

PROJECT: REFERENCE: NC-9

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2	LEGEND (SOIL & ROCK)
2A	SUPPLEMENTAL LEGEND (GSI)
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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY HENDERSON

PROJECT DESCRIPTION RETAINING WALLS 2 - 8

SITE DESCRIPTION NC-9 FROM US 74 ALT TO
HENDERSON/BUNCOMBE COUNTY LINE

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	NC-9	1	

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

C. PAYNE

T. WILLIAMS

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S. GOWAN

INVESTIGATED BY S&ME, INC.

DRAWN BY C. CHANDLER

CHECKED BY K. HILL

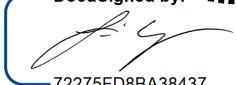
SUBMITTED BY L. CAMPOS

DATE APRIL 2025



8848 RED OAK BLVD
SUITE A
CHARLOTTE, NC 28217
(704) 523-4726



DocuSigned by:

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4/14/2025

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 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>												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 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												ANGULARITY OF GRAINS												WEATHERED ROCK (WR)												CRYSTALLINE ROCK (CR)											
GENERAL CLASS.		GRANULAR MATERIALS (≤ 35% PASSING #200)						SILT-CLAY MATERIALS (> 35% PASSING #200)						ORGANIC MATERIALS				FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.																													
GROUP CLASS.	A-1-a	A-1-b	A-3	A-2-4	A-2	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	NON-CRYSTALLINE ROCK (NCR)																															
SYMBOL																COASTAL PLAIN SEDIMENTARY ROCK (CP)																															
% PASSING	#10	#40	#200	50 MX	30 MX	50 MX	25 MX	51 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN																														
MATERIAL PASSING #40	LL	PI		—	—	40 MX	41 MN	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	0	0	4 MX	8 MX	12 MX	16 MX	NO MX			GRANULAR SOILS		SILT-CLAY SOILS		MUCK, PEAT																															
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS, GRAVEL, AND SAND		FINE SAND		SILTY OR CLAYEY GRAVEL AND SAND		SILTY SOILS		CLAYEY SOILS								HIGHLY ORGANIC SOILS																														
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD						FAIR TO POOR						FAIR TO POOR		POOR		UNSUITABLE																														
PI OF A-7-5 SUBGROUP IS ≤ LL - 30; PI OF A-7-6 SUBGROUP IS > LL - 30																																															
CONSISTENCY OR DENSENESS												MISCELLANEOUS 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		25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES		SLOPE INDICATOR INSTALLATION																															
GENERAL		VERY LOOSE		< 4				N/A				SOIL SYMBOL		TEST BORING		CONE PENETROMETER TEST																															
GRANULAR MATERIAL (NON-COHESIVE)		LOOSE		4 TO 10								ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT		AUGER BORING		CONE PENETROMETER TEST																															
		MEDIUM DENSE		10 TO 30										CORE BORING		SOUNDING ROD																															
		DENSE		30 TO 50								INFERRED SOIL BOUNDARY		MONITORING WELL		TEST BORING WITH CORE																															
		VERY DENSE		> 50								INFERRED ROCK LINE		PIEZOMETER INSTALLATION		SPT N-VALUE																															
GENERAL		VERY SOFT		< 2				< 0.25				ALLUVIAL SOIL BOUNDARY																																			
SILT-CLAY MATERIAL (COHESIVE)		SOFT		2 TO 4				0.25 TO 0.5																																							
		MEDIUM STIFF		4 TO 8				0.5 TO 1.0																																							
		STIFF		8 TO 15				1 TO 2																																							
		VERY STIFF		15 TO 30				2 TO 4																																							
		HARD		> 30				> 4																																							
TEXTURE OR GRAIN SIZE												RECOMMENDATION SYMBOLS																																			
U.S. STD. SIEVE SIZE		4		10		40		60		200		270		UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE		UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK		UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK																													
OPENING (MM)		4.76		2.00		0.42		0.25		0.075		0.053		SHALLOW UNDERCUT		UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK		UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK																													
BOULDER (BLDR.)		COBBLE (COB.)		GRAVEL (GR.)		COARSE SAND (CSE, SD.)		FINE SAND (F SD.)		SILT (SL.)		CLAY (CL.)																																			
GRAIN SIZE		305		75		2.0		0.25		0.05		0.005																																			
MM		IN.		IN.		IN.		IN.		IN.		IN.																																			
SOIL MOISTURE - CORRELATION OF TERMS												ABBREVIATIONS																																			
SOIL MOISTURE SCALE (ATTERBERG LIMITS)		FIELD MOISTURE DESCRIPTION		GUIDE FOR FIELD MOISTURE DESCRIPTION								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 UNIT WEIGHT																															
												CSE. - COARSE		ORG. - ORGANIC																																	
												DPT - DILATOMETER TEST		PMT - PRESSUREMETER TEST		SAMPLE ABBREVIATIONS																															
												DPT - DYNAMIC PENETRATION TEST		SAP. - SAPROLITIC		S - BULK																															
												e - VOID RATIO		SD. - SAND, SANDY		SS - SPLIT SPOON																															
												F - FINE		SL. - SILT, SILTY		ST - SHELBY TUBE																															
												FOSS. - FOSSILIFEROUS		SLR. - SLIGHTLY		RS - ROCK																															
												FRAC. - FRACTURED, FRACTURES		TRI. - TRICONE REFUSAL		RT - RECOMPACTED TRIAXIAL																															
												FRAGS. - FRAGMENTS		w - MOISTURE CONTENT		CBR - CALIFORNIA BEARING RATIO																															
												HL. - HIGHLY		V - VERY																																	
PLASTICITY												EQUIPMENT USED ON SUBJECT PROJECT																																			
PLASTICITY INDEX (PI)		DRY STRENGTH										DRILL UNITS:		ADVANCING TOOLS:		HAMMER TYPE:																															
												☐ CME-45C		☐ CLAY BITS		☒ AUTOMATIC ☐ MANUAL																															
												☐ CME-55		☐ 6" CONTINUOUS FLIGHT AUGER		CORE SIZE:																															
												☐ CME-550X		☒ 8" HOLLOW AUGERS		☐ -B ☐ -H																															
												☐ VANE SHEAR TEST		☐ HARD FACED FINGER BITS		☒ -N Q																															
												☐ PORTABLE HOIST		☐ TUNG.-CARBIDE INSERTS		HAND TOOLS:																															
												☐ CME-750X		☒ CASING ☐ W/ ADVANCER		☐ POST HOLE DIGGER																															
												☒ DIEDRICH D-50		☐ TRICONE ☐ STEEL TEETH		☐ HAND AUGER																															
														☐ TRICONE ☐ TUNG.-CARB.		☐ SOUNDING ROD																															
														☐ CORE BIT		☐ VANE SHEAR TEST																															
DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.																																															

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 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.

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SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SUBSURFACE INVESTIGATION

SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

GEOLOGICAL STRENGTH INDEX (GSI) FOR
JOINTED ROCKS (Hoek and Marinos, 2000)

From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.

SURFACE CONDITIONS

VERY GOOD
Very rough, fresh unweathered surfaces

GOOD
Rough, slightly weathered, iron stained surfaces

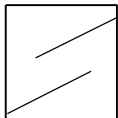
FAIR
Smooth, moderately weathered and altered surfaces

POOR
Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments

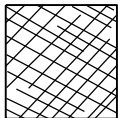
VERY POOR
Slickensided, highly weathered surfaces with soft clay coatings or fillings

DECREASING SURFACE QUALITY ➡

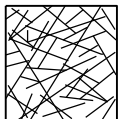
STRUCTURE



INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities



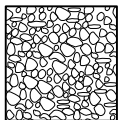
BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets



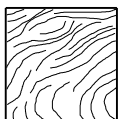
VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets



BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity

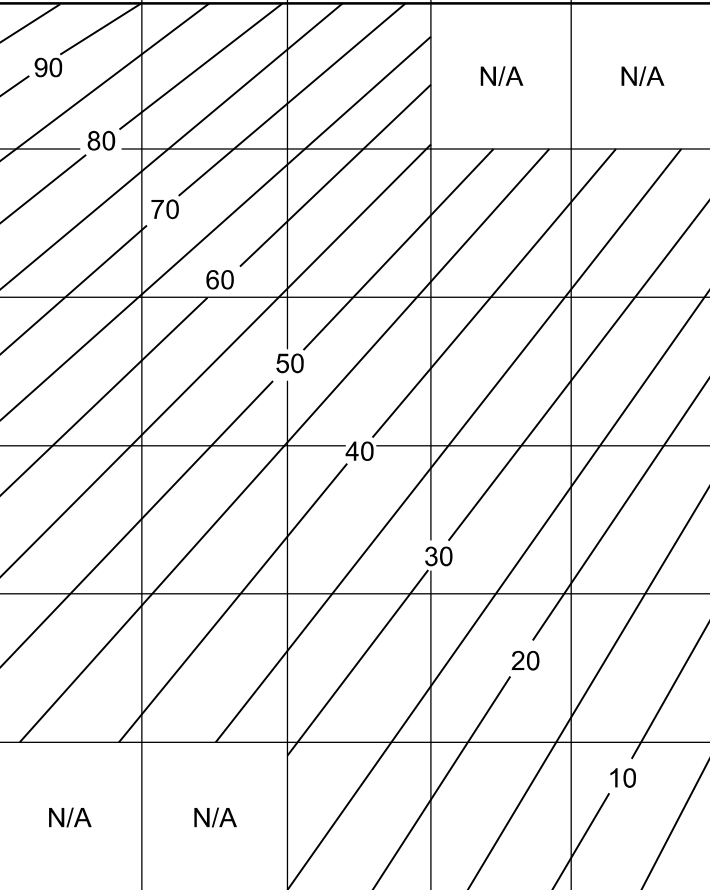


DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces



LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes

DECREASING INTERLOCKING OF ROCK PIECES
⇩



GSI FOR HETEROGENEOUS ROCK MASSES SUCH
AS FLYSCH (Marinos, P and Hoek E., 2000)

From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.

SURFACE CONDITIONS OF
DISCONTINUITIES
(Predominantly bedding planes)

VERY GOOD - Very Rough, fresh unweathered surfaces

GOOD - Rough, slightly weathered surfaces

FAIR - Smooth, moderately weathered and altered surfaces

POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments

VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings

COMPOSITION AND STRUCTURE



A. Thick bedded, very blocky sandstone
The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability.



B. Sandstone with thin inter-layers of siltstone



C. Sandstone and siltstone in similar amounts



D. Siltstone or silty shale with sandstone layers



E. Weak siltstone or clayey shale with sandstone layers

C, D, E, and G - may be more or less folded than illustrated but this does not change the strength. Tectonic deformation, faulting and loss of continuity moves these categories to F and H.



F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure

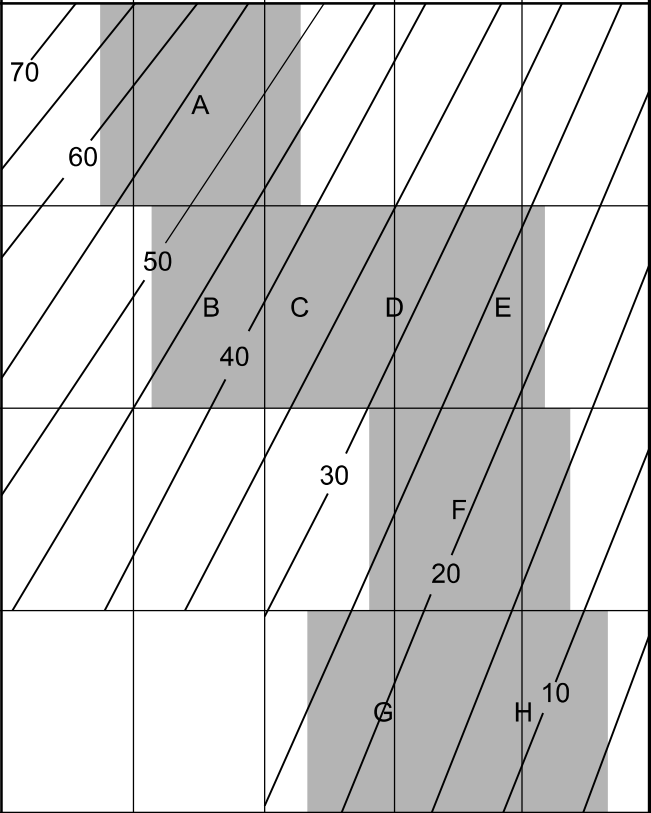


G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers



H. Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.

➡ Means deformation after tectonic disturbance



8/17/99

\\Charlotte\Projects\2024\24350796\NCDOT\Division 14\NC9 74A to Buncombe Co.Bat Cave\GEO\NCDOT\CADD_GEO_WALLS\Plan\of\NC-9_GEO_psh_retaining_walls-2.dgn

RETAINING WALL 2 ENVELOPE

NAD 83/NA 2011



8848 RED OAK BLVD
SUITE A
CHARLOTTE, NC 28217
(704) 523-4726

PROJECT REFERENCE NO. SHEET NO.

NC-9

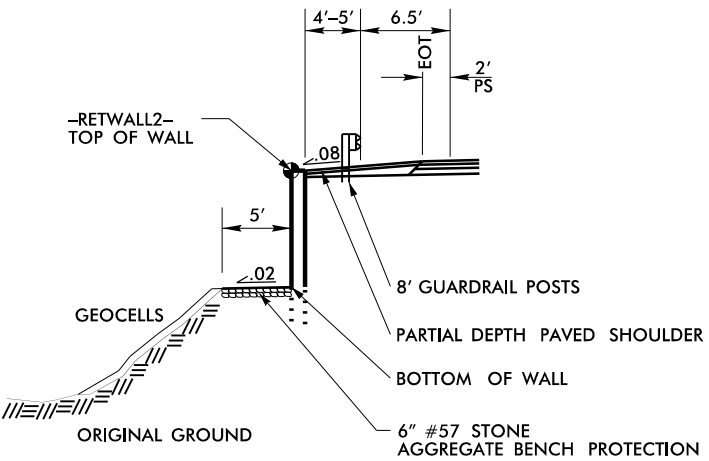
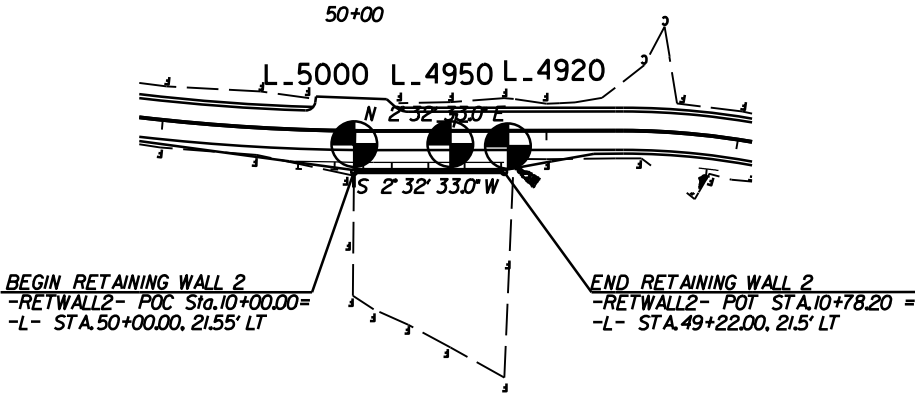
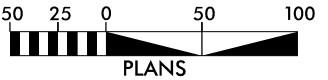
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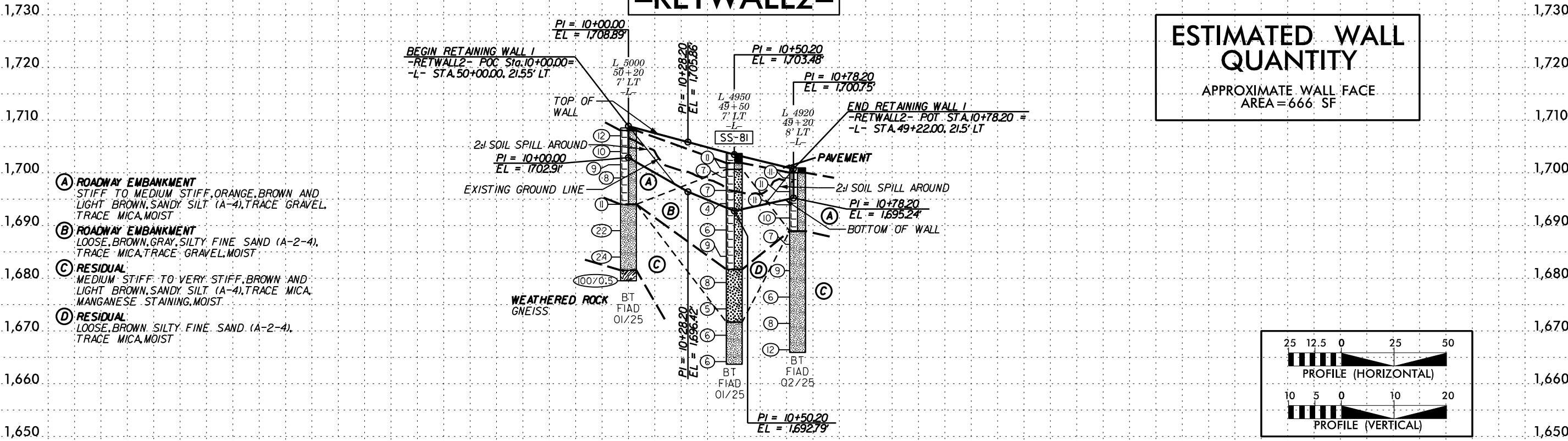
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RETAINING WALL 2 TYPICAL



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11 + 00

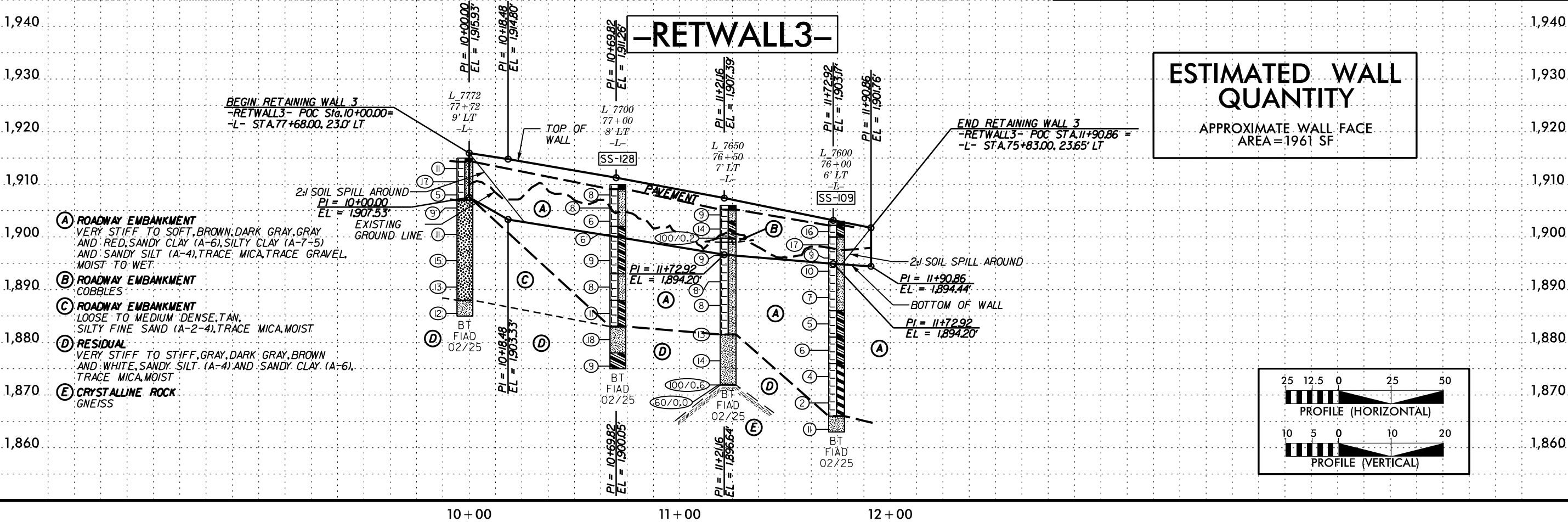
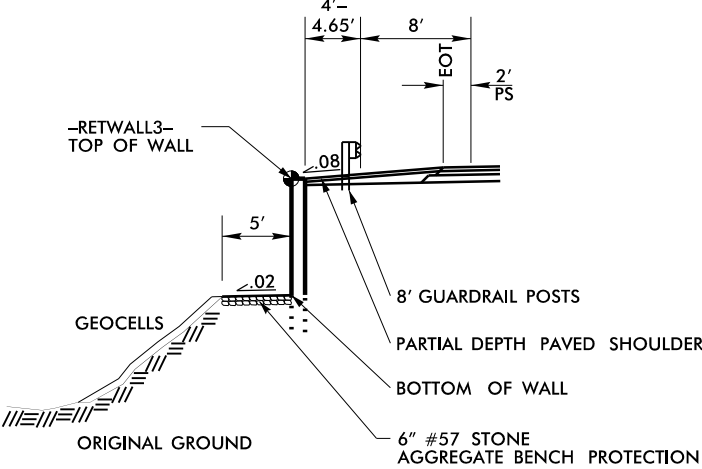
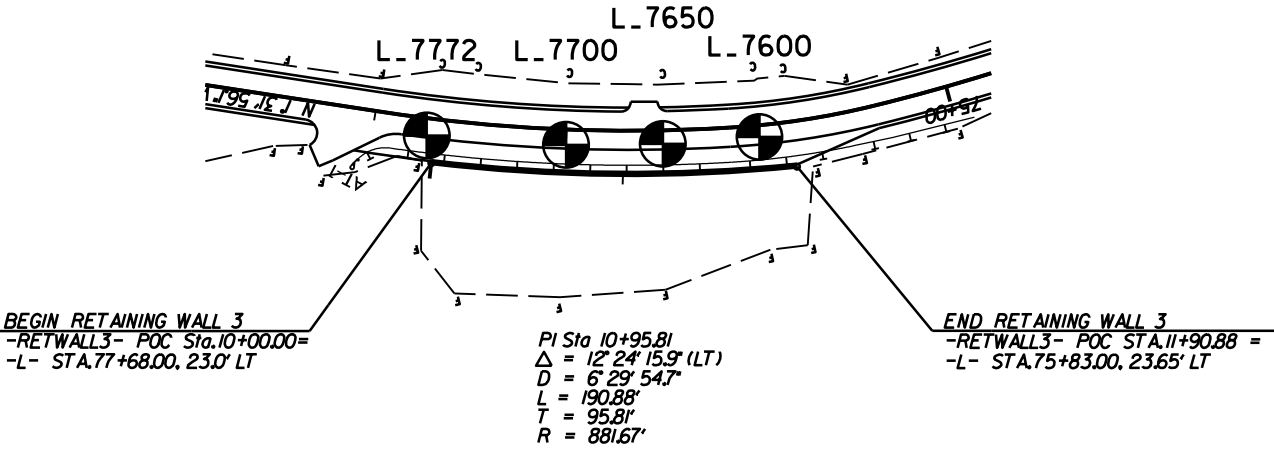
RETAINING WALL 3 ENVELOPE

NAD 83/NA 2011

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NC-9	4
RW SHEET NO.	
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\\Charlotte\Projects\2024\24350796\NCDOT_Division 14\NC9 74A to Buncombe Co.Bat Cave\GEO\NCDOT\CAADD_GEO_WALLS\Plan\Prof\NC-9_GEO.psh_retaining_walls-4.dgn

RETAINING WALL 4 ENVELOPE

NAD 83 / NA 2011

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PROJECT REFERENCE NO.
NC-9

SHEET NO.
5

R/W SHEET NO.

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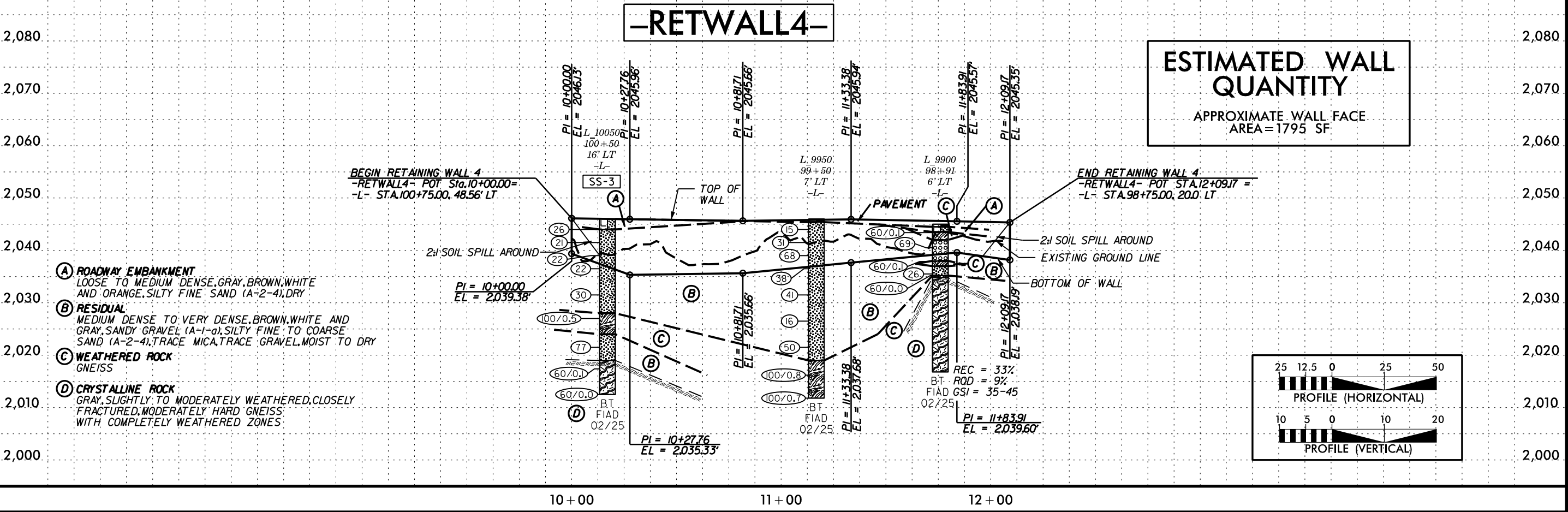
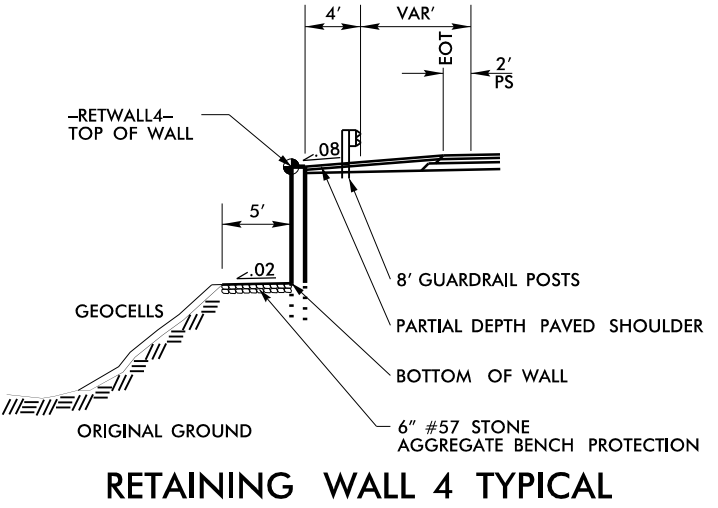
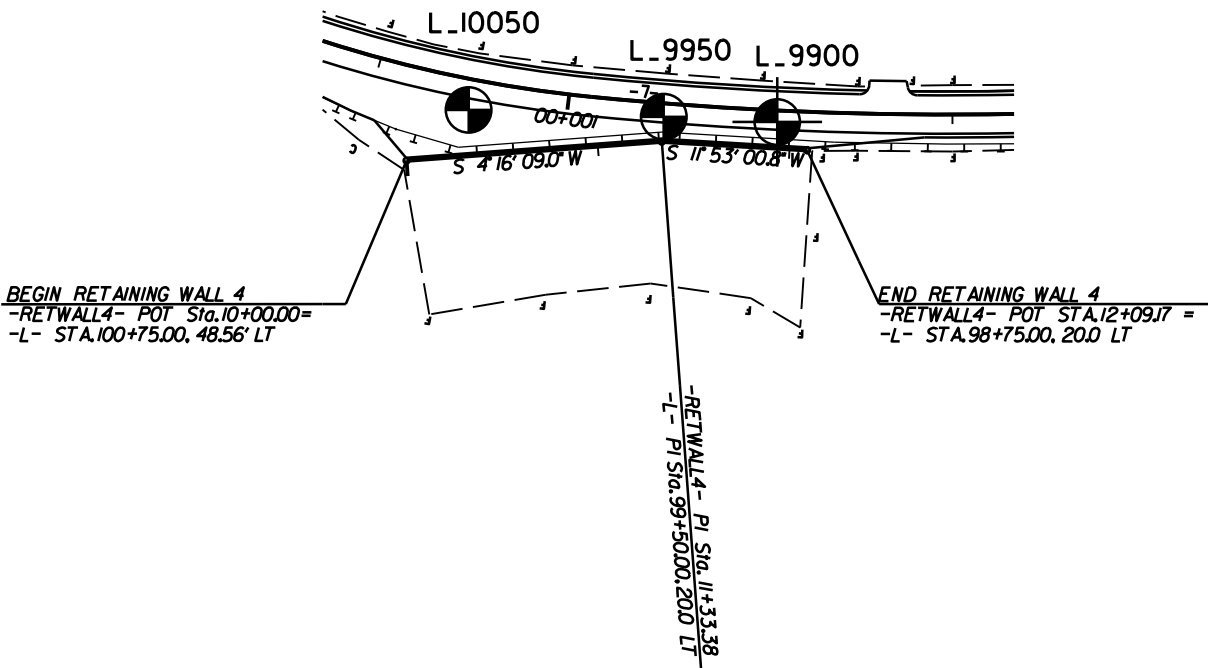
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037845
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PLANS



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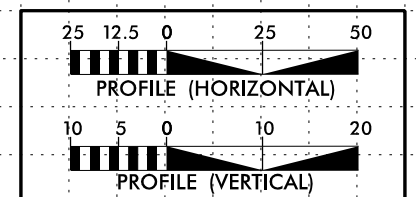
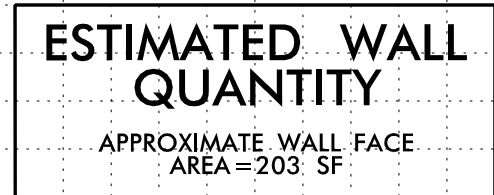
SHEET NO. 6

GEOTECHNICAL
ENGINEER

NORTH CAROLINA
PROFESSIONAL
SEAL
037845
ENGINEER
LUTS A. CAMPOS

R/W SHEET NO.

A circular professional engineer seal for the State of North Carolina. The outer ring contains the text "NORTH CAROLINA" at the top and "PROFESSIONAL" at the bottom. Inside this ring, the word "SEAL" is at the top, the license number "037845" is in the center, and the word "ENGINEER" is at the bottom. Below the word "ENGINEER" is the name "LUIS A. CAMPOS". The seal is surrounded by a decorative border of small dots.



PI Sta 10+18.35
 $\Delta = 2^{\circ}09'05''$ (RT)
 $D = 5^{\circ}51'50.0''$
 $L = 36.69'$
 $T = 18.35'$
 $R = 977.09'$

PI Sta 10+83.75
 $\Delta = 1^{\circ}41'37.2''$ (RT)
 $D = 12^{\circ}28'06.0''$
 $L = 93.79'$
 $T = 47.06'$
 $R = 459.53'$

PI Sta 11+39.90
 $\Delta = 1^{\circ}37'09.6''$ (RT)
 $D = 8^{\circ}35'17.0''$
 $L = 18.86'$
 $T = 9.43'$
 $R = 667.16'$

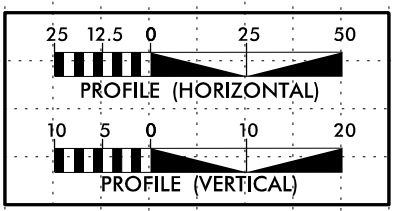
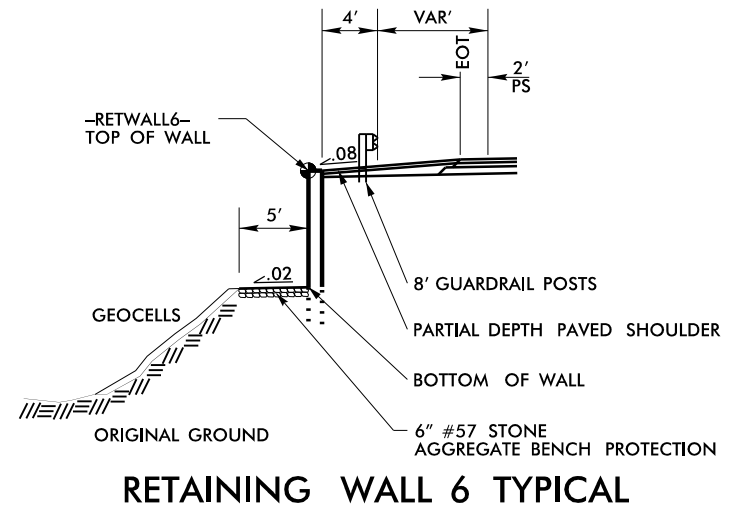
L-8350
 L-8275
 L-8200

BEGIN RETAINING WALL 6
 -RET WALL 6- POC Sta. 10+00.00 =
 -L- STA. 83+50.00, 21.0' LT

END RETAINING WALL 6
 -RET WALL 6- POC STA. 11+49.33 =
 -L- STA. 81+95.00, 21.0' LT

-RET WALL 6-
 PCC Sta. 11+30.48

-RET WALL 6-
 PCC Sta. 10+36.69

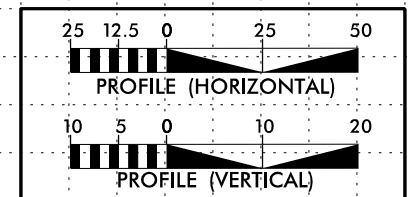
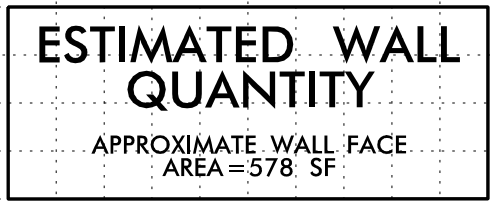


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$$$$SYTIME$$$$
$$$$:Charlottesville, VA$$$$
$$$$BILSRNAME$$$$
Co.Bat Cave GEO-NC DOT CADD GEO.WALLS\PlanPr\NC-9_GEO_psh-retaining.walls-6.dgn
Division 14_NC9_744 to Buncombe
24350796_NCDOT
Projects\2024
$$$$

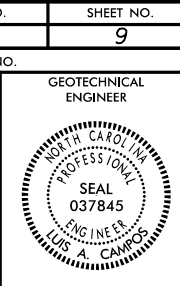
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8848 RED OAK BLVD
SUITE A
CHARLOTTE, NC 28226
(704) 523-4726

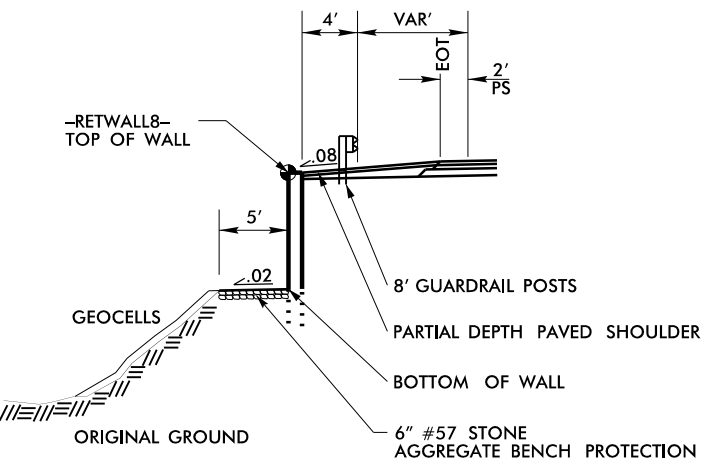
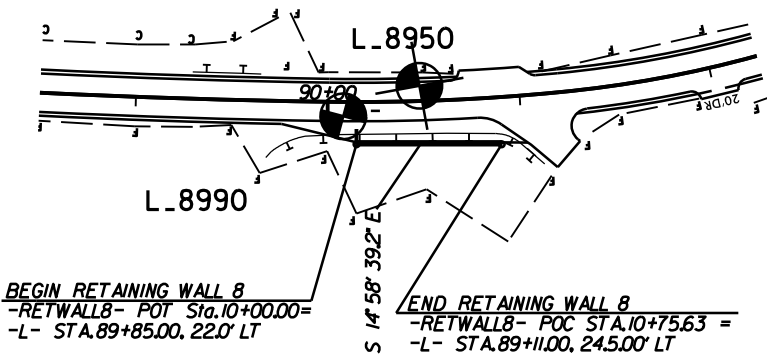
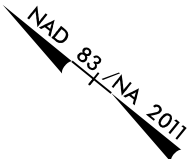
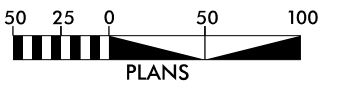


RETAINING WALL 8 ENVELOPE

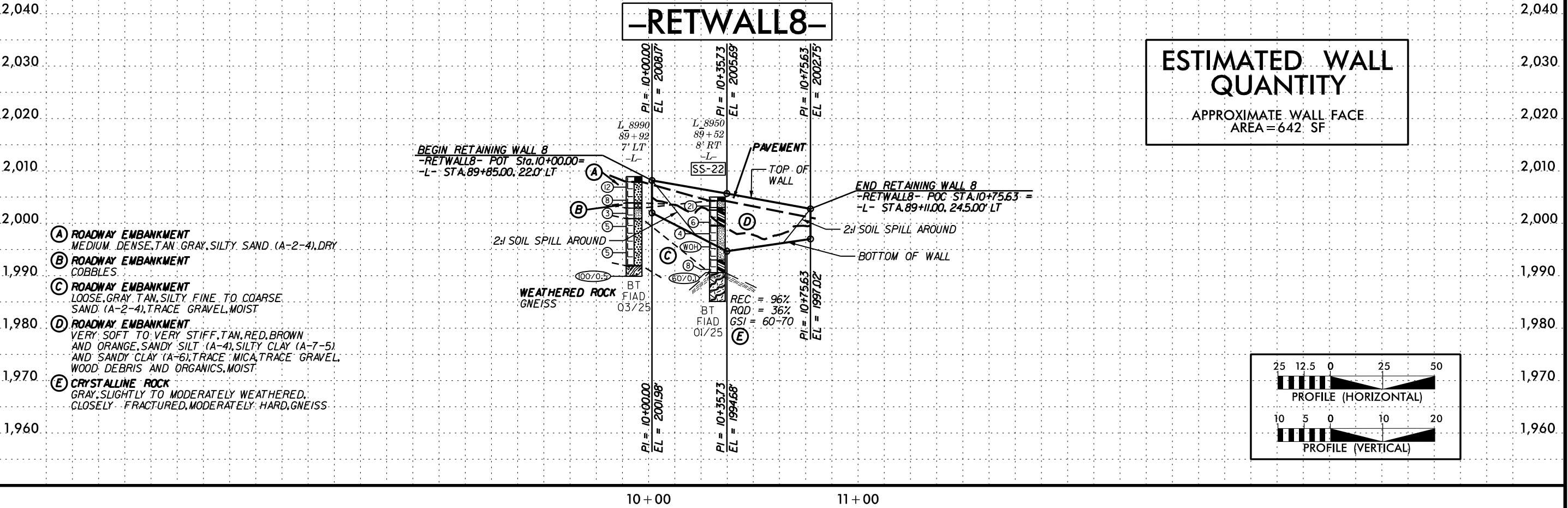
8848 RED OAK BLVD
SUITE A
CHARLOTTE, NC 28217
(704) 523-4726



PROJECT REFERENCE NO. NC-9
SHEET NO. 9
RW SHEET NO.
GEOTECHNICAL ENGINEER
DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED



RETAINING WALL 8 TYPICAL



8/17/99
\$\$\$\$\$SYTIME\$\$\$\$\$
I:\Charlotte\350\Projects\2024\24350796\NCDDT_Division 14\NC9 74A to Buncombe Co.Bat Cave\GEO-NCDDT\CADD_GEO_WALLS\Plan\Prof\NC-9_GEO_psh_retaining_walls-8.dgn
\$\$\$\$\$SYTIME\$\$\$\$\$

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 18314.1045035			TIP W0920			COUNTY HENDERSON			GEOLOGIST Payne, C.							
SITE DESCRIPTION NC-9 FROM US-74A TO BUNCOMBE COUNTY LINE									GROUND WTR (ft)							
BORING NO. L_3975			STATION 39+75			OFFSET 8 ft LT			ALIGNMENT -L-			0 HR. N/A				
COLLAR ELEV. 1,630.0 ft			TOTAL DEPTH 23.8 ft			NORTHING 638,873			EASTING 1,021,373			24 HR. FIAD				
DRILL RIG/HAMMER EFF./DATE SME275 DIEDRICH D-50 91% 01/19/2024						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic							
DRILLER Williams Jr., T.			START DATE 02/03/25			COMP. DATE 02/07/25			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)	
1630														1,630.0 ROAD SURFACE 0.0		
	1,629.5	0.5	10	5	6									1,629.6 ROADWAY EMBANKMENT ASPHALT (5.25") 0.4		
	1,626.5	3.5	5	6	5							M		1,627.0 STIFF, BROWN, SANDY CLAY (A-6), TRACE MICA, TRACE GRAVEL 3.0		
1625	1,624.0	6.0	2	2	3						SS-91	27%		STIFF TO MEDIUM STIFF, BROWN, SANDY SILT (A-4), TRACE MICA, TRACE GRAVEL		
	1,621.5	8.5	3	4	6							M		1,622.0 RESIDUAL 8.0		
1620														STIFF, BROWN, SANDY SILT (A-4), TRACE MICA		
	1,616.5	13.5	5	9	14							M		1,618.0 MEDIUM DENSE TO VERY DENSE, GRAY WHITE, SILTY FINE TO COARSE SAND (A-2-4) 12.0		
1615																
	1,611.5	18.5	9	14	38							M				
1610														1,608.0 22.0		
	1,606.5	23.5												1,606.2 WEATHERED ROCK GNEISS 23.8		
														Boring Terminated at Elevation 1,606.2 ft IN WEATHERED ROCK (GNEISS)		

WBS 18314.1045035			TIP W0920			COUNTY HENDERSON			GEOLOGIST Payne, C.					
SITE DESCRIPTION NC-9 FROM US-74A TO BUNCOMBE COUNTY LINE									GROUND WTR (ft)					
BORING NO. L_4920			STATION 49+20			OFFSET 8 ft LT			ALIGNMENT -L-			0 HR. N/A		
COLLAR ELEV. 1,701.0 ft			TOTAL DEPTH 35.0 ft			NORTHING 639,387			EASTING 1,022,045			24 HR. FIAD		
DRILL RIG/HAMMER EFF./DATE SME275 DIEDRICH D-50 91% 01/19/2024						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic					
DRILLER Williams Jr., T.			START DATE 02/03/25			COMP. DATE 02/03/25			SURFACE WATER DEPTH N/A					
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
1705														
1700	1,700.1	0.9												1,701.0 ROAD SURFACE 0.0
1695	1,697.5	3.5	12	6	5							M		1,700.1 ROADWAY EMBANKMENT 0.9
	1,695.0	6.0	5	6	5							M		ASPHALT (2") OVER GRAVEL (3")
1690	1,692.5	8.5	4	5	6							M		STIFF, BROWN, SANDY SILT (A-4), TRACE MICA
	1,687.5	13.5	3	4	6							M		
1685	1,682.5	18.5	2	3	4							M		1,689.0 RESIDUAL 12.0
1680	1,677.5	23.5										M		MEDIUM STIFF TO STIFF, BROWN, SANDY SILT (A-4), TRACE MICA
	1,672.5	28.5	3	4	5							M		
1670	1,667.5	33.5	3	4	4							M		
			3	5	7							M		1,666.0 Boring Terminated at Elevation 1,666.0 ft IN RESIDUAL SANDY SILT 35.0

NCDOT BORE DOUBLE W0920_GEO_RDY.GPJ NC_DOT.GDT 4/4/25

WBS		18314.1045035		TIP		W0920		COUNTY		HENDERSON		GEOLOGIST		Payne, C.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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BORING NO.				L_5000				STATION				50+00				OFFSET				7 ft LT				ALIGNMENT				-L-				0 HR.		N/A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
COLLAR ELEV.				1,709.0 ft				TOTAL DEPTH				29.0 ft				NORTHING				639,467				EASTING				1,022,050				24 HR.		FIAD																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
DRILL RIG/HAMMER EFF./DATE										SME275 DIEDRICH D-50 91% 01/19/2024										DRILL METHOD										Mud Rotary										HAMMER TYPE										Automatic																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
DRILLER						Williams Jr., T.						START DATE						01/29/25						COMP. DATE						01/29/25						SURFACE WATER DEPTH												N/A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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WBS		18314.1045035			TIP		W0920			COUNTY			HENDERSON			GEOLOGIST			Payne, C.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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BORING NO.					L_7650					STATION					76+50					OFFSET					7 ft LT					ALIGNMENT					-L-					0 HR.		N/A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
COLLAR ELEV.					1,906.0 ft					TOTAL DEPTH					34.1 ft					NORTHING					640,629					EASTING					1,023,123					24 HR.		FIAD																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
DRILL RIG/HAMMER EFF./DATE										SME275 DIEDRICH D-50 91% 01/19/2024										DRILL METHOD					Mud Rotary					HAMMER TYPE					Automatic																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
DRILLER					Williams Jr., T.					START DATE					02/04/25					COMP. DATE					02/04/25					SURFACE WATER DEPTH										N/A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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GEOTECHNICAL BORING REPORT
BORE LOG

WBS 18314.1045035		TIP W0920		COUNTY HENDERSON		GEOLOGIST Payne, C.								
SITE DESCRIPTION NC-9 FROM US-74A TO BUNCOMBE COUNTY LINE							GROUND WTR (ft)							
BORING NO. L_7700		STATION 77+00		OFFSET 8 ft LT		ALIGNMENT -L-		0 HR. N/A						
COLLAR ELEV. 1,910.0 ft		TOTAL DEPTH 35.0 ft		NORTHING 640,678		EASTING 1,023,112		24 HR. FIAD						
DRILL RIG/HAMMER EFF./DATE SME275 DIEDRICH D-50 91% 01/19/2024				DRILL METHOD Mud Rotary			HAMMER TYPE Automatic							
DRILLER Williams Jr., T.		START DATE 02/04/25		COMP. DATE 02/04/25		SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT				SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)
1910													1,910.0	0.0
1905	1,909.0	1.0	8	4	4								1,909.1	0.9
	1,906.5	3.5	5	5	3						M		ROADWAY EMBANKMENT	
	1,904.0	6.0	2	3	3						M		ASPHALT (9.25") OVER GRAVEL (2")	
1900	1,901.5	8.5	2	2	4						M		MEDIUM STIFF, BROWN, SANDY SILT (A-4), TRACE MICA, TRACE GRAVEL	
	1,896.5	13.5	2	4	5						M		1,902.0	8.0
	1,891.5	18.5	2	4	4						M		MEDIUM STIFF TO STIFF, BROWN GRAY, RED, SANDY CLAY (A-6), TRACE MICA, TRACE GRAVEL	
1895										SS-128	24%		1,893.0	17.0
1890	1,886.5	23.5	6	6	5						M		MEDIUM STIFF, BROWN, SANDY SILT (A-4), TRACE MICA, TRACE GRAVEL	
	1,881.5	28.5	8	8	10						M		1,888.0	22.0
	1,876.5	33.5	4	4	5						M		1,883.0	27.0
1885											M		STIFF, BROWN, SANDY CLAY (A-6), TRACE MICA, TRACE GRAVEL	
1880	1,881.5	28.5	8	8	10						M		1,883.0	27.0
	1,876.5	33.5	4	4	5						M		RESIDUAL	
											M		VERY STIFF, GRAY BROWN, SANDY SILT (A-4), TRACE MICA	
1875											M		1,878.0	32.0
											M		1,875.0	35.0
													STIFF, DARK GRAY, SANDY CLAY (A-6), TRACE MICA	
													Boring Terminated at Elevation 1,875.0 ft IN RESIDUAL SANDY CLAY	

WBS 18314.1045035		TIP W0920		COUNTY HENDERSON		GEOLOGIST Payne, C.								
SITE DESCRIPTION NC-9 FROM US-74A TO BUNCOMBE COUNTY LINE							GROUND WTR (ft)							
BORING NO. L_7772		STATION 77+72		OFFSET 9 ft LT		ALIGNMENT -L-		0 HR. N/A						
COLLAR ELEV. 1,915.0 ft		TOTAL DEPTH 30.0 ft		NORTHING 640,749		EASTING 1,023,105		24 HR. FIAD						
DRILL RIG/HAMMER EFF./DATE SME275 DIEDRICH D-50 91% 01/19/2024				DRILL METHOD Mud Rotary			HAMMER TYPE Automatic							
DRILLER Williams Jr., T.		START DATE 02/04/25		COMP. DATE 02/04/25		SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT				SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
1915														1,915.0 ROAD SURFACE 0.0
	1,914.0	1.0	8	5	6									1,914.3 ROADWAY EMBANKMENT 0.7
														ASPHALT (8")
	1,911.5	3.5	4	8	9									VERY STIFF TO MEDIUM STIFF, BROWN, SANDY SILT (A-4), TRACE MICA, TRACE GRAVEL
1910	1,909.0	6.0	2	2	3									
	1,906.5	8.5	2	4	5									1,907.0 RESIDUAL 8.0
1905														LOOSE TO MEDIUM DENSE, TAN, SILTY FINE SAND (A-2-4), TRACE MICA
	1,901.5	13.5	4	5	6									
1900														
	1,896.5	18.5	6	8	7									
1895														
	1,891.5	23.5	5	5	8									
1890														
	1,886.5	28.5	3	4	8									1,888.0 STIFF, BROWN, SANDY SILT (A-4), TRACE MICA 27.0
1885														1,885.0 Boring Terminated at Elevation 1,885.0 ft IN RESIDUAL SANDY SILT 30.0

NCDOT BORE DOUBLE W0920_GEO_RDY.GPJ NC_DOT.GDT 4/4/25

NCDOT BORE DOUBLE W0920 GEO RDY.GPJ NC DOT GDT 4/4/25

WBS 18314.1045035			TIP W0920			COUNTY HENDERSON			GEOLOGIST Black, G.					
SITE DESCRIPTION NC-9 FROM US-74A TO BUNCOMBE COUNTY LINE									GROUND WTR (ft)					
BORING NO. L_8275			STATION 82+75			OFFSET 78 ft LT			ALIGNMENT -L-			0 HR. N/A		
COLLAR ELEV. 1,916.0 ft			TOTAL DEPTH 29.2 ft			NORTHING 641,211			EASTING 1,022,977			24 HR. FIAD		
DRILL RIG/HAMMER EFF./DATE SME2938 CME-750X 84% 04/18/2024						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic					
DRILLER Gowan, S.			START DATE 03/13/25			COMP. DATE 03/13/25			SURFACE WATER DEPTH N/A					
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
1920														
1915	1,915.0	1.0	3	6	5									1,916.0 GROUND SURFACE 0.0
														1,915.0 ROADWAY EMBANKMENT 1.0
	1,912.5	3.5	4	3	3							M		GRAVEL
1910	1,910.0	6.0	2	4	5							M		STIFF TO MEDIUM STIFF, DARK BROWN, SANDY SILT (A-4), TRACE GRAVEL
														1,910.5 5.5
	1,907.5	8.5	5	7	6							M		RESIDUAL
1905												M		STIFF, ORANGE BROWN, SANDY SILT (A-4), TRACE MANGANESE
	1,902.5	13.5	8	18	22									1,904.0 12.0
1900												M		MEDIUM DENSE TO DENSE, ORANGE BROWN, SILTY FINE TO COARSE SAND (A-2-4), TRACE MANGANESE
	1,897.5	18.5	20	25	31									
1895												M		
	1,892.5	23.5	11	15	15									
1890												M		
	1,887.5	28.5	68	32/0.2										1,889.0 27.0
														1,886.8 WEATHERED ROCK 29.2
														GNEISS
														Boring Terminated at Elevation 1,886.8 ft IN WEATHERED ROCK (GNEISS)

NC DOT BORE DOUBLE W0920 GEO_RDY.GPJ NC DOT.GDT 4/14/25

WBS 18314.1045035			TIP W0920			COUNTY HENDERSON			GEOLOGIST Black, G.				
SITE DESCRIPTION NC-9 FROM US-74A TO BUNCOMBE COUNTY LINE									GROUND WTR (ft)				
BORING NO. L_8675			STATION 86+75			OFFSET 9 ft LT			ALIGNMENT -L-			0 HR. N/A	
COLLAR ELEV. 1,984.0 ft			TOTAL DEPTH 21.2 ft			NORTHING 641,560			EASTING 1,022,802			24 HR. FIAD	
DRILL RIG/HAMMER EFF./DATE SME2938 CME-750X 84% 04/18/2024						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic				
DRILLER Gowan, S.			START DATE 03/12/25			COMP. DATE 03/12/25			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	MOI		
1985													
1980	1,983.0	1.0	3	5	3								1,984.0 ROAD SURFACE 0.0
	1,980.5	3.5	2	1	1						M		1,983.2 ROADWAY EMBANKMENT 0.8
	1,978.0	6.0	1	2	1						M		ROADWAY EMBANKMENT
1975	1,975.5	8.5	1	2	3						M		MEDIUM STIFF TO SOFT, ORANGE BROWN, SANDY SILT (A-4), TRACE MICA
	1,970.5	13.5	1	2	3						M		
1970	1,965.5	18.5	10	34	13						M		
1965	1,962.8	21.2	60/0.0								M		1,967.0 RESIDUAL 17.0
													1,962.8 HARD, ORANGE BROWN, SANDY SILT (A-4), TRACE MICA 21.2
													Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 1,962.8 ft ON CRYSTALLINE ROCK (GNEISS)

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 18314.1045035			TIP W0920			COUNTY HENDERSON			GEOLOGIST Payne, C.							
SITE DESCRIPTION NC-9 FROM US-74A TO BUNCOMBE COUNTY LINE									GROUND WTR (ft)							
BORING NO. L_8950			STATION 89+52			OFFSET 8 ft RT			ALIGNMENT -L-							
COLLAR ELEV. 2,005.0 ft			TOTAL DEPTH 19.9 ft			NORTHING 641,814			EASTING 1,022,693							
DRILL RIG/HAMMER EFF./DATE SME275 DIEDRICH D-50 91% 01/19/2024						DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic							
DRILLER Williams Jr., T.			START DATE 01/16/25			COMP. DATE 01/16/25			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION		DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)		
2005	2,004.3	0.7												2,005.0	ROAD SURFACE	0.
	2,004.3		15	11	10									2,004.3	ROADWAY EMBANKMENT	0.
	2,001.5	3.5	2	2	4									2,003.0	ASPHALT (7.25") OVER MACADAM BASE (2")	2.
2000	1,999.0	6.0	6	2	2									2,002.5		2.
	1,999.5													1,999.5	VERY STIFF, TAN, SANDY SILT (A-4), TRACE MICA AND GRAVEL	5.
	1,996.5	8.5	WOH	WOH	WOH									1,999.5	STIFF, RED BROWN, SILTY CLAY (A-7-5)	5.
1995	1,992.2	12.8	4	3	5									1,993.0	MEDIUM STIFF, BROWN, SANDY CLAY (A-6), TRACE MICA	12.
	1,990.7	14.3	60/0.1											1,993.0	SOFT TO VERY SOFT, BROWN, SANDY SILT (A-4), TRACE GRAVEL AND ORGANICS	12.
1990														1,990.6	MEDIUM STIFF, BROWN AND ORANGE, SANDY CLAY (A-6)	14.
														1,985.1	CRYSTALLINE ROCK	19.
															GRAY, SLIGHTLY TO MODERATELY WEATHERED, CLOSELY FRACTURED, MODERATELY HARD GNEISS	
															REC = 96% RQD = 36% GSI = 60-70	
															Boring Terminated at Elevation 1,985.1 ft IN CRYSTALLINE ROCK (GNEISS)	

GEOTECHNICAL BORING REPORT

CORE LOG

[illegible]

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 18314.1045035		TIP W0920		COUNTY HENDERSON		GEOLOGIST Hager, M.							
SITE DESCRIPTION NC-9 FROM US-74A TO BUNCOMBE COUNTY LINE						GROUND WTR (ft)							
BORING NO. L_8990		STATION 89+92		OFFSET 7 ft LT		ALIGNMENT -L-							
COLLAR ELEV. 2,008.9 ft		TOTAL DEPTH 19.0 ft		NORTHING 641,848		EASTING 1,022,667							
DRILL RIG/HAMMER EFF./DATE SME2938 CME-750X 84% 04/18/2024				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic							
DRILLER Gowan, S.		START DATE 03/11/25		COMP. DATE 03/11/25		SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT			SAMP. NO.	MOI	L O G	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft) DEPTH (ft)
2010													
2005	2,007.9	1.0	5	7	5	12					D		2,008.9 ROAD SURFACE 0.0
	2,005.4	3.5	2	3	5	8					D		2,007.9 ROADWAY EMBANKMENT 1.0
	2,002.9	6.0	3	1	2	3					M		2,003.9 ASPHALT (8.25") OVER STONE (4") 5.0
2000	2,000.4	8.5	2	2	3	5					M		2,002.9 MEDIUM DENSE, TAN GRAY, SILTY SAND (A-2-4) 6.0
											M		2,000.9 COBBLES 8.0
1995	1,995.4	13.5	1	2	3	5					M		2,000.9 SOFT, TAN AND BROWN, SANDY SILT (A-4), TRACE GRAVEL AND WOOD DEBRIS 8.0
1990	1,990.4	18.5				5					M		2,000.9 LOOSE, GRAY TAN, SILTY FINE TO COARSE SAND (A-2-4), TRACE GRAVEL 8.0
			100/0.5										1,991.9 WEATHERED ROCK 17.0
													1,989.9 GNEISS 19.0
													Boring Terminated at Elevation 1,989.9 ft IN WEATHERED ROCK (GNEISS)

NCDOT BORE DOUBLE W0920_GEO_RDY.GPJ NC_DOT.GDT 4/4/25

BORE LOG

WBS 18314.1045035				TIP W0920				COUNTY HENDERSON				GEOLOGIST Payne, C.					
SITE DESCRIPTION NC-9 FROM US-74A TO BUNCOMBE COUNTY LINE												GROUND WTR (ft)					
BORING NO. L_9900				STATION 98+91				OFFSET 6 ft LT				ALIGNMENT -L-				0 HR. Dry	
COLLAR ELEV. 2,045.0 ft				TOTAL DEPTH 28.2 ft				NORTHING 642,740				EASTING 1,022,619				24 HR. FIAD	
DRILL RIG/HAMMER EFF./DATE SME275 DIEDRICH D-50 91% 01/19/2024								DRILL METHOD NW Casing W/SPT & Core				HAMMER TYPE Automatic					
DRILLER Williams Jr., T.				START DATE 01/14/25				COMP. DATE 01/15/25				SURFACE WATER DEPTH N/A					
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)		
2045														2,045.0	ROAD SURFACE 0.0		
	2,044.0	1.0		6	60/0.1									2,044.5	ROADWAY EMBANKMENT 0.5		
														2,043.5	ASPHALT (3") OVER MACADAM BASE (3") 1.5		
	2,041.5	3.5		45	34	35								2,042.0	LOOSE, BROWN AND ORANGE, SILTY FINE SAND (A-2-4) 3.0		
2040																	
	2,039.0	6.0		21	14	60/0.1								2,038.0	WEATHERED ROCK GNEISS 7.0		
														2,037.0	RESIDUAL 8.0		
	2,036.5	8.5															
2035	2,035.2	9.8		22	10	16								2,035.2	VERY DENSE, GRAY, FINE TO COARSE SANDY GRAVEL (A-1-a) 9.8		
														2,034.8	WEATHERED ROCK GNEISS 10.2		
2030																	
2025																	
2020																	

CORE LOG

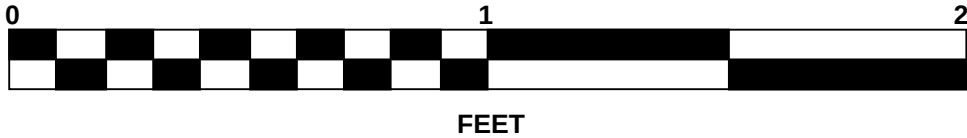
WBS 18314.1045035					TIP W0920			COUNTY HENDERSON			GEOLOGIST Payne, C.		
SITE DESCRIPTION NC-9 FROM US-74A TO BUNCOMBE COUNTY LINE											GROUND WTR (ft)		
BORING NO. L_9900				STATION 98+91			OFFSET 6 ft LT			ALIGNMENT -L-		0 HR. Dry	
COLLAR ELEV. 2,045.0 ft				TOTAL DEPTH 28.2 ft			NORTHING 642,740			EASTING 1,022,619		24 HR. FIAD	
DRILL RIG/HAMMER EFF./DATE SME275 DIEDRICH D-50 91% 01/19/2024							DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic			
DRILLER Williams Jr., T.				START DATE 01/14/25			COMP. DATE 01/15/25			SURFACE WATER DEPTH N/A			
CORE SIZE NQ2				TOTAL RUN 18.0 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) % ROD (ft) %		SAMP. NO.	STRATA REC. (ft) % ROD (ft) %		L O G	DESCRIPTION AND REMARKS ELEV. (ft) DEPTH (ft)		
2034.8	2,034.8	10.2	3.0	3:59 1:43 0:49	(2.1) 70%	(0.9) 30%		(5.9) 33%	(1.6) 9%		Begin Coring @ 10.2 ft CRYSTALLINE ROCK GRAY, SLIGHTLY TO MODERATELY WEATHERED, CLOSELY FRACTURED, MODERATELY HARD GNEISS WITH COMPLETELY WEATHERED ZONES GSI = 35-45	10.2	
	2,031.8	13.2		2:36 1:37 0:51	(2.3) 46%	(0.7) 14%							
2030			5.0	2:04 1:12 0:59									
	2,026.8	18.2		0:45 1:17 1:42 1:12 1:14	(0.9) 18%	(0.0) 0%							
2025			5.0	1:04 1:18 0:43 0:48 0:59	(0.6) 12%	(0.0) 0%							
	2,021.8	23.2											
2020			5.0										
	2,016.8	28.2									Boring Terminated at Elevation 2,016.8 ft IN CRYSTALLINE ROCK (GNEISS)	28.2	

NCDOT BORE DOUBLE W0920_GEO_RDY.GPJ NC_DOT_GDT 4/4/25

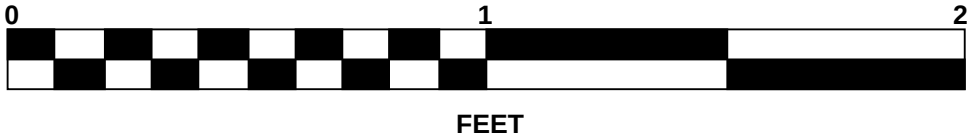
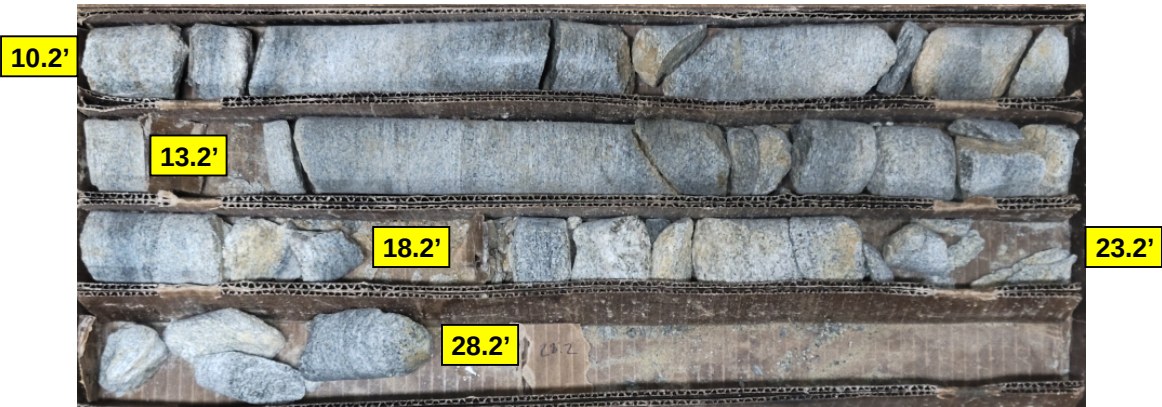
WBS		18314.1045035		TIP		W0920		COUNTY		HENDERSON		GEOLOGIST		Payne, C.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
SITE DESCRIPTION													NC-9 FROM US-74A TO BUNCOMBE COUNTY LINE			GROUND WTR (ft)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
BORING NO.				L_10050				STATION				100+50				OFFSET				16 ft LT				ALIGNMENT				-L-				0 HR.		Dry																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
COLLAR ELEV.				2,046.0 ft				TOTAL DEPTH				33.5 ft				NORTHING				642,897				EASTING				1,022,651				24 HR.		FIAD																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
DRILL RIG/HAMMER EFF./DATE										SME275 DIEDRICH D-50 91% 01/19/2024										DRILL METHOD										H.S. Augers										HAMMER TYPE										Automatic																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
DRILLER						Williams Jr., T.						START DATE						01/08/25						COMP. DATE						01/09/25						SURFACE WATER DEPTH												N/A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
			0.5ft	0.5ft	0.5ft	0	25	50	75	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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CORE PHOTOGRAPHS

L_8950
14.4 – 19.9 FEET



L_9900
10.2 – 28.2 FEET



SUMMARY OF LABORATORY TEST DATA
Soil Classification and Gradation



S&ME, Inc. Charlotte, 8848 Red Oak Boulevard, Suite A, Charlotte, North Carolina 28217

S&ME Project No.: 24350796

S&ME Project Name: NC-9 from US-74A to Buncombe County Line

Date Report: 2/18/2025

State Project No.: -

County: Henderson

Date Tested: 1/10 - 2/17/2025

WBS No.: 18314.1045035

TIP No.: -

Client Name: Stantec

Client Address: Raleigh, NC

Boring No.	Sample No.	Station #:	Offset	Alignment	Sample Depth (feet)	AASHTO Classification		Total % Passing				Total Mortar Fraction (%)				LL	PL	PI	Moist. %
								Sieve #				Coarse Sand	Fine Sand	Silt	Clay				
								10	40	60	200								
L_3975	SS-91	39+75	-8	-L-	6.0-7.5	A-4	(0)	100	91	81	48	20	39	24	17	34	31	3	26.6
L_4950	SS-81	49+50	-7	-L-	8.5-10.0	A-2-4	(0)	98	81	66	31	33	42	17	8	NP			26.8
L_7600	SS-109	76+00	-6	-L-	8.5-10.0	A-4	(0)	98	82	71	43	28	33	19	20	37	33	4	22.8
L_7700	SS-128	77+00	-8	-L-	13.5-15.0	A-6	(3)	98	83	73	51	25	27	18	30	39	28	11	24.3
L_8950	SS-22	89+50	8	-L-	6.0-7.5	A-4	(1)	98	90	80	48	18	39	21	22	35	28	7	29.6
L_10050	SS-3	100+50	-16	-L-	6.0-7.5	A-2-4	(0)	98	87	73	32	26	50	19	5	NP			17.6

References / Comments / Deviations:

NP=Not Plastic

QNS=Quantity Not Sufficient

AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT

AASHTO T89: Determining the Liquid Limit of Soils

AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO M145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

Karen Warner

Technician Name:

118-06-0305

Certification #

Signature

Luis Campos, P.E.

Technical Responsibility:

Project Manager

Position

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