This electronic collection of documents is provided for the convenience of the user and is Not a Certified Document –

The documents contained herein were originally issued and sealed by the individuals whose names and license numbers appear on each page, on the dates appearing with their signature on that page.

This file or an individual page shall not be considered a certified document.

CONTENTS SHEET NO.

Ä

REFERENCE

4611.

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

DESCRIPTION

STRUCTURE SUBSURFACE INVESTIGATION

l	TITLE SHEET
2	LEGEND (SOIL & ROCK)
-	
2A	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4	CROSS SECTIONS
5-10	BORE LOGS & CORE REPORT

COUNTY BUNCOMBE	
PROJECT DESCRIPTION $_$	BRIDGE NO. 259 ON SR 3466
	OVER SOUTH HOMINY CREEK
SITE DESCRIPTION	

STATE	STATE PROJECT	REFERENCE NO.	SHEET NO.	TOTAI SHEET
N.C.	B-5400	46115	1	10

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, CEDTECHNICAL 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 LIKEN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE DESTREY DATA THE VIEW OF THE STANDARD TEST METHOD. THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY YARY 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 DIES 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 OF FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS FOO BE ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

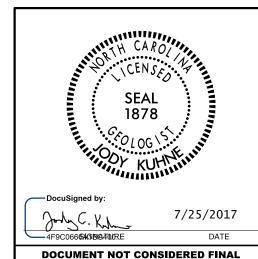
- NOTES:

 1. 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.

 2. BY HAVING REDUESTED 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.

DO CHEEK
CJ COFFEY
NVESTIGATED BY D_MULLEN
DS DS
CHECKED BY D MULLEN
SUBMITTED BY <u>J KUHNE</u> 7/25/2017
)ATE

PERSONNEL



UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO. SHEET NO. SHEET NO. 2

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	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.	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.	ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.
ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION	GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.	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	AQUIFER - A WATER BEARING FORMATION OR STRATA.
IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH	ANGULARITY OF GRAINS	REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:	ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.
AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6	THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS:	\$(1/72(1/72	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.
SOIL LEGEND AND AASHTO CLASSIFICATION	ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.	WEATHERED // NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > ROCK (WR) 100 BLOWS PER FOOT IF TESTED.	ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT
GENERAL GRANULAR MATERIALS SILT-CLAY MATERIALS OPCOMIC MATERIALS	MINERALOGICAL COMPOSITION	CRYSTALLINE CRYSTALLINE CRYSTALLINE CRYSTALLINE	WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND
LLASS. (≤ 35% PASSING "2001) (> 35% PASSING "2001)	MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.	ROCK (CR) WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.	SURFACE. <u>CALCAREOUS (CALC.)</u> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.
GROUP A-1 A-3 A-2 A-4 A-5 A-6 A-7 A-1, A-2 A-4, A-5 CLASS. A-1-a A-1-b A-2-4 A-2-5 A-2-6 A-2-7 B-2-6 A-2-7 A-4, A-5 A-3 A-6, A-7	COMPRESSIBILITY	NON-CRYSTALLINE FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN	COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM
SYMBOL COCCOGCOCCOCCOCCOCCOCCOCCOCCOCCOCCOCCOCC	SLIGHTLY COMPRESSIBLE LL < 31	ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.	OF SLOPE.
7. PASSING	MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50	COASTAL PLAIN COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SEDIMENTARY ROCK SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED	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.
*10 50 MX GRANULAR SIL1- MUCK,	PERCENTAGE OF MATERIAL	CP) SHELL BEDS. ETC. WEATHERING	DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT
#40 30 MX 50 MX 51 MN PEAT SOILS PEAT SOILS SOILS PEAT	GRANULAR SILT - CLAY ORGANIC MATERIAL SOILS SOILS OTHER MATERIAL	FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER	ROCKS OR CUTS MASSIVE ROCK.
MATERIAL	TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10%	HAMMER IF CRYSTALLINE.	<u>DIP</u> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.
PASSING *40 SOILS WITH	LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35%	VERY SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN,	DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE
LL 40 MX 41 MN LITTLE OR PI 6 MX NP 10 MX 11 MN 11 MN 10 MX 10 MX 11 MN 11 MN 11 MN 11 MN MODERATE HIGHLY	HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE	(V SLI.) CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.	LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.
GROUP INDEX 0 0 0 4 MX 8 MX 12 MX 16 MX NO MX AMOUNTS OF SOULS	GROUND WATER	SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO	FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE
USUAL TYPES STONE FRAGS. FINE SILTY OR CLAYEY SILTY CLAYEY MATTER	✓ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING	(SLI.) 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.	SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.
OF MAJOR GRAVEL, AND SAND GRAVEL AND SAND SOILS SOILS	▼ STATIC WATER LEVEL AFTER 24 HOURS	MODERATE SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN	FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM
CEN PATING	<u> </u>	(MOD.) GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS	PARENT MATERIAL.
AS SUBGRADE EXCELLENT TO GOOD FAIR TO POOR POOR UNSUITABLE	SPRING OR SEEP	DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.	FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.
PI OF A-7-5 SUBGROUP IS ≤ LL - 30; PI OF A-7-6 SUBGROUP IS > LL - 30		MODERATELY ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL	FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.
CONSISTENCY OR DENSENESS RANGE OF STANDARD RANGE OF UNCONFINED	MISCELLANEOUS SYMBOLS	SEVERE AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH (MOD. SEV.) AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES 'CLUNK' SOUND WHEN STRUCK.	JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
PRIMARY SOIL TYPE COMPACTIFIES OR PENETRATION RESISTENCE COMPRESSIVE STRENGTH	ROADWAY EMBANKMENT (RE) 25/025 DIP & DIP DIRECTION	<u>IF TESTED, WOULD YIELD SPT REFUSAL</u>	LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO
(N-VALUE) (TUNS/FT-)	WITH SOIL DESCRIPTION OF ROCK STRUCTURES	SEVERE ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC CLEAR AND EVIDENT BUT (SEV.) REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED	ITS LATERAL EXTENT.
GENERALLY VERY LOOSE < 4 GRANULAR LOOSE 4 TO 10	SOIL SYMBOL Opt omt test boring SLOPE INDICATOR INSTALLATION	TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN.	LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.
MATERIAL DENSE 10 10 30 N/A	ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT AUGER BORING CONE PENETROMETER	IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF VERY ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC ELEMENTS ARE DISCERNIBLE	MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
(NON-COHESIVE) VERY DENSE > 50	THAN ROADWAY EMBANKMENT TEST	SEVERE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK	PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE
VERY SOFT < 2 < 0.25	— INFERRED SOIL BOUNDARY — CORE BORING SOUNDING ROD	(V SEV.) REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <u>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</u>	OF AN INTERVENING IMPERVIOUS STRATUM.
GENERALLY SOFT 2 TO 4 0.25 TO 0.5 SILT-CLAY MEDIUM STIFF 4 TO 8 0.5 TO 1.0	INFERRED ROCK LINE MONITORING WELL TEST BORING WITH CORE	COMPLETE ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND	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
MATERIAL STIFF 8 TO 15 1 TO 2 COHESIVE) VERY STIFF 15 TO 30 2 TO 4	PIEZOMETER COT NO VOLUE	SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS	ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE
HARD > 30 > 4	****** ALLUVIAL SOIL BOUNDARY \(\triangle \tr	ALSO AN EXAMPLE. ROCK HARDNESS	RUN AND EXPRESSED AS A PERCENTAGE,
TEXTURE OR GRAIN SIZE	RECOMMENDATION SYMBOLS	VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK, BREAKING OF HAND SPECIMENS REQUIRES	SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.
U.S. STD. SIEVE SIZE 4 10 40 60 200 270	UNDERCUT UNCLASSIFIED EXCAVATION - UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE ACCEPTABLE, BUT NOT TO BE	SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.	SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND
OPENING (MM) 4.76 2.00 0.42 0.25 0.075 0.053	USED IN THE TOP 2 FEET OF	HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRES Y = 10 DETACH HAND SPECIMEN.	RELATIVELY ININ COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDBING OR SCHISTOSITY OF THE INTRUDED ROCKS.
BOULDER COBBLE GRAVEL COARSE FINE SILT CLAY (BLDR.) (COB.) (GR.) SAND SAND (SL.) (CL.)	SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - SHEET OF SPEET OF ACCEPTABLE DEGRADABLE ROCK EMBANKMENT OR BACKFILL	MODERATELY CAN BE SCRATCHED BY KNIFE OR PICK, GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE	SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT
(BLDR.) (COB.) (GR.) (CSE. SD.) (F SD.) (SL.) (CL.)	ABBREVIATIONS	HARD EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED	OR SLIP PLANE.
GRAIN MM 305 75 2.0 0.25 0.05 0.005 SIZE IN. 12 3	AR - AUGER REFUSAL MED MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA MICACEOUS WEA WEATHERED	BY MODERATE BLOWS. MEDIUM CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT.	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
	CL CLAY MOD MODERATELY γ - UNIT WEIGHT	HARD CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE	WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL
SOIL MOISTURE - CORRELATION OF TERMS SOIL MOISTURE SCALE FIELD MOISTURE COURSE TO A MOISTURE OF SCALE	CPT - CONE PENETRATION TEST NP - NON PLASTIC $\gamma_{\rm d}$ - DRY UNIT WEIGHT CSE COARSE ORG ORGANIC	POINT OF A GEOLOGIST'S PICK.	TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY
(ATTERBERG LIMITS) DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION	DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST SAMPLE ABBREVIATIONS	SOFT CAN BE GROVED 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	TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
- SATURATED - USUALLY LIQUID; VERY WET, USUALLY	DPT - DYNAMIC PENETRATION TEST SAP SAPROLITIC S - BULK e - VOID RATIO SD SAND, SANDY SS - SPLIT SPOON	PIECES CAN BE BROKEN BY FINGER PRESSURE.	STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY
(SAT.) FROM BELOW THE GROUND WATER TABLE LL _ LIQUID LIMIT	F - FINE SL, - SILT, SILTY ST - SHELBY TUBE FOSS FOSSILIFEROUS SLI SLIGHTLY RS - ROCK	VERY CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH SOFT OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY	THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.
PLASTIC CEMICOLID DEGUIDES DOVING TO	FOSS FOSSILIFEROUS SLI SLIGHTLY RS - ROCK FRACT - FRACTURED, FRACTURES TCR - TRICONE REFUSAL RT - RECOMPACTED TRIAXIAL	FINGERNAIL.	TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.
RAINGE - WEI - (W) ATTAIN OPTIMUM MOISTURE	FRAGS FRAGMENTS	FRACTURE SPACING BEDDING	BENCH MARK: BM #1: -BY- STA 5+70.32 17.52' LT
	EQUIPMENT USED ON SUBJECT PROJECT	TERM SPACING TERM THICKNESS VERY WIDE MORE THAN 10 FEET VERY THICKLY BEDDED 4 FEET	SPIKE IN ROOT OF 14" POPLAR ELEVATION: 2185.90 FEET
OM _ OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE	DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE:	WIDE 3 TO 10 FEET THICKLY BEDDED 1.5 - 4 FEET MODERATELY CLOSE 1 TO 3 FEET THINLY BEDDED 0.16 - 1.5 FEET	ELEVATION: 2103.70 FEET
SL SHRINKAGE LIMIT	CME-45C CLAY BITS X AUTOMATIC MANUAL	CLOSE 0.16 TO 1 FOOT VERY THINLY BEDDED 0.03 - 0.16 FEET	NOTES:
- DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE	6° CONTINUOUS FLIGHT AUGER CORE SIZE:	VERY CLOSE LESS THAN 0.16 FEET THICKLY LAMINATED 0.008 - 0.03 FEET THINLY LAMINATED < 0.008 FEET	
PLASTICITY	CME-55 CORE SIZE:	INDURATION	
PLASTICITY INDEX (PI) DRY STRENGTH	X CME-550 HARD FACED FINGER BITS	FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.	
NON PLASTIC 0-5 VERY LOW	TUNGCARBIDE INSERTS	RUBBING WITH FINGER FREES NUMEROUS GRAINS; FRIABLE GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.	
SLIGHTLY PLASTIC 6-15 SLIGHT MODERATELY PLASTIC 16-25 MEDIUM	VANE SHEAR TEST CASING X W/ ADVANCER HAND TOOLS: POST HOLE DIGGER	CRAINS CAN DE CERARATER FROM CAMPLE MITH CTEEL PROPE	
HIGHLY PLASTIC 26 OR MORE HIGH	POST HOLE DIGGER POST HOLE DIGGER STEEL TEETH HAND AUGER	MODERATELY INDURATED ORALINS CHIN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.	
COLOR	TRICONE TUNGCARB. SOUNDING ROD	INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE;	
DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY).	CORE BIT VANE SHEAR TEST	DIFFICULT TO BREAK WITH HAMMER.	
MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.		EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.	DATE: 8-15-1-
		L	

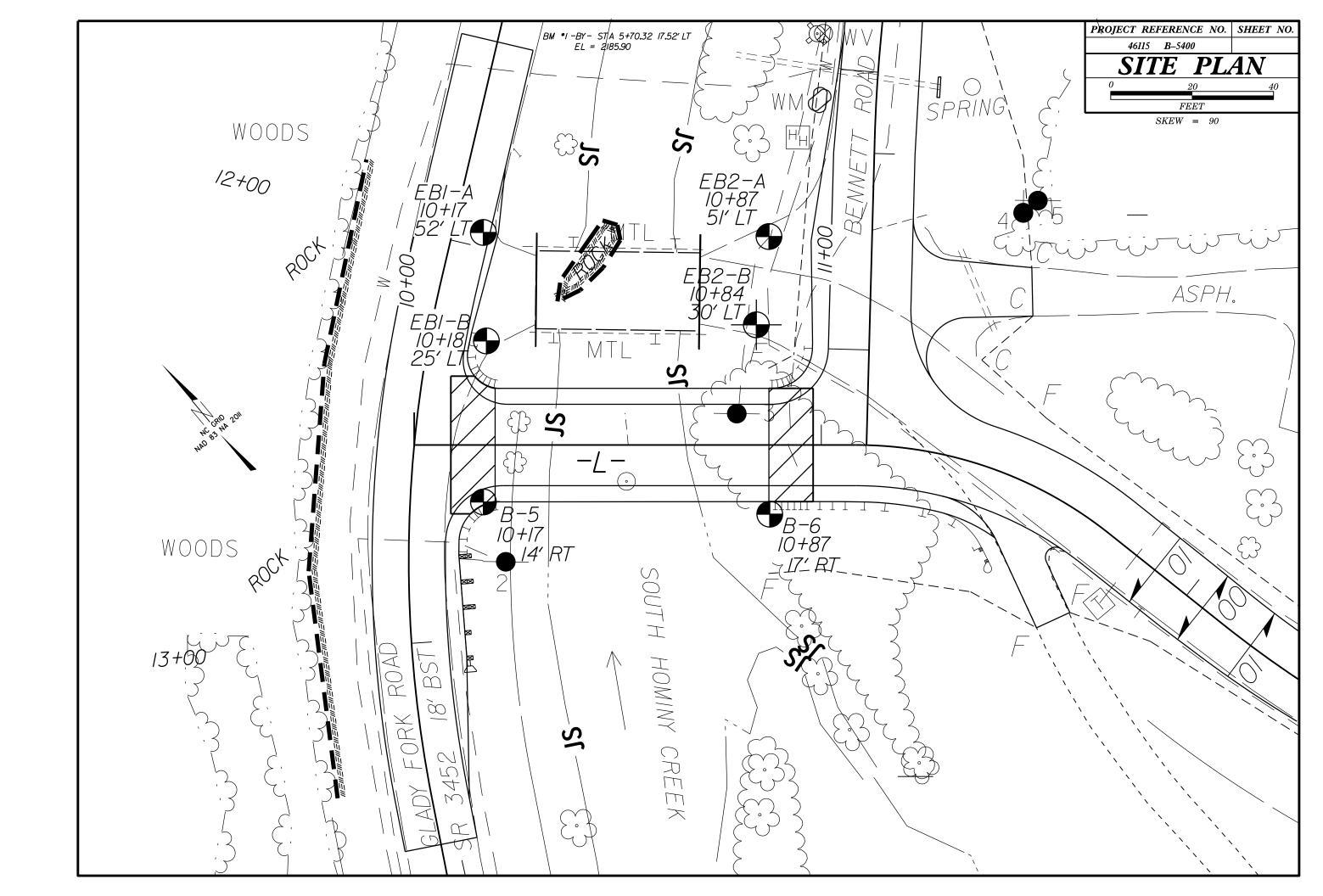
PROJECT REFERE	NCE NO.	SHEET NO.
-5400	46115	2A

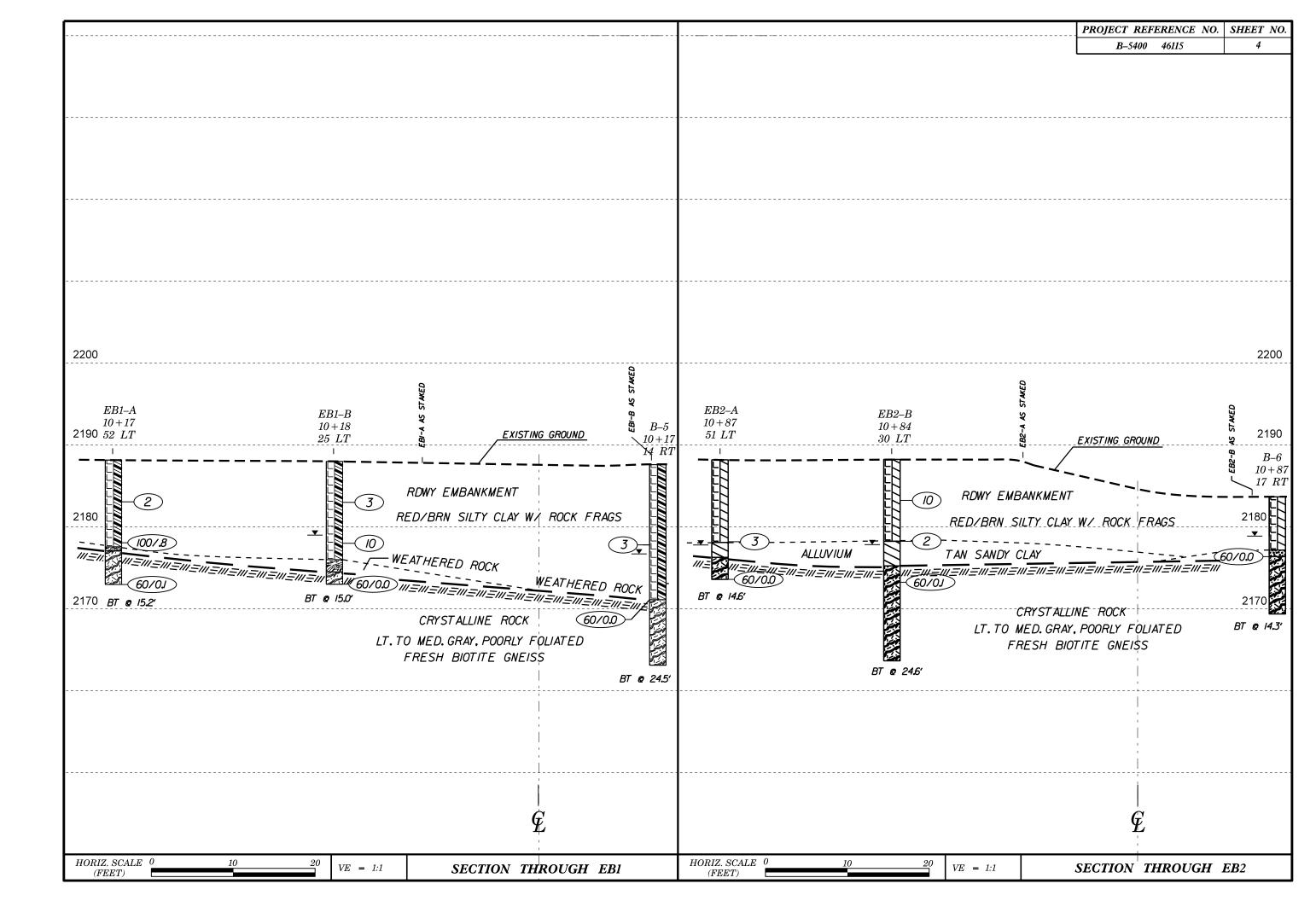
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

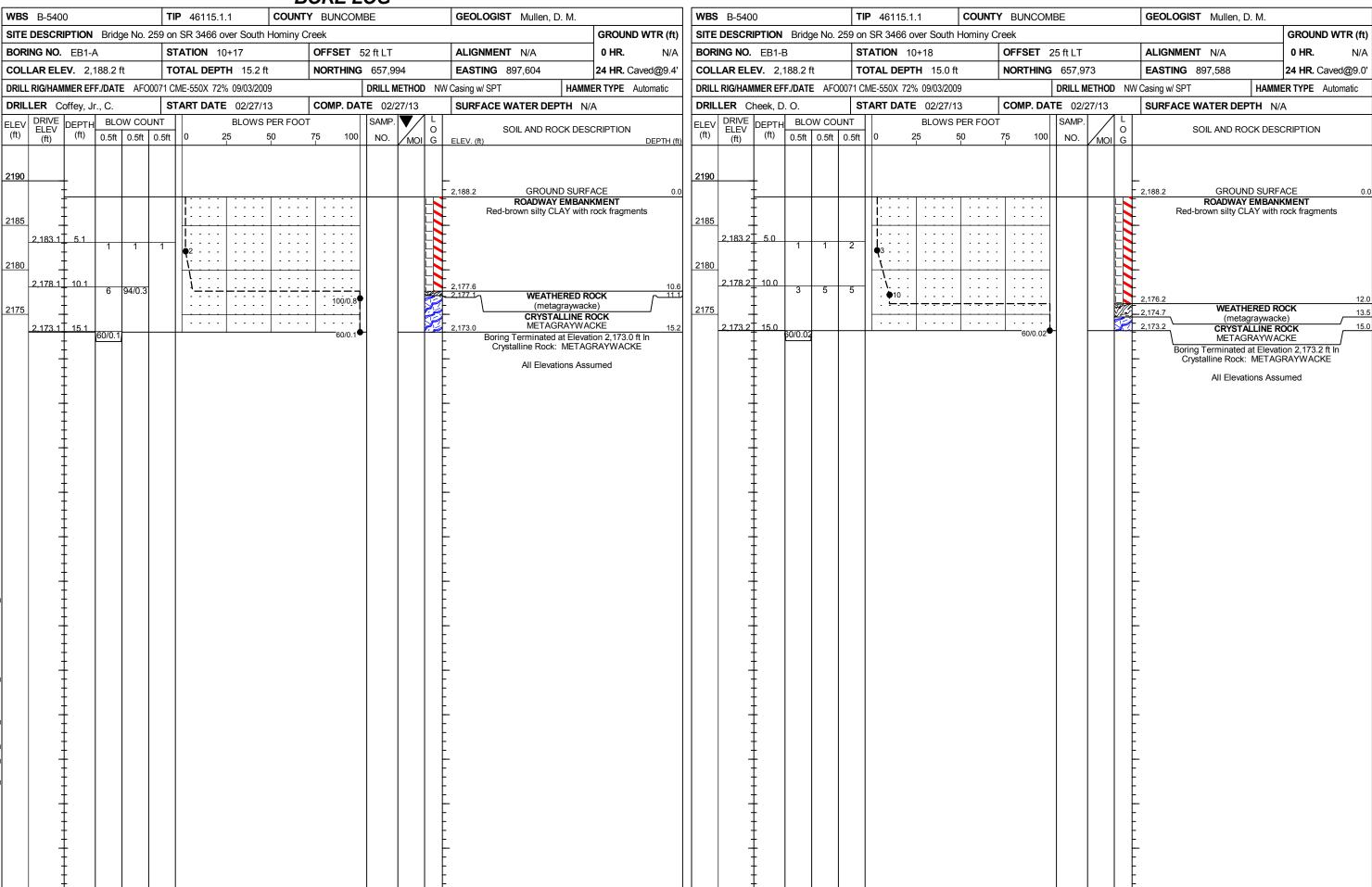
SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

		FR	OM AAS	HTO LRFD BRII	DGE DESIGN SPECIFICATIONS					
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	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.	ough, fresh	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, slicken- sided or highly weathered surfaces with soft clay coatings or fillings
STRUCTURE			1	ALITY ->	COMPOSITION AND STRUCTURE					
INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities BLOCKY - well interlocked un-	PIECES -	90 80		N/A N/A	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.	70 60	A			
disturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks	OCKING OF ROCK	70 60	50		8. Sand- stone with thin inter- layers of siltstone amounts C. Sand- stone and stone and siltstone or silty shale with sand- stone layers layers layers	, / /	50 B 40	C I	D/E	
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	 SING INTERL		40	30	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.			30	F 20	
DISINTEGRATED - poorly inter- locked, heavily broken rock mass with mixture of angular and rounded rock pieces	— - ∭- - OECREA			20	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				/ 	10
LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes	V	N/A N/A		10	/ Into small rock pieces. → Means deformation after tectonic disturbance					DATE: 8-19-1

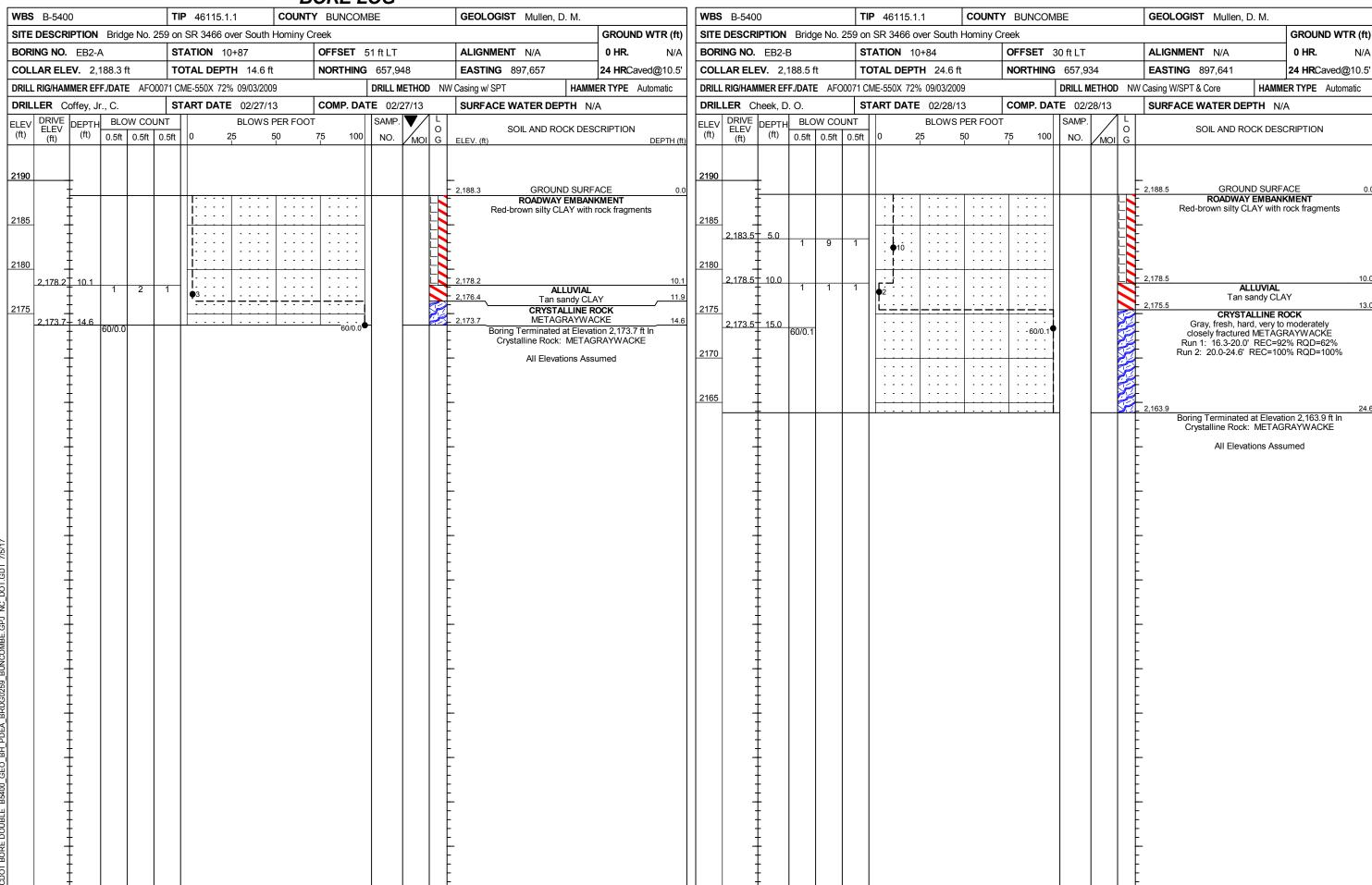




GEOTECHNICAL BORING REPORT BORE LOG



GEOTECHNICAL BORING REPORT BORE LOG



SHEET 7

GEOTECHNICAL BORING REPORT CORE LOG

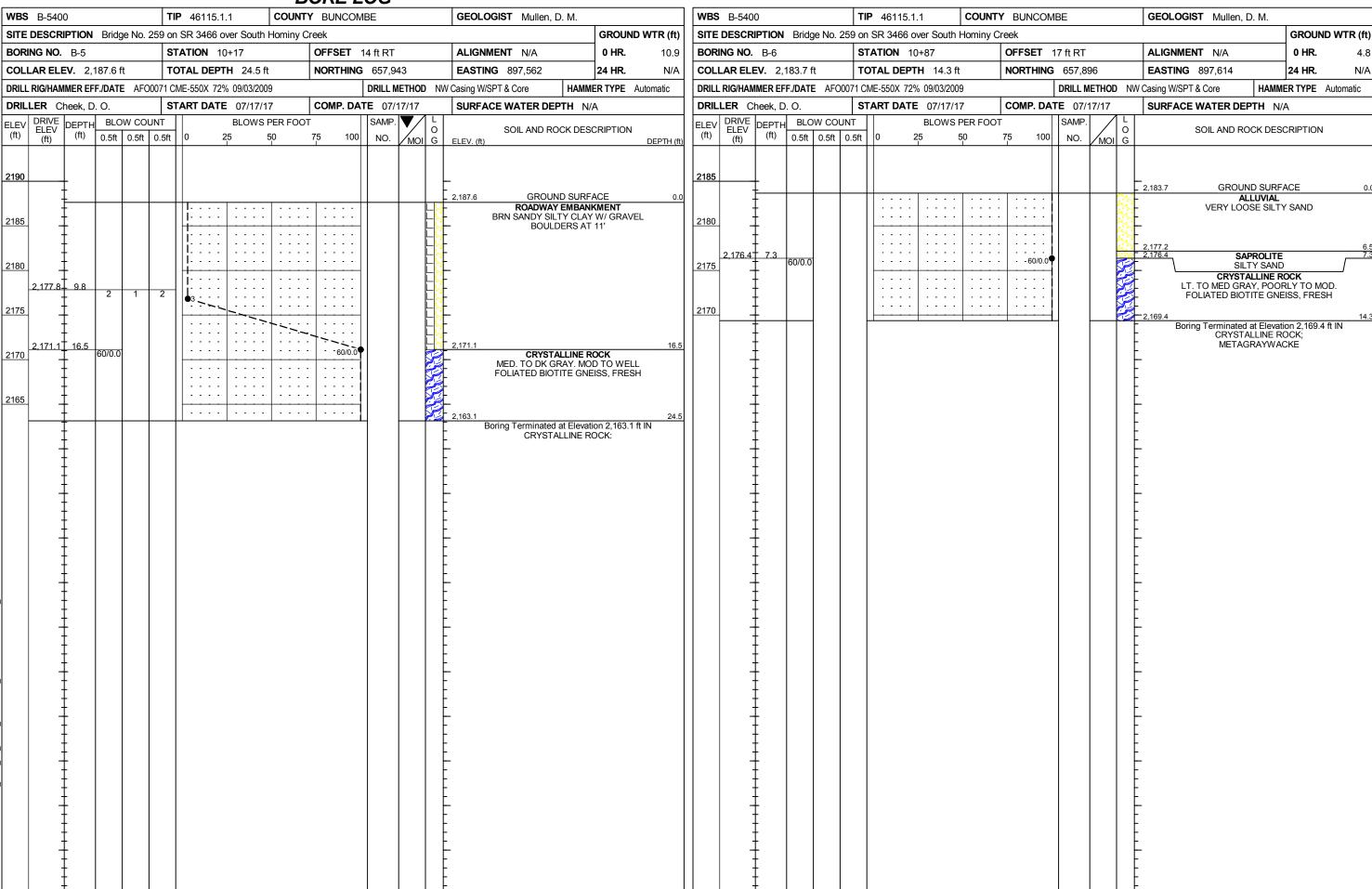
									C	Ol	RE L	.00	3							
WBS	B-5400				TIP	46115	5.1.1	С	OUNT	ΥB	UNCON	/IBE			GEOL	OGIST	Mullen, E	D. M.		
SITE	DESCRIP	TION	Bridg	ge No. 25	9 on SI	₹ 3466	over Sou	ıth Hor	miny C	reek									GROU	ND WTR (ft)
BORI	NG NO.	EB2-E	3		STA	ΓΙΟΝ	10+84			OF	FSET	30 ft I	_T		ALIGN	IMENT 1	N/A		0 HR.	N/A
COLI	COLLAR ELEV. 2,188.5 ft TOTAL DEPTH 24.6 ft NORTHING 657,934 EASTING 89								NG 897	,641		24 HR	Caved@10.5'							
DRILL	RIG/HAMM	IER EF	F./DATI	E AFO00	71 CME	-550X 7	72% 09/03/	2009		·		DRIL	L METHO	D NW	Casing W	//SPT & Cor	re	HAMM	IER TYPE	Automatic
DRILL RIG/HAMMER EFF./DATE AFO0071 CME-550X 72% 09/03/200 DRILLER Cheek, D. O. START DATE 02/28/									СС	MP. DA)2/28/13			ACE WAT		TH N/	/A		
-	E SIZE N				TOTA	AL RU	N 8.3 ft													
ELEV	DUN	EPTH	RUN	DRILL RATE	REC.	JN RQD	SAMP.	STR REC. (ft) %	ATA	L					NESCRIDI	TION AND	DEMARK	<u></u>		
(ft)	(ft)	(ft)	(ft)	(Min/ft)	(ft) %	(ft) %	NO.	(ft) %	(ft) %	Ğ	ELEV.	(ft)			DESCINIF I	I ION AND	INLINIAINI	···		DEPTH (ft)
2172.16	2,172.2	16.3	0.7		(2.4)	(0.0)		Begin Coring @ 16.3 ft CRYSTALLINE ROCK (continued)												
2170	1,1,2,2	10.0	3.7		(3.4) 92%	(2.3) 62%					_				CRISIAL	LINE ROC	K (CONUIN	uea)		
	2,168.5	20.0	4.6		(4.6)	(4.6)														
	1		4.0		100%	100%														
2165	2,163.9	24.6									 _ 2,163.9)								24.6
	+										_		Boring	Termina	ated at El	levation 2, ²	163.9 ft In	Crystall	ine Rock:	
	\pm										_					levations A				
	Ŧ														AII LI	icvations A	Sourieu			
	Ŧ																			
	1										_									
	‡										-									
	‡										-									
	‡																			
	‡										-									
	‡										_									
	‡										_									
	1										_									
	+										_									
	1										_									
	1										_									
	1										_									
=	Ŧ																			
2	Ŧ																			
	Ŧ																			
	Ŧ																			
2											_									
5	1																			
	‡										_									
2	‡										_									
3	‡										_									
	‡										_									
	‡										_									
.i	±										_									
	<u> </u>										_									
	1										_									
	 										<u> </u>									
Š	‡										-									
1	‡										-									
	‡										-									
	‡										-									
3	‡										-									
	‡										<u>-</u>									

B-5400 BORING EB2-B



STATION 10+84, 30' LT 16.3 TO 24.6' BLOCKY GOOD GNEISS GSI = 65 - 75

GEOTECHNICAL BORING REPORT BORE LOG



GEOTECHNICAL BORING REPORT CORE LOG

									C	O	RE L	OG					
WBS	B-540	0			TIP	46115	5.1.1	С	OUNT	ΥΕ	BUNCOM	IBE	GEOLOGI	IST Mullen, E). M.		
SITE	DESCR	IPTION	Brido	ge No. 259	on SI	R 3466	over Sou	ıth Hor	miny (Creek						GROU	ND WTR (ft
BORI	NG NO.	B-5			STA	TION	10+17			OF	FSET	14 ft RT	ALIGNME	NT N/A		0 HR.	10.9
COLI	AR ELI	EV. 2,	187.61	ft	TOT	AL DE	PTH 24.	5 ft		NC	RTHING	657,943	EASTING	897,562		24 HR.	N/A
DRILL	RIG/HAN	MER EF	F./DATI	E AFO007	1 CME	-550X 7	72% 09/03/	2009				DRILL METHOD N	IW Casing W/SP1	Γ & Core	HAMM	ER TYPE	Automatic
DRIL	LER C	heek, D). O.		STAI	RT DA	TE 07/1	7/17		CC	MP. DA	TE 07/17/17	SURFACE	WATER DEF	TH N/	A	
COR	E SIZE	NXWL			ı		N 8.0 ft										
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (ft)	JN RQD (ft) %	SAMP. NO.	REC. (ft)	ATA RQD (ft) %	L O G	ELEV. (ft)	DESCRIPTION	N AND REMARK	(S		DEPTH (
171.14	2,171.1	16.5		N/ 00/0 0	(0.0)	(0.0)							Begin Cor	ing @ 16.5 ft ALLINE ROCK			
2170	2,168.1	Т	3.0	N=60/0.0 1:05/1.0 0:58/1.0 1:18/1.0	(2.9) 95%						2,171.1 		CRYSTA	ALLINE ROCK			16
2165		<u> </u>	5.0	1:59/1.0 1:28/1.0 1:45/1.0 1:45/1.0	(4.9) 98%	(4.9) 98%					-						
	2,163.1	24.5		2:09/1.0							2,163.1	Boring Termina	ated at Floretian	2 162 1 ft INI CI	OVETALI	INE DOC	24
	_	<u> </u>									E						
	-	ł									_						
		‡									_						
	-	‡									_						
	-	‡									-						
	_	‡									_						
	-	‡									-						
	-	‡									-						
	-	Ŧ									F						
	-	Ŧ									F						
	_	Ŧ									E						
	-	Ŧ									E						
	_	Ī									_						
		‡									_						
	-	‡									-						
	-	‡									-						
	-	† † † † †									-						
	_	‡									<u>L</u>						
	-	ŧ									-						
		Ŧ									-						
	-	Ŧ									F						
	-	Ī									Ē						
	-	Ŧ									E						
	-	Ð															
	_	Ī									_						
	-	ł									_						
		‡									_						
	-	‡									_						
	-	‡									-						
	-	‡									_						
	- -	‡									<u> </u>						
		‡									<u> </u>						
	-	‡									_						
	-	‡									-						
			L	1	l	L	l	L	L	1	I						



B-5400 BORING B-5

STATION 10+17, 14' RT 16.5 TO 24.5 BLOCKY GOOD TO VERY GOOD GNEISS GSI = 75 - 85

GEOTECHNICAL BORING REPORT CORE LOG

	C	ORE LOG		
WBS B-5400	TIP 46115.1.1 COUNT	Y BUNCOMBE	GEOLOGIST Mullen, D. M.	
SITE DESCRIPTION Bridge No. 259	on SR 3466 over South Hominy C	Creek		GROUND WTR (ft
BORING NO. B-6	STATION 10+87	OFFSET 17 ft RT	ALIGNMENT N/A	0 HR. 4.8
COLLAR ELEV. 2,183.7 ft	TOTAL DEPTH 14.3 ft	NORTHING 657,896	EASTING 897,614	24 HR. N/A
DRILL RIG/HAMMER EFF./DATE AFO0071	1 CME-550X 72% 09/03/2009	DRILL METHOD NW	Casing W/SPT & Core HAMM	ER TYPE Automatic
DRILLER Cheek, D. O.	START DATE 07/17/17	COMP. DATE 07/17/17	SURFACE WATER DEPTH N/	A
CORE SIZE NXWL	TOTAL RUN 7.0 ft			
ELEV (ft) DEPTH RUN RATE (Min/ft)	RUN 7.0 ft STRATA REC. RQD (ft) (ft	L O D D	ESCRIPTION AND REMARKS	DEPTH (
176.37			Begin Coring @ 7.3 ft CRYSTALLINE ROCK	
$I = \begin{bmatrix} 5.0 & \frac{0.1071.0}{2.28/1.0} \end{bmatrix}$	(1.8) (1.8) 90% 90% (4.9) (4.7) 98% 94%	2,176.4		7
		Boring Terminated	d at Elevation 2,169.4 ft IN CRYSTALI METAGRAYWACKE	LINE ROCK;



B-5400 BORING B-6 STATION 10+87 17' RT 7.5 TO 14.3

BLOCK GOOD TO VERY GOOD GNEISS GSI = 75 - 85