STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34431 (R-2417AA)	1	37

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34431 (R-2417AA) F.A. PROJ. STP-NHF-421 (2)

COUNTY LEE

PROJECT DESCRIPTION US 421-NC 87 (SANFORD BYPASS) FROM WEST OF SR 1400 TO WEST OF US 1-15-501

SITE DESCRIPTION STR 1: BRIDGE ON SR 1400 (CUMNOCK RD.) OVER US 421-NC 87 (SANFORD BYPASS)

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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) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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.

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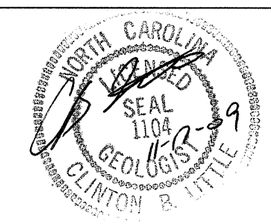
PERSONNEL
C.C. MURRAY
J.E. ESTEP
M.R. MOORE

INVESTIGATED BY C.C. MURRAY
CHECKED BY C.B. LITTLE
SUBMITTED BY C.B. LITTLE
DATE NOVEMBER 2009



DRAWN BY: J.K. McCLURE

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NOTE - 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.

PROJECT: 34431

ID: R-2417AA

PROJECT REFERENCE NO.	SHEET NO.
34431(R-2417AA)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

VERY STIFF, GRAY, SETT CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING #10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#40	30 MX	50 MX	51 MN											
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT				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		HIGHLY ORGANIC SOILS
PLASTIC INDEX	6 MX		NP	10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GENERATING AS A 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

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE MM: 305 | 75 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	26 OR MORE	HIGH

COLOR

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.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%
MODERATELY ORGANIC	5 - 10%	12 - 20%
HIGHLY ORGANIC	>10%	>20%

OTHER MATERIAL	
TRACE	1 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- SPT N-VALUE
- REF SPT REFUSAL
- TEST W/ CORE BORING

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS
S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [X] CME-550
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [X] W/ ADVANCER
- [ ] TRICONE ____" STEEL TEETH
- [X] TRICONE 2 15/16" TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC
- [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [X] -N 0/NQ
- [ ] -H_____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, YIELDS SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, YIELDS SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
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 PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FEET
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

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. AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - 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 (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 THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BL-106 PINC 39+38.35=
-BY1- PINC 18+96.63
-L- 48+14.15 (0.84' LT.) ELEVATION: 288.82 FT.

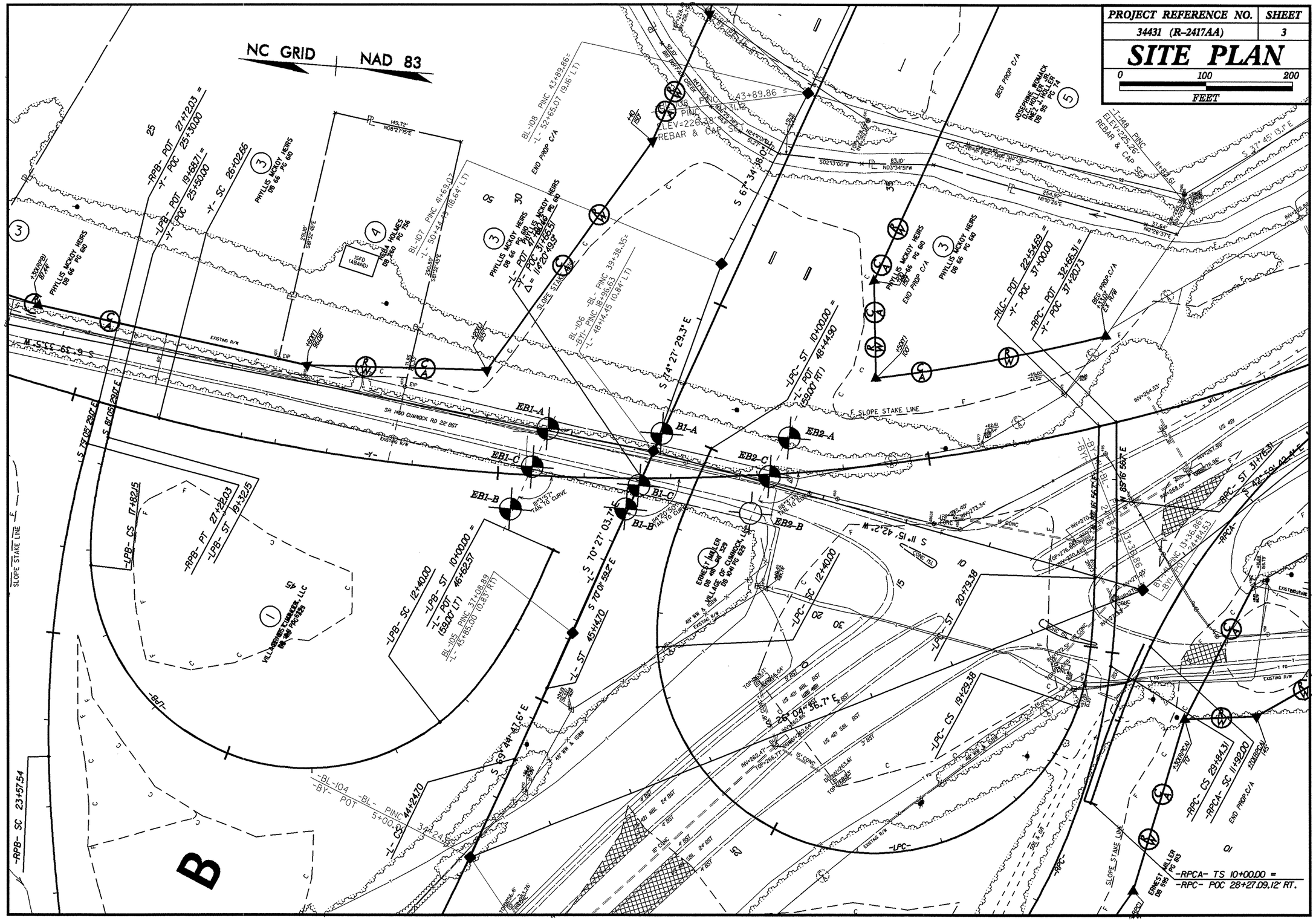
NOTES:

REVISED 02/23/06

PROJECT REFERENCE NO.	SHEET
34431 (R-2417AA)	3

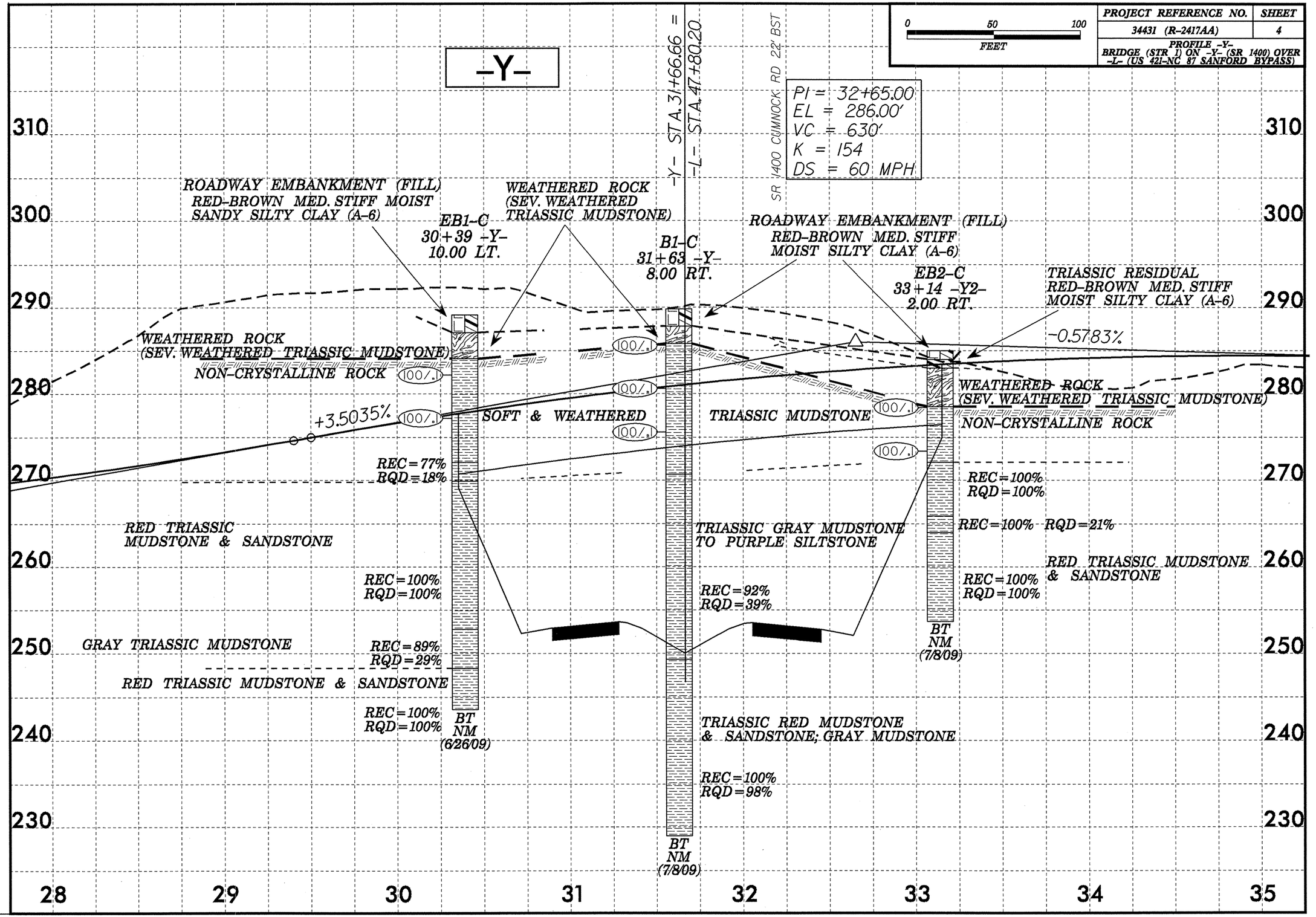
SITE PLAN

0 100 200
FEET



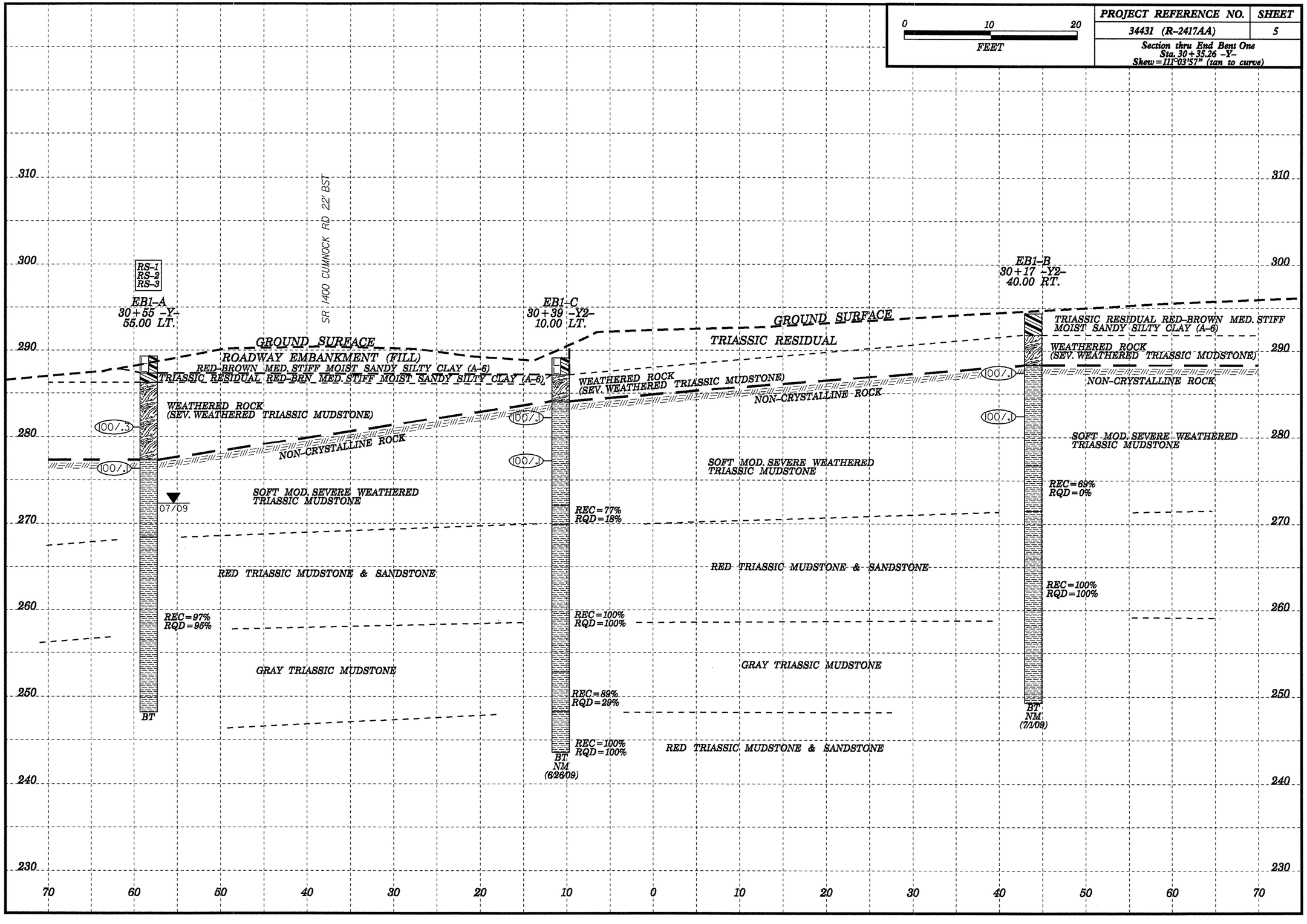
PROJECT REFERENCE NO.	SHEET
34431 (R-2417AA)	4

PROFILE -Y-
BRIDGE (STR 1) ON -Y- (SR 1400) OVER -L- (US 421-NC 87 SANFORD BYPASS)



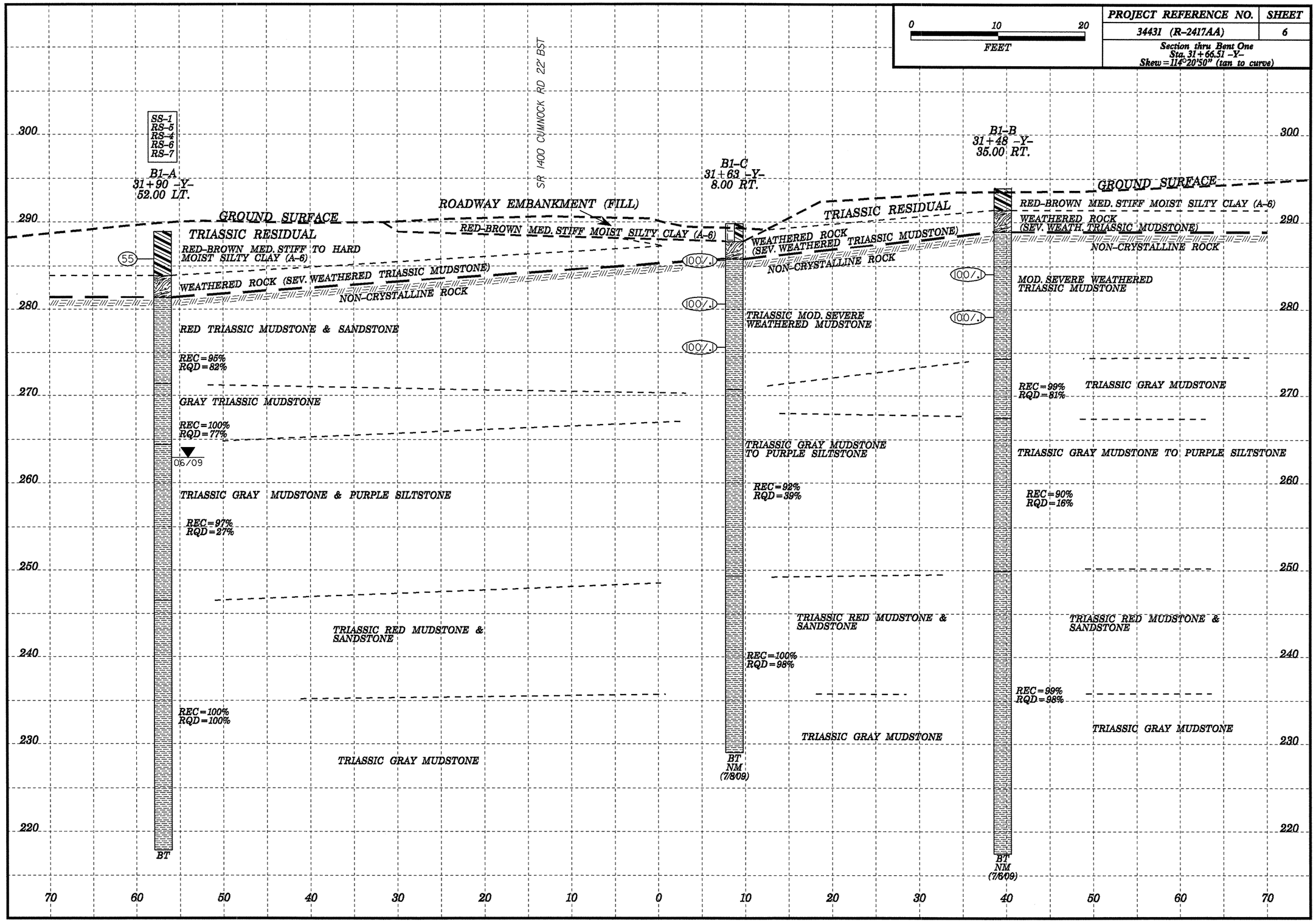
PROJECT REFERENCE NO.	SHEET
34431 (R-2417AA)	5

Section thru End Bent One
Sta. 30+35.26 -Y-
Skew = III°03'57" (tan to curve)



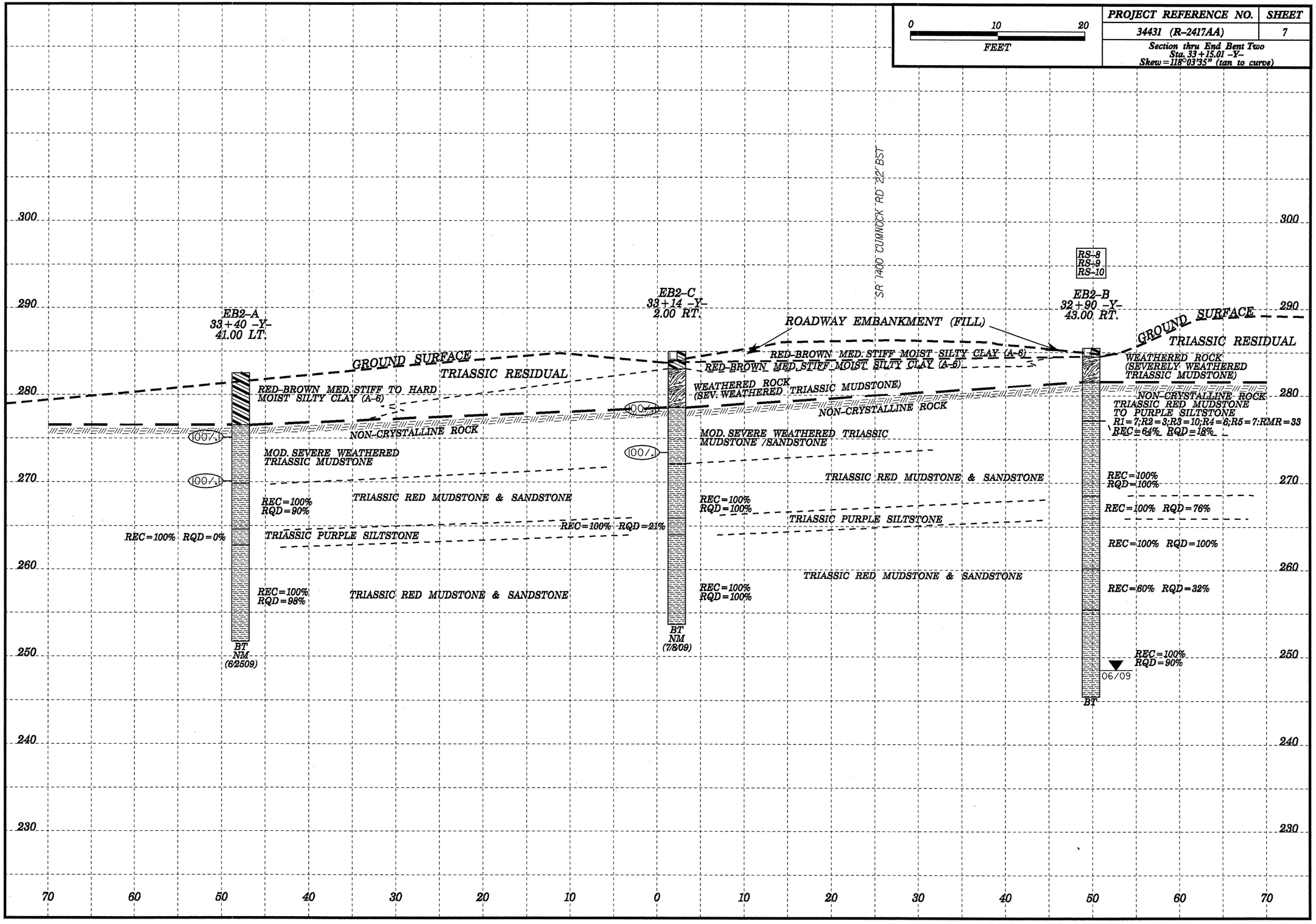
PROJECT REFERENCE NO.	SHEET
34431 (R-2417AA)	6

Section thru Bent One
Sta. 31+66.51 -Y-
Skew = 114°20'50" (tan to curve)



PROJECT REFERENCE NO.	SHEET
34431 (R-2417AA)	7

Section thru End Bent Two
Sta. 33+15.01 -Y-
Skew = 118°03'35" (tan to curve)



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 30+55	**OFFSET** 55ft LT	**ALIGNMENT** -Y-	**0 HR.** NM
COLLAR ELEV. 289.3 ft	**TOTAL DEPTH** 41.1 ft	**NORTHING** 651,908	**EASTING** 1,928,432	**24 HR.** 17.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/30/09	**COMP. DATE** 07/01/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 12.0 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
290										289.3 GROUND SURFACE	0.0
								M		**ROADWAY EMBANKMENT** RED-BROWN MED. STIFF MOIST SANDY SILTY CLAY (A-6) 287.3	2.0
										286.2 **TRIASSIC RESIDUAL** RED-BROWN MED. STIFF MOIST SANDY SILTY CLAY (A-6)	3.1
285										**WEATHERED ROCK** TRIASSIC MUDSTONE; soft; sev. weath.	
	281.4	7.9	100/.3			100/.3					
280											
	276.4	12.9	100/.1			100/.1				277.3 **NON-CRYSTALLINE ROCK** TRIASSIC MUDSTONE;mod. severe weath;soft to med. hard	12.0
275											
270											
										268.4 **NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE & SANDSTONE;sli. weath.;med. to mod. hard;very thinly to thinly bedded @10 deg;no joints R1=7;R2=20;R3=20;R4=12;R5=7 (RMR=66)	20.9
265							RS-1				
260							RS-2				
255											
250							RS-3				
										248.2 SOFT SEAM @ 38.3-38.6'	41.1
245										Boring Terminated at Elevation 248.2 ft IN TRIASSIC MUDSTONE	
240											
235											
230											
225											
220											
215											
210											

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 30+55	**OFFSET** 55ft LT	**ALIGNMENT** -Y-	**0 HR.** NM
COLLAR ELEV. 289.3 ft	**TOTAL DEPTH** 41.1 ft	**NORTHING** 651,908	**EASTING** 1,928,432	**24 HR.** 17.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/30/09	**COMP. DATE** 07/01/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 12.0 ft	
CORE SIZE CNWL-NO/NQ	**TOTAL RUN** 23.0 ft	**DRILLER** Estep, J. E.		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
271.2											Begin Coring @ 18.1 ft	
270	271.2	18.1	3.0		(1.7) 57%	(0.0) 0%					**NON-CRYSTALLINE ROCK** TRIASSIC MUDSTONE;mod. severe weath;soft to med. hard *(continued)* 268.4	20.9
	268.2	21.1	5.0		(4.6) 92%	(4.5) 90%	RS-1	(19.6) 97%	(19.2) 95%		**NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE & SANDSTONE;sli. weath.;med. to mod. hard;very thinly to thinly bedded @10 deg;no joints R1=7;R2=20;R3=20;R4=12;R5=7 (RMR=66)	
265	263.2	26.1	5.0		(5.0) 100%	(5.0) 100%	RS-2					
260	258.2	31.1	5.0		(4.8) 96%	(4.8) 96%						
255	253.2	36.1	5.0		(5.0) 100%	(4.7) 94%	RS-3				SOFT SEAM @ 38.3-38.6'	
250	248.2	41.1									248.2 Boring Terminated at Elevation 248.2 ft IN TRIASSIC MUDSTONE	41.1
245												
240												
235												
230												
225												
220												
215												
210												
205												
200												
195												

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. EB1-C	**STATION** 30+39	**OFFSET** 10ft LT	**ALIGNMENT** -Y-	**0 HR.** NM
COLLAR ELEV. 289.1 ft	**TOTAL DEPTH** 45.5 ft	**NORTHING** 651,923	**EASTING** 1,928,387	**24 HR.** NM
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/25/09	**COMP. DATE** 06/25/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 5.0 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
290										289.1 GROUND SURFACE	0.0
								M		**ROADWAY EMBANKMENT** RED-BROWN MED. STIFF MOIST SANDY SILTY CLAY (A-6) 287.1	2.0
285										**WEATHERED ROCK** TRIASSIC MUDSTONE; sev. weath. 284.1	5.0
	282.3	6.8	100/.1			100/.1				**NON-CRYSTALLINE ROCK** TRIASSIC MUDSTONE; mod. severe weath.	
280											
	277.3	11.8	100/.1			100/.1					
275										272.1	17.0
270										**NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE;soft; mod. severe weath.;thickly laminated to v. thinly bedded @ 10 deg.;no joints observed R1=4;R2=0;R3=5;R4=0;R5=7:RMR=16 269.9	19.2
265										**NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE & SANDSTONE;med. to mod. hard;sli. to v. sli. weath.;thinly to thickly bedded @ 10-15 deg.; no joints R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84	
260											
255										252.8	36.3
250										**NON-CRYSTALLINE ROCK** GRAY TRIASSIC MUDSTONE;soft to mod. hard; mod. sever to mod. weath.;thinly bedded @ 10 deg.; 2 jts. @ 85 deg R1=4;R2=8;R3=10;R4=6;R5=7:RMR=35 248.3	40.8
245										**NON-CRYSTALLINE ROCK** RED TRIASSIC SANDSTONE; mod. hard; v. sli. weath. ; thickly bedded ; no jts. R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84 243.6	45.5
240										Boring Terminated at Elevation 243.6 ft IN TRIASSIC MUDSTONE	
235											
230											
225											
220											
215											
210											

NCDOT BORE SINGLE R2417AA_GEO_BRDG_SR1400.GPJ NC_DOT.GDT 11/10/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE		**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)				**GROUND WTR (ft)**
BORING NO. EB1-C	**STATION** 30+39	**OFFSET** 10ft LT	**ALIGNMENT** -Y-	**0 HR.** NM
COLLAR ELEV. 289.1 ft	**TOTAL DEPTH** 45.5 ft	**NORTHING** 651,923	**EASTING** 1,928,387	**24 HR.** NM
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/25/09	**COMP. DATE** 06/25/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 5.0 ft	
CORE SIZE CNWL-NO/NQ	**TOTAL RUN** 28.5 ft	**DRILLER** Estep, J. E.		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
272.1											Begin Coring @ 17.0 ft	
270	272.1 / 268.6	17.0 / 20.5	3.5		(3.1) 89%	(1.6) 46%		(1.7) 77%	(0.4) 18%		272.1 **NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE;soft; mod. severe weath.;thickly laminated to v. thinly bedded @ 10 deg.;no joints observed R1=4;R2=0;R3=5;R4=0;R5=7:RMR=16 269.9	17.0 / 19.2
265	263.6	25.5	5.0		(5.0) 100%	(5.0) 100%		(17.1) 100%	(17.1) 100%		**NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE & SANDSTONE;med. to mod. hard;sli. to v. sli. weath.;thinly to thickly bedded @ 10-15 deg.; no joints R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84	
260	258.6	30.5	5.0		(5.0) 100%	(5.0) 100%						
255	253.6	35.5	5.0		(5.0) 100%	(5.0) 100%					252.8	36.3
250	248.6	40.5	5.0		(4.4) 88%	(1.9) 38%		(4.0) 89%	(1.3) 29%		**NON-CRYSTALLINE ROCK** GRAY TRIASSIC MUDSTONE;soft to mod. hard; mod. sever to mod. weath.;thinly bedded @ 10 deg.; 2 jts. @ 85 deg R1=4;R2=8;R3=10;R4=6;R5=7:RMR=35 248.3	40.8
245	243.6	45.5	5.0		(5.0) 100%	(5.0) 100%		(4.7) 100%	(4.7) 100%		**NON-CRYSTALLINE ROCK** RED TRIASSIC SANDSTONE; mod. hard; v. sli. weath. ; thickly bedded ; no jts. R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84 243.6	45.5
240											Boring Terminated at Elevation 243.6 ft IN TRIASSIC MUDSTONE	
235												
230												
225												
220												
215												
210												
205												
200												
195												

NCDOT CORE SINGLE R2417AA_GEO_BRDG_SR1400.GPJ NC_DOT.GDT 11/10/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 30+17	**OFFSET** 40ft RT	**ALIGNMENT** -Y-	**0 HR.** NM
COLLAR ELEV. 294.3 ft	**TOTAL DEPTH** 45.0 ft	**NORTHING** 651,944	**EASTING** 1,928,336	**24 HR.** NM
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/30/09	**COMP. DATE** 06/30/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 6.0 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
295										294.3 GROUND SURFACE	0.0
								M		**TRIASSIC RESIDUAL** RED-BROWN MED. STIFF MOIST SANDY SILTY CLAY (A-6) 291.8	2.5
290										**WEATHERED ROCK** SEV. WEATHERED TRIASSIC MUDSTONE 288.3	6.0
	287.5	6.8	100/.1			100/.1				**NON-CRYSTALLINE ROCK** TRIASSIC MUDSTONE;soft;mod. severe weath.	
285											
	282.5	11.8	100/.1			100/.1					
280											
										276.7	17.6
275										**NON-CRYSTALLINE ROCK** TRIASSIC MUDSTONE;soft;mod. severe weath;thickly laminated to v. thinly bedded @<10 deg;1 jt. @ 45deg. R1=4;R2=3;R3=10;R4=6;R5=7:RMR=30 271.5	22.8
270										**NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE & SANDSTONE;mod. hard;sli. to v. slight weath.;thickly bedded @ 10 deg.; no joints R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84	
265											
260											
255											
250										249.3	45.0
										Boring Terminated at Elevation 249.3 ft IN TRIASSIC SANDSTONE	
245											
240											
235											
230											
225											
220											
215											

NCDOT BORE SINGLE R2417AA_GEO_BRDG_SR1400.GPJ NC_DOT.GDT 11/10/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 10

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.	
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 30+17	**OFFSET** 40ft RT	**ALIGNMENT** -Y-	**0 HR.** NM
COLLAR ELEV. 294.3 ft	**TOTAL DEPTH** 45.0 ft	**NORTHING** 651,944	**EASTING** 1,928,336	**24 HR.** NM
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/30/09	**COMP. DATE** 06/30/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 6.0 ft	
CORE SIZE CNWL-NO/NQ	**TOTAL RUN** 27.4 ft	**DRILLER** Estep, J. E.		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
276.7											Begin Coring @ 17.6 ft	
275	276.7	17.6	2.8		(2.0) 71%	(0.0) 0%		(3.6) 69%	(0.0) 0%		276.7 **NON-CRYSTALLINE ROCK** TRIASSIC MUDSTONE;soft;mod. severe weath;thickly laminated to v. thinly bedded @<10 deg;1 jt. @ 45deg. R1=4;R2=3;R3=10;R4=6;R5=7:RMR=30	17.6
	273.9	20.4										
			5.0		(4.2) 84%	(2.5) 50%					271.5	22.8
270								(22.2) 100%	(22.1) 100%		**NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE & SANDSTONE;mod. hard;sli. to v. slight weath.;bedding @ 10 deg.; no joints R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84	
	268.9	25.4										
			5.0		(5.0) 100%	(5.0) 100%						
265												
	263.9	30.4										
			5.0		(5.0) 100%	(5.0) 100%						
260												
	258.9	35.4										
			5.0		(5.0) 100%	(5.0) 100%						
255												
	253.9	40.4										
			4.6		(4.6) 100%	(4.6) 100%						
250												
	249.3	45.0									249.3	45.0
											Boring Terminated at Elevation 249.3 ft IN TRIASSIC SANDSTONE	
245												
240												
235												
230												
225												
220												
215												
210												
205												
200												

NCDOT CORE SINGLE R2417AA_GEO_BRDG_SR1400.GPJ NC_DOT.GDT 11/10/09

SHEET

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 31+90	**OFFSET** 52ft LT	**ALIGNMENT** -Y-	**0 HR.** NM
COLLAR ELEV. 288.9 ft	**TOTAL DEPTH** 71.0 ft	**NORTHING** 651,777	**EASTING** 1,928,437	**24 HR.** 26.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/23/09	**COMP. DATE** 06/24/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 7.5 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
290										288.9 GROUND SURFACE	0.0
	286.8	2.1								**TRIASSIC RESIDUAL** RED-BROWN MED. STIFF TO HARD MOIST SILTY CLAY (A-6)	
285			23	27	28	●55	SS-1	M		283.9	5.0
										WEATHERED ROCK TRIASSIC MUDSTONE;soft;sev. weath.	
280										281.4	7.5
										NON-CRYSTALLINE ROCK RED TRIASSIC MUDSTONE & SANDSTONE; med. hard; mod. severe to mod. weath.; thinly bedded @ 10 deg; 2 jts @ 30 deg., 2 jts. @ 60 deg. R1=7;R2=17;R3=10;R4=12;R5=7:RMR=53	
275											
270										271.4	17.5
										NON-CRYSTALLINE ROCK GRAY TRIASSIC MUDSTONE; med. hard; mod. to sli. weath.; thinly bedded @10 deg.; 1 jt. @ 60 deg.; 2 @ 90 deg (wavy & partially healed) R1=12;R2=17;R3=10;R4=12;R5=7:RMR=58	
265										264.4	24.5
										NON-CRYSTALLINE ROCK TRIASSIC GRAY MUDSTONE & PURPLE SILTSTONE; soft; mod. severe to mod. weath.; thickly laminated to thinly bedded; bedding dips @10 deg,calcite infilling; no joints evident R1=4;R2=3;R3=10;R4=6;R5=7:RMR=30	
260											
255											
250											
							RS-5			246.5	42.4
245							RS-4			**NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE & SANDSTONE; mod. hard; sli. weath.; thickly bedded; no joints observed R1-12;R2=20;R3=25;R4=20;R5=7:RMR=84	
							RS-6				
240											
							RS-7				
235											
230											
225											
220											
										217.9	71.0
215										Boring Terminated at Elevation 217.9 ft IN TRIASSIC MUDSTONE	
210											

NCDOT BORE SINGLE R2417AA_GEO_BRDG_SR1400.GPJ NC_DOT.GDT 11/10/09

SHEET //

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 31+90	**OFFSET** 52ft LT	**ALIGNMENT** -Y-	**0 HR.** NM
COLLAR ELEV. 288.9 ft	**TOTAL DEPTH** 71.0 ft	**NORTHING** 651,777	**EASTING** 1,928,437	**24 HR.** 26.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/23/09	**COMP. DATE** 06/24/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 7.5 ft	
CORE SIZE CNWL-NO/NQ	**TOTAL RUN** 63.5 ft	**DRILLER** Estep, J. E.		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
281.4											Begin Coring @ 7.5 ft	
280	281.4	7.5	3.5		(3.0) 86%	(2.4) 69%		(9.5) 95%	(8.2) 82%		281.4 **NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE & SANDSTONE; med. hard; mod. severe to mod. weath.; thinly bedded @ 10 deg; 2 jts @ 30 deg., 2 jts. @ 60 deg. R1=7;R2=17;R3=10;R4=12;R5=7:RMR=53	7.5
	277.9	11.0										
275			5.0		(5.0) 100%	(4.3) 86%						
	272.9	16.0										
270			5.0		(5.0) 100%	(4.1) 82%		(7.0) 100%	(5.4) 77%		271.4 **NON-CRYSTALLINE ROCK** GRAY TRIASSIC MUDSTONE; med. hard; mod. to sli. weath.; thinly bedded @10 deg.; 1 jt. @ 60 deg.; 2 @ 90 deg (wavy & partially healed) R1=12;R2=17;R3=10;R4=12;R5=7:RMR=58	17.5
	267.9	21.0										
265			5.0		(5.0) 100%	(2.9) 58%						
	262.9	26.0						(17.4) 97%	(4.8) 27%		264.4 **NON-CRYSTALLINE ROCK** TRIASSIC GRAY MUDSTONE & PURPLE SILTSTONE; soft; mod. severe to mod. weath.; thickly laminated to thinly bedded; bedding dips @10 deg,calcite infilling; no joints evident R1=4;R2=3;R3=10;R4=6;R5=7:RMR=30	24.5
260			5.0		(4.5) 90%	(1.2) 24%						
	257.9	31.0										
255			5.0		(5.0) 100%	(3.2) 64%						
	252.9	36.0										
250			5.0		(5.0) 100%	(0.0) 0%						
	247.9	41.0										
245			5.0		(5.0) 100%	(3.9) 78%	RS-5 RS-4	(28.6) 100%	(28.6) 100%		246.5 **NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE & SANDSTONE; mod. hard; sli. weath.; thickly bedded; no joints observed R1-12;R2=20;R3=25;R4=20;R5=7:RMR=84	42.4
	242.9	46.0					RS-6					
240			5.0		(5.0) 100%	(5.0) 100%						
	237.9	51.0										
235			5.0		(5.0) 100%	(5.0) 100%	RS-7					
	232.9	56.0										
230			5.0		(5.0) 100%	(5.0) 100%						
	227.9	61.0										
225			5.0		(5.0) 100%	(5.0) 100%						
	222.9	66.0										
220			5.0		(5.0) 100%	(5.0) 100%						
	217.9	71.0									217.9	71.0
215											Boring Terminated at Elevation 217.9 ft IN TRIASSIC MUDSTONE	
210												
205												

NCDOT CORE SINGLE R2417AA_GEO_BRDG_SR1400.GPJ NC_DOT.GDT 11/10/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. B1-C	**STATION** 31+63	**OFFSET** 8ft RT	**ALIGNMENT** -Y-	**0 HR.** N/A
COLLAR ELEV. 289.8 ft	**TOTAL DEPTH** 60.8 ft	**NORTHING** N/A	**EASTING** N/A	**24 HR.** N/A
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 07/07/09	**COMP. DATE** 07/07/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 4.0 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
290										289.8 GROUND SURFACE	0.0
								M		287.8 **ROADWAY EMBANKMENT** RED-BROWN SILTY CLAY	2.0
								M		285.8 **TRIASSIC RESIDUAL** RED-BROWN SILTY CLAY	4.0
285	285.7	4.1	100/.1			100/.1				**NON-CRYSTALLINE ROCK** TRIASSIC MOD. SEVERE WEATHERED MUDSTONE	
280	280.7	9.1	100/.1			100/.1					
275	275.7	14.1	100/.1			100/.1					
270										270.7	19.1
										NON-CRYSTALLINE ROCK TRIASSIC GRAY MUDSTONE TO PURPLE SILTSTONE R1=7;R2=8;R3=10;R4=6;R5=7:RMR=38	
265											
260											
255											
250										249.3	40.5
										NON-CRYSTALLINE ROCK TRIASSIC RED MUDSTONE & SANDSTONE;GRAY MUDSTONE R1=12;R2=20;R3=20;R4=20;R5=7:RMR=79	
245											
240											
235											
230										229.0	60.8
225										Boring Terminated at Elevation 229.0 ft IN TRIASSIC MUDSTONE	
220											
215											
210											

NCDOT BORE SINGLE OLD_R2417AA_GEO_BRDG_SR1400.GPJ NC_DOT.GDT 11/13/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 12

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. B1-C	**STATION** 31+63	**OFFSET** 8ft RT	**ALIGNMENT** -Y-	**0 HR.** N/A
COLLAR ELEV. 289.8 ft	**TOTAL DEPTH** 60.8 ft	**NORTHING** N/A	**EASTING** N/A	**24 HR.** N/A
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 07/07/09	**COMP. DATE** 07/07/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 4.0 ft	
CORE SIZE NXWL	**TOTAL RUN** 41.7 ft	**DRILLER** Estep, J. E.		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
270.7											Begin Coring @ 19.1 ft	
270	270.7	19.1	1.7		(1.6) 94%	(0.9) 53%		(19.7) 92%	(8.4) 39%		270.7 **NON-CRYSTALLINE ROCK** TRIASSIC GRAY MUDSTONE TO PURPLE SILTSTONE R1=7;R2=8;R3=10;R4=6;R5=7:RMR=38	19.1
	269.0	20.8	5.0		(5.0) 100%	(2.6) 52%						
265	264.0	25.8	5.0		(3.9) 78%	(1.0) 20%						
260	259.0	30.8	5.0		(5.0) 100%	(3.2) 64%						
255	254.0	35.8	5.0		(4.5) 90%	(0.7) 14%						
250	249.0	40.8	5.0		(5.0) 100%	(4.8) 96%		(20.3) 100%	(19.8) 98%		249.3 **NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE & SANDSTONE;GRAY MUDSTONE R1=12;R2=20;R3=20;R4=20;R5=7:RMR=79	40.5
245	244.0	45.8	5.0		(5.0) 100%	(5.0) 100%						
240	239.0	50.8	5.0		(5.0) 100%	(5.0) 100%						
235	234.0	55.8	5.0		(5.0) 100%	(5.0) 100%						
230	229.0	60.8									229.0 Boring Terminated at Elevation 229.0 ft IN TRIASSIC MUDSTONE	60.8
225												
220												
215												
210												
205												
200												
195												

NCDOT CORE SINGLE OLD_R2417AA_GEO_BRDG_SR1400.GPJ NC_DOT.GDT 11/13/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 31+48	**OFFSET** 35ft RT	**ALIGNMENT** -Y- — **0 HR.** NM
COLLAR ELEV. 293.9 ft	**TOTAL DEPTH** 76.4 ft	**NORTHING** 651,812	**EASTING** 1,928,347 — **24 HR.** NM
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/01/09	**COMP. DATE** 07/02/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 5.0 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
295										293.9 GROUND SURFACE	0.0
								M		**TRIASSIC RESIDUAL** RED-BROWN MED. STIFF MOIST SILTY CLAY (A-6) 291.4	2.5
290										**WEATHERED ROCK** TRIASSIC MUDSTONE; soft; sev. weath. 288.9	5.0
285	284.2	9.7	100/.1			100/.1				**NON-CRYSTALLINE ROCK** TRIASSIC MUDSTONE; soft; mod. severe weath.	
280	279.2	14.7	100/.1			100/.1					
275										274.3	19.6
270										**NON-CRYSTALLINE ROCK** TRIASSIC GRAY MUDSTONE; med. hard; mod. weath.; thinly bedded @ 10 deg.; 2 healed jts. @ 80-90 deg, 1 @ 40, 1 @ 60 R1=12;R2=17;R3=10;R4=6;R5=7:RMR=52	
265										267.5	26.4
260										**NON-CRYSTALLINE ROCK** TRIASSIC GRAY MUDSTONE TO PURPLE SILTSTONE; soft; mod. severe weath.; mudstone thickly laminated,siltstone very thinly bedded; 1 healed jt. @ 80-90 deg R1=4;R2=3;R3=5;R4=6;R5=7;RMR=25	
255											
250										249.9	44.0
245										**NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE & SANDSTONE, GRAY MUDSTONE; mod. hard; mod. to sli. weath.; thickly bedded; no joints R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84	
240											
235											
230											
225											
220											
215										217.5	76.4
										Boring Terminated at Elevation 217.5 ft IN TRIASSIC SANDSTONE	

NCDOT BORE SINGLE R2417AA_GEO_BRDG_SR1400.GPJ NC_DOT.GDT 11/10/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE		**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 31+48	**OFFSET** 35ft RT	**ALIGNMENT** -Y-	**0 HR.** NM
COLLAR ELEV. 293.9 ft	**TOTAL DEPTH** 76.4 ft	**NORTHING** 651,812	**EASTING** 1,928,347	**24 HR.** NM
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core			**HAMMER TYPE** Automatic
START DATE 07/01/09	**COMP. DATE** 07/02/09	**SURFACE WATER DEPTH** N/A		**DEPTH TO ROCK** 5.0 ft
CORE SIZE CNWL-NO/NQ	**TOTAL RUN** 56.8 ft	**DRILLER** Estep, J. E.		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS — ELEV. (ft)	DEPTH (ft)
274.3											Begin Coring @ 19.6 ft	
	274.3 / 272.5	19.6 / 21.4	1.8		(1.8) 100%	(1.6) 89%		(6.7) 99%	(5.5) 81%		274.3 **NON-CRYSTALLINE ROCK** TRIASSIC GRAY MUDSTONE; med. hard; mod. weath.; thinly bedded @ 10 deg.; 2 healed jts. @ 80-90 deg, 1 @ 40, 1 @ 60 R1=12;R2=17;R3=10;R4=6;R5=7:RMR=52	19.6
270			5.0		(4.9) 98%	(3.9) 78%						
	267.5	26.4									267.5	26.4
265			5.0		(4.1) 82%	(0.4) 7%		(15.9) 90%	(2.9) 16%		**NON-CRYSTALLINE ROCK** TRIASSIC GRAY MUDSTONE TO PURPLE SILTSTONE; soft; mod. severe weath.; mudstone thickly laminated,sltstone very thinly bedded; 1 healed jt. @ 80-90 deg R1=4;R2=3;R3=5;R4=6;R5=7;RMR=25	
	262.5	31.4										
260			5.0		(4.7) 94%	(2.1) 42%						
	257.5	36.4										
255			5.0		(4.7) 94%	(0.4) 8%						
	252.5	41.4										
250			5.0		(4.7) 94%	(2.1) 42%					249.9	44.0
	247.5	46.4						(32.1) 99%	(31.9) 98%		**NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE & SANDSTONE, GRAY MUDSTONE; mod. hard; mod. to sli. weath.; thickly bedded; no joints R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84	
245			5.0		(4.8) 96%	(4.8) 96%						
	242.5	51.4										
240			5.0		(5.0) 100%	(5.0) 100%						
	237.5	56.4										
235			5.0		(5.0) 100%	(5.0) 100%						
	232.5	61.4										
230			5.0		(5.0) 100%	(5.0) 100%						
	227.5	66.4										
225			5.0		(5.0) 100%	(5.0) 100%						
	222.5	71.4										
220			5.0		(5.0) 100%	(5.0) 100%						
	217.5	76.4									217.5	76.4
215											Boring Terminated at Elevation 217.5 ft IN TRIASSIC SANDSTONE	
210												
205												
200												
195												

NCDOT CORE SINGLE R2417AA_GEO_BRDG_SR1400.GPJ NC_DOT.GDT 11/10/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 33+40	**OFFSET** 41ft LT	**ALIGNMENT** -Y-	**0 HR.** NM
COLLAR ELEV. 282.5 ft	**TOTAL DEPTH** 30.8 ft	**NORTHING** 651,629	**EASTING** 1,928,443	**24 HR.** NM
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/24/09	**COMP. DATE** 06/24/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 6.0 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
285											
										282.5 GROUND SURFACE	0.0
280								M		**TRIASSIC RESIDUAL** RED-BROWN MED. STIFF TO HARD MOIST SILTY CLAY (A-6)	
										276.5	6.0
275	275.2	7.3	100/.1			100/.1				**NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE;soft;mod. severe weath.	
270	270.2	12.3	100/.1			100/.1				269.8	12.7
265										**NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE & SANDSTONE; mod. hard;sli. weath.; thickly bedded; 1 jt. @ 70 deg. R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84	
										264.6	17.9
260										**NON-CRYSTALLINE ROCK** TRIASSIC PURPLE SILTSTONE;soft to med. hard; mod. severe weath.; v. thinly bedded @ 10 deg.; no joints R1=4;R2=3;R3=10;R4=6;R5=7:RMR=30	
										262.8	19.7
255										**NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE & SANDSTONE; mod hard; mod. to sli. weath.;thinly to thickly bedded @ 10 deg.; 1 jt. @ 20 deg. R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84	
										251.7	30.8
250										Boring Terminated at Elevation 251.7 ft IN TRIASSIC SANDSTONE	
245											
240											
235											
230											
225											
220											
215											
210											
205											

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SHEET 14

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 33+40	**OFFSET** 41ft LT	**ALIGNMENT** -Y-	**0 HR.** NM
COLLAR ELEV. 282.5 ft	**TOTAL DEPTH** 30.8 ft	**NORTHING** 651,629	**EASTING** 1,928,443	**24 HR.** NM
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/24/09	**COMP. DATE** 06/24/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 6.0 ft	
CORE SIZE CNWL-NO/NQ	**TOTAL RUN** 18.1 ft	**DRILLER** Estep, J. E.		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
269.8											Begin Coring @ 12.7 ft	
	269.8	12.7	3.4		(3.4) 100%	(3.4) 100%		(5.2) 100%	(4.7) 90%		269.8 **NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE & SANDSTONE; mod. hard;sli. weath.; thickly bedded; 1 jt. @ 70 deg. R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84	12.7
	266.4	16.1									264.6	17.9
265			5.0		(5.0) 100%	(2.7) 54%					**NON-CRYSTALLINE ROCK** TRIASSIC PURPLE SILTSTONE;soft to med. hard; mod. severe weath.; v. thinly bedded @ 10 deg.; no joints R1=4;R2=3;R3=10;R4=6;R5=7:RMR=30	
								(1.8) 100%	(0.0) 0%		262.8	19.7
	261.4	21.1						(11.1) 100%	(10.9) 98%		**NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE & SANDSTONE; mod hard; mod. to sli. weath.;thinly to thickly bedded @ 10 deg.; 1 jt. @ 20 deg. R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84	
260			5.0		(5.0) 100%	(4.8) 96%						
	256.4	26.1										
255			4.7		(4.7) 100%	(4.7) 100%						
	251.7	30.8									251.7	30.8
250											Boring Terminated at Elevation 251.7 ft IN TRIASSIC SANDSTONE	
245												
240												
235												
230												
225												
220												
215												
210												
205												
200												
195												
190												

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. EB2-C	**STATION** 33+14	**OFFSET** 2ft RT	**ALIGNMENT** -Y- — **0 HR.** NM
COLLAR ELEV. 285.0 ft	**TOTAL DEPTH** 31.3 ft	**NORTHING** 651,649	**EASTING** 1,928,397 — **24 HR.** NM
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/07/09	**COMP. DATE** 07/07/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 6.5 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	ELEV. (ft)	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
285										285.0	GROUND SURFACE	0.0
								M		284.0	**ROADWAY EMBANKMENT** RED-BROWN MED. STIFF MOIST SILTY CLAY (A-6)	1.0
										283.0	**TRIASSIC RESIDUAL** RED-BROWN MED. STIFF MOIST SILTY CLAY (A-6)	2.0
280	278.5	6.5	100/.1			100/.1				278.5	**WEATHERED ROCK** TRIASSIC MUDSTONE; soft; severe weath.	6.5
275	273.5	11.5	100/.1			100/.1					**NON-CRYSTALLINE ROCK** TRIASSIC MUDSTONE/SANDSTONE; soft; mod. severe weath.	
270										272.1	**NON-CRYSTALLINE ROCK** RED TRIASSIC SANDSTONE;mod. hard; sli. weath.; v. thickly bedded; no joints R1=12;R2=20;R3=20;R4=20;R5=7:RMR=79	12.9
265										265.9	**NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE; soft; mod. severe weath.; v. thinly bedded @10 deg.; no joints R1=7;R2=3;R3=10;R4=6;R5=7:RMR=33	19.1
260										264.0	**NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE & SANDSTONE; med. to mod. hard; mod. to sli. weath.; thickly to v. thickly bedded; 1 jt @ 60 deg. R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84	21.0
255										253.7	Boring Terminated at Elevation 253.7 ft IN TRIASSIC SANDSTONE	31.3
250												
245												
240												
235												
230												
225												
220												
215												
210												
205												

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SHEET 15

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. EB2-C	**STATION** 33+14	**OFFSET** 2ft RT	**ALIGNMENT** -Y- — **0 HR.** NM
COLLAR ELEV. 285.0 ft	**TOTAL DEPTH** 31.3 ft	**NORTHING** 651,649	**EASTING** 1,928,397 — **24 HR.** NM
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/07/09	**COMP. DATE** 07/07/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 6.5 ft
CORE SIZE CNWL-NO/NQ	**TOTAL RUN** 18.4 ft	**DRILLER** Estep, J. E.	

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	ELEV. (ft)	DESCRIPTION AND REMARKS	DEPTH (ft)
272.1												Begin Coring @ 12.9 ft	
270	272.1	12.9	3.4		(3.4) 100%	(3.4) 100%		(6.2) 100%	(6.2) 100%		272.1	**NON-CRYSTALLINE ROCK** RED TRIASSIC SANDSTONE;mod. hard; sli. weath.; v. thickly bedded; no joints R1=12;R2=20;R3=20;R4=20;R5=7:RMR=79	12.9
	268.7	16.3	5.0		(5.0) 100%	(3.5) 70%					265.9		19.1
265	263.7	21.3						(1.9) 100%	(0.4) 21%		264.0	**NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE; soft; mod. severe weath.; v. thinly bedded @10 deg.; no joints R1=7;R2=3;R3=10;R4=6;R5=7:RMR=33	21.0
260	258.7	26.3	5.0		(5.0) 100%	(5.0) 100%		(10.3) 100%	(10.3) 100%			**NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE & SANDSTONE; med. to mod. hard; mod. to sli. weath.; thickly to v. thickly bedded; 1 jt @ 60 deg. R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84	
255	253.7	31.3	5.0		(5.0) 100%	(5.0) 100%					253.7	Boring Terminated at Elevation 253.7 ft IN TRIASSIC SANDSTONE	31.3
250													
245													
240													
235													
230													
225													
220													
215													
210													
205													
200													
195													

NCDOT CORE SINGLE R2417AA_GEO_BRDG_SR1400.GPJ NC_DOT.GDT 11/10/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 32+90	**OFFSET** 43ft RT	**ALIGNMENT** -Y- — **0 HR.** N/A
COLLAR ELEV. 285.5 ft	**TOTAL DEPTH** 40.0 ft	**NORTHING** 651,667	**EASTING** 1,928,353 — **24 HR.** 37.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 06/24/09	**COMP. DATE** 06/25/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 3.9 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
285.5										GROUND SURFACE	0.0
284.5								M		**ROADWAY EMBANKMENT** RED-BROWN MED. STIFF MOIST SILTY CLAY (A-6)	1.0
281.6										**WEATHERED ROCK** TRIASSIC MUDSTONE; soft; severely weathered	3.9
277.1										**NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE TO PURPLE SILTSTONE; soft to med. hard; mod. severe weath.; v. thinly bedded @ 10 deg.; 1 jt. @ 70 deg. R1=7;R2=3;R3=10;R4=6;R5=7:RMR=33	8.4
							RS-8			**NON-CRYSTALLINE ROCK** TRIASSIC RED SANDSTONE; med. to mod. hard; v. sli. weath.;thickly bedded, no jts. R1=12;R2=20;R3=20;R4=20;R5=7:RMR=79	17.0
266.2							RS-9 RS-10			**NON-CRYSTALLINE ROCK** TRIASSIC PURPLE SILTSTONE; soft; mod severe weath.; v. thinly bedded @ 10 deg.; no jts. R1=4;R2=17;R3=10;R4=12;R5=7:RMR=50	19.3
260.2										**NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE & SANDSTONE; med. to mod. hard; sli. to v. sli. weath.;thinly to thickly bedded @ 10 deg.; 1 jt. @ 45 deg., 1 jt. @ 70 deg. R1=12;R2=20;R3=10;R4=12;R5=7:RMR=61	25.3
255.5										**NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE; med. hard.; sli. weath.; thinly bedded @10 deg.; 4 jts. @ 70 deg. R1=12;R2=8;R3=10;R4=6;R5=7:RMR=43	30.0
245.5										**NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE & SANDSTONE TO GRAY MUDSTONE; mod. hard w/soft seam @ 35' to 36'; mod. to sli. weath.; thickly bedded.; 2 jts. @ 45 deg. R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84	40.0
										Boring Terminated at Elevation 245.5 ft IN TRIASSIC MUDSTONE	

NCDOT BORE SINGLE R2417AA_GEO_BRDG_SR1400.GPJ NC_DOT.GDT 11/12/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 16

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** LEE	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION BRIDGE ON -Y- (SR 1400) OVER -L- (SANFORD BYPASS)			**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 32+90	**OFFSET** 43ft RT	**ALIGNMENT** -Y- — **0 HR.** N/A
COLLAR ELEV. 285.5 ft	**TOTAL DEPTH** 40.0 ft	**NORTHING** 651,667	**EASTING** 1,928,353 — **24 HR.** 37.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 06/24/09	**COMP. DATE** 06/25/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 3.9 ft
CORE SIZE CNWL-NO/NQ	**TOTAL RUN** 36.1 ft	**DRILLER** Estep, J. E.	

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS — ELEV. (ft)	DEPTH (ft)
281.6											Begin Coring @ 3.9 ft	
280	281.6 / 280.5	3.9 / 5.0	1.1		(1.1) 100%	(0.4) 36%		(2.9) 64%	(0.8) 18%		281.6 **NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE TO PURPLE SILTSTONE; soft to med. hard; mod. severe weath.; v. thinly bedded @ 10 deg.; 1 jt. @ 70 deg. R1=7;R2=3;R3=10;R4=6;R5=7:RMR=33	3.9
			5.0		(3.4) 68%	(1.2) 24%					277.1	8.4
275	275.5	10.0						(8.6) 100%	(8.6) 100%		**NON-CRYSTALLINE ROCK** TRIASSIC RED SANDSTONE; med. to mod. hard; v. sli. weath.;thickly bedded, no jts. R1=12;R2=20;R3=20;R4=20;R5=7:RMR=79	
			5.0		(5.0) 100%	(5.0) 100%						
270	270.5	15.0										
			5.0		(5.0) 100%	(4.4) 88%	RS-8				268.5	17.0
								(2.3) 100%	(1.7) 74%		**NON-CRYSTALLINE ROCK** TRIASSIC PURPLE SILTSTONE; soft; mod. severe weath.; v. thinly bedded @ 10 deg.; no jts. R1=4;R2=17;R3=10;R4=12;R5=7:RMR=50	19.3
265	265.5	20.0					RS-9 RS-10	(6.0) 100%	(6.0) 100%			
			5.0		(5.0) 100%	(5.0) 100%						
260	260.5	25.0									260.2 **NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE & SANDSTONE; med. to mod. hard; sli. to v. sli. weath.;thinly to thickly bedded @ 10 deg.; 1 jt. @ 45 deg., 1 jt. @ 70 deg. R1=12;R2=20;R3=10;R4=12;R5=7:RMR=61	25.3
			5.0		(3.1) 62%	(1.8) 36%		(2.8) 60%	(1.5) 32%			
255	255.5	30.0									**NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE; med. hard.; sli. weath.; thinly bedded @10 deg.; 4 jts. @ 70 deg. R1=12;R2=8;R3=10;R4=6;R5=7:RMR=43	
			5.0		(5.0) 100%	(5.0) 100%		(10.0) 100%	(9.0) 90%		255.5	30.0
250	250.5	35.0									**NON-CRYSTALLINE ROCK** TRIASSIC RED MUDSTONE & SANDSTONE TO GRAY MUDSTONE; mod. hard w/soft seam @ 35' to 36'; mod. to sli. weath.; thickly bedded.; 2 jts. @ 45 deg. R1=12;R2=20;R3=25;R4=20;R5=7:RMR=84	
			5.0		(5.0) 100%	(4.0) 80%						
245	245.5	40.0									245.5	40.0
											Boring Terminated at Elevation 245.5 ft IN TRIASSIC MUDSTONE	
240												
235												
230												
225												
220												
215												
210												
205												

NCDOT CORE SINGLE R2417AA_GEO_BRDG_SR1400.GPJ NC_DOT.GDT 11/12/09

TEST RESULTS

PROJECT: 34431 (R-2417AA)
COUNTY: LEE
SITE DESCRIPTION: BRIDGE (STR 1) ON SR 1400 (CUMNOCK RD.) OVER US 421-NC 87 (SANFORD BYPASS)

SOIL SAMPLE RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS	N	L.L.	P.I.	% BY WEIGHT C. SAND	F. SAND	SILT	CLAY	% PASSING SIEVES 10	40	200	% MOISTURE	% ORGANIC	UNIT WT. (d)	VOID RATIO
		B1-A																
SS-1	52.0 LT	31+90 -Y-	2.1-3.6	A-6(9)	55	35	11	7.1	11.7	51.0	30.2	100	96	85				

ROCK SAMPLE RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	RQD	UNIT WT (pcf)	Q(ksf)	E(MPsi)
		EB1-A					
RS-1	55.0 LT.	30+55 -Y-	23.2-23.7	95%	160.3	2058	2.49
RS-2			27.7-28.3	95%	162.2	2222	2.37
RS-3			36.3-36.8	95%	164.7	3514	4.68
		B1-A					
RS-5	52.0 LT.	31+90 -Y-	41.4-41.7	27%	166.2	2867.04	4.93
RS-4			42.4-42.7	100%	176.7	1015.2	1.149
RS-6			44.6-44.8	100%	165	2908.8	3.33
RS-7			51.2-51.8	100%	160.3	1329.12	1.644
		EB2-B					
RS-8	43.0 RT.	32+90 -Y-	14.7-15.1	100%	158.9	2656.8	2.04
RS-9			18.1-18.5	76%	181.8	866.88	0.881
RS-10			19.3-20.0	100%	156.8	1154.88	1.828

EB1-A PHOTO 1 OF 2

EB1-A PHOTO 2 OF 2

EB1-B PHOTO 1 OF 3

EB1-B PHOTO 2 OF 3

EB1-B PHOTO 3 OF 3

EB1-C PHOTO 1 OF 4

EB1-C PHOTO 2 OF 4

EB1-C PHOTO 3 OF 4

EB1-C PHOTO 4 OF 4

B1-A PHOTO 1 OF 7

B1-A PHOTO 2 OF 7

B1-A PHOTO 3 OF 7

B1-A PHOTO 4 OF 7

B1-A PHOTO 5 OF 7

B1-A PHOTO 6 OF 7

B1-A PHOTO 7 OF 7

B1-B PHOTO 1 OF 6

B1-B PHOTO 2 OF 6

B1-B PHOTO 3 OF 6

B1-B PHOTO 4 OF 6

B1-B PHOTO 5 OF 6

B1-B PHOTO 6 OF 6

B1-C PHOTO 1 OF 5

B1-C PHOTO 2 OF 5

B1-C PHOTO 3 OF 5

B1-C PHOTO 4 OF 5

B1-C PHOTO 5 OF 5

EB2-A PHOTO 1 OF 2

EB2-A PHOTO 2 OF 2

EB2-B PHOTO 1 OF 4

EB2-B PHOTO 2 OF 4

EB2-B PHOTO 3 OF 4

EB2-B PHOTO 4 OF 4

EB2-C PHOTO 1 OF 3

EB2-C PHOTO 2 OF 3

EB2-C PHOTO 3 OF 3

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34431.1.2 (R-2417AA)	1	16

PROJECT: 34431.1.2

ID: R-2417AA

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34431.1.2 (R-2417AA) F.A. PROJ. STP-NHF-421(2)

COUNTY LEE

PROJECT DESCRIPTION US 421-NC 87 (SANFORD BYPASS) FROM WEST OF SR 1400 TO WEST OF US 1-15-501

SITE DESCRIPTION DUAL BRIDGES ON US 421/NC 87 (SANFORD BYPASS) OVER ATLANTIC & WESTERN RR (STRUCTURES #4 & #5)

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4, 5	PROFILES
6-9	CROSS SECTIONS
10-15	BORE LOGS
16	SOIL TEST RESULTS

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) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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 THIS 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.

PERSONNEL

C. C. MURRAY

J. E. ESTEP

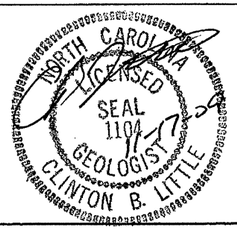
M. R. MOORE

INVESTIGATED BY C.C. MURRAY

CHECKED BY C. B. LITTLE

SUBMITTED BY C. B. LITTLE

DATE NOVEMBER, 2009



DRAWN BY: J. E. ROLFSMEYER

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NOTE - 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.

PROJECT REFERENCE NO.	SHEET NO.
34431.1.2 (R-2417AA)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING # 10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
# 40	30 MX	50 MX	51 MN											
# 200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT				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		HIGHLY ORGANIC SOILS
PLASTIC INDEX	6 MX		NP	10 MX	10 MN	11 MN	11 MN	10 MX	10 MN	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A 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

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE MM: 305 | 75 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	26 OR MORE	HIGH

COLOR

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.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%
MODERATELY ORGANIC	5 - 10%	12 - 20%
HIGHLY ORGANIC	>10%	>20%

OTHER MATERIAL	
TRACE	1 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SOUNDING ROD
- SPT CPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- REF SPT REFUSAL

SAMPLE DESIGNATIONS
- S - BULK SAMPLE
- SS - SPLIT SPOON SAMPLE
- ST - SHELBY TUBE SAMPLE
- RS - ROCK SAMPLE
- RT - RECOMPACTED TRIAXIAL SAMPLE
- CBR - CALIFORNIA BEARING RATIO SAMPLE

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [X] CME-550
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [X] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [ ] -N_____
- [ ] -H_____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, YIELDS SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, YIELDS SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
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 PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FEET
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

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, AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - 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 (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 THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BL-128 @ BL STA. 129+00.77 N 646918.0590 E 1935806.7120,
ELEVATION: 255.42 FT.

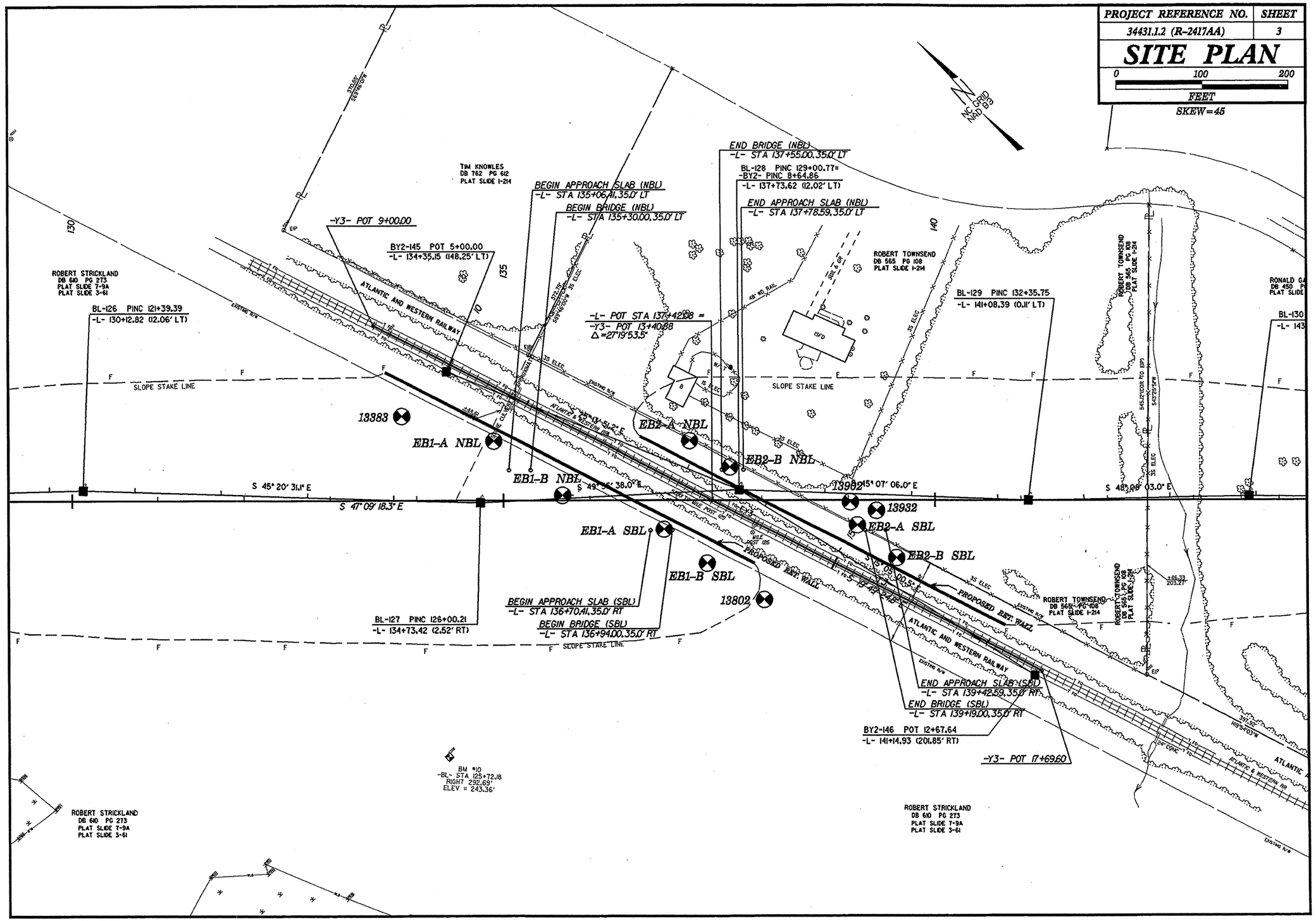
NOTES:
BORING ELEVATIONS DERIVED FROM POINTS SET BY NCDOT-LOCATION & SURVEY UNIT AS WELL AS BL-128.

PROJECT REFERENCE NO.	SHEET
34431.1.2 (R-2417AA)	3

SITE PLAN

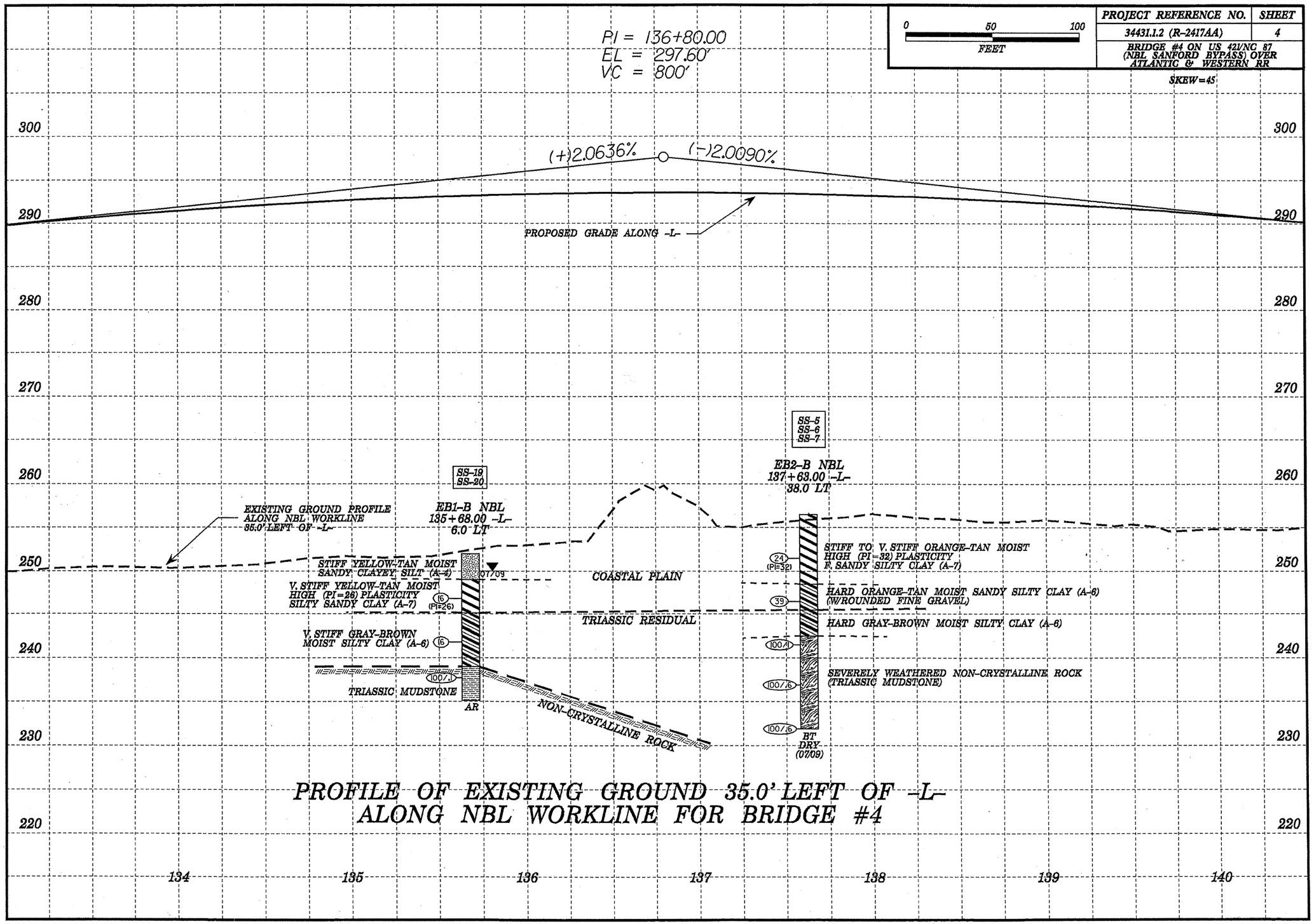
0 100 200
FEET

SKEW=45



PROJECT REFERENCE NO.	SHEET
34431.1.2 (R-2417AA)	4
BRIDGE #4 ON US 421/NC 87 (NBL SANFORD BYPASS) OVER ATLANTIC & WESTERN RR	

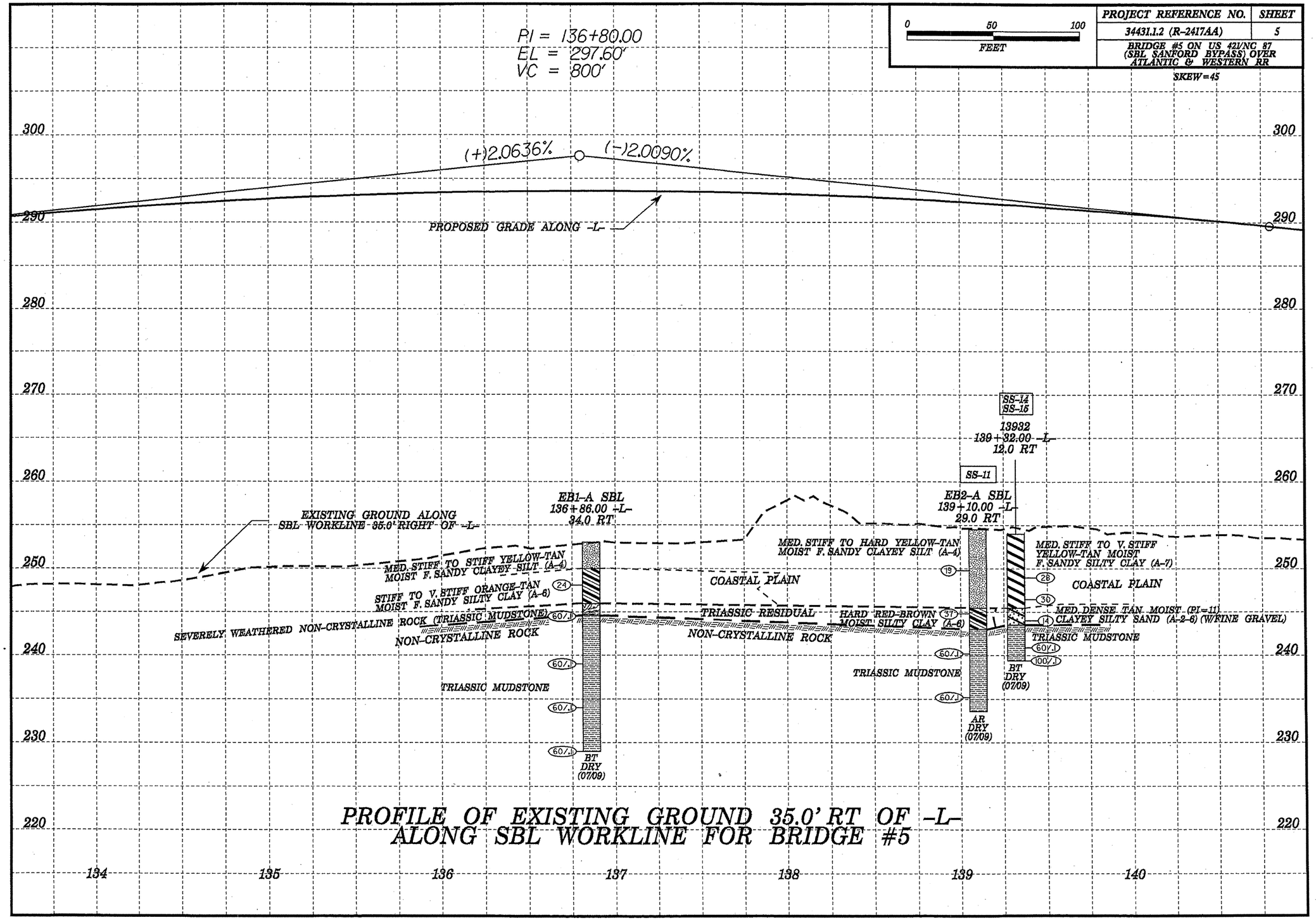
SKEW=45



PROFILE OF EXISTING GROUND 35.0' LEFT OF -L- ALONG NBL WORKLINE FOR BRIDGE #4

PROJECT REFERENCE NO.	SHEET
34431.1.2 (R-2417AA)	5
BRIDGE #5 ON US 421/NC 87 (SBL SANFORD BYPASS) OVER ATLANTIC & WESTERN RR	

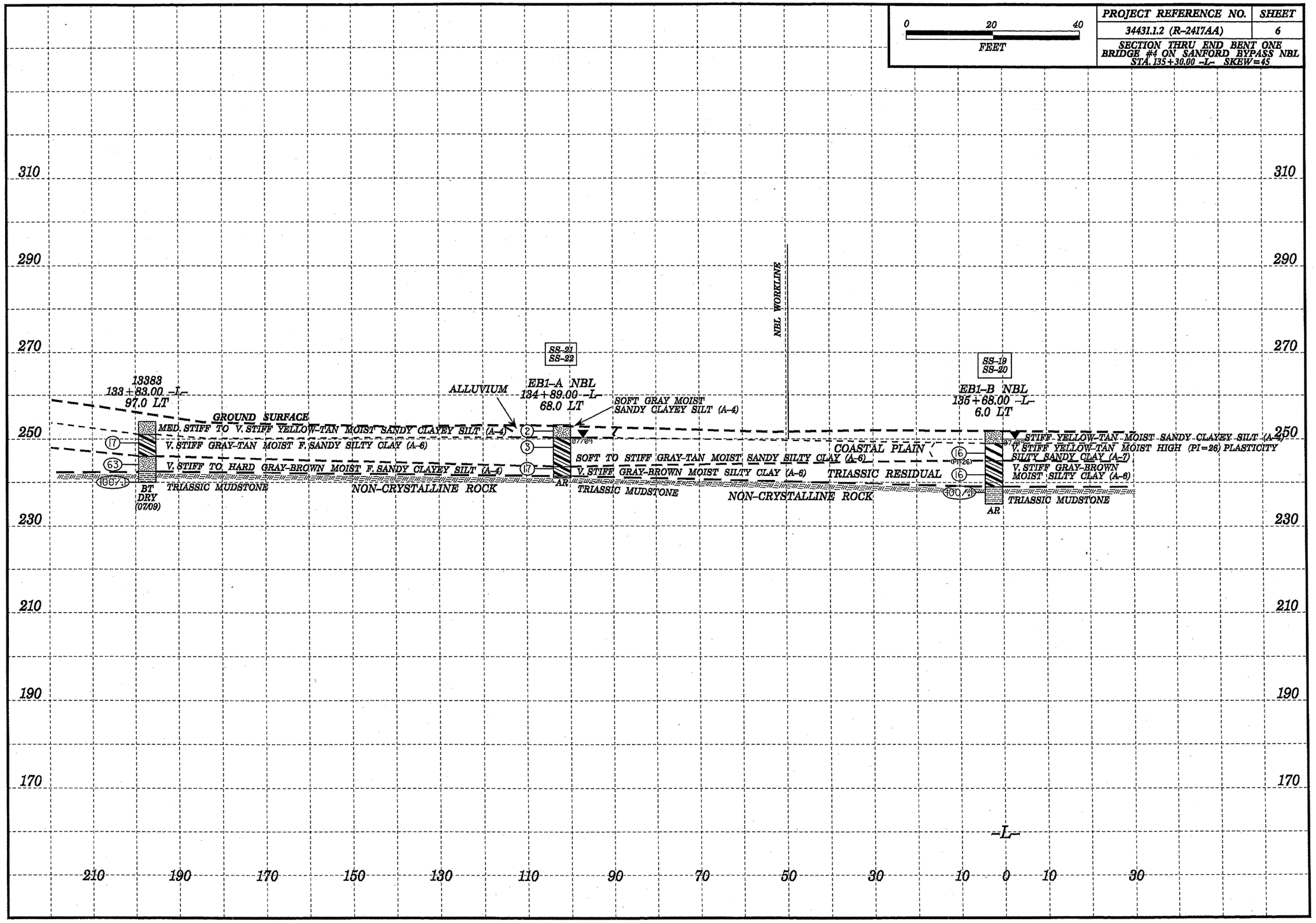
SKEW=45



PROFILE OF EXISTING GROUND 35.0' RT OF -L-
ALONG SBL WORKLINE FOR BRIDGE #5

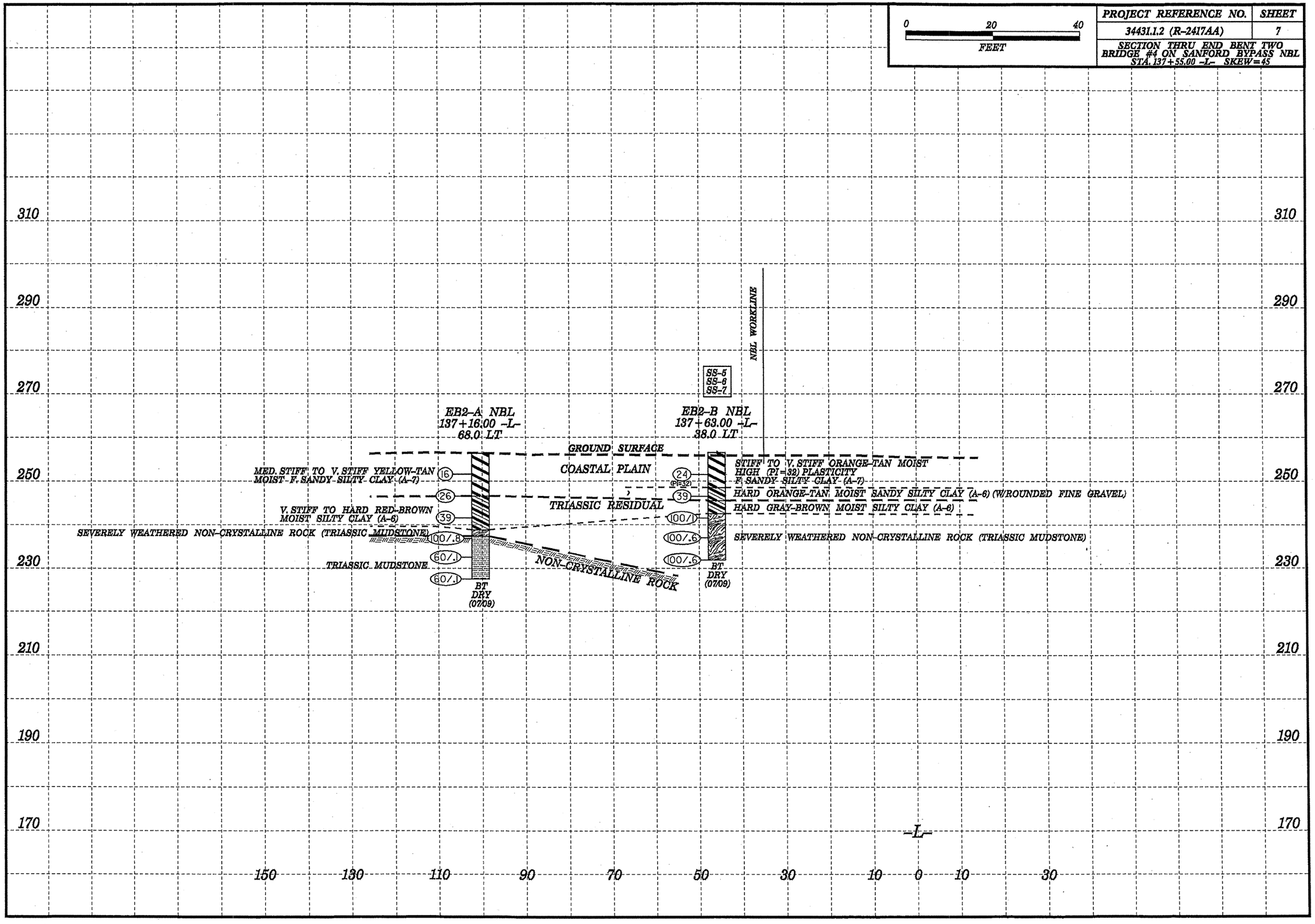
PROJECT REFERENCE NO.	SHEET
34431.1.2 (R-2417AA)	6

SECTION THRU END BENT ONE
BRIDGE #4 ON SANFORD BYPASS NBL
STA. 135+30.00 -L- SKEW=45



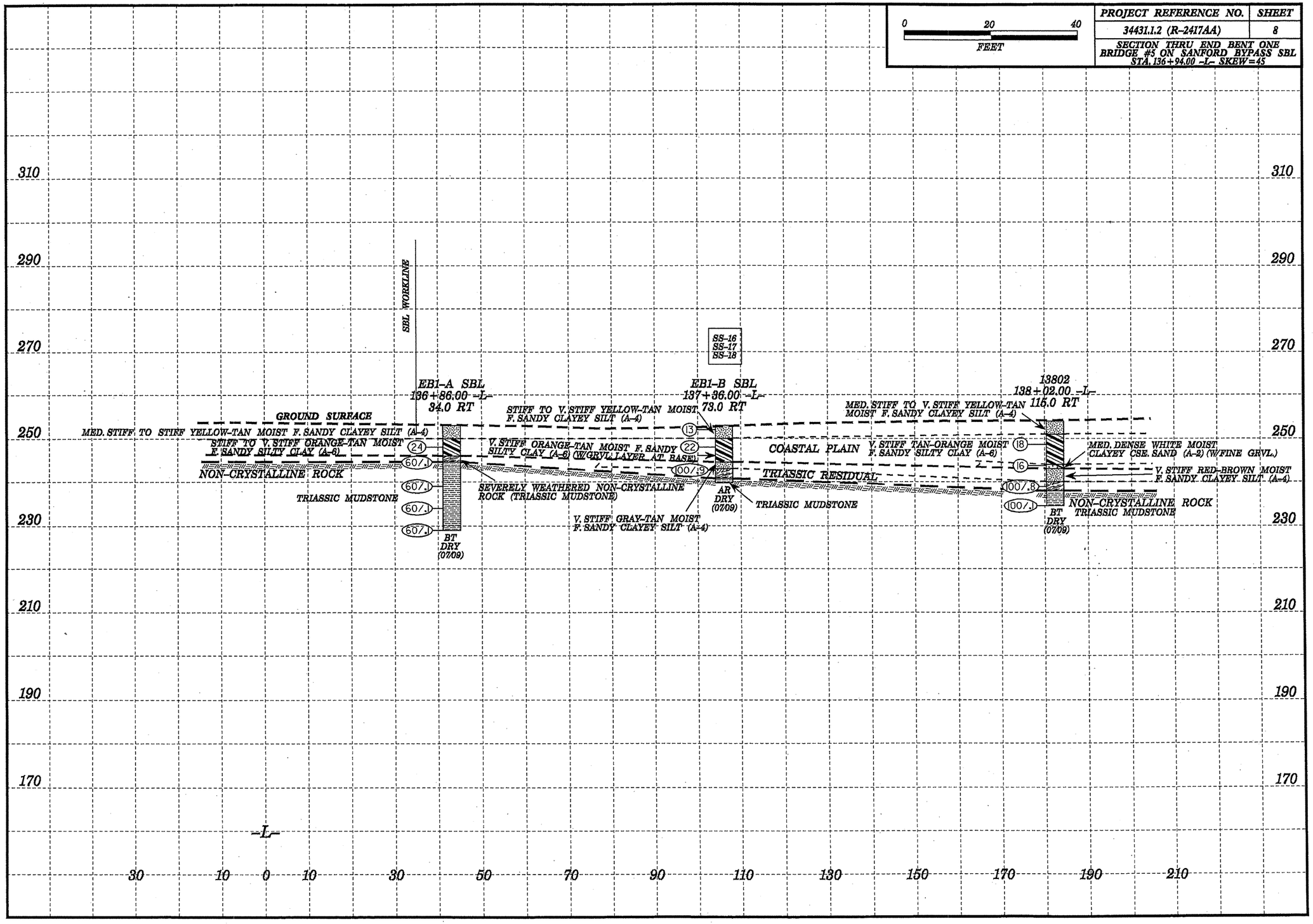
PROJECT REFERENCE NO.	SHEET
34431.1.2 (R-2417AA)	7

SECTION THRU END BENT TWO
BRIDGE #4 ON SANFORD BYPASS NBL
STA. 137+55.00 -L- SKEW=45



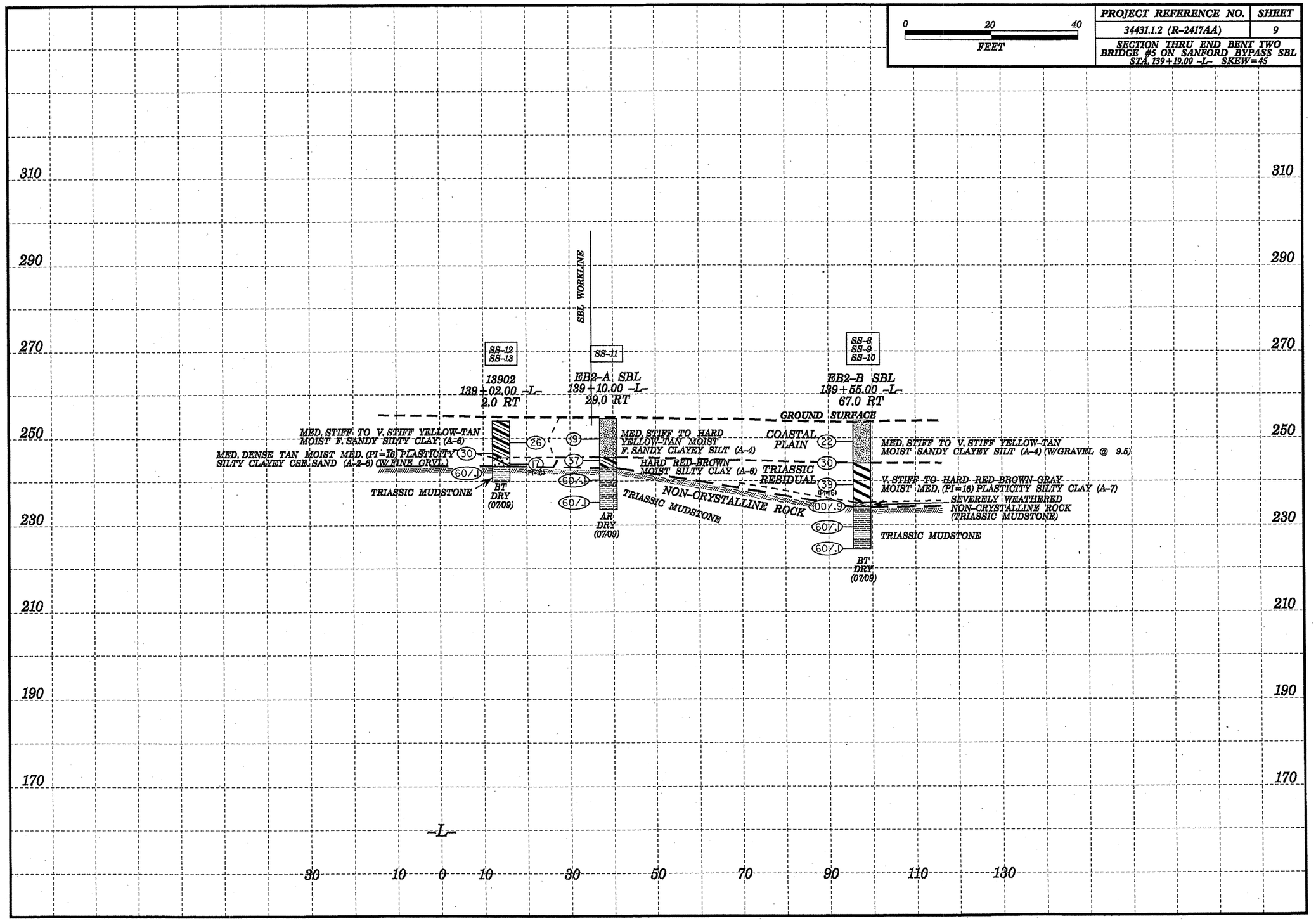
PROJECT REFERENCE NO.	SHEET
34431.1.2 (R-2417AA)	8

SECTION THRU END BENT ONE
BRIDGE #5 ON SANFORD BYPASS SBL
STA. 136+94.00 -L- SKEW=45



PROJECT REFERENCE NO.	SHEET
34431.1.2 (R-2417AA)	9

SECTION THRU END BENT TWO
BRIDGE #5 ON SANFORD BYPASS SBL
STA. 139+19.00 -L- SKEW=45



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431.1.2	ID. R-2417AA	COUNTY LEE	GEOLOGIST Murray, C. C.
SITE DESCRIPTION BRIDGES #4 & 5 ON US 421/ NC 87 (SANFORD BYPASS) OVER ATLANTIC & WESTERN RR			GROUND WTR (ft)
BORING NO. 13383	STATION 133+83	OFFSET 97ft LT	ALIGNMENT -L-
COLLAR ELEV. 254.0 ft	TOTAL DEPTH 14.0 ft	NORTHING 647,246	EASTING 1,935,578
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
START DATE 07/28/09	COMP. DATE 07/28/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 11.5 ft

GROUND WTR (ft)	
0 HR.	Dry
24 HR.	Dry

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
255										254.0 GROUND SURFACE	0.0
										COASTAL PLAIN MED. STIFF TO V. STIFF YELLOW-TAN MOIST SANDY CLAYEY SILT (A-4)	3.0
250	250.1	3.9	5	6	11	17		M		COASTAL PLAIN V. STIFF GRAY-TAN MOIST F. SANDY SILTY CLAY (A-6)	8.0
245	245.1	8.9	7	25	38	63		M		TRIASSIC RESIDUAL V. STIFF TO HARD GRAY-BROWN MOIST F. SANDY CLAYEY SILT (A-4)	11.5
240					100/.1	100/.1				NON-CRYSTALLINE ROCK TRIASSIC MUDSTONE	14.0
235										Boring Terminated at Elevation 240.0 ft IN NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE)	
230											
225											
220											
215											
210											
205											
200											
195											
190											
185											
180											
175											

NCDOT BORE SINGLE R2417_GEO_BRDG0004&0005_LEE.GPJ NC_DOT.GDT 10/28/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET 10/16

PROJECT NO. 34431.1.2	ID. R-2417AA	COUNTY LEE	GEOLOGIST Murray, C. C.
SITE DESCRIPTION BRIDGES #4 & 5 ON US 421/ NC 87 (SANFORD BYPASS) OVER ATLANTIC & WESTERN RR			GROUND WTR (ft)
BORING NO. 13802	STATION 138+02	OFFSET 115ft RT	ALIGNMENT -L-
COLLAR ELEV. 254.0 ft	TOTAL DEPTH 19.4 ft	NORTHING 646,806	EASTING 1,935,741
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
START DATE 07/28/09	COMP. DATE 07/28/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 16.0 ft

GROUND WTR (ft)	
0 HR.	Dry
24 HR.	Dry

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
255										254.0 GROUND SURFACE	0.0
										COASTAL PLAIN MED. STIFF TO V. STIFF YELLOW-TAN MOIST F. SANDY CLAYEY SILT (A-4)	3.0
250	249.7	4.3	8	8	10	18		M		COASTAL PLAIN V. STIFF TAN-ORANGE MOIST F. SANDY SILTY CLAY (A-6)	10.0
245	244.7	9.3	5	6	10	16		M		244.0 / 243.0 COASTAL PLAIN MED. DENSE WHITE MOIST CLAYEY CSE. SAND (A-2) (W/ FINE GRAVEL)	11.0
240	239.7	14.3	33	67/.3		100/.8				TRIASSIC RESIDUAL V. STIFF RED-BROWN MOIST F. SANDY CLAYEY SILT (A-4)	14.0
235	234.7	19.3	100/.1			100/.1				WEATHERED ROCK TRIASSIC MUDSTONE	16.0
										NON-CRYSTALLINE ROCK TRIASSIC MUDSTONE	19.4
										Boring Terminated at Elevation 234.6 ft IN NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE)	
230											
225											
220											
215											
210											
205											
200											
195											
190											
185											
180											
175											

NCDOT BORE SINGLE R2417_GEO_BRDG0004&0005_LEE.GPJ NC_DOT.GDT 10/28/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431.1.2	ID. R-2417AA	COUNTY LEE	GEOLOGIST Murray, C. C.
SITE DESCRIPTION BRIDGES #4 & 5 ON US 421/ NC 87 (SANFORD BYPASS) OVER ATLANTIC & WESTERN RR			GROUND WTR (ft)
BORING NO. 13902	STATION 139+02	OFFSET 2ft RT	ALIGNMENT -L- — 0 HR. Dry
COLLAR ELEV. 254.0 ft	TOTAL DEPTH 14.1 ft	NORTHING 646,820	EASTING 1,935,891 — 24 HR. Dry
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
START DATE 07/23/09	COMP. DATE 07/23/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 10.5 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
255										254.0 GROUND SURFACE	0.0
										COASTAL PLAIN MED. STIFF TO V. STIFF YELLOW-TAN MOIST F. SANDY SILTY CLAY (A-6)	
250	250.0	4.0									
			5	10	16	26	SS-12	M			
	247.5	6.5									
			5	12	18	30		M			
245	245.0	9.0								245.5	8.5
			8	8	9	17	SS-13	M		243.5 COASTAL PLAIN MED. DENSE TAN MOIST MED. (PI=16) PLASTICITY SILTY CLAYEY CSE. SAND (A-2-6) (W/ FINE GRAVEL)	10.5
	242.5	11.5									
			35	60/.1		60/.1					
240						100/.1				239.9 NON-CRYSTALLINE ROCK TRIASSIC MUDSTONE	14.1
										Boring Terminated at Elevation 239.9 ft IN NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE)	
235											
230											
225											
220											
215											
210											
205											
200											
195											
190											
185											
180											
175											

NCDOT BORE SINGLE R2417_GEO_BRDG0000430005_LEE.GPJ NC_DOT.GDT 10/28/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET 11/16

PROJECT NO. 34431.1.2	ID. R-2417AA	COUNTY LEE	GEOLOGIST Murray, C. C.
SITE DESCRIPTION BRIDGES #4 & 5 ON US 421/ NC 87 (SANFORD BYPASS) OVER ATLANTIC & WESTERN RR			GROUND WTR (ft)
BORING NO. 13932	STATION 139+32	OFFSET 12ft RT	ALIGNMENT -L- — 0 HR. Dry
COLLAR ELEV. 254.0 ft	TOTAL DEPTH 14.6 ft	NORTHING 646,793	EASTING 1,935,906 — 24 HR. Dry
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
START DATE 07/23/09	COMP. DATE 07/23/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 10.5 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
255										254.0 GROUND SURFACE	0.0
										COASTAL PLAIN MED. STIFF TO V. STIFF YELLOW-TAN MOIST F. SANDY SILTY CLAY (A-7)	
250	250.0	4.0									
			7	11	17	28	SS-14	M			
	247.5	6.5									
			6	12	18	30		M			
245	245.0	9.0								245.5	8.5
			12	6	8	14	SS-15	M		243.5 COASTAL PLAIN MED. DENSE TAN MOIST (PI=11) CLAYEY SILTY SAND (A-2-6) (W/ FINE GRAVEL)	10.5
	241.5	12.5									
			37	60/.1		60/.1					
240	239.5	14.5								239.4 NON-CRYSTALLINE ROCK TRIASSIC MUDSTONE	14.6
			100/.1			100/.1				Boring Terminated at Elevation 239.4 ft IN NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE)	
235											
230											
225											
220											
215											
210											
205											
200											
195											
190											
185											
180											
175											

NCDOT BORE SINGLE R2417_GEO_BRDG0000430005_LEE.GPJ NC_DOT.GDT 10/28/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431.1.2	ID. R-2417AA	COUNTY LEE	GEOLOGIST Murray, C. C.
SITE DESCRIPTION BRIDGE #4 ON US 421/ NC 87 (NBL SANFORD BYPASS) OVER ATLANTIC & WESTERN RR			GROUND WTR (ft)
BORING NO. EB1-A NBL	STATION 134+89	OFFSET 68ft LT	ALIGNMENT -L-	0 HR. Dry
COLLAR ELEV. 253.3 ft	TOTAL DEPTH 12.3 ft	NORTHING 647,153	EASTING 1,935,636	24 HR. 3.0 *
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic	
START DATE 07/28/09	COMP. DATE 07/28/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 11.9 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
255											
										253.3 GROUND SURFACE	0.0
	252.8	0.5								ALLUVIAL	
			1	0	2	2	SS-21	W		SOFT GRAY MOIST SANDY CLAYEY SILT (A-4)	
250										250.3	3.0
	249.1	4.2								COASTAL PLAIN	
			0	1	2	3	SS-22	W		SOFT TO STIFF GRAY-TAN MOIST SANDY SILTY CLAY (A-6)	
245											
	244.1	9.2								243.6	9.7
			2	5	12	17		M		TRIASSIC RESIDUAL	
										V. STIFF GRAY-BROWN MOIST SILTY CLAY (A-6) 241.4	11.9
240										241.0	12.3
										NON-CRYSTALLINE ROCK	
										TRIASSIC MUDSTONE	
235										Boring Terminated by Auger Refusal at Elevation 241.0 ft IN NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE)	
230										* LIKELY SURFACE WATER ONLY	
225											
220											
215											
210											
205											
200											
195											
190											
185											
180											
175											

NCDOT BORE SINGLE R2417_GEO_BRDG0004&0005_LEE.GPJ NC_DOT.GDT 10/28/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET 12/16

PROJECT NO. 34431.1.2	ID. R-2417AA	COUNTY LEE	GEOLOGIST Murray, C. C.
SITE DESCRIPTION BRIDGE #4 ON US 421/ NC 87 (NBL SANFORD BYPASS) OVER ATLANTIC & WESTERN RR			GROUND WTR (ft)
BORING NO. EB1-B NBL	STATION 135+68	OFFSET 6ft LT	ALIGNMENT -L-	0 HR. Dry
COLLAR ELEV. 252.0 ft	TOTAL DEPTH 16.9 ft	NORTHING 647,053	EASTING 1,935,652	24 HR. 2.0 *
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic	
START DATE 07/28/09	COMP. DATE 07/28/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 13.0 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
255											
										252.0 GROUND SURFACE	0.0
250										COASTAL PLAIN	
										STIFF YELLOW-TAN MOIST SANDY CLAYEY SILT (A-4)	
										249.0	3.0
	247.8	4.2								COASTAL PLAIN	
			4	6	10	16	SS-19	M		V. STIFF YELLOW-TAN MOIST HIGH (PI=26) PLASTICITY SILTY SANDY CLAY (A-7)	
245										245.1	6.9
	242.8	9.2								TRIASSIC RESIDUAL	
			4	7	9	16	SS-20	M		V. STIFF GRAY-BROWN MOIST SILTY CLAY (A-6)	
240										239.0	13.0
	237.8	14.2								NON-CRYSTALLINE ROCK	
			100/.1			100/.1				TRIASSIC MUDSTONE	
235										235.1	16.9
										Boring Terminated by Auger Refusal at Elevation 235.1 ft IN NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE)	
230										* LIKELY SURFACE WATER ONLY	
225											
220											
215											
210											
205											
200											
195											
190											
185											
180											
175											

NCDOT BORE SINGLE R2417_GEO_BRDG0004&0005_LEE.GPJ NC_DOT.GDT 10/28/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431.1.2	ID. R-2417AA	COUNTY LEE	GEOLOGIST Murray, C. C.
SITE DESCRIPTION BRIDGE #4 ON US 421/ NC 87 (NBL SANFORD BYPASS) OVER ATLANTIC & WESTERN RR			GROUND WTR (ft)
BORING NO. EB2-A NBL	STATION 137+16	OFFSET 68ft LT	ALIGNMENT -L-	0 HR. Dry
COLLAR ELEV. 256.3 ft	TOTAL DEPTH 28.8 ft	NORTHING 646,998	EASTING 1,935,803	24 HR. Dry
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic	
START DATE 07/22/09	COMP. DATE 07/22/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 19.0 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	ELEV. (ft)	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
260												
255										256.3	GROUND SURFACE	0.0
	252.6	3.7									COASTAL PLAIN MED. STIFF TO V. STIFF YELLOW-TAN MOIST F. SANDY SILTY CLAY (A-7)	
250			7	8	8	16		M				
	247.6	8.7										
			9	14	12	26		M		246.6		9.7
245											TRIASSIC RESIDUAL V. STIFF TO HARD RED-BROWN MOIST SILTY CLAY (A-6)	
	242.6	13.7										
			12	14	25	39		M				
240										238.8		17.5
	237.6	18.7								237.3	WEATHERED ROCK (TRIASSIC MUDSTONE)	19.0
			12	88/.3		100/.6					NON-CRYSTALLINE ROCK TRIASSIC MUDSTONE	
235												
	232.6	23.7										
			60/.1			60/.1						
230												
	227.6	28.7	60/.1			60/.1				227.5		28.8
225											Boring Terminated at Elevation 227.5 ft IN NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE)	
220												
215												
210												
205												
200												
195												
190												
185												
180												

NCDOT BORE SINGLE R2417_GEO_BRDG0004&0005_LEE.GPJ NC_DOT.GDT 10/28/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET 13/16

PROJECT NO. 34431.1.2	ID. R-2417AA	COUNTY LEE	GEOLOGIST Murray, C. C.
SITE DESCRIPTION BRIDGE #4 ON US 421/ NC 87 (NBL SANFORD BYPASS) OVER ATLANTIC & WESTERN RR			GROUND WTR (ft)
BORING NO. EB2-B NBL	STATION 137+63	OFFSET 38ft LT	ALIGNMENT -L-	0 HR. Dry
COLLAR ELEV. 256.5 ft	TOTAL DEPTH 24.6 ft	NORTHING 646,944	EASTING 1,935,817	24 HR. Dry
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic	
START DATE 07/22/09	COMP. DATE 07/22/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	ELEV. (ft)	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
260												
255										256.5	GROUND SURFACE	0.0
	252.5	4.0									COASTAL PLAIN STIFF TO V. STIFF ORANGE-TAN MOIST HIGH (PI=32) PLASTICITY F. SANDY SILTY CLAY (A-7)	
250			7	10	14	24	SS-5	M				
	247.5	9.0								248.5		8.0
			10	11	28	39	SS-6	M		245.5	COASTAL PLAIN HARD ORANGE-TAN MOIST SANDY SILTY CLAY (A-6) (W/ ROUNDED FINE GRAVEL)	11.0
245											TRIASSIC RESIDUAL HARD GRAY-BROWN MOIST SILTY CLAY (A-6)	
	242.5	14.0								242.5		14.0
			37	63/.5		100/1	SS-7				WEATHERED ROCK (TRIASSIC MUDSTONE)	
240												
	237.5	19.0										
			65	35/.1		100/.6						
235												
	232.5	24.0										
			63	37/.1		100/.6				231.9		24.6
230											Boring Terminated at Elevation 231.9 ft IN WEATHERED ROCK (TRIASSIC MUDSTONE)	
225												
220												
215												
210												
205												
200												
195												
190												
185												
180												

NCDOT BORE SINGLE R2417_GEO_BRDG0004&0005_LEE.GPJ NC_DOT.GDT 10/28/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431.1.2	ID. R-2417AA	COUNTY LEE	GEOLOGIST Murray, C. C.
SITE DESCRIPTION BRIDGE #5 ON US 421/ NC 87 (SBL SANFORD BYPASS) OVER ATLANTIC & WESTERN RR			GROUND WTR (ft)
BORING NO. EB1-A SBL	STATION 136+86	OFFSET 34ft RT	ALIGNMENT -L-	0 HR. Dry
COLLAR ELEV. 253.0 ft	TOTAL DEPTH 24.0 ft	NORTHING 646,944	EASTING 1,935,711	24 HR. Dry
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic	
START DATE 07/28/09	COMP. DATE 07/28/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 8.4 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
255											
										253.0 GROUND SURFACE	0.0
250	249.1	3.9	6	9	15	24		M		COASTAL PLAIN MED. STIFF TO STIFF YELLOW-TAN MOIST F. SANDY CLAYEY SILT (A-4) 250.0	3.0
245	245.1	7.9	65	60/.1		60/.1				COASTAL PLAIN STIFF TO V. STIFF ORANGE-TAN MOIST F. SANDY SILTY CLAY (A-6) 246.0	7.0
										WEATHERED ROCK TRIASSIC MUDSTONE 244.6	8.4
240	239.1	13.9	60/.1			60/.1				NON-CRYSTALLINE ROCK TRIASSIC MUDSTONE	
235	234.1	18.9	60/.1			60/.1					
230	229.1	23.9	60/.1			60/.1				229.0	24.0
										Boring Terminated at Elevation 229.0 ft IN NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE)	
225											
220											
215											
210											
205											
200											
195											
190											
185											
180											
175											

NCDOT BORE SINGLE R2417_GEO_BRDG00048&0005_LEE.GPJ NC_DOT.GDT 10/28/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET 14/16

PROJECT NO. 34431.1.2	ID. R-2417AA	COUNTY LEE	GEOLOGIST Murray, C. C.
SITE DESCRIPTION BRIDGE #5 ON US 421/ NC 87 (SBL SANFORD BYPASS) OVER ATLANTIC & WESTERN RR			GROUND WTR (ft)
BORING NO. EB1-B SBL	STATION 137+36	OFFSET 73ft RT	ALIGNMENT -L-	0 HR. Dry
COLLAR ELEV. 253.0 ft	TOTAL DEPTH 13.3 ft	NORTHING 646,881	EASTING 1,935,721	24 HR. Dry
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic	
START DATE 07/28/09	COMP. DATE 07/28/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 12.3 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
255											
	253.0	0.0								253.0 GROUND SURFACE	0.0
250	249.0	4.0	5	6	7	13	SS-16	M		COASTAL PLAIN STIFF TO V. STIFF YELLOW-TAN MOIST F. SANDY CLAYEY SILT (A-4) 250.0	3.0
245	244.0	9.0	7	9	13	22	SS-17	M		COASTAL PLAIN V. STIFF ORANGE-TAN MOIST F. SANDY SILTY CLAY (A-6) (W/ THIN GRAVEL LAYER AT BASE) 244.5	8.5
240			4	24	76/.4	100/.9	SS-18			TRIASSIC RESIDUAL V. STIFF GRAY-TAN MOIST F. SANDY CLAYEY SILT (A-4) 243.0	10.0
										WEATHERED ROCK TRIASSIC MUDSTONE 240.7	12.3
										NON-CRYSTALLINE ROCK TRIASSIC MUDSTONE 239.7	13.3
										Boring Terminated by Auger Refusal at Elevation 239.7 ft IN NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE)	
235											
230											
225											
220											
215											
210											
205											
200											
195											
190											
185											
180											
175											

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NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431.1.2	ID. R-2417AA	COUNTY LEE	GEOLOGIST Murray, C. C.
SITE DESCRIPTION BRIDGE #5 ON US 421/ NC 87 (SBL SANFORD BYPASS) OVER ATLANTIC & WESTERN RR			GROUND WTR (ft)
BORING NO. EB2-A SBL	STATION 139+10	OFFSET 29ft RT	ALIGNMENT -L-	0 HR. Dry
COLLAR ELEV. 254.5 ft	TOTAL DEPTH 20.9 ft	NORTHING 646,795	EASTING 1,935,879	24 HR. Dry
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic	
START DATE 07/23/09	COMP. DATE 07/23/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 11.5 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
255										254.5 GROUND SURFACE	0.0
										COASTAL PLAIN MED. STIFF TO HARD YELLOW-TAN MOIST F. SANDY CLAYEY SILT (A-4)	
250	250.8	3.7	4	8	11	19		M			
245	245.8	8.7	5	15	22	37	SS-11			245.5	9.0
										TRIASSIC RESIDUAL HARD RED-BROWN MOIST SILTY CLAY (A-6)	
243.0											11.5
240	240.8	13.7	37	60/.1		60/.1				NON-CRYSTALLINE ROCK TRIASSIC MUDSTONE	
235	235.8	18.7	25	60/.1		60/.1				233.6	20.9
230										Boring Terminated by Auger Refusal at Elevation 233.6 ft IN NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE)	
225											
220											
215											
210											
205											
200											
195											
190											
185											
180											
175											

NCDOT BORE SINGLE R2417_GEO_BRDG0004&0005_LEE.GPJ NC_DOT.GDT 10/29/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET 15/16

PROJECT NO. 34431.1.2	ID. R-2417AA	COUNTY LEE	GEOLOGIST Murray, C. C.
SITE DESCRIPTION BRIDGE #5 ON US 421/ NC 87 (SBL SANFORD BYPASS) OVER ATLANTIC & WESTERN RR			GROUND WTR (ft)
BORING NO. EB2-B SBL	STATION 139+55	OFFSET 67ft RT	ALIGNMENT -L-	0 HR. Dry
COLLAR ELEV. 254.1 ft	TOTAL DEPTH 29.6 ft	NORTHING 646,737	EASTING 1,935,886	24 HR. Dry
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic	
START DATE 07/23/09	COMP. DATE 07/23/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 20.0 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
255										254.1 GROUND SURFACE	0.0
										COASTAL PLAIN MED. STIFF TO V. STIFF YELLOW-TAN MOIST SANDY CLAYEY SILT (A-4) (W/ GRAVEL @ 9.5)	
250	250.1	4.0	8	10	12	22	SS-8	M			
245	245.1	9.0	7	11	19	30		W		244.1	10.0
										TRIASSIC RESIDUAL V. STIFF TO HARD RED-BROWN-GRAY MOIST MED. (PI=16) PLASTICITY SILTY CLAY (A-7)	
240	240.1	14.0	17	17	22	39	SS-9	M			
235	235.1	19.0	19	81/.4		100/.9	SS-10	M		235.1	19.0
										234.1 WEATHERED ROCK TRIASSIC MUDSTONE	20.0
										NON-CRYSTALLINE ROCK TRIASSIC MUDSTONE	
230	230.1	24.0	35	60/.1		60/.1		M			
225	225.1	29.0	45	60/.1		60/.1				224.5	29.6
										Boring Terminated at Elevation 224.5 ft IN NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE)	
220											
215											
210											
205											
200											
195											
190											
185											
180											
175											

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TEST RESULTS

PROJECT: 34431.1.2 (R-2417AA)
COUNTY: LEE
SITE DESCRIPTION: DUAL BRIDGES #4 & 5 ON US 421/ NC 87 (SANFORD BYPASS) OVER ATLANTIC & WESTERN RR

SOIL SAMPLE RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS	N	L.L.	P.I.	% BY WEIGHT C. SAND	F. SAND	SILT	CLAY	% PASSING SIEVES 10	40	200	% MOISTURE	% ORGANIC	UNIT WT. (d)	VOID RATIO
		13932																
SS-14	12 RT	139+32 -L-	4.0-5.5	A-7-6(17)	28	42	23	0.6	31	32.1	36.3	100	100	78				
SS-15	12 RT	139+32 -L-	9.0-10.0	A-2-6(0)	14	32	11	30.8	21.3	31.7	16.1	49	37	28				
		13902																
SS-12	2 RT	139+02 -L-	4.0-5.5	A-6(12)	26	32	16	0.6	23.0	38.2	38.3	100	100	84				
SS-13	2 RT	139+02 -L-	9.0-10.5	A-2-6(0)	17	31	16	62.4	12.7	10.8	14.1	50	22	14				
	BRIDGE #4 (SANFORD BYPASS NBL)																	
		EB1-A NBL																
SS-21	68 LT	134+89 -L-	0.5-2.0	A-4(6)	2	29	7	3.0	15.3	55.5	26.2	100	98	89				
SS-22	68 LT	134+89 -L-	4.2-5.7	A-6(9)	3	31	11	2.0	12.9	50.9	34.2	100	98	91				
		EB1-B NBL																
SS-19	6 LT	135+68 -L-	4.2-5.7	A-7-6(18)	16	49	26	7.7	20.3	23.7	48.3	93	90	72				
SS-20	6 LT	135+68 -L-	9.2-10.7	A-6(12)	16	34	12	2.4	6.4	58.9	32.2	100	98	95				
		EB2-B NBL																
SS-5	38 LT	137+63 -L-	4.0-5.5	A-7-6(28)	24	54	32	1.2	22.0	34.5	42.3	100	100	84				
SS-6	38 LT	137+63 -L-	9.0-10.5	A-6(8)	39	39	13	11.1	11.7	43.0	34.2	82	76	67				
SS-7	38 LT	137+63 -L-	14.0-15.0	A-6(14)	100/1	35	14	1.2	4.0	58.5	36.3	100	99	97				
	BRIDGE #5 (SANFORD BYPASS SBL)																	
		EB1-B SBL																
SS-16	73 RT	137+36 -L-	0.0-1.5	A-4(8)	13	30	10	1.4	15.9	50.5	32.2	97	96	88				
SS-17	73 RT	137+36 -L-	4.0-5.5	A-6(9)	22	34	11	0.6	28.2	47.0	24.2	100	100	84				
SS-18	73 RT	137+36 -L-	9.0-9.9	A-4(7)	100/.9	30	9	3.0	18.5	56.3	22.2	96	94	85				
		EB2-A SBL																
SS-11	29 RT	139+10 -L-	8.7-10.2	A-6(19)	37	37	19	1.6	4.4	53.7	40.3	100	99	97				
		EB2-B SBL																
SS-8	67 RT	139+55 -L-	4.0-5.5	A-4(3)	22	31	10	4.8	46.7	22.3	26.2	100	100	57				
SS-9	67 RT	139+55 -L-	14.0-15.5	A-7-6(18)	39	41	16	1.0	1.6	57.1	40.3	100	99	98				
SS-10	67 RT	139+55 -L-	19.0-19.9	A-6(14)	100/.9	38	15	2.4	2.0	51.3	44.3	94	92	91				

ROCK SAMPLE RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	RQD	UNIT WT	Q(MPa) (ksf)	E(MPa) (MPsi)

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34431 (R-2417AA)	1	27

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34431 (R-2417AA) F.A. PROJ. STP-NHF-421(2)

COUNTY LEE

PROJECT DESCRIPTION PROPOSED US 421 /NC 87 (SANFORD BYPASS) FROM WEST OF SR 1400 (CUMNOCK ROAD) TO EAST OF US 1 & 15/501

SITE DESCRIPTION STATION 52+08 -L DUAL STREAM CROSSINGS ON SANFORD BYPASS OVER BIG BUFFALO CREEK

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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) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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 THIS 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.

PERSONNEL
MURRAY
ESTEP
MOORE

INVESTIGATED BY MURRAY
CHECKED BY JEB
SUBMITTED BY LITTLE
DATE OCTOBER 2009

NORTH CAROLINA LICENSED SEAL 1184 GEOLOGIST CLINTON B. LITTLE 10-12-09

DRAWN BY: LITTLE /ROLFSMEYER

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N.C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.

PROJECT: 34431

ID: R-2417AA

PROJECT REFERENCE NO.	SHEET NO.
34431(R-2417AA)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING # 10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
# 40	30 MX	50 MX	51 MN											
# 200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT				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		HIGHLY ORGANIC SOILS
PLASTIC INDEX	6 MX		NP	10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A 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

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE MM: 305 | 75 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT PLASTIC RANGE (PI) PL — PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	26 OR MORE	HIGH

COLOR

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.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%
MODERATELY ORGANIC	5 - 10%	12 - 20%
HIGHLY ORGANIC	>10%	>20%

OTHER MATERIAL	
TRACE	1 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SOUNDING ROD
- SPT CPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- REF SPT REFUSAL

SAMPLE DESIGNATIONS
S - BULK SAMPLE
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE
RS - ROCK SAMPLE
RT - RECOMPACTED TRIAXIAL SAMPLE
CBR - CALIFORNIA BEARING RATIO SAMPLE

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [X] CME-550
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- NW CASING [X] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC
- [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [X] -N XWL
- [ ] -H_____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, YIELDS SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, YIELDS SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
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 PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FEET
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

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. AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - 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 (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 THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

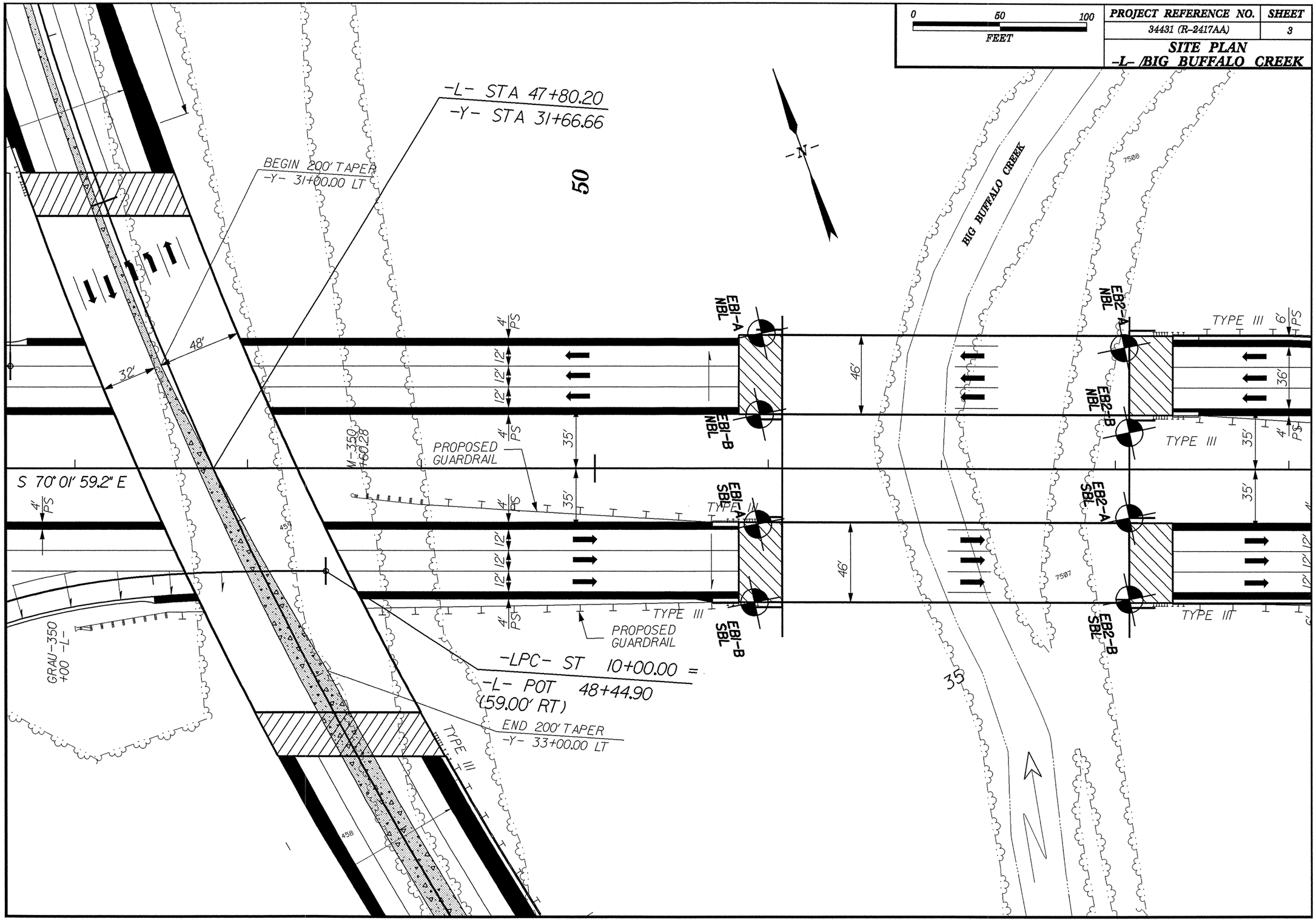
TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: (BL-108) N 651638.6190 E 1928841.9200
BL STA. 43+89.86
ELEVATION: 226.38 FT.

NOTES:

PROJECT REFERENCE NO.	SHEET
34431 (R-2417AA)	3

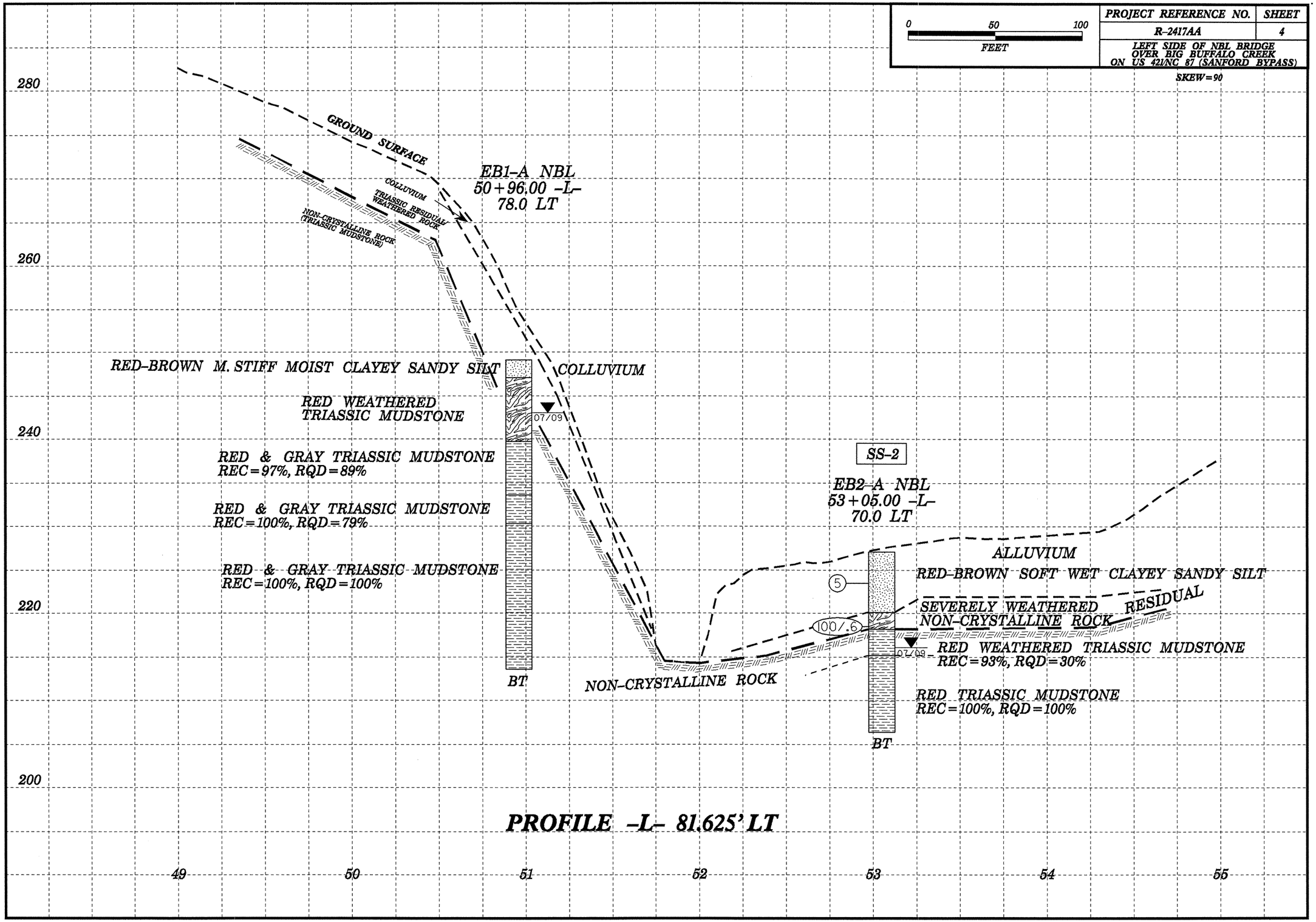
SITE PLAN
-L- /BIG BUFFALO CREEK



PROJECT REFERENCE NO.	SHEET
R-2417AA	4
LEFT SIDE OF NBL BRIDGE OVER BIG BUFFALO CREEK ON US 421/NC 87 (SANFORD BYPASS)	

0 50 100
FEET

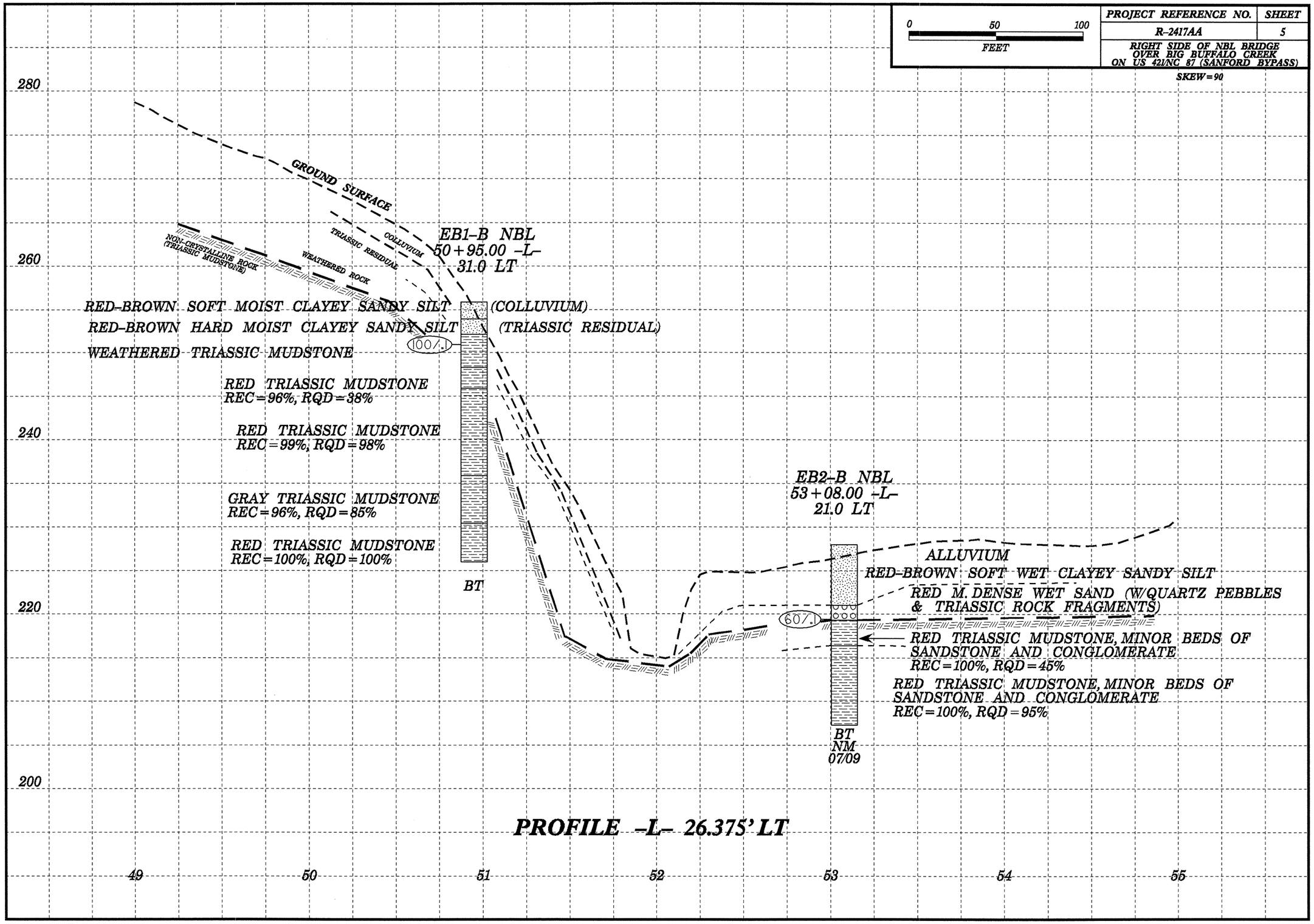
SKEW=90



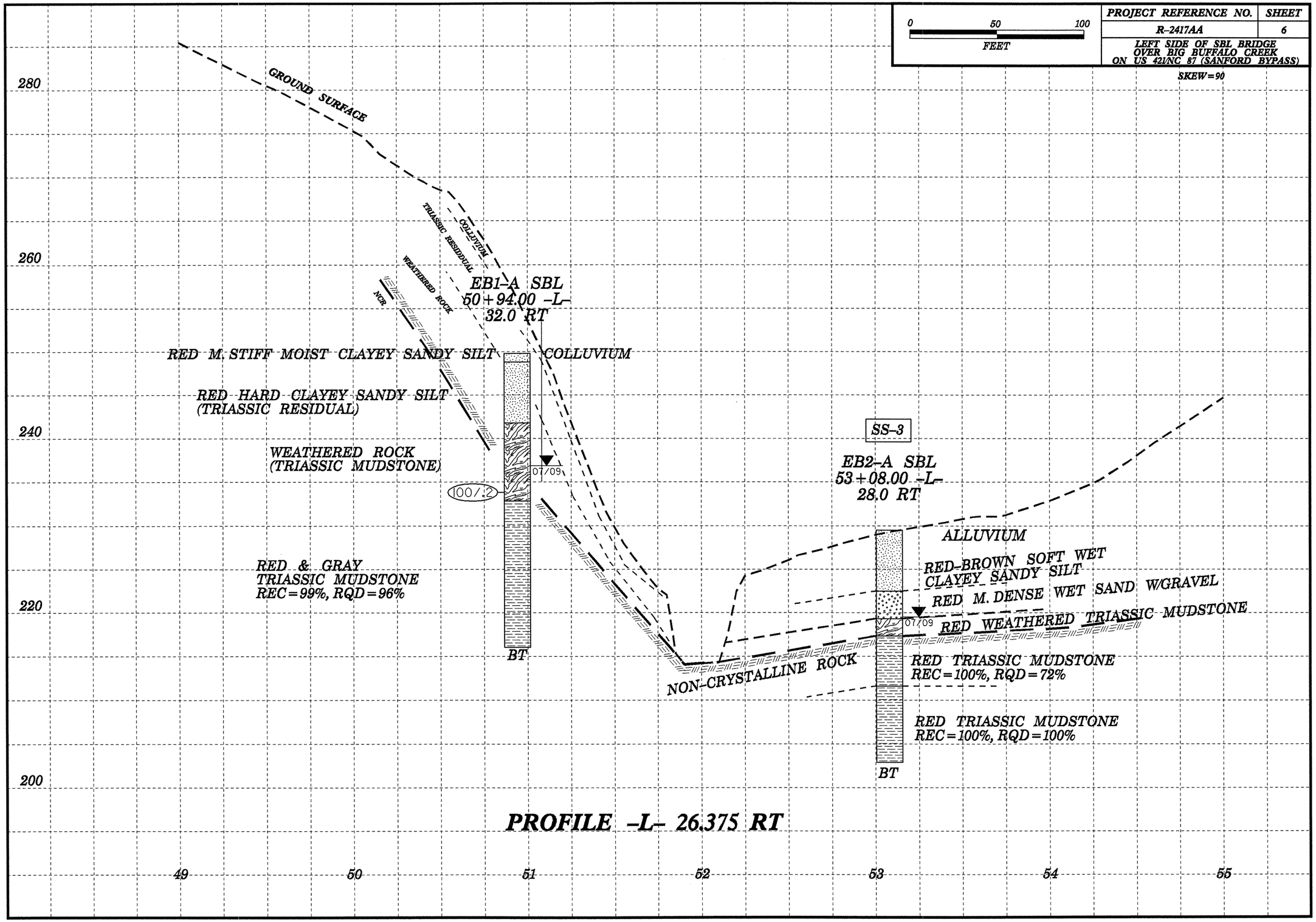
PROFILE -L- 81.625' LT

PROJECT REFERENCE NO.	SHEET
R-2417AA	5
RIGHT SIDE OF NBL BRIDGE OVER BIG BUFFALO CREEK ON US 421/NC 87 (SANFORD BYPASS)	

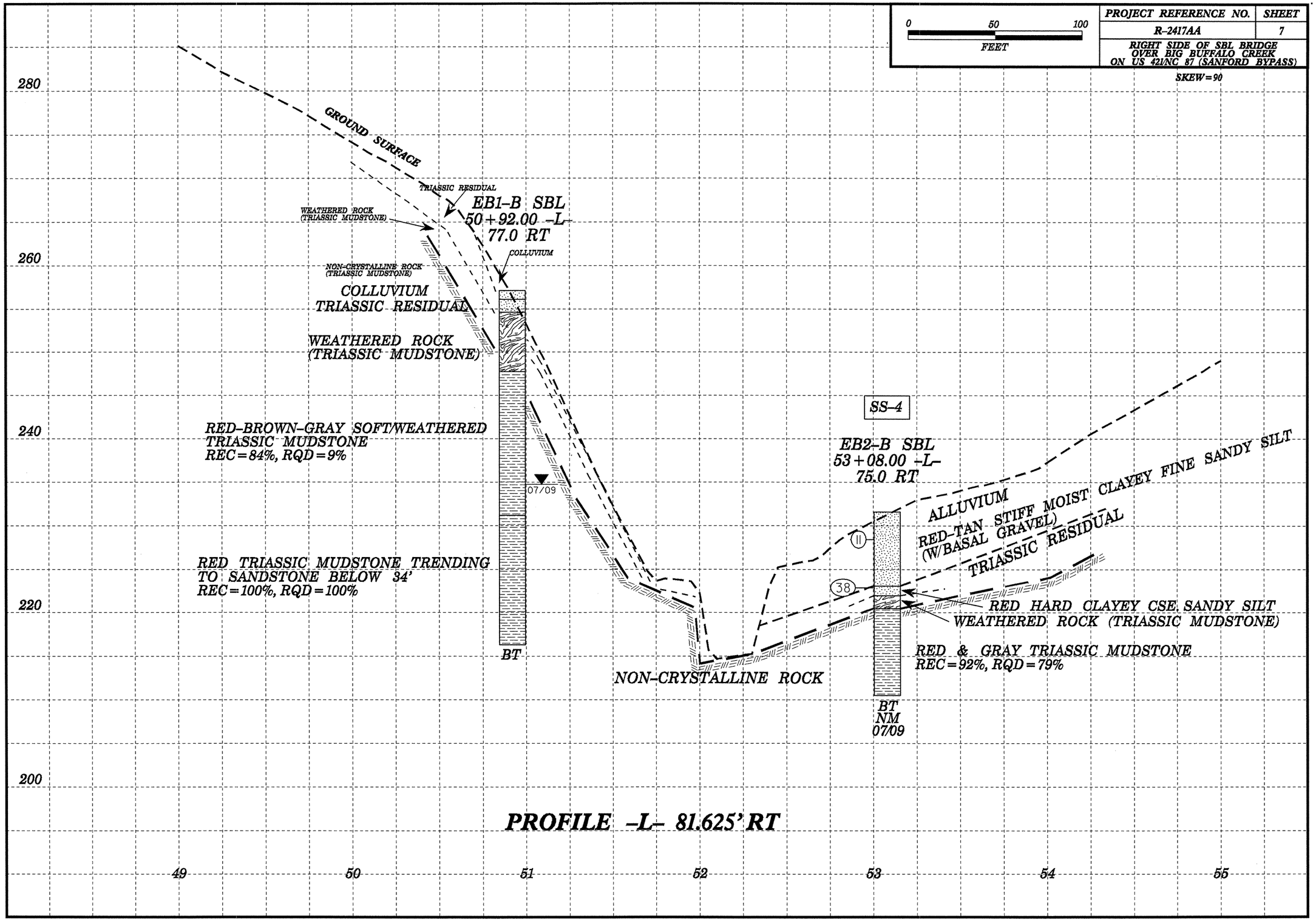
SKEW=90



PROJECT REFERENCE NO.	SHEET
R-2417AA	6
LEFT SIDE OF SBL BRIDGE OVER BIG BUFFALO CREEK ON US 421/NC 87 (SANFORD BYPASS)	

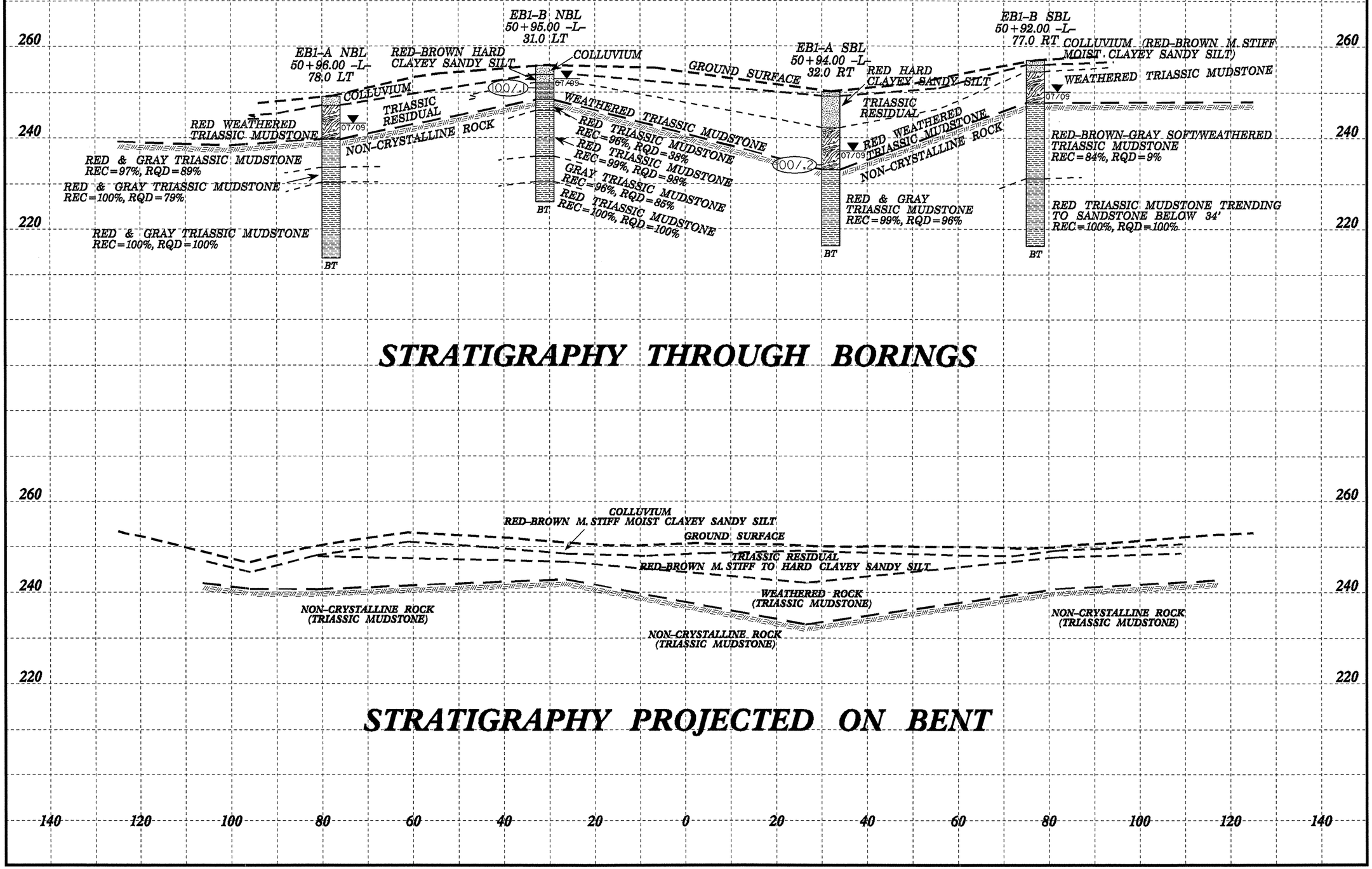


PROJECT REFERENCE NO.	SHEET
R-2417AA	7
RIGHT SIDE OF SBL BRIDGE OVER BIG BUFFALO CREEK ON US 421/NC 87 (SANFORD BYPASS)	

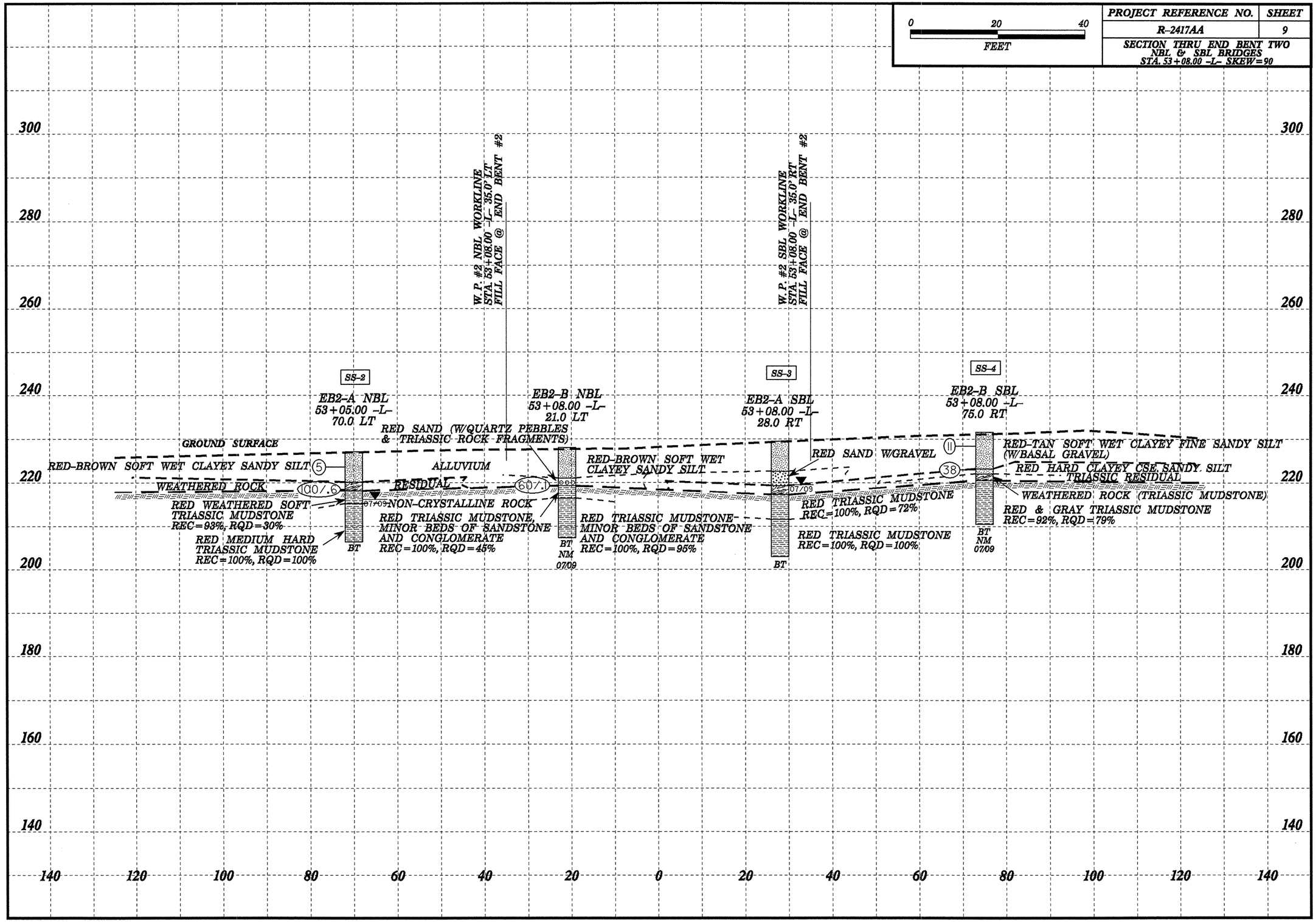


PROJECT REFERENCE NO.	SHEET
R-2417AA	8
SECTION THRU END BENT ONE NBL & SBL BRIDGES STA. 51+08.00 -L- SKEW=90	

0 20 40
FEET



PROJECT REFERENCE NO.	SHEET
R-2417AA	9
SECTION THRU END BENT TWO NBL & SBL BRIDGES STA. 53+08.00 -L- SKEW=90	



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB1-A SBL	**STATION** 50+94	**OFFSET** 32ft RT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 250.1 ft	**TOTAL DEPTH** 33.8 ft	**NORTHING** 651,658	**EASTING** 1,928,667 — **24 HR.** 13.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/15/09	**COMP. DATE** 07/15/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 17.0 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
250.1										GROUND SURFACE 0.0
249.1								M		**COLLUVIUM** RED-BROWN CLAYEY SANDY SILT 1.0
										TRIASSIC RESIDUAL RED HARD CLAYEY SANDY SILT
242.1								M		**WEATHERED ROCK** RED WEATHERED TRIASSIC MUDSTONE SOFT 8.0
233.1	235.1	15.0	100/.2			100/.2	RS-6			**NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE MEDIUM HARD 17.0
							RS-7			
							RS-8			
216.3							RS-9			Boring Terminated at Elevation 216.3 ft IN TRIASSIC MUDSTONE 33.8

NCDOT BORE SINGLE R2417AA_GEO_BRDG_BIG_BUFFALO_CRK.GPJ NC_DOT.GDT 10/09/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 10/27

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee		**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK				**GROUND WTR (ft)**
BORING NO. EB1-A SBL	**STATION** 50+94	**OFFSET** 32ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 250.1 ft	**TOTAL DEPTH** 33.8 ft	**NORTHING** 651,658	**EASTING** 1,928,667	**24 HR.** 13.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core			**HAMMER TYPE** Automatic
START DATE 07/15/09	**COMP. DATE** 07/15/09	**SURFACE WATER DEPTH** N/A		**DEPTH TO ROCK** 17.0 ft
CORE SIZE NXWL	**TOTAL RUN** 25.6 ft	**DRILLER** N/A		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS (ELEV. (ft) / DEPTH (ft))
242.1											Begin Coring @ 8.0 ft
	242.1	8.0	2.8		(2.8) 100%	(0.5) 18%		(6.5) 72%	(0.5) 6%		242.1 **WEATHERED ROCK** RED WEATHERED TRIASSIC MUDSTONE SOFT 8.0
240	239.3	10.8									
			4.2		(2.2) 52%	(0.0) 0%					
235	235.1	15.0									
	234.9	15.2									
	234.3	15.8	0.6	N=100/.2	(0.3) 50%	(0.0) 0%					233.1 17.0
			5.0		(5.0) 100%	(3.6) 72%	RS-6	(16.6) 99%	(16.2) 96%		**NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE MEDIUM HARD R1=7;R2=15;R3=20;R4=12;R5=7 RMR=58 ROCK TYPE B
230	229.3	20.8									
			5.0		(4.8) 96%	(4.8) 96%	RS-7				
225	224.3	25.8									
			5.0		(5.0) 100%	(5.0) 100%	RS-8				
220	219.3	30.8									
			3.0		(3.0) 100%	(2.8) 93%	RS-9				
	216.3	33.8									216.3 33.8
215											Boring Terminated at Elevation 216.3 ft IN TRIASSIC MUDSTONE

NCDOT CORE SINGLE R2417AA_GEO_BRDG_BIG_BUFFALO_CRK.GPJ NC_DOT.GDT 10/01/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB1-B SBL	**STATION** 50+92	**OFFSET** 77ft RT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 257.1 ft	**TOTAL DEPTH** 40.8 ft	**NORTHING** 651,617	**EASTING** 1,928,650 — **24 HR.** 7.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/15/09	**COMP. DATE** 07/15/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 9.4 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
260											
										257.1 GROUND SURFACE	0.0
										256.1 **COLLUVIUM** RED-BROWN CLAYEY SANDY SILT	1.0
255										254.6 **TRIASSIC RESIDUAL** RED-BROWN CLAYEY SANDY SILT	2.5
								M		**WEATHERED ROCK** WEATHERED TRIASSIC MUDSTONE	
250										247.7 **NON-CRYSTALLINE ROCK** RED-BROWN-GRAY TRIASSIC MUDSTONE SOFT/WEATHERED	9.4
245											
240											
235											
										231.2 **NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE TRENDING TO SANDSTONE BELOW 34'	25.9
230											
225											
220											
										216.3 Boring Terminated at Elevation 216.3 ft IN TRIASSIC MUDSTONE	40.8
215											
210											
205											
200											
195											
190											
185											
180											

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 11/27

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB1-B SBL	**STATION** 50+92	**OFFSET** 77ft RT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 257.1 ft	**TOTAL DEPTH** 40.8 ft	**NORTHING** 651,617	**EASTING** 1,928,650 — **24 HR.** 7.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/15/09	**COMP. DATE** 07/15/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 9.4 ft
CORE SIZE NXWL	**TOTAL RUN** 31.4 ft	**DRILLER** N/A	

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
247.7											Begin Coring @ 9.4 ft	
	247.7 / 246.3	9.4 / 10.8	1.4		(1.0) 71%	(0.0) 0%		(13.8) 84%	(1.5) 9%		247.7 **NON-CRYSTALLINE ROCK** RED-BROWN-GRAY TRIASSIC MUDSTONE SOFT/WEATHERED R1=4;R2=3;R3=10;R4=6;R5=7 RMR=30 ROCK TYPE B	9.4
245			5.0		(3.5) 70%	(0.0) 0%						
	241.3	15.8										
240			5.0		(4.5) 90%	(0.7) 14%						
	236.3	20.8										
235			5.0		(4.7) 94%	(0.8) 16%						
	231.3	25.8									231.2 **NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE TRENDING TO SANDSTONE BELOW 34' R1=12;R2=20;R3=25;R4=12;R5=7 RMR=76 ROCK TYPE B	25.9
230			5.0		(5.0) 100%	(5.0) 100%		(14.9) 100%	(14.9) 100%			
	226.3	30.8										
225			5.0		(5.0) 100%	(5.0) 100%						
	221.3	35.8										
220			5.0		(5.0) 100%	(5.0) 100%						
	216.3	40.8									216.3 Boring Terminated at Elevation 216.3 ft IN TRIASSIC MUDSTONE	40.8
215												
210												
205												
200												
195												
190												
185												
180												
175												
170												

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB1-A NBL	**STATION** 50+96	**OFFSET** 78ft LT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 249.1 ft	**TOTAL DEPTH** 35.5 ft	**NORTHING** 651,761	**EASTING** 1,928,707 — **24 HR.** 6.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/10/09	**COMP. DATE** 07/10/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 9.4 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
250										249.1 GROUND SURFACE	0.0
								M		**COLLUVIUM** 247.1 RED-BROWN CLAYEY SANDY SILT	2.0
245										**WEATHERED ROCK** RED WEATHERED TRIASSIC MUDSTONE	
240										239.7	9.4
										NON-CRYSTALLINE ROCK RED & GRAY TRIASSIC MUDSTONE	
235							RS-10			233.6	15.5
										NON-CRYSTALLINE ROCK RED & GRAY TRIASSIC MUDSTONE	
230										230.3	18.8
							RS-11			**NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE	
225											
							RS-12				
220							RS-13				
215							RS-14			213.6	35.5
210										Boring Terminated at Elevation 213.6 ft IN TRIASSIC MUDSTONE	
205											
200											
195											
190											
185											
180											
175											
170											

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 12/27

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB1-A NBL	**STATION** 50+96	**OFFSET** 78ft LT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 249.1 ft	**TOTAL DEPTH** 35.5 ft	**NORTHING** 651,761	**EASTING** 1,928,707 — **24 HR.** 6.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/10/09	**COMP. DATE** 07/10/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 9.4 ft
CORE SIZE NXWL	**TOTAL RUN** 26.1 ft	**DRILLER** N/A	

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
239.7											Begin Coring @ 9.4 ft	
	239.7 / 238.6	9.4 / 10.5	1.1		(0.9) 82%	(0.9) 82%		(5.9) 97%	(5.4) 89%		239.7 **NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE R1=7;R2=17;R3=20;R4=12;R5=7 RMR=60 ROCK TYPE B	9.4
235			5.0		(5.0) 100%	(4.5) 90%	RS-10					
	233.6	15.5									233.6	15.5
			5.0		(5.0) 100%	(3.7) 74%		(3.3) 100%	(2.6) 79%		**NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE R1=7;R2=17;R3=10;R4=12;R5=7 RMR=50 ROCK TYPE B	
230											230.3	18.8
	228.6	20.5					RS-11	(16.7) 100%	(16.7) 100%		**NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE R1=12;R2=20;R3=25;R4=12;R5=7 RMR=68 ROCK TYPE B	
			5.0		(5.0) 100%	(5.0) 100%						
225												
	223.6	25.5										
			5.0		(5.0) 100%	(4.9) 98%	RS-12					
220							RS-13					
	218.6	30.5										
			5.0		(5.0) 100%	(5.0) 100%						
215							RS-14					
	213.6	35.5									213.6	35.5
210											Boring Terminated at Elevation 213.6 ft IN TRIASSIC MUDSTONE	
205												
200												
195												
190												
185												
180												
175												
170												
165												
160												

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB1-B NBL	**STATION** 50+95	**OFFSET** 31ft LT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 255.9 ft	**TOTAL DEPTH** 29.9 ft	**NORTHING** 651,717	**EASTING** 1,928,690 — **24 HR.** 3.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/14/09	**COMP. DATE** 07/14/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 3.8 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
260											
										255.9 GROUND SURFACE	0.0
255						2				**COLLUVIUM** RED-BROWN CLAYEY SANDY SILT (TRIASSIC) — 253.9	2.0
	251.9	4.0	100/.1			100/.1				**TRIASSIC RESIDUAL** RED-BROWN CLAYEY SANDY SILT — 252.1	3.8
250										**NON-CRYSTALLINE ROCK** WEATHERED TRIASSIC MUDSTONE — 248.3	7.6
										NON-CRYSTALLINE ROCK RED TRIASSIC MUDSTONE — 245.9	10.0
245										**NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE	
240											
235										235.9	20.0
										NON-CRYSTALLINE ROCK GRAY TRIASSIC MUDSTONE	
230										230.4	25.5
										NON-CRYSTALLINE ROCK RED TRIASSIC MUDSTONE	
225										226.0	29.9
										Boring Terminated at Elevation 226.0 ft IN TRIASSIC MUDSTONE	
220											
215											
210											
205											
200											
195											
190											
185											
180											

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 13/27

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB1-B NBL	**STATION** 50+95	**OFFSET** 31ft LT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 255.9 ft	**TOTAL DEPTH** 29.9 ft	**NORTHING** 651,717	**EASTING** 1,928,690 — **24 HR.** 3.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/14/09	**COMP. DATE** 07/14/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 3.8 ft
CORE SIZE NXWL	**TOTAL RUN** 22.3 ft	**DRILLER** N/A	

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS — ELEV. (ft)	DEPTH (ft)
248.3											Begin Coring @ 7.6 ft	
	248.3	7.6	2.3		(2.3) 100%	(0.9) 39%		(2.3) 96%	(0.9) 38%		248.3 **NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE R1=7;R2=8;R3=8;R4=12;R5=7 RMR=42 ROCK TYPE B	7.6
	246.0	9.9									245.9	10.0
245			5.0		(4.8) 96%	(4.6) 92%		(9.9) 99%	(9.8) 98%		**NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE R1-12;R2=20;R3=17;R4=12;R5=7 RMR=68 ROCK TYPE B	
	241.0	14.9										
240			5.0		(5.0) 100%	(5.0) 100%						
	236.0	19.9									235.9	20.0
235			5.0		(4.8) 96%	(4.3) 86%		(5.3) 96%	(4.7) 85%		**NON-CRYSTALLINE ROCK** GRAY TRIASSIC MUDSTONE R1=7;R2=17;R3=10;R4=6;R5=7 RMR=47 ROCK TYPE B	
	231.0	24.9									230.4	25.5
230			5.0		(5.0) 100%	(5.0) 100%		(4.4) 100%	(4.4) 100%		**NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE R1=12;R2=20;R3=25;R4=12;R5=7 RMR=76 ROCK TYPE B	
	226.0	29.9									226.0	29.9
225											Boring Terminated at Elevation 226.0 ft IN TRIASSIC MUDSTONE	
220												
215												
210												
205												
200												
195												
190												
185												
180												
175												
170												

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB2-A SBL	**STATION** 53+08	**OFFSET** 28ft RT	**ALIGNMENT** -L- / **0 HR.** N/A
COLLAR ELEV. 229.5 ft	**TOTAL DEPTH** 27.0 ft	**NORTHING** 651,589	**EASTING** 1,928,870 / **24 HR.** 10.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/17/09	**COMP. DATE** 07/17/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 12.2 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
230										229.5 GROUND SURFACE	0.0
225								M		**ALLUVIAL** RED-BROWN CLAYEY SANDY SILT	
							SS-3			222.5	7.0
220										**ALLUVIAL** RED SAND W/GRAVEL	
										219.3	10.2
										WEATHERED ROCK RED WEATHERED TRIASSIC MUDSTONE	
										217.3	12.2
215										**NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE	
210										211.6	17.9
										NON-CRYSTALLINE ROCK RED TRIASSIC MUDSTONE	
205										202.9	26.6
200										Boring Terminated at Elevation 202.5 ft IN TRIASSIC MUDSTONE	
195											
190											
185											
180											
175											
170											
165											
160											
155											
150											

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 14/27

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB2-A SBL	**STATION** 53+08	**OFFSET** 28ft RT	**ALIGNMENT** -L- / **0 HR.** N/A
COLLAR ELEV. 229.5 ft	**TOTAL DEPTH** 27.0 ft	**NORTHING** 651,589	**EASTING** 1,928,870 / **24 HR.** 10.0
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/17/09	**COMP. DATE** 07/17/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 12.2 ft
CORE SIZE NXWL	**TOTAL RUN** 14.4 ft	**DRILLER** N/A	

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
217.3											Begin Coring @ 12.2 ft	
	217.3	12.2	4.8		(4.8) 100%	(3.5) 73%		(5.7) 100%	(4.1) 72%		217.3 **NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE R1=4;R2=4;R3=10;R4=12;R5=7 RMR=37 ROCK TYPE B	12.2
215												
	212.5	17.0									211.6	17.9
			5.0		(5.0) 100%	(4.7) 94%		(8.7) 100%	(8.7) 100%		**NON-CRYSTALLINE ROCK** RED TRIASSIC MUDSTONE R1=7;R2=20;R3=20;R4=12;R5=7 RMR=66 ROCK TYPE B	
210												
	207.5	22.0										
			4.6		(4.6) 100%	(4.6) 100%						
205												
	202.9	26.6									202.9	26.6
200											Boring Terminated at Elevation 202.5 ft IN TRIASSIC MUDSTONE	
195												
190												
185												
180												
175												
170												
165												
160												
155												
150												
145												
140												

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB2-B SBL	**STATION** 53+08	**OFFSET** 75ft RT	**ALIGNMENT** -L-
COLLAR ELEV. 231.6 ft	**TOTAL DEPTH** 21.1 ft	**NORTHING** 651,545	**EASTING** 1,928,854
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/21/09	**COMP. DATE** 07/21/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 11.1 ft

GROUND WTR (ft)	
0 HR.	N/A
24 HR.	N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
235											
										231.6 GROUND SURFACE	0.0
230	229.4	2.2								**ALLUVIAL** RED-TAN CLAYEY FINE SANDY SILT W/BASAL GRAVEL	
			5	6	5	11	SS-4	M			
225	223.9	7.7									
			10	12	26	38		M		223.1	8.5
										222.0 **TRIASSIC RESIDUAL** RED CLAYEY CSE. SANDY SILT	9.6
220										220.5 **WEATHERED ROCK** WEATHERED ROCK (TRIASSIC MUDSTONE)	11.1
							RS-15 RS-16			**NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE	
215											
							RS-17 RS-18				
210										210.5	21.1
										Boring Terminated at Elevation 210.5 ft IN TRIASSIC MUDSTONE	
205											
200											
195											
190											
185											
180											
175											
170											
165											
160											
155											

NCDOT BORE SINGLE R2417AA_GEO_BRDG_BIG_BUFFALO_CRK.GPJ NC_DOT.GDT 10/01/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 15/27

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB2-B SBL	**STATION** 53+08	**OFFSET** 75ft RT	**ALIGNMENT** -L-
COLLAR ELEV. 231.6 ft	**TOTAL DEPTH** 21.1 ft	**NORTHING** 651,545	**EASTING** 1,928,854
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/21/09	**COMP. DATE** 07/21/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 11.1 ft
CORE SIZE NXWL	**TOTAL RUN** 10.0 ft	**DRILLER** N/A	

GROUND WTR (ft)	
0 HR.	N/A
24 HR.	N/A

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
220.5											Begin Coring @ 11.1 ft	
	220.5	11.1	5.0		(4.7) 94%	(3.6) 72%	RS-15 RS-16	(9.2) 92%	(7.9) 79%		220.5 **NON-CRYSTALLINE ROCK** RED & GRAY TRIASSIC MUDSTONE;MINOR CONGLOMERATE R1=7;R2=17;R3=20;R4=12;R5=7 RMR=63 ROCK TYPE B	11.1
215	215.5	16.1	5.0		(4.5) 90%	(4.3) 86%	RS-17 RS-18					
210	210.5	21.1									210.5	21.1
											Boring Terminated at Elevation 210.5 ft IN TRIASSIC MUDSTONE	
205												
200												
195												
190												
185												
180												
175												
170												
165												
160												
155												
150												
145												

NCDOT CORE SINGLE R2417AA_GEO_BRDG_BIG_BUFFALO_CRK.GPJ NC_DOT.GDT 10/01/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB2-A NBL	**STATION** 53+05	**OFFSET** 70ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 227.1 ft	**TOTAL DEPTH** 20.7 ft	**NORTHING** 651,682	**EASTING** 1,928,900
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/16/09	**COMP. DATE** 07/16/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 8.9 ft

GROUND WTR (ft)	
0 HR.	N/A
24 HR.	11.0

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
230											
										227.1 GROUND SURFACE	0.0
225										ALLUVIAL RED-BROWN CLAYEY SANDY SILT	
	224.5	2.6	4	3	2	5	SS-2	M			
220										220.1	7.0
	219.5	7.6	35	65						WEATHERED ROCK 218.2	8.9
215										NON-CRYSTALLINE ROCK RED WEATHERED TRIASSIC MUDSTONE SOFT 215.2	11.9
210										NON-CRYSTALLINE ROCK RED TRIASSIC MUDSTONE MEDIUM HARD	
										206.4	20.7
205										Boring Terminated at Elevation 206.4 ft IN TRIASSIC MUDSTONE	
200											
195											
190											
185											
180											
175											
170											
165											
160											
155											
150											

NCDOT BORE SINGLE R2417AA_GEO_BRDG_BIG_BUFFALO_CRK.GPJ NC_DOT.GDT 10/01/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 16/27

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB2-A NBL	**STATION** 53+05	**OFFSET** 70ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 227.1 ft	**TOTAL DEPTH** 20.7 ft	**NORTHING** 651,682	**EASTING** 1,928,900
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/16/09	**COMP. DATE** 07/16/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 8.9 ft
CORE SIZE NXWL	**TOTAL RUN** 11.8 ft	**DRILLER** N/A	

GROUND WTR (ft)	
0 HR.	N/A
24 HR.	11.0

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
218.2											Begin Coring @ 8.9 ft	
	218.2	8.9	2.5		(2.5) 100%	(0.9) 36%		(2.8) 93%	(0.9) 30%		218.2 NON-CRYSTALLINE ROCK RED WEATHERED TRIASSIC MUDSTONE SOFT R1=4;R2=8;R3=10;R4=6;R5=7 RMR=35 ROCK TYPE B	8.9
215	215.7	11.4									215.2	11.9
			5.0		(4.8) 96%	(4.5) 90%		(8.8) 100%	(8.8) 100%		NON-CRYSTALLINE ROCK RED TRIASSIC MUDSTONE MEDIUM HARD R1=7;R2=20;R3=30;R4=20;R5=7 RMR=84 ROCK TYPE B	
210	210.7	16.4										
			4.3		(4.3) 100%	(4.3) 100%						
	206.4	20.7									206.4	20.7
205											Boring Terminated at Elevation 206.4 ft IN TRIASSIC MUDSTONE	
200												
195												
190												
185												
180												
175												
170												
165												
160												
155												
150												
145												
140												

NCDOT CORE SINGLE R2417AA_GEO_BRDG_BIG_BUFFALO_CRK.GPJ NC_DOT.GDT 10/01/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB2-B NBL	**STATION** 53+08	**OFFSET** 21ft LT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 228.0 ft	**TOTAL DEPTH** 20.7 ft	**NORTHING** 651,635	**EASTING** 1,928,886 — **24 HR.** N/A
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/16/09	**COMP. DATE** 07/16/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 8.7 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
230											
										228.0 GROUND SURFACE	0.0
225										ALLUVIAL RED-BROWN CLAYEY SANDY SILT	
								W			
220	220.4	7.6								221.0	7.0
			13	22	60/.1	60/.1				ALLUVIAL 219.3 RED SAND, QUARTZ PEBBLES, TRIASSIC ROCK FRAGMENTS	8.7
							RS-1			216.4 NON-CRYSTALLINE ROCK RED TRIASSIC MUDSTONE, MINOR BEDS OF SANDSTONE AND CONGLOMERATE	11.6
215							RS-2				
							RS-3			NON-CRYSTALLINE ROCK RED TRIASSIC MUDSTONE, MINOR BEDS OF SANDSTONE AND CONGLOMERATE	
210							RS-4				
							RS-5			207.3	20.7
205										Boring Terminated at Elevation 207.3 ft IN TRIASSIC MUDSTONE	
200											
195											
190											
185											
180											
175											
170											
165											
160											
155											
150											

NCDOT BORE SINGLE R2417AA_GEO_BRDG_BIG_BUFFALO_CRK.GPJ NC_DOT.GDT 10/01/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 17/27

PROJECT NO. 34431	**ID.** R-2417AA	**COUNTY** Lee	**GEOLOGIST** Murray, C. C.
SITE DESCRIPTION STATION 52+08.00 -L- SANFORD BYPASS OVER BIG BUFFALO CREEK			**GROUND WTR (ft)**
BORING NO. EB2-B NBL	**STATION** 53+08	**OFFSET** 21ft LT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 228.0 ft	**TOTAL DEPTH** 20.7 ft	**NORTHING** 651,635	**EASTING** 1,928,886 — **24 HR.** N/A
DRILL MACHINE CME-550X	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
START DATE 07/16/09	**COMP. DATE** 07/16/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 8.7 ft
CORE SIZE NXWL	**TOTAL RUN** 12.0 ft	**DRILLER** N/A	

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
219.3											Begin Coring @ 8.7 ft	
	219.3	8.7	2.0		(2.0) 100%	(0.7) 35%	RS-1	(2.9) 100%	(1.3) 45%		219.3 NON-CRYSTALLINE ROCK RED TRIASSIC MUDSTONE, MINOR BEDS OF SANDSTONE AND CONGLOMERATE R1=7;R2=8;R3=10;R4=12;R5=7 RMR=44 ROCK TYPE B	8.7
	217.3	10.7	5.0		(5.0) 100%	(4.2) 84%	RS-2	(9.1) 100%	(8.6) 95%		216.4	11.6
215							RS-3				NON-CRYSTALLINE ROCK RED TRIASSIC MUDSTONE, MINOR BEDS OF SANDSTONE AND CONGLOMERATE R1=7;R2=15;R3=20;R4=12;R5=7 RMR=61 ROCK TYPE B	
	212.3	15.7	5.0		(5.0) 100%	(5.0) 100%	RS-4					
210							RS-5					
	207.3	20.7									207.3	20.7
205											Boring Terminated at Elevation 207.3 ft IN TRIASSIC MUDSTONE	
200												
195												
190												
185												
180												
175												
170												
165												
160												
155												
150												
145												
140												

NCDOT CORE SINGLE R2417AA_GEO_BRDG_BIG_BUFFALO_CRK.GPJ NC_DOT.GDT 10/01/09

SOIL SAMPLE DATA													R-2417AA		
													BIG BUFFALO CREEK		
SAMPLE	**OFFSET**	**STATION**	**DEPTH**	**AASHTO**	**LL**	**PI**	**C. SAND**	**F. SAND**	**SILT**	**CLAY**	**10**	**40**	**200**	**MOIST**	**ORGAN**
		-L-													
SS-2	70' LT	53+05	2.6-4.1'	A-4(0)	22	4	22.1	33.8	23.8	20.3	100	93	51	-	-
SS-3	28' RT	53+08	7.0-8.5	A-2-4(0)	21	NP	51.7	27.8	12.5	8.1	84	56	21	-	-
SS-4	75' RT.	53+08	2.2-3.7	A-4(4)	31	10	8.9	41.3	25.7	24.2	100	98	60	-	-

North Carolina Dept. of Transportation
Division of Highways
Materials and Tests
Physical Testing Laboratory

Rock Compression

Lab Number: 351141
Project #: 94431, 34431
County:
Tip ID: R-2417AA

Structure Description: <3 Different>
Test Date: 09/29/2009

Sample No.	Diameter in	Area in²	Specimen Height in	H/D Ratio	Weight lbf	Unit Weight lbf/ft3	Ultimate lbf	Ultimate ksi	Ultimate (corrected) ksi	40% Ult. Load lbf	Sec Mod @ 40% Mpsi
RS-1	1.8700	2.7465	3.3	1.765	0.8300	158.2	31400	11.45	11.27	12570	1.353
RS-2	1.8700	2.7465	4.16	2.23	1.0800	163.1	66700	24.3	24.6	26700	6.42
RS-3	1.8700	2.7465	4.15	2.22	1.0800	163.9	15450	5.62	5.69	6180	0.839
RS-4	1.8700	2.7465	4.16	2.23	1.0800	163.1	25500	9.29	9.4	10200	1.603
RS-5	1.8700	2.7465	4.89	2.61	1.0800	139	60600	22.1	22.7	24200	3.76
RS-6	1.8700	2.7465	4.12	2.2	1.0500	160.5	34100	12.41	12.55	13630	2.04
RS-7	1.8700	2.7465	4.12	2.2	1.0500	160.5	40100	14.59	14.76	16030	2.39
RS-8	1.8700	2.7465	4.08	2.18	1.0900	167.9	15490	5.64	5.7	6200	2.85
RS-9	1.8700	2.7465	4.06	2.17	1.0500	162.7	25400	9.26	9.35	10180	1.966
RS-10	1.8700	2.7465	4.18	2.24	1.0900	163.9	38800	14.13	14.31	15520	2.77
RS-11	1.8700	2.7465	4.17	2.23	1.0500	158.3	42100	15.32	15.51	16830	2.54
RS-12	1.8700	2.7465	4.12	2.2	1.0400	159	49900	18.18	18.39	19980	3.62
RS-13	1.8700	2.7465	4.16	2.23	1.0600	160.1	41200	14.99	15.17	16460	4.35
RS-14	1.8700	2.7465	4.16	2.23	1.1100	167.7	41700	15.19	15.38	16690	4.15
RS-15	1.8700	2.7465	4.12	2.2	1.0400	158.9	64200	23.4	23.6	25700	3.58
RS-16	1.8700	2.7465	3.72	1.99	0.9600	162.3	18960	6.9	6.9	7580	0.841
RS-17	1.8700	2.7465	4.11	2.2	1.0700	164	25900	9.42	9.52	10350	1.667
RS-18	1.8700	2.7465	4.18	2.23	1.0700	161.2	46900	17.06	17.28	18750	2.94

18/27

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 34431 TIP: R-2417AA COUNTY: Lee

DESCRIPTION(1): PROPOSED US 421 OVER BIG BUFFALO CREEK

EXISTING BRIDGE

Information from: Field Inspection X Microfilm ____ (reel ____ pos: ____)
Other (explain) ____

Bridge No.: N/A Length: ____ Total Bents: ____ Bents in Channel: ____ Bents in Floodplain: ____
Foundation Type: N/A

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: N/A

Interior Bents: N/A

Channel Bed: STREAM IS ACTIVELY DEGRADING, BUT THERE IS NO EVIDENCE OF SIGNIFICANT SCOUR EVENTS.

Channel Bank: MINOR LATERAL EROSION OCCURRING.

EXISTING SCOUR PROTECTION

Type(3): NONE

Extent(4): ____

Effectiveness(5): ____

Obstructions(6): LOGS & DEAD TREES - MODERATE DEBRIS

DESIGN INFORMATION

Channel Bed Material(7): RESIDUAL SOILS/WEATHERED ROCK (TRIASSIC MUDSTONE)

Channel Bank Material(8): LEFT SIDE (LINE BACK)- RESIDUAL SOIL/WEATHERED ROCK
RIGHT SIDE (LINE AHEAD) - ALLUVIAL SOFT SANDY SILT

Channel Bank Cover(9): BRUSH,SMALL TREES

Floodplain Width(10): 100' UPSTREAM, 300' DOWNSTREAM

Floodplain Cover(11): LOGGED OVER W/SECONDARY BRUSH

Stream is(12): Aggrading ____ Degrading X Static ____

Channel Migration Tendency(13): MINOR-OVERALL TENDENCY TO WEST

Observations and Other Comments: NEW CROSSING - THERE IS NO EXISTING STRUCTURE.

DESIGN SCOUR ELEVATIONS(14) Feet ____ Meters ____

	100YR	500YR									
CHANNEL	213	212									

Comparison of DSE to Hydraulics Unit theoretical scour:
DSE = HYDRAULICS THEORETICAL
CONTRACTION SCOUR IN CHANNEL ONLY, NO END BENT IMPACT

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank							
Sample No.							
Retained #4							
Passed #10							
Passed #40							
Passed #200							
Coarse Sand							
Fine Sand							
Silt							
Clay							
LL							
PI							
AASHTO							
Station							
Offset							
Depth							

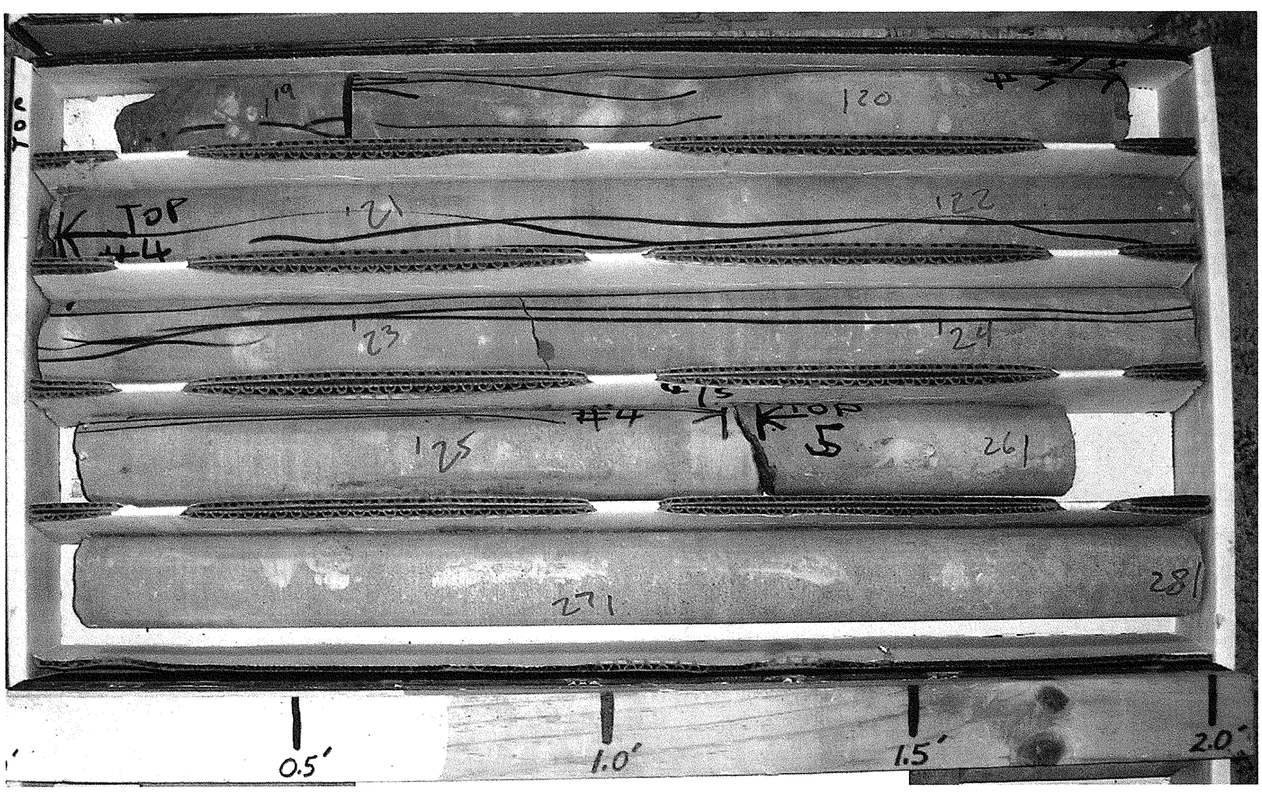
Template Revised 02/07/06

Reported by: MURRAY/LITTLE Date: 10/7/2009

INSTRUCTIONS

1. Describe the specific site's location, including route number and body of water crossed.
2. Note scour evidence at existing end bents or abutments (e.g. undermining, sloughing, degradations).
3. Note existing scour protection (e.g. rip rap).
4. Describe extent of existing scour protection.
5. Describe whether or not the scour protection appears to be working.
6. Note obstructions such as dams, fallen trees, debris at bents, etc.
7. Describe the channel bed material based on observation and/or samples. Include any lab results with report.
8. Describe the channel bank material based on observation and/or samples. Include any lab results with report.
9. Describe the material covering the banks (e.g. grass, trees, rip rap, none).
10. Determine the approximate floodplain width from field observation or a topographic map.
11. Describe the material covering the floodplain (e.g. grass, trees, crops).
12. Use professional judgement to specify if the stream is degrading, aggrading, or static.
13. Describe potential and direction of the stream to migrate laterally during the bridge's life (approx. 100 years).
14. Give the design scour elevation (DSE) expected over the life of the bridge (approx. 100 years). This elevation can be given as a range across the site, or for each bent. Discuss the relationship between the Hydraulics Unit theoritical scour and the DSE. If the DSE is dependent on scour counter measures, explain (e.g. rip rap armoring on slopes). The DSE is based on the erodability of materials, giving consideration to the influence of joints, foliation, bedding characteristics, % core recovery, % RQD, differential weathering, shear strength, observations at existing structures, other tests deemed appropriate, and overall geologic conditions at the site.

EB1-A NBL PHOTO 1/3



EB1-A NBL PHOTO 2/3

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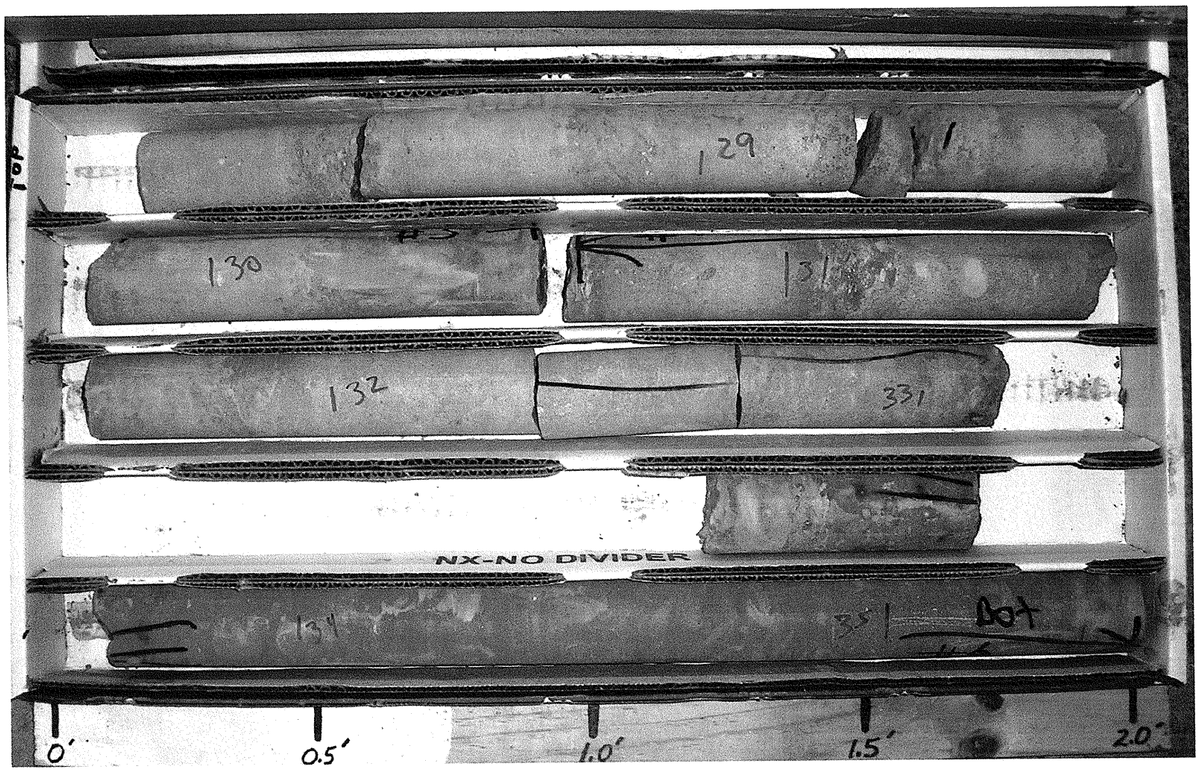

EB1-A NBL PHOTO 3/3

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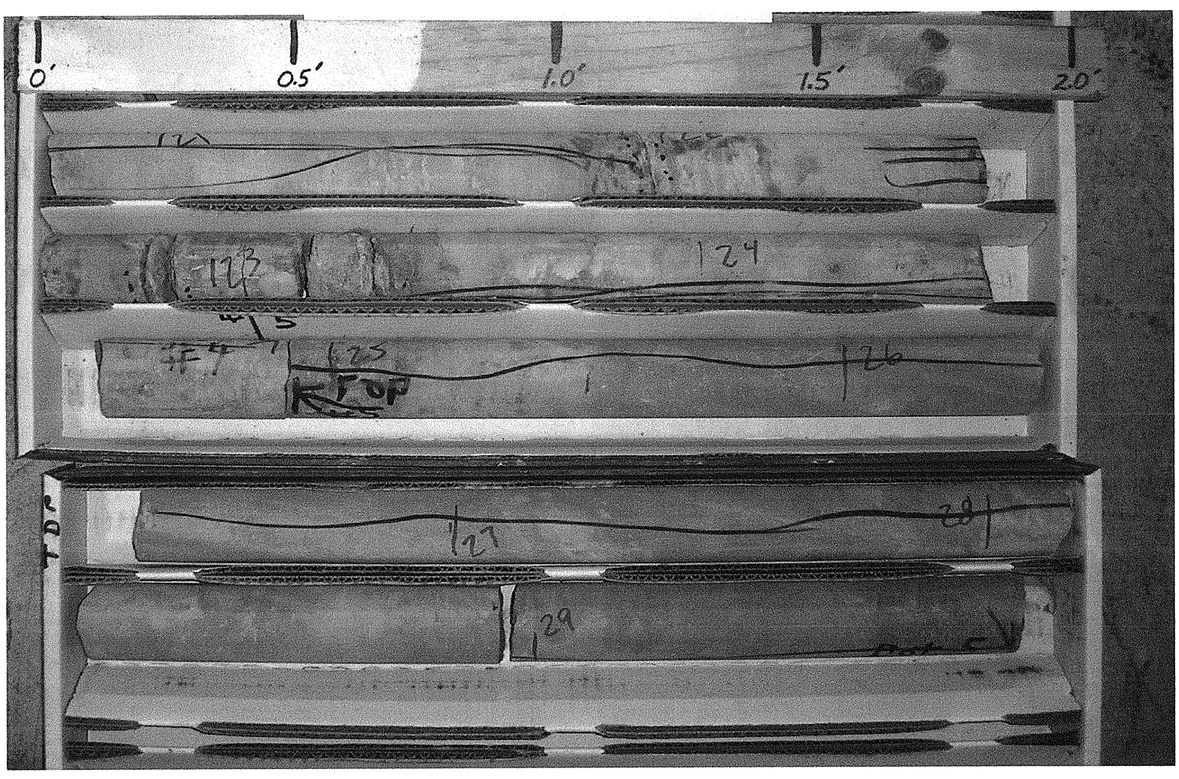
EB1-B NBL PHOTO 1/2



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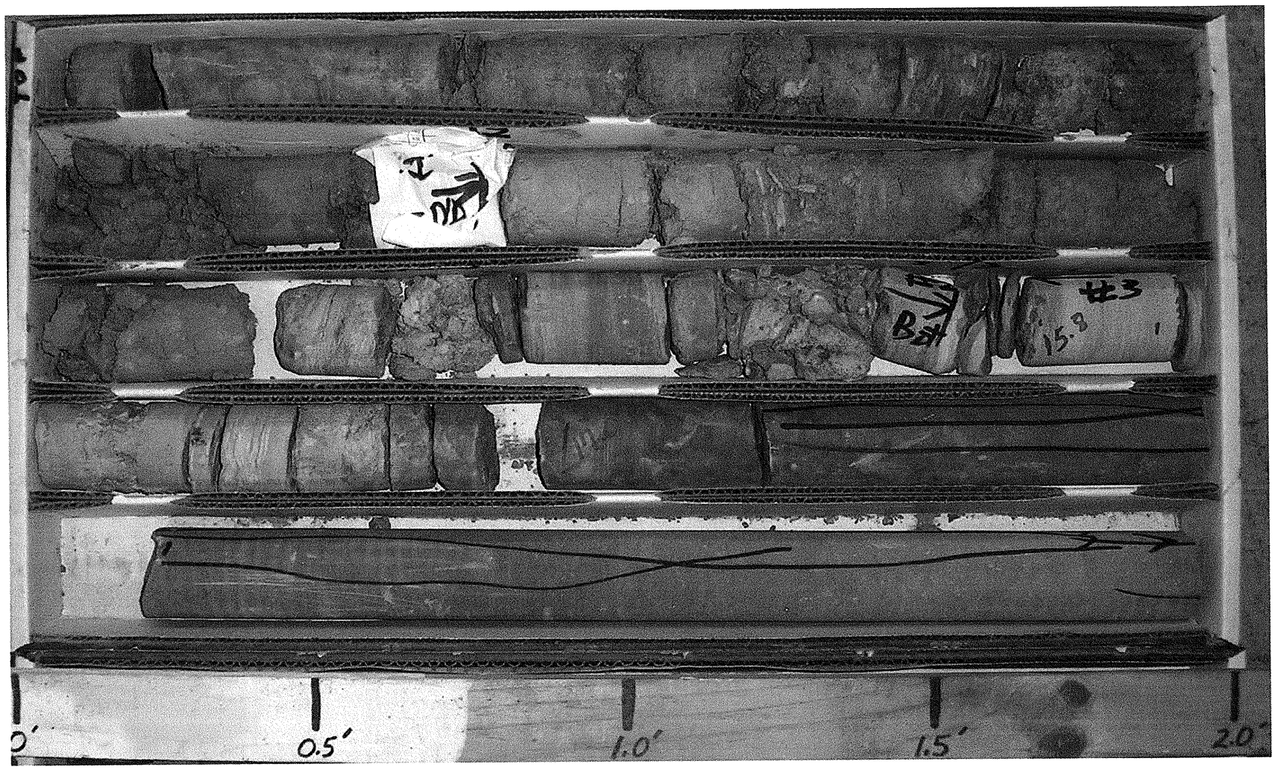

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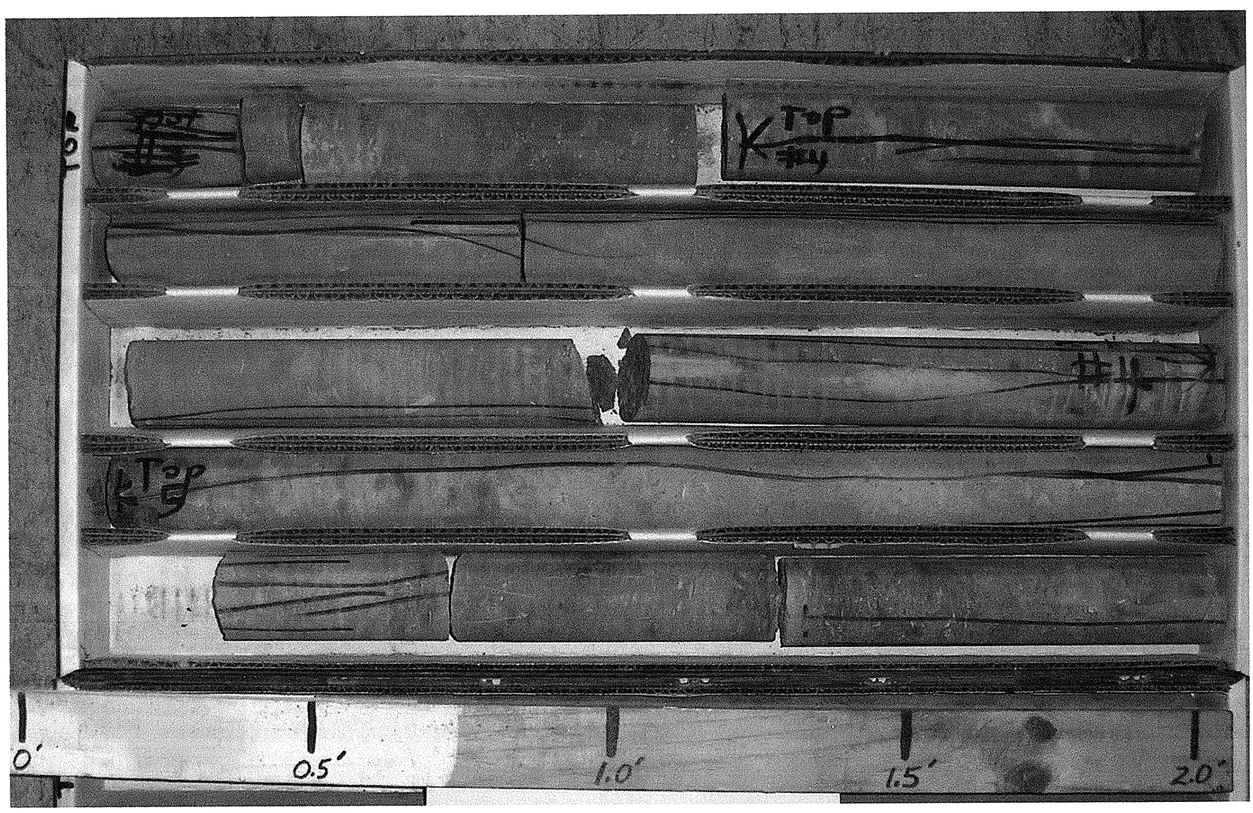

EB1-A SBL PHOTO 2/3

EB1-A SBL PHOTO 3/3

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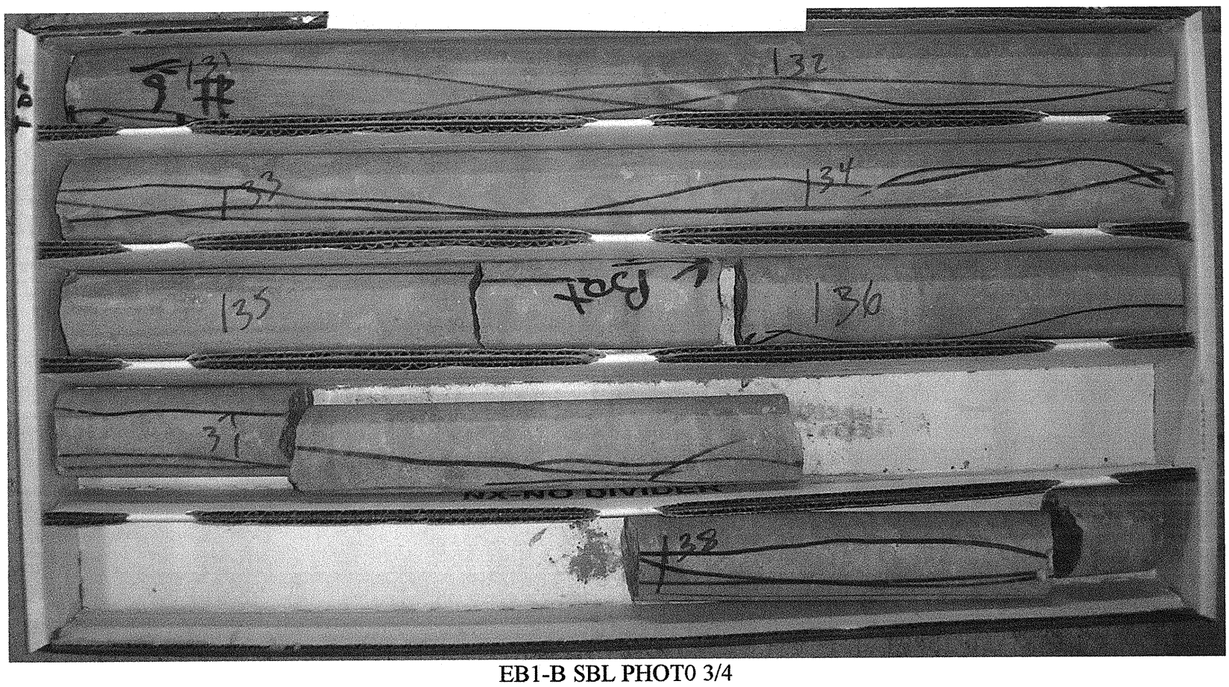
EB1-B SBL PHOTO 1/4

EB1-B SBL PHOTO 2/4



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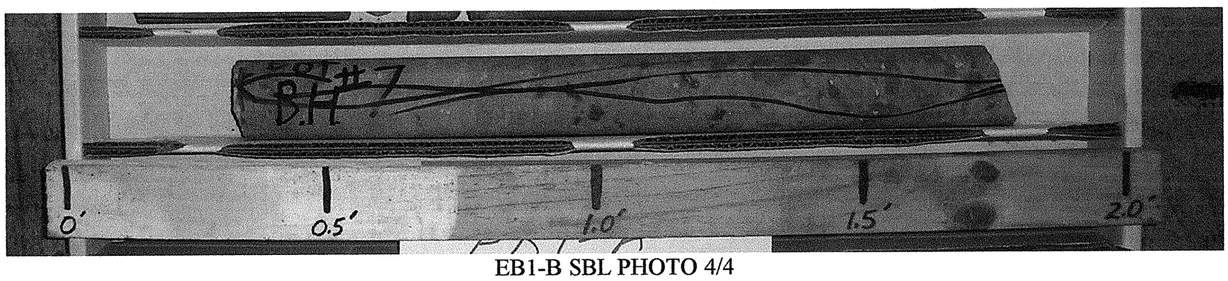
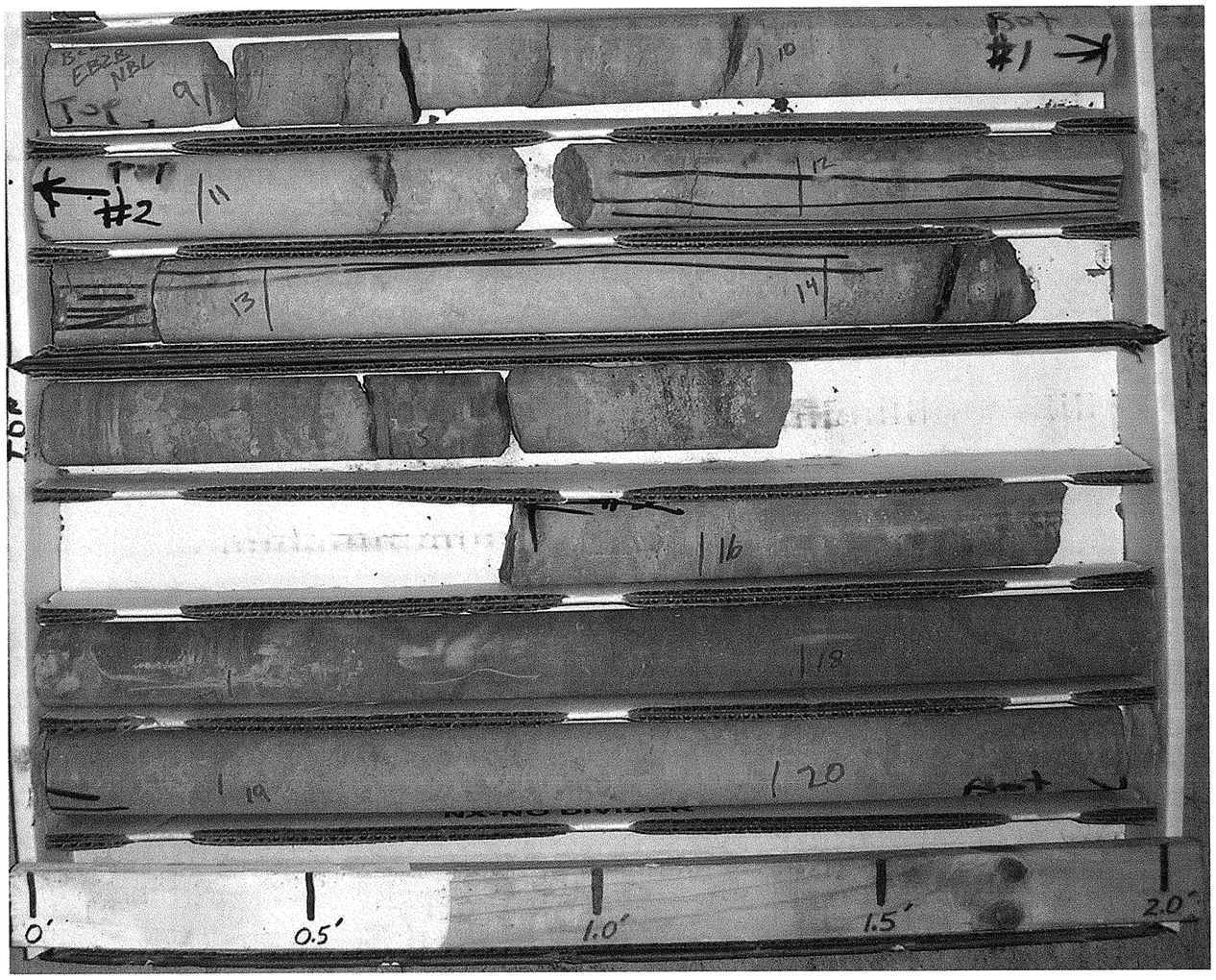


EB1-B SBL PHOTO 4/4

EB2-A NBL PHOTO 1/1



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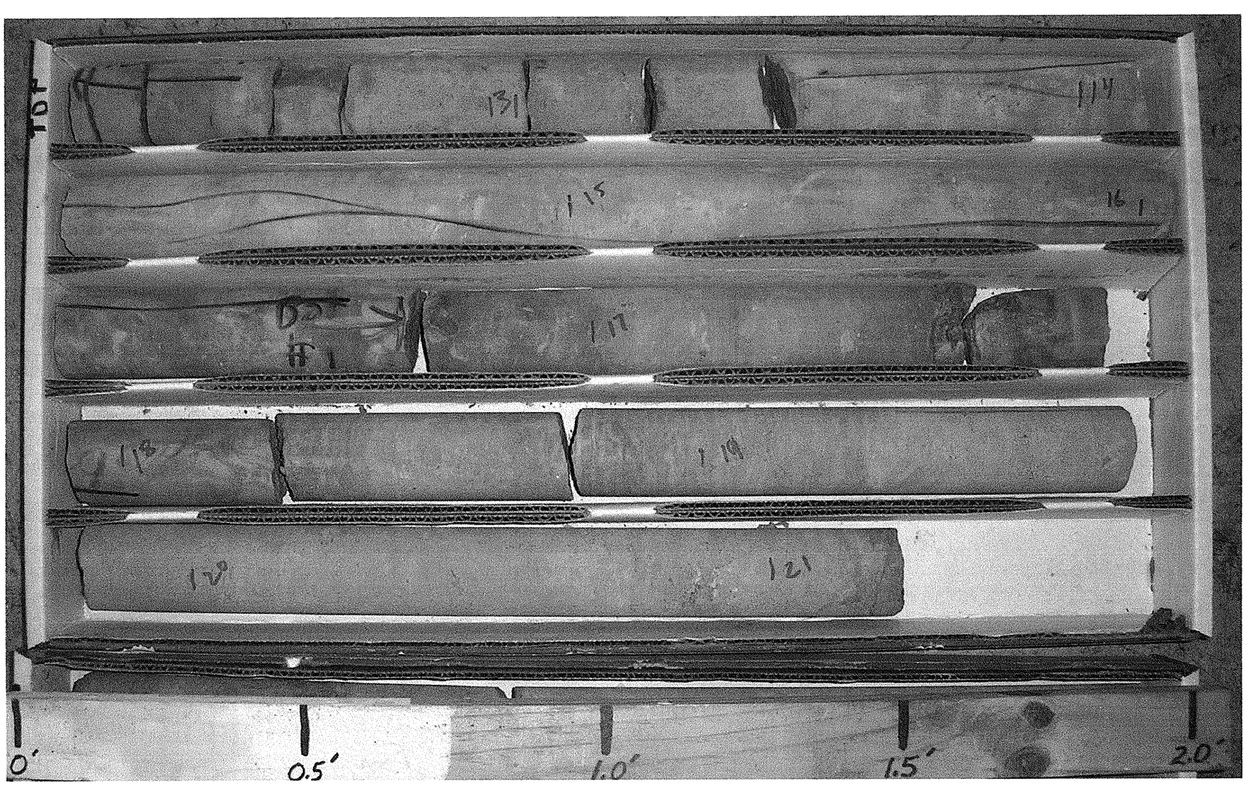

EB2-A SBL PHOTO 1/2

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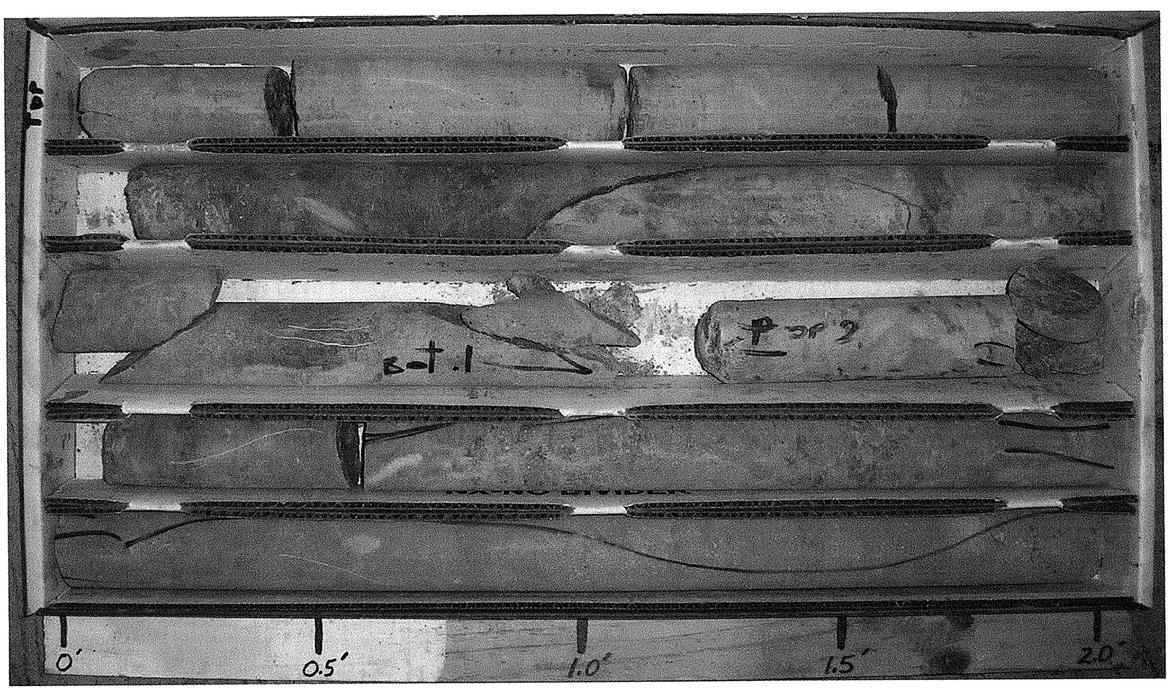

EB2-B SBL PHOTO 1/1