITABLE BEARING MATERIALS AND REPLACE WITH ADDITIONAL CLASS VI FOUNDATION CONDITIONING MATERIAL. IF MORE THAN 1.0 FEET OF ADDITIONAL EXCAVATION IS NEEDED, CONTACT THE OPERATIONS ENGINEER FOR APPROVAL.

FOUNDATION RECOMMENDATION COMMENTS

- Culvert settlement is anticipated to approach 1.0 inches.
- Culvert foundation will require the following estimated pay item quantities:

Item	Spec. Section	Quantity	Units
Undercut Excavation	225	80	CY
Geotextile for Soil Stabilization, Type 4	270	80	CY
Foundation Conditioning Material, Box Culvert (Class VI)	414	120	tons

PROJECT: 32574 REFERENCE: A-0011C

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5	BORING LOGS

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY CLAY
 PROJECT DESCRIPTION NC 69 FROM GEORGIA STATE
LINE TO US 64

SITE DESCRIPTION CULVERT ON -L- (NC 69)
STATION 94 + 91 OVER HYATT MILL CREEK

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	A-0011C	1	5

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:

- THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
- BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

TRIGON

GOODNIGHT, D. J.

WEIS, J. M.

INVESTIGATED BY FALCON ENG.

DRAWN BY HILL, M. J.

CHECKED BY HUNSBERGER, W. S.

SUBMITTED BY FALCON ENG.

DATE MAY 2019



DocuSigned by:
Jeremy R Hamm 5/15/2019
 ED7938089E22487...
 SIGNATURE DATE

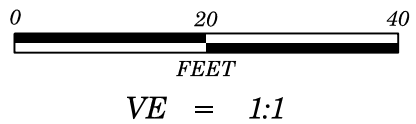
**DOCUMENT NOT CONSIDERED FINAL
 UNLESS ALL SIGNATURES COMPLETED**

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

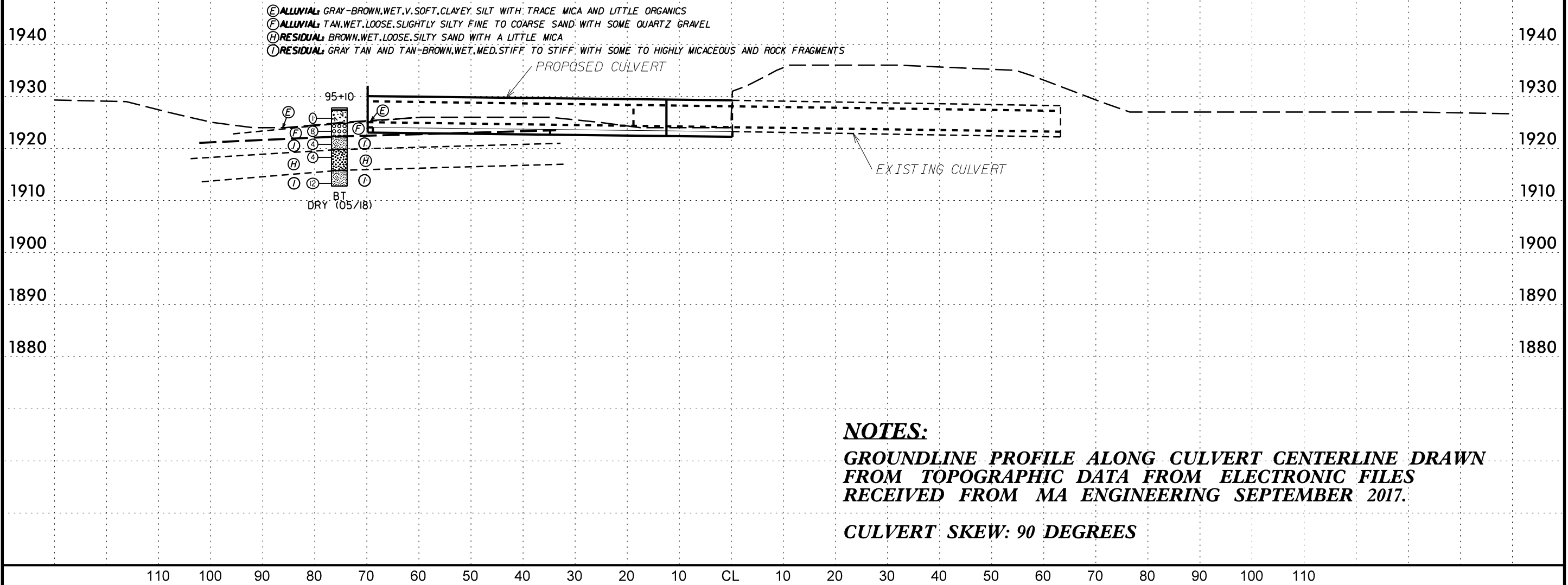
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION						GRADATION						ROCK DESCRIPTION						TERMS AND DEFINITIONS																									
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 298, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i> .												WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.						HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED, AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS: WEATHERED ROCK (WR) - NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED. CRYSTALLINE ROCK (CR) - FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. NON-CRYSTALLINE ROCK (NCR) - FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC. COASTAL PLAIN SEDIMENTARY ROCK (CP) - COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.						ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOGGED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.																			
SOIL LEGEND AND AASHTO CLASSIFICATION																																											
GENERAL CLASS.		GRANULAR MATERIALS (<= 35% PASSING #200)						SILT-CLAY MATERIALS (> 35% PASSING #200)						ORGANIC MATERIALS																													
GROUP CLASS.	A-1	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7																												
SYMBOL	[Pattern]			[Pattern]			[Pattern]			[Pattern]			[Pattern]		[Pattern]																												
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS		SILT-CLAY SOILS	MUCK, PEAT																												
MATERIAL PASSING #40 LL PI	6 MX		-	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER																															
GROUP INDEX	0			0			4 MX	8 MX	12 MX	16 MX	NO MX	HIGHLY ORGANIC SOILS																															
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND		SILTY SOILS		CLAYEY SOILS																																			
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD						FAIR TO POOR			FAIR TO POOR	POOR	UNSATURABLE																															
PI OF A-7-5 SUBGROUP IS <= LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30																																											
CONSISTENCY OR DENSENESS																																											
PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY			RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)			RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)																																				
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE			4 10 20 30 > 50			N/A																																				
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD			2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30			< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4																																				
TEXTURE OR GRAIN SIZE																																											
U.S. STD. SIEVE SIZE OPENING (MM)		4	10	20	40	60	100	200	270																																		
BOULDER (BLDR.)		COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE, SD.)		FINE SAND (F SD.)		SILT (SL.)	CLAY (CL.)																																		
GRAIN SIZE	MM 305	75	2.0	0.25		0.05		0.005																																			
SIZE	IN. 12	3																																									
SOIL MOISTURE - CORRELATION OF TERMS																																											
SOIL MOISTURE SCALE (ATTERBERG LIMITS)						FIELD MOISTURE DESCRIPTION						GUIDE FOR FIELD MOISTURE DESCRIPTION																															
LL						- SATURATED - (SAT.)						USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE																															
PLASTIC RANGE (PI)						- WET - (W)						SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE																															
OM						- MOIST - (M)						SOLID; AT OR NEAR OPTIMUM MOISTURE																															
SL						- DRY - (D)						REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE																															
PLASTICITY																																											
NON PLASTIC						VERY LOW						SLIGHT																															
SLIGHTLY PLASTIC						MEDIUM						HIGH																															
MODERATELY PLASTIC																																											
HIGHLY PLASTIC																																											
COLOR																																											
DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-BROWN). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.																																											
<input checked="" type="checkbox"/> MOBILE B-57																																											
RECOMMENDATION SYMBOLS <input checked="" type="checkbox"/> UNDERCUT <input checked="" type="checkbox"/> UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE <input checked="" type="checkbox"/> UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL <input checked="" type="checkbox"/> SHALLOW UNDERCUT <input checked="" type="checkbox"/> UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK																																											
ABBREVIATIONS AR - AUGER REFUSAL MED. - MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA - MICACEOUS WEA. - WEATHERED CL. - CLAY MOD. - MODERATELY UNIT WEIGHT %g - DRY UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC DPT - DYNAMIC PENETRATION TEST SAP. - SAPROLITIC SD. - SAND, SANDY SL. - SILTY, SILTY SLI. - SLIGHTLY TCR - TRIAXIAL REFUSAL w - MOISTURE CONTENT V - VERY CSE. - COARSE PMT - PRESSUREMETER TEST S - BULK SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO DMT - DILATOMETER TEST F - FINE FOSS. - FOSSILIFEROUS FRAC. - FRACTURED, FRACTURES FRAGS. - FRAGMENTS																																											
EQUIPMENT USED ON SUBJECT PROJECT DRILL UNITS: <input type="checkbox"/> CME-45C <input type="checkbox"/> CME-55 <input type="checkbox"/> CME-550 <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> PORTABLE HOIST <input checked="" type="checkbox"/> MOBILE B-57 ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE <input type="checkbox"/> * STEEL TEETH <input type="checkbox"/> TRICONE <input type="checkbox"/> * TUNG-CARB. <input type="checkbox"/> CORE BIT HAMMER TYPE: <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL CORE SIZE: <input type="checkbox"/> -B <input type="checkbox"/> -H <input type="checkbox"/> -N HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST																																											
ROCK HARDNESS VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. MODERATELY HARD CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. MEDIUM HARD CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. SOFT CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE. VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.						FRATURE SPACING <table border="1" style="width: 100%;"> <tr><th>TERM</th><th>SPACING</th></tr> <tr><td>VERY WIDE</td><td>MORE THAN 10 FEET</td></tr> <tr><td>WIDE</td><td>3 TO 10 FEET</td></tr> <tr><td>MODERATELY CLOSE</td><td>1 TO 3 FEET</td></tr> <tr><td>CLOSE</td><td>0.16 TO 1 FOOT</td></tr> <tr><td>VERY CLOSE</td><td>LESS THAN 0.16 FEET</td></tr> </table>						TERM	SPACING	VERY WIDE	MORE THAN 10 FEET	WIDE	3 TO 10 FEET	MODERATELY CLOSE	1 TO 3 FEET	CLOSE	0.16 TO 1 FOOT	VERY CLOSE	LESS THAN 0.16 FEET	BEDDING <table border="1" style="width: 100%;"> <tr><th>TERM</th><th>THICKNESS</th></tr> <tr><td>VERY THICKLY BEDDED</td><td>4 FEET</td></tr> <tr><td>THICKLY BEDDED</td><td>1.5 - 4 FEET</td></tr> <tr><td>THINLY BEDDED</td><td>0.16 - 1.5 FEET</td></tr> <tr><td>VERY THINLY BEDDED</td><td>0.03 - 0.16 FEET</td></tr> <tr><td>THICKLY LAMINATED</td><td>0.008 - 0.03 FEET</td></tr> <tr><td>THINLY LAMINATED</td><td>< 0.008 FEET</td></tr> </table>						TERM	THICKNESS	VERY THICKLY BEDDED	4 FEET	THICKLY BEDDED	1.5 - 4 FEET	THINLY BEDDED	0.16 - 1.5 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET	THINLY LAMINATED	< 0.008 FEET
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INDURATION FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC. FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.																																											



PROJECT REFERENCE NO.	SHEET NO.
A-0011C	4
PROFILE OF CULVERT AT -L- STATION 94+91	

-L-
94+91



GEOTECHNICAL BORING REPORT

BORE LOG

WBS 32574.1.FD7		TIP A-0011C		COUNTY CLAY		GEOLOGIST Goodnight, D. J.										
SITE DESCRIPTION NC 69 ROAD WIDENING FROM GA STATE LINE TO US 64 (HAYESVILLE BYPASS)							GROUND WTR (ft)									
BORING NO. B-038		STATION 95+10		OFFSET 78 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 1,927.8 ft		TOTAL DEPTH 15.0 ft		NORTHING 492,424		EASTING 555,305										
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 95% 03/19/2018				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Estep, J. E.		START DATE 05/10/18		COMP. DATE 05/10/18		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
1930														1,927.8	0.0	GROUND SURFACE
														1,927.3	0.5	0.5' TOPSOIL
1925	1,926.8	1.0	1	WOH	1								W	1,924.8	3.0	ALLUVIAL GRAY-BROWN, CLAYEY SILT (A-5) WITH TRACE MICA AND ORGANICS
	1,924.3	3.5	10	5	3								W	1,922.3	5.5	TAN, SLIGHTLY SILTY FINE TO COARSE SAND (A-1-b) WITH SOME QUARTZ GRAVEL
1920	1,921.8	6.0	1	2	2								W	1,919.8	8.0	RESIDUAL GRAY AND TAN, SANDY SILT (A-4) WITH SOME MICA AND ROCK FRAGMENTS
	1,919.3	8.5	1	2	2								W	1,915.8	12.0	BROWN, SILTY SAND (A-2-4) WITH A LITTLE MICA
1915	1,914.3	13.5	3	5	7								W	1,912.8	15.0	TAN-BROWN, SANDY SILT (A-4) HIGHLY MICACEOUS
																Boring Terminated at Elevation 1,912.8 ft IN RESIDUAL: SANDY SILT

NCDOT BORE DOUBLE A011C_GEO_RDWY_GINT.GPJ NC_DOT.GDT 5/8/19



July 25, 2019

Robert J. Porter, Jr. PE
MA Engineering Consultants, Inc.
598 East Chatham St, Suite 137
Cary, NC 27511

TIP No.: A-0011C
County: Clay
Project Description: NC 69 from Georgia State Line to US 64
Site Description: Culvert on -L- at Station 94+91 over Hyatt Mill Creek
Subject: Culvert Foundation Recommendations

Dear Mr. Porter:

As authorized, Falcon Engineering Inc. (Falcon) has completed the Culvert Foundation Recommendations for the above referenced project based on current NCDOT LRFD bridge design policy and procedures.

Foundation recommendations and notes on plans are presented in the attachments. These recommendations are based on subsurface data obtained by Falcon as presented in the Subsurface Investigation Report submitted under separate cover. Culvert geometry and scour data used in our analysis were obtained from the Culvert Scour Report (CSR) provided to us by MA Engineering.

Falcon appreciates the opportunity to have provided Stantec with geotechnical engineering services. If you have any questions concerning the contents of this report or need additional information, please do not hesitate to contact our office.

Respectfully submitted:

FALCON ENGINEERING, INC.

A handwritten signature in blue ink that reads "Stephen C. Crockett".

Stephen C. Crockett, PE
Geotechnical Engineer

A handwritten signature in blue ink that reads "Jeremy R. Hamm".

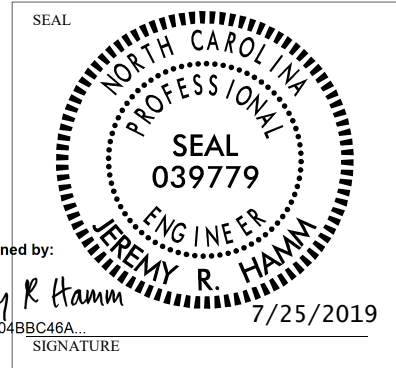
Jeremy R. Hamm, PE
Geotechnical Engineering Manager

Attachments: Foundation Recommendations and Notes on Plans

FOUNDATION RECOMMENDATIONS

WBS #	32574.1.FD7	DESCRIPTION	Culvert on -L- at Station 94+91 over
T.I.P. NO.	A-0011C		Hyatt Mill Creek
COUNTY	Clay		
STATION	94+91 -L-		

	INITIALS	DATE
DESIGN	JRH	05/07/19
CHECK	SCC	05/08/19
APPROVAL		



CULVERT SIZE	STATION	FOUNDATION TYPE	EXCAVATION DEPTH	MISCELLANEOUS DETAILS
Dual 10' x 7' Reinforced Concrete Box Culverts	-L- 94+91	12" Class VI Foundation Conditioning Material	1.0 foot below bottom of culvert	Approximate Culvert Extension = 72 ft upstream Culvert Skew = 90 degrees Exist. Culvert Invert Elevation = 1923.24 ft Slope = 1.13%

FOUNDATION RECOMMENDATION SPECIAL NOTES ON PLANS

1. EXCAVATE FOUNDATION A MINIMUM OF 1.0 FEET BELOW CULVERT BEARING ELEVATION. PLACE 1.0 FEET OF CLASS VI FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH SECTION 414 OF THE STANDARD SPECIFICATIONS.
2. OVEREXCAVATE LOOSE/SOFT MATERIAL IF PRESENT TO SUITABLE BEARING MATERIALS AND REPLACE WITH ADDITIONAL CLASS VI FOUNDATION CONDITIONING MATERIAL. IF MORE THAN 1.0 FEET OF ADDITIONAL EXCAVATION IS NEEDED, CONTACT THE OPERATIONS ENGINEER FOR APPROVAL.

FOUNDATION RECOMMENDATION COMMENTS

1. Culvert settlement is anticipated to approach 1.5 inches.
2. Culvert foundation will require an estimated 80 tons of foundation conditioning material.

PROJECT: 32574 REFERENCE: A-0011C

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5	BORING LOGS

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY CLAY
 PROJECT DESCRIPTION NC 69 FROM GEORGIA STATE
LINE TO US 64

SITE DESCRIPTION CULVERT ON -L- (NC 69)
STATION 179+58 OVER BLAIR CREEK

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	A-0011C	1	5

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

- NOTES:
- THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
 - BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

TRIGON

GOODNIGHT, D. J.

WEIS, J. M.

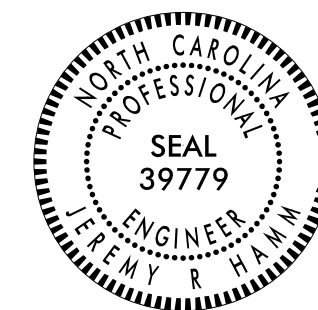
INVESTIGATED BY FALCON ENG.

DRAWN BY HILL, M. J.

CHECKED BY HUNSBERGER, W. S.

SUBMITTED BY FALCON ENG.





DATE MAY 2019



DocuSigned by:
 Jeremy R Hamm 5/15/2019
 ED7938089E22487...
 SIGNATURE DATE

**DOCUMENT NOT CONSIDERED FINAL
 UNLESS ALL SIGNATURES COMPLETED**

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SUBSURFACE INVESTIGATION
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS																																																																																																										
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 208, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>										WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.										HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED, AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:										ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOADED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.																																																																																																										
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.										WEATHERED ROCK (WR)  NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.										CRSTALLINE ROCK (CR)  FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.																																																																																																										
MINERALOGICAL COMPOSITION MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.										COMPRESSIONIBILITY SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50										NON-CRSTALLINE ROCK (NCR)  FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.										COASTAL PLAIN SEDIMENTARY ROCK (CP)  COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.																																																																																																										
PERCENTAGE OF MATERIAL										WEATHERING										FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.																																																																																																																				
GROUND WATER										VERY SLIGHT (IV SL.) ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.										SLIGHT (SL.) ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.																																																																																																																				
MISCELLANEOUS SYMBOLS										MODERATE (MOD.) SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.										MODERATELY SEVERE (MOD. SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>																																																																																																																				
RECOMMENDATION SYMBOLS										SEVERE (SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF</i>										VERY SEVERE (IV SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</i>																																																																																																																				
ABBREVIATIONS										COMPLETE ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.										VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.																																																																																																																				
TEXTURE OR GRAIN SIZE										SOIL MOISTURE - CORRELATION OF TERMS										FRACTURE SPACING																																																																																																																				
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COLOR DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-BROWN). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.										FRACURE SPACING										INDURATION																																																																																																																				
BENCH MARK: BORING ELEVATIONS TAKEN FROM a0011c_ls_tin.tin DATED 09/06/17 ELEVATION: FEET										NOTES: FIAD - FILLED IMMEDIATELY AFTER DRILLING																																																																																																																														

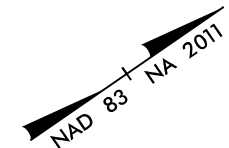
8/17/19

28 FOR -L- PROFILE

RADII ARE 10' UNLESS OTHERWISE.

SEE SHEET 28 FOR -L- PROFILE

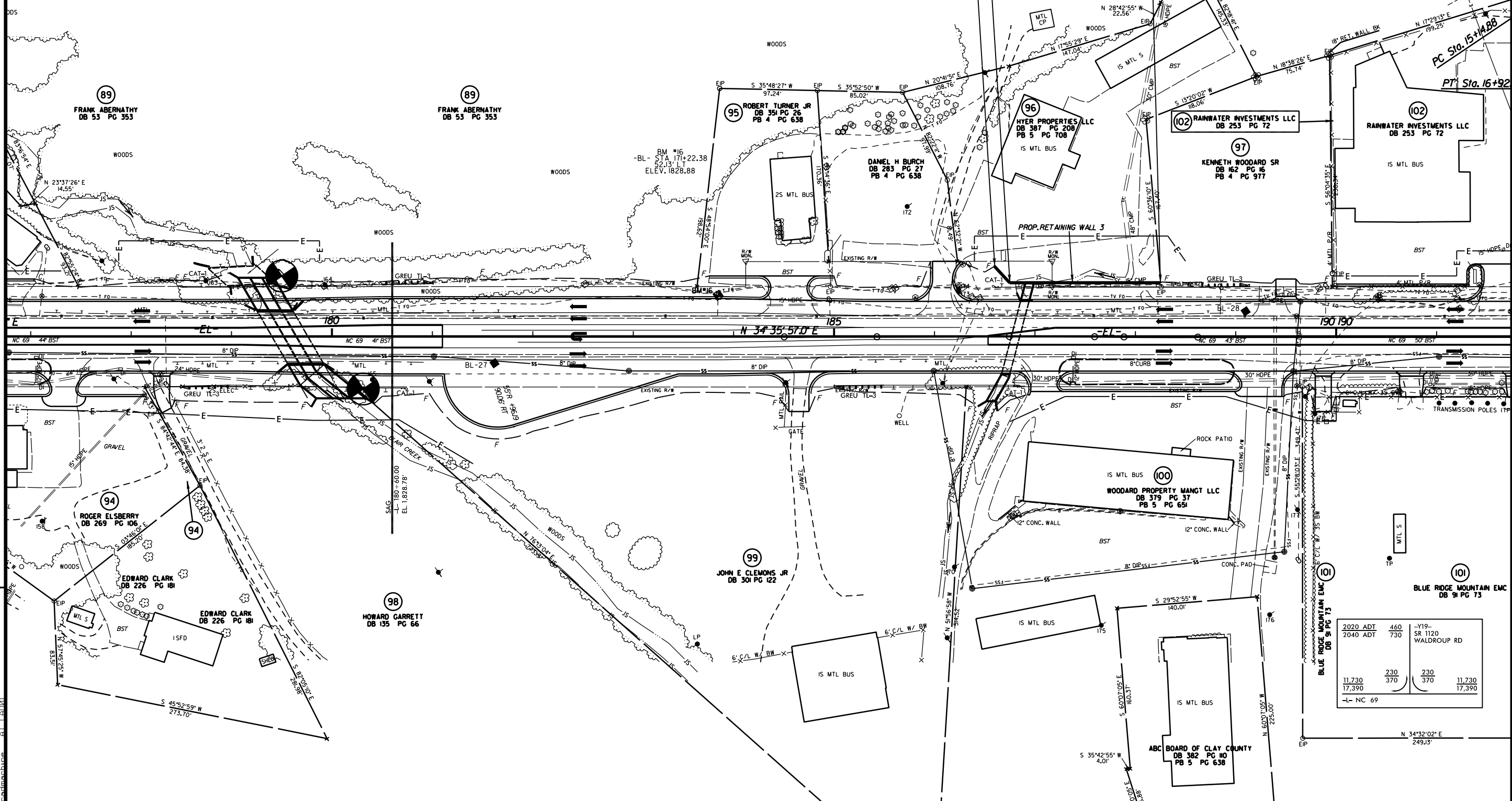
DRIVEWAY RADII ARE 10' UNLESS NOTED OTHERWISE.



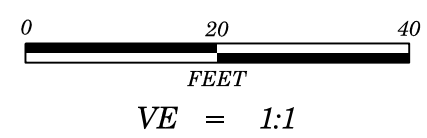
PROJECT REFERENCE NO. A-0011C		SHEET NO. 3	
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR A/W ACQUISITION			
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED			
M A Engineering		NC License: F-0160	
598 East Chatham Street Suite 137 Cary, NC 27511		Phone: 919.297.0220 Fax: 919.297.0221	

REVISIONS

20-NOV-2018 15:10 T:\Projects\A-0011C\A-0011C.GEO.ROADWAY.CADD.GEOTECH.Site&Sub.A\A0011C.GEO.psh3.CULV2.dgn



2020 ADT	460	-Y19-	
2040 ADT	730	SR 1120	
		WALDROUP RD	
11,730	230	230	11,730
17,390	370	370	17,390
-L- NC 69			

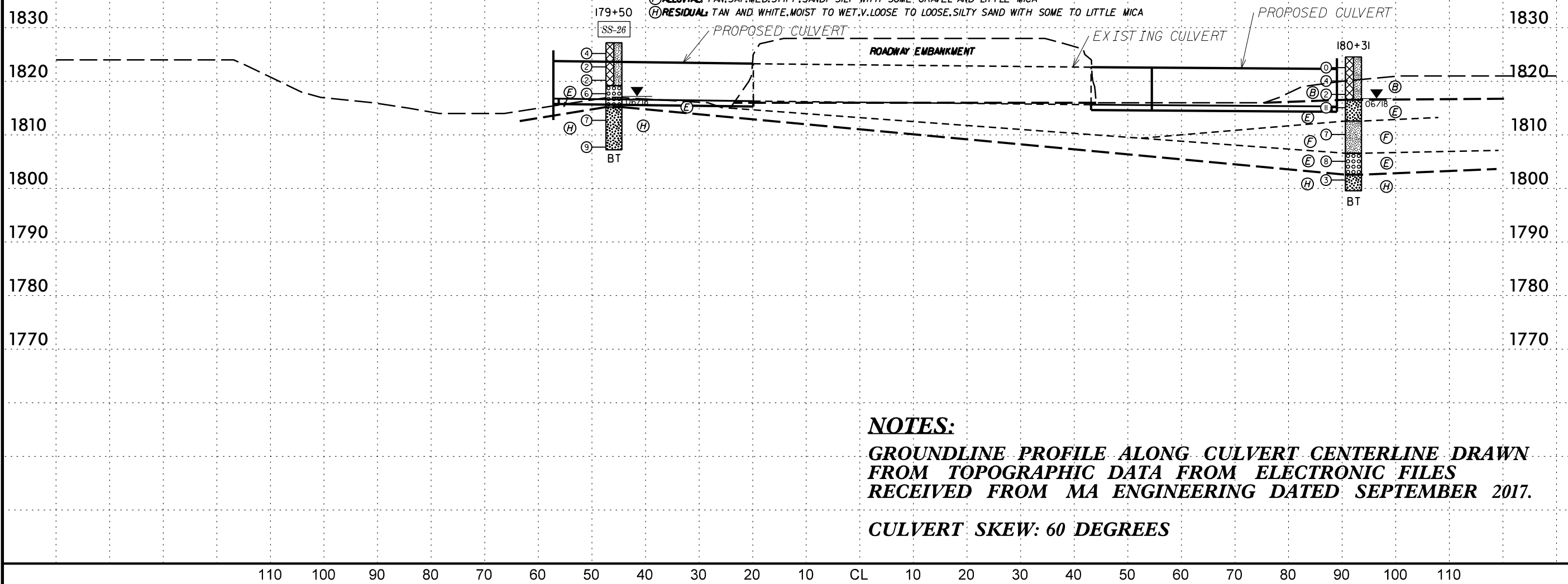


PROJECT REFERENCE NO.	SHEET NO.
A-0011C	4
PROFILE OF CULVERT AT -L- STATION 179+58	

-L- 179+58

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-26	60 FT LT	179+50	1.0'-2.5'	A-4	NP	NP	32	28	29	11	97	81	40	19.1	-

- ⓑ **ARTIFICIAL FILL:** BROWN, MOIST, V. SOFT TO SOFT, SANDY SILT WITH TRACE GRAVEL
- Ⓔ **ALLUVIAL:** BROWN AND TAN, MOIST TO SAT, LOOSE TO MED. DENSE, SILTY SAND AND SAND WITH SOME GRAVEL
- Ⓕ **ALLUVIAL:** TAN, SAT. MED. STIFF, SANDY SILT WITH SOME GRAVEL AND LITTLE MICA
- Ⓖ **RESIDUAL:** TAN AND WHITE, MOIST TO WET, V. LOOSE TO LOOSE, SILTY SAND WITH SOME LITTLE MICA



NOTES:
GROUNDLINE PROFILE ALONG CULVERT CENTERLINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM MA ENGINEERING DATED SEPTEMBER 2017.
CULVERT SKEW: 60 DEGREES

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 32574.1.FD7		TIP A-0011C		COUNTY CLAY		GEOLOGIST Goodnight, D.									
SITE DESCRIPTION NC 69 ROAD WIDENING FROM GA STATE LINE TO US 64 (HAYESVILLE BYPASS)							GROUND WTR (ft)								
BORING NO. B-081		STATION 179+50		OFFSET 60 ft LT		ALIGNMENT -L-									
COLLAR ELEV. 1,827.1 ft		TOTAL DEPTH 20.0 ft		NORTHING 500,167		EASTING 555,825									
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 95% 03/19/2018			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Estep, J. E.		START DATE 06/11/18		COMP. DATE 06/11/18		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
1830															
1825	1,826.1	1.0	3	2	2							SS-26	M	GROUND SURFACE	0.0
	1,823.6	3.5	1	1	1								M	ARTIFICIAL FILL TAN, SANDY SILT (A-4) WITH LITTLE MICA	
1820	1,821.1	6.0	1	1	1								M		
	1,818.6	8.5	2	3	3								M		
1815	1,816.1	8.5											W	ALLUVIAL TAN, SLIGHTLY SILTY FINE TO COARSE SAND (A-1-b) WITH SOME GRAVEL	8.0
	1,815.1												W		12.0
1810	1,813.6	13.5	2	3	4								M	RESIDUAL TAN, SILTY SAND (A-2-4) SAPROLITIC WITH SOME MICA	
	1,808.6	18.5	15	5	4								W		20.0
Boring Terminated at Elevation 1,807.1 ft IN RESIDUAL: SILTY SAND															

WBS 32574.1.FD7		TIP A-0011C		COUNTY CLAY		GEOLOGIST Goodnight, D.									
SITE DESCRIPTION NC 69 ROAD WIDENING FROM GA STATE LINE TO US 64 (HAYESVILLE BYPASS)							GROUND WTR (ft)								
BORING NO. B-083		STATION 180+31		OFFSET 52 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 1,824.6 ft		TOTAL DEPTH 25.0 ft		NORTHING 500,170		EASTING 555,964									
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 95% 03/19/2018			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Estep, J. E.		START DATE 06/12/18		COMP. DATE 06/12/18		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
1825															
	1,823.6	1.0	WOH	WOH	WOH								M	0.3' TOPSOIL	0.0
1820	1,821.1	3.5	WOH	1	3								M	ARTIFICIAL FILL BROWN, SANDY SILT (A-4) WITH TRACE GRAVEL	
	1,818.6	6.0	1	1	1								W	ALLUVIAL BROWN, SILTY SAND (A-2-4) WITH SOME GRAVEL	8.0
1815	1,816.1	8.5	WOH	5	6								W		12.0
	1,812.6												Sat.	TAN, SANDY SILT (A-4) WITH SOME GRAVEL AND LITTLE MICA	
1810	1,811.1	13.5	WOH	4	3								Sat.		18.0
	1,806.6												Sat.	BROWN, SLIGHTLY SILTY FINE TO COURSE SAND (A-1-b) WITH SOME GRAVEL	22.0
1805	1,806.1	18.5	7	5	3								W	RESIDUAL TAN AND WHITE, SILTY SAND (A-2-4) SAPROLITIC WITH LITTLE MICA	25.0
	1,802.6														
1800	1,801.1	23.5	1	1	2								W		
Boring Terminated at Elevation 1,799.6 ft IN RESIDUAL: SILTY SAND															

NCDOT BORE DOUBLE A011C_GEO_RDWY_GINT.GPJ NC_DOT.GDT 5/8/19



July 25, 2019

Robert J. Porter, Jr. PE
MA Engineering Consultants, Inc.
598 East Chatham St, Suite 137
Cary, NC 27511

TIP No.: A-0011C
County: Clay
Project Description: NC 69 from Georgia State Line to US 64
Site Description: Culvert on -L- at Station 179+58 over Blair Creek
Subject: Culvert Foundation Recommendations

Dear Mr. Porter:

As authorized, Falcon Engineering Inc. (Falcon) has completed the Culvert Foundation Recommendations for the above referenced project based on current NCDOT LRFD bridge design policy and procedures.

Foundation recommendations and notes on plans are presented in the attachments. These recommendations are based on subsurface data obtained by Falcon as presented in the Subsurface Investigation Report submitted under separate cover. Culvert geometry and scour data used in our analysis were obtained from the Culvert Scour Report (CSR) provided to us by MA Engineering.

Falcon appreciates the opportunity to have provided Stantec with geotechnical engineering services. If you have any questions concerning the contents of this report or need additional information, please do not hesitate to contact our office.

Respectfully submitted:

FALCON ENGINEERING, INC.

A handwritten signature in blue ink that reads "Stephen C. Crockett".

Stephen C. Crockett, PE
Geotechnical Engineer

A handwritten signature in blue ink that reads "Jeremy R. Hamm".

Jeremy R. Hamm, PE
Geotechnical Engineering Manager

Attachments: Foundation Recommendations and Notes on Plans

FOUNDATION RECOMMENDATIONS

WBS # 32574.1.FD7

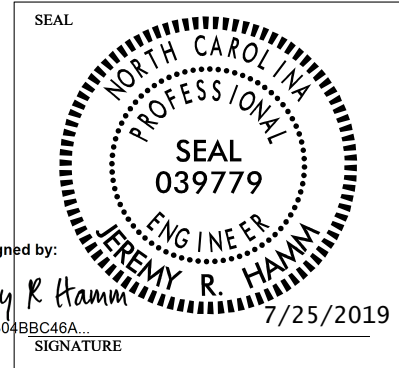
T.I.P. NO. A-0011C

COUNTY Clay

STATION 179+58 -L-

DESCRIPTION Culvert on -L- at Station 179+58 over Blair Creek

	INITIALS	DATE
DESIGN	JRH	05/07/19
CHECK	SCC	05/08/19
APPROVAL		



CULVERT SIZE	STATION	FOUNDATION TYPE	EXCAVATION DEPTH	MISCELLANEOUS DETAILS
Triple 10' x 8' Reinforced Concrete Box Culverts	-L- 179+58	12" Class VI Foundation Conditioning Material	1.0 foot below bottom of culvert	Approximate Culvert Extension = 37 ft upstream, 49 ft downstream Culvert Skew = 60 degrees Exist. Culvert Invert Elevation = 1815.93 ft Slope = 1.2% upstream, 0.7% downstream

FOUNDATION RECOMMENDATION SPECIAL NOTES ON PLANS

- EXCAVATE FOUNDATION A MINIMUM OF 1.0 FEET BELOW CULVERT BEARING ELEVATION. PLACE 1.0 FEET OF CLASS VI FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH SECTION 414 OF THE STANDARD SPECIFICATIONS.
- OVEREXCAVATE LOOSE/SOFT MATERIAL IF PRESENT TO SUITABLE BEARING MATERIALS AND REPLACE WITH ADDITIONAL CLASS VI FOUNDATION CONDITIONING MATERIAL. IF MORE THAN 1.0 FEET OF ADDITIONAL EXCAVATION IS NEEDED, CONTACT THE OPERATIONS ENGINEER FOR APPROVAL.

FOUNDATION RECOMMENDATION COMMENTS

- Culvert settlement is anticipated to approach 2.0 inches.
- Culvert foundation will require an estimated 145 tons of foundation conditioning material.