STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34817.1.2 (U-2519CB)	1	13

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34817.1.2 (U-2519CB) F.A. PROJ. NHF-DPR-0100(001)

COUNTY CUMBERLAND

PROJECT DESCRIPTION FAYETTVILLE OUTER LOOP FROM SOUTH OF SR 1400 (CLIFFDALE RD) TO EAST OF SR 1415 (YADKIN RD)

SITE DESCRIPTION STRUCTURES 1 AND 2 ON -L- OVER SR 1400 (CLIFFDALE RD) AT -Y5- STATION 250+05.30

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2	LEGEND
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9-11	BORE LOGS
12-13	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.

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PERSONNEL

CMW

S&ME

JRS

INVESTIGATED BY JL. STONE

CHECKED BY DN. ARGENBRIGHT

SUBMITTED BY DN. ARGENBRIGHT

DATE JANUARY 2008

NORTH CAROLINA LICENSED SEAL 2007 GEOLOGIST JOSEPH L. STONE 1-10-08

DRAWN BY: J.R. SWARTLEY

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: 34817.1.2 ID: U-2519CB

PROJECT REFERENCE NO.	SHEET NO.
34817.1.2 (U-2519CB)	2 of 13

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	6 MX		NP	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				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)	- 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	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	>10%	>20%	HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- 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
- 25/026 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
- [ ] CME-550
- [ ] PORTABLE HOIST
- [X] CME-750
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 2 15/16 " 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 REGULTS 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-21-Y5- STA. 765+27.64 83.40' LT

ELEVATION: 243.58 FT.

NOTES:

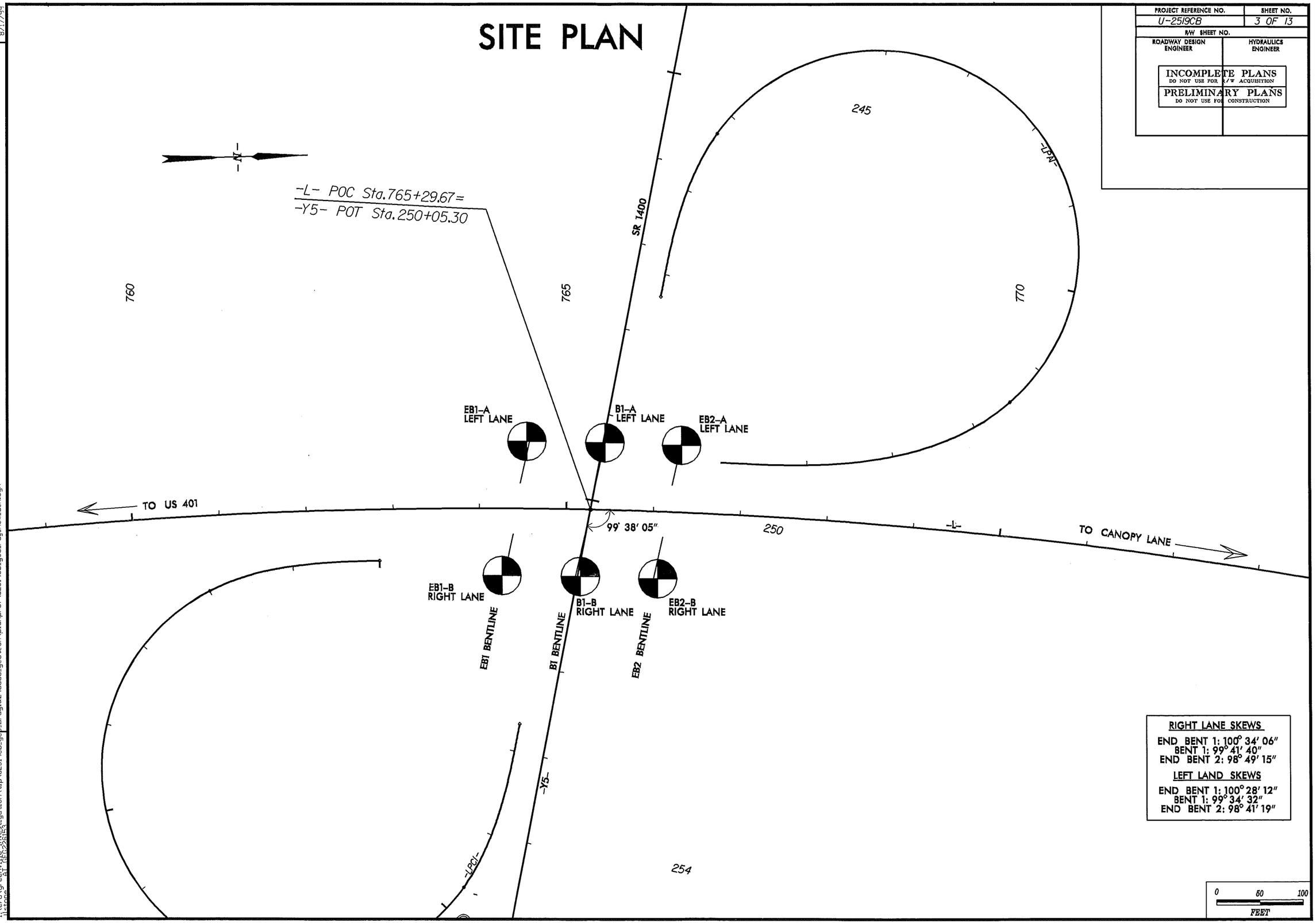
UNDIVIDED C.P. = UNDIVIDED COASTAL PLAIN

REVISED 02/23/06

SITE PLAN

PROJECT REFERENCE NO.	SHEET NO.
U-2519CB	3 OF 13
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



RIGHT LANE SKEWS
END BENT 1: 100° 34' 06"
BENT 1: 99° 41' 40"
END BENT 2: 98° 49' 15"

LEFT LAND SKEWS
END BENT 1: 100° 28' 12"
BENT 1: 99° 34' 32"
END BENT 2: 98° 41' 19"

REVISIONS

8/17/99

11-JAN-2008 08:27
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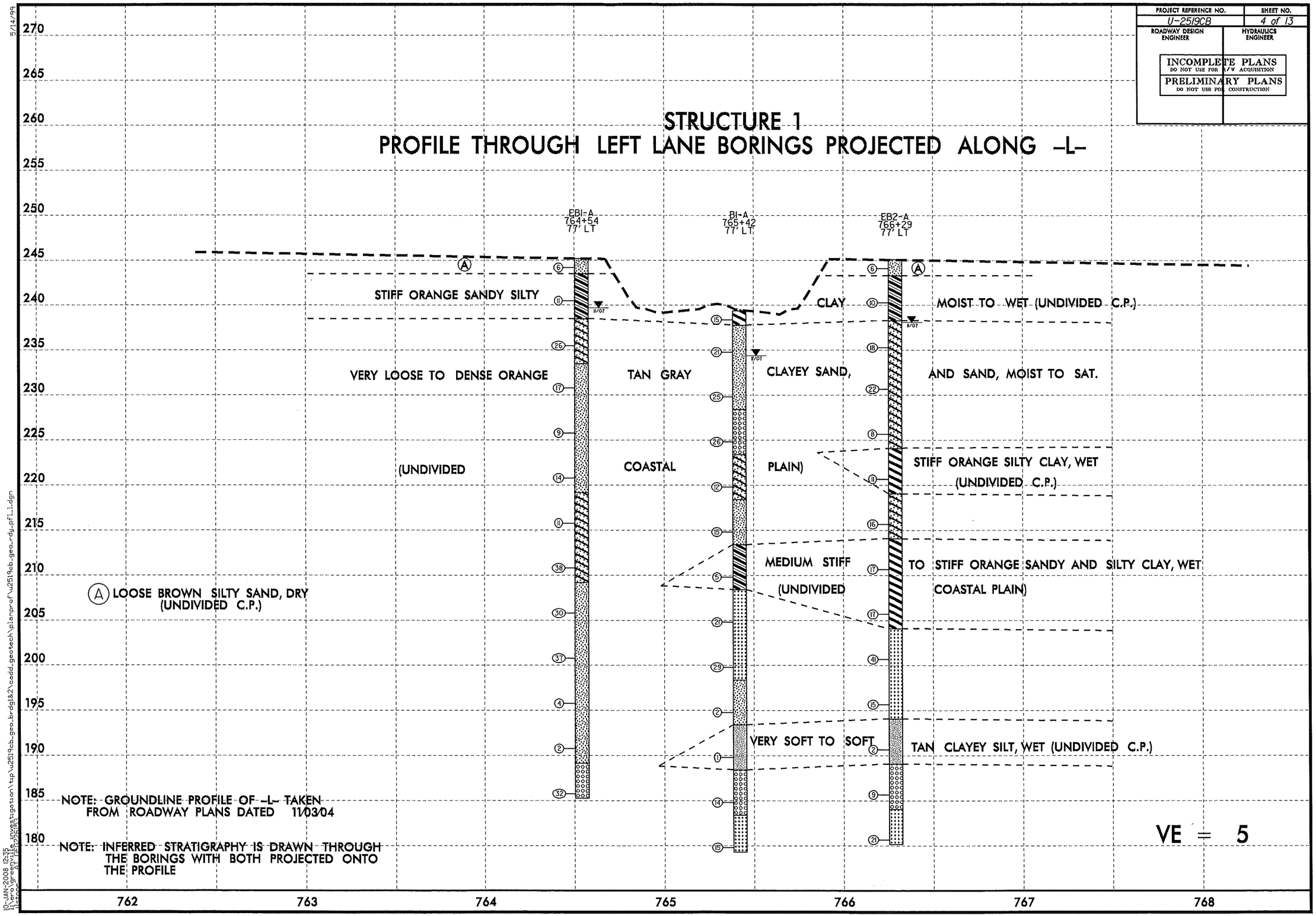
PROJECT REFERENCE NO.	SHEET NO.
U-2519CB	4 of 13
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

STRUCTURE 1
PROFILE THROUGH LEFT LANE BORINGS PROJECTED ALONG -L-



NOTE: GROUNDLINE PROFILE OF -L- TAKEN FROM ROADWAY PLANS DATED 11/03/04

NOTE: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE

VE = 5

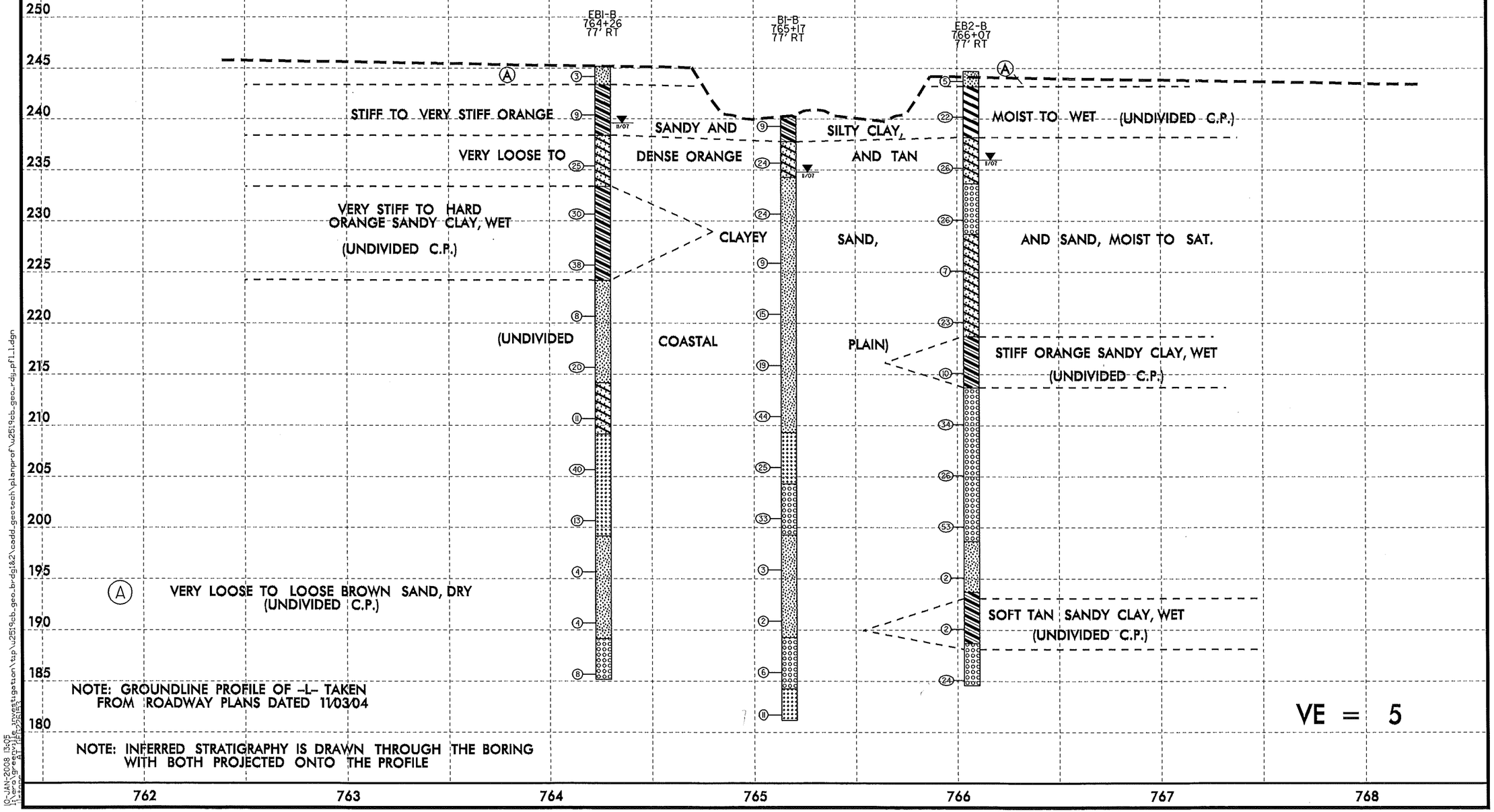
5/14/99

10-JAN-2008 12:35

PROJECT REFERENCE NO.	SHEET NO.
U-2519CB	5 of 13
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

STRUCTURE 2
PROFILE THROUGH RIGHT LANE BORINGS PROJECTED ALONG -L-



NOTE: GROUNDLINE PROFILE OF -L- TAKEN FROM ROADWAY PLANS DATED 11/03/04

NOTE: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORING WITH BOTH PROJECTED ONTO THE PROFILE

VE = 5

5/14/99

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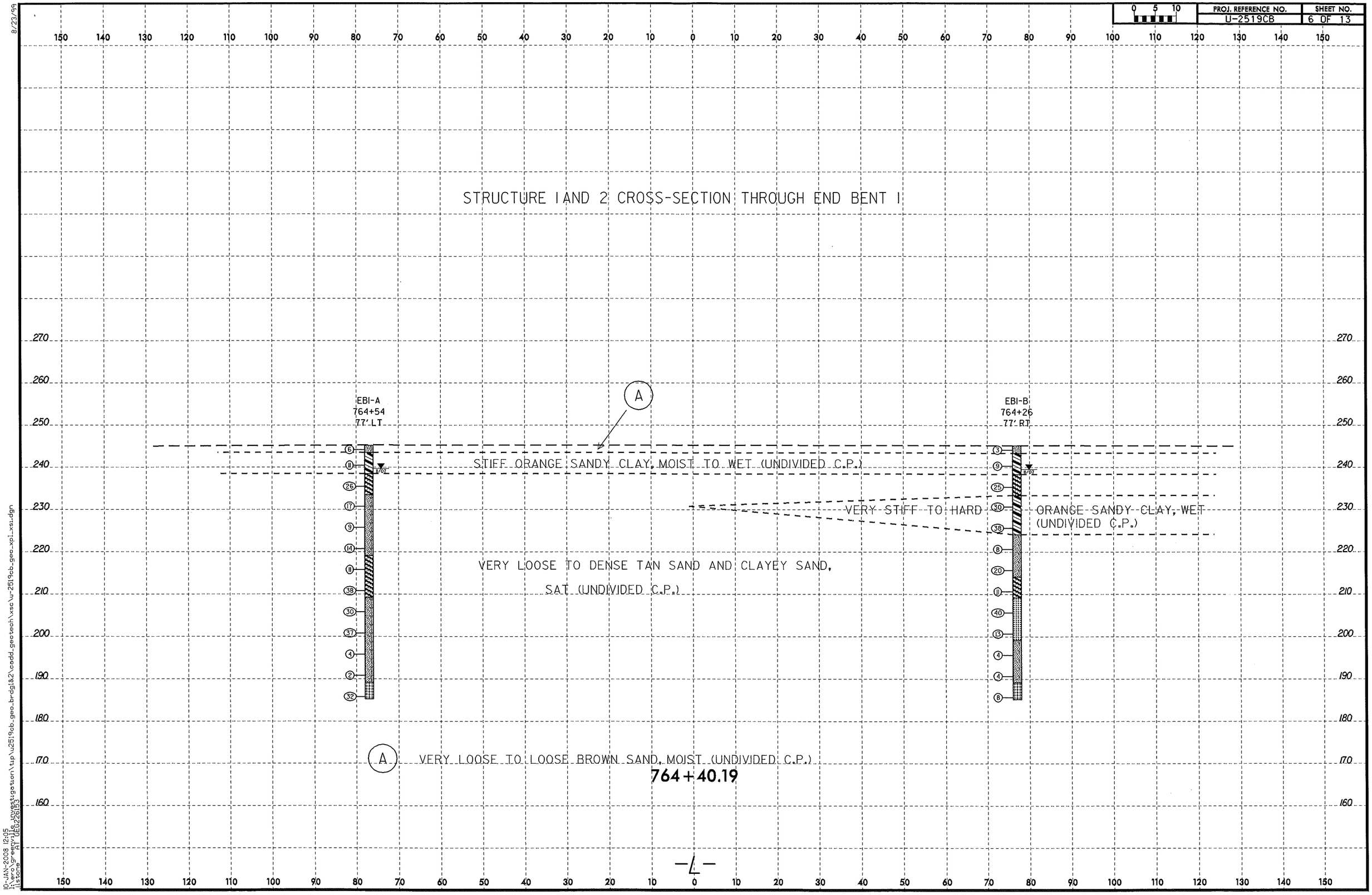
PROJ. REFERENCE NO. U-2519CB
SHEET NO. 6 OF 13



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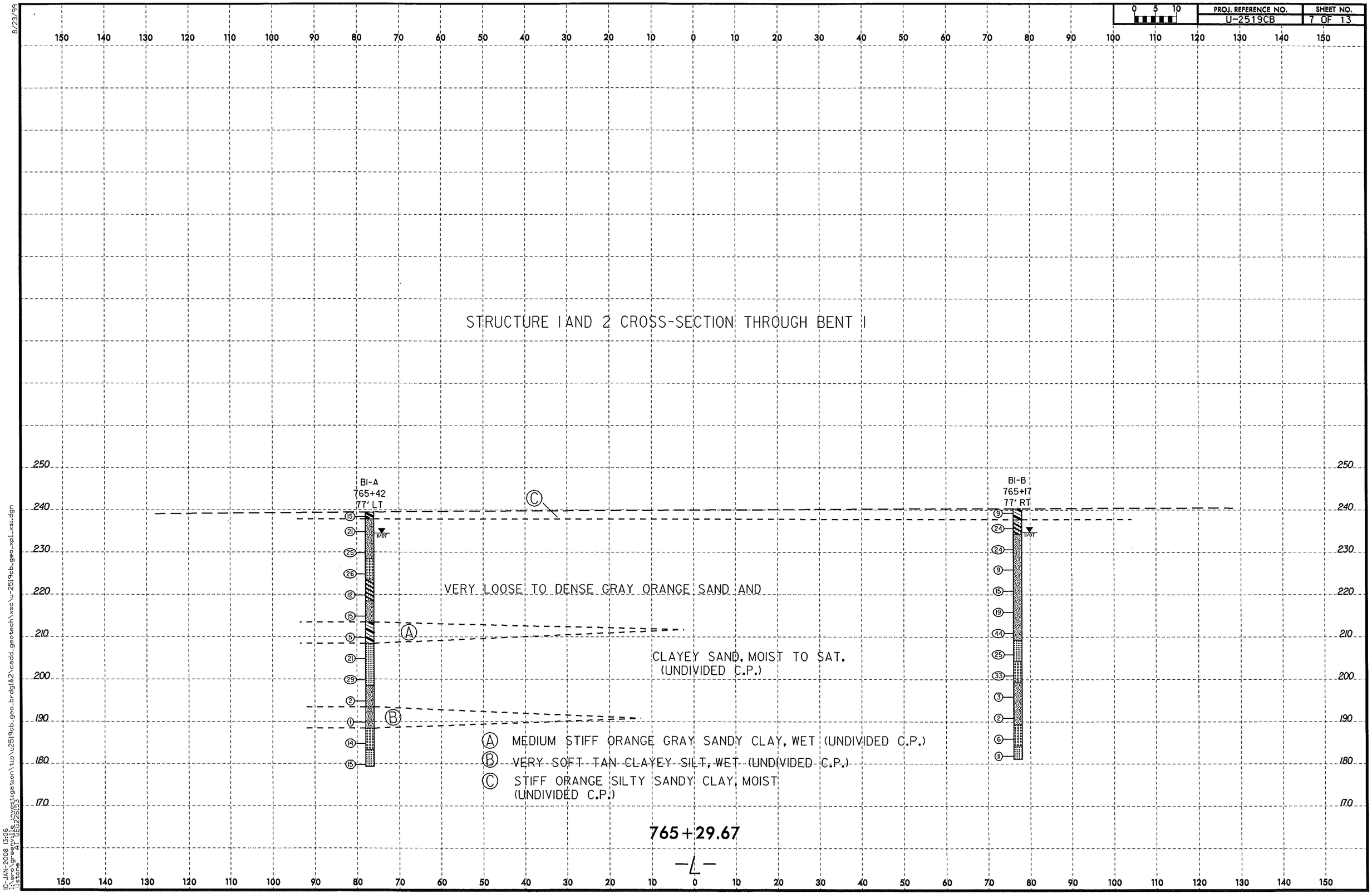
ilstone AT GEG226153

PROJ. REFERENCE NO. U-2519CB
SHEET NO. 7 OF 13



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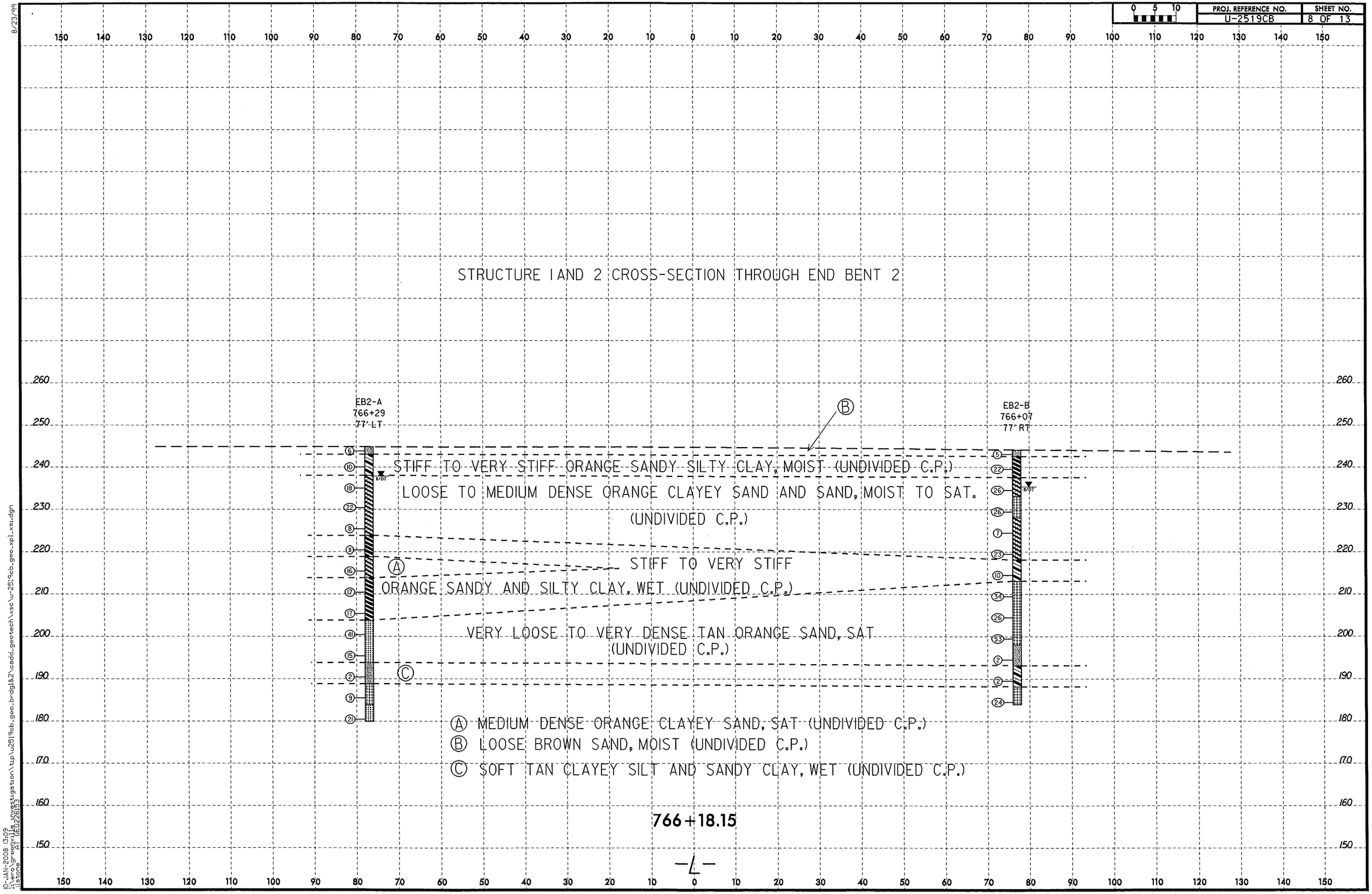
listone AT GEG226153

PROJ. REFERENCE NO. U-2519CB | SHEET NO. 8 OF 13



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ilstone AT GEG226153

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** Wrike, C. M.
SITE DESCRIPTION STRUCTURE 1 ON -L- OVER SR 1400 (CLIFFDALE RD.) AT -Y5- STATION 250+05.03			**GROUND WTR (ft)**
BORING NO. EB1-A LT. LN.	**STATION** 764+54	**OFFSET** 77ft LT	**ALIGNMENT** -L- / **0 HR.** N/A
COLLAR ELEV. 245.3 ft	**TOTAL DEPTH** 59.9 ft	**NORTHING** 478,183	**EASTING** 1,992,769 / **24 HR.** 5.5
DRILL MACHINE CME-750	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 10/31/07	**COMP. DATE** 11/01/07	**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	SAMP. NO.	MOI	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)
								GROUND SURFACE	245.3	0.0
	245.3	0.0								
			2	3	3	SS-11		UNDIVIDED COASTAL PLAIN BROWN SAND, MOIST	243.6	1.7
	241.6	3.7						UNDIVIDED COASTAL PLAIN ORANGE SANDY CLAY, MOIST TO WET		
			3	5	6	SS-12	15%		238.6	6.7
	236.6	8.7						UNDIVIDED COASTAL PLAIN ORANGE AND GRAY CLAYEY SAND AND SAND, SAT.		
			10	13	13	SS-13			233.6	11.7
	231.9	13.4								
			10	10	7	SS-14				
	226.9	18.4								
			4	4	5	SS-15	21%			
	221.9	23.4								
			4	4	10				219.3	26.0
	216.9	28.4								
			8	6	5	SS-16				
	211.9	33.4								
			5	16	22				209.3	36.0
	206.9	38.4								
			14	8	22	SS-17				
	201.9	43.4								
			11	17	20					
	196.9	48.4								
			2	2	2	SS-18				
	191.9	53.4								
			WOH	1	1	SS-19			189.3	56.0
	186.9	58.4								
			4	9	23	SS-20			185.4	59.9

Boring Terminated at Elevation 185.4 ft IN DENSE SAND

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** Wrike, C. M.
SITE DESCRIPTION STRUCTURE 2 ON -L- OVER SR 1400 (CLIFFDALE RD.) AT -Y5- STATION 250+05.03			**GROUND WTR (ft)**
BORING NO. EB1-B RT. LN.	**STATION** 764+26	**OFFSET** 77ft RT	**ALIGNMENT** -L- / **0 HR.** N/A
COLLAR ELEV. 245.3 ft	**TOTAL DEPTH** 60.0 ft	**NORTHING** 478,154	**EASTING** 1,992,923 / **24 HR.** 5.6
DRILL MACHINE CME-750	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 10/31/07	**COMP. DATE** 10/31/07	**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	SAMP. NO.	MOI	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)
								GROUND SURFACE	245.3	0.0
	245.3	0.0								
			2	2	1	SS-1		UNDIVIDED COASTAL PLAIN BROWN SAND, MOIST	243.5	1.8
	241.5	3.8						UNDIVIDED COASTAL PLAIN ORANGE SANDY CLAY, MOIST TO WET		
			3	4	5	SS-2	18%		238.5	6.8
	236.5	8.8						UNDIVIDED COASTAL PLAIN ORANGE CLAYEY SAND, SAT.		
			7	12	13	SS-3			233.5	11.8
	231.8	13.5						UNDIVIDED COASTAL PLAIN ORANGE SANDY CLAY, WET		
			9	8	22	SS-4				
	226.8	18.5								
			11	21	17				224.3	21.0
	221.8	23.5						UNDIVIDED COASTAL PLAIN GRAY CLAYEY SAND AND SAND, SAT.		
			3	4	4	SS-5				
	216.8	28.5								
			9	7	13				214.3	31.0
	211.8	33.5								
			8	5	6	SS-6			209.3	36.0
	206.8	38.5								
			9	20	20	SS-7				
	201.8	43.5								
			5	8	5				199.3	46.0
	196.8	48.5								
			2	2	2	SS-8				
	191.8	53.5								
			2	2	2	SS-9			189.3	56.0
	186.8	58.5								
			2	2	6	SS-10			185.3	60.0

Boring Terminated at Elevation 185.3 ft IN LOOSE SAND

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** Wrike, C. M.
SITE DESCRIPTION STRUCTURE 1 ON -L- OVER SR 1400 (CLIFFDALE RD.) AT -Y5- STATION 250+05.03			**GROUND WTR (ft)**
BORING NO. B1-A LT. LN.	**STATION** 765+42	**OFFSET** 77ft LT	**ALIGNMENT** -L- / **0 HR.** N/A
COLLAR ELEV. 239.6 ft	**TOTAL DEPTH** 60.1 ft	**NORTHING** 478,272	**EASTING** 1,992,770 / **24 HR.** 5.0
DRILL MACHINE N/A	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 11/01/07	**COMP. DATE** 11/01/07	**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	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
	240 / 239.6	0.0								239.6 GROUND SURFACE	0.0
			3	6	9	15	SS-44			238.0 UNDIVIDED COASTAL PLAIN ORANGE SILTY CLAY, MOIST	1.6
	236.0	3.6								UNDIVIDED COASTAL PLAIN ORANGE SAND, MOIST TO SAT.	
235			9	10	11	21	SS-45				
	231.0	8.6									
230			7	12	13	25	SS-46			228.6	11.0
	226.0	13.6									
225			12	15	11	26	SS-47			223.6 UNDIVIDED COASTAL PLAIN GRAY ORANGE CLAYEY SAND, SAT.	16.0
	221.0	18.6									
220			4	5	7	12	SS-48	18%		218.6 UNDIVIDED COASTAL PLAIN GRAY ORANGE SAND, SAT.	21.0
	216.0	23.6									
215			8	8	7	15	SS-49			213.6 UNDIVIDED COASTAL PLAIN GRAY ORANGE SANDY CLAY, WET	26.0
	211.0	28.6									
210			4	2	3	5	SS-50			208.6 UNDIVIDED COASTAL PLAIN ORANGE SAND, SAT.	31.0
	206.0	33.6									
205			9	9	12	21	SS-51				
	201.0	38.6									
200			13	14	15	29				198.6	41.0
	196.0	43.6									
195			1	1	1	2	SS-52			193.6 UNDIVIDED COASTAL PLAIN TAN CLAYEY SILT, WET	46.0
	191.0	48.6									
190			WOH	WOH	1	1	SS-53			188.6 UNDIVIDED COASTAL PLAIN TAN BROWN SAND, SAT.	51.0
	186.0	53.6									
185			4	7	7	14	SS-54			183.6	56.0
	181.0	58.6									
180			6	7	8	15	SS-55			179.5 Boring Terminated at Elevation 179.5 ft IN MEDIUM DENSE SAND	60.1
175											
170											
165											
160											

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** Wrike, C. M.
SITE DESCRIPTION STRUCTURE 2 ON -L- OVER SR 1400 (CLIFFDALE RD.) AT -Y5- STATION 250+05.03			**GROUND WTR (ft)**
BORING NO. B1-B RT. LN.	**STATION** 765+17	**OFFSET** 77ft RT	**ALIGNMENT** -L- / **0 HR.** N/A
COLLAR ELEV. 240.3 ft	**TOTAL DEPTH** 59.9 ft	**NORTHING** 478,243	**EASTING** 1,992,924 / **24 HR.** 5.5
DRILL MACHINE CME-750	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 11/01/07	**COMP. DATE** 11/01/07	**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	SOIL AND ROCK DESCRIPTION
	245									
240	240.3	0.0								240.3 GROUND SURFACE 0.0
			2	2	7	9	SS-56			UNDIVIDED COASTAL PLAIN ORANGE SANDY CLAY, MOIST TO WET 237.8 2.5
	236.7	3.6								UNDIVIDED COASTAL PLAIN ORANGE CLAYEY SAND, MOIST TO SAT.
235			10	11	13	24	SS-57			234.3 6.0
	231.7	8.6								UNDIVIDED COASTAL PLAIN ORANGE SAND, SAT.
230			4	11	13	24	SS-58			
	226.9	13.4								
225			4	4	5	9	SS-59			
	221.9	18.4								
220			10	8	7	15				
	216.9	23.4								
215			10	11	8	19	SS-60			
	211.9	28.4								
210			15	19	25	44				209.3 31.0
	206.9	33.4								
205			6	12	13	25	SS-61			204.3 36.0
	201.9	38.4								
200			7	16	17	33	SS-62			199.3 41.0
	196.9	43.4								
195			2	2	1	3	SS-63			
	191.9	48.4								
190			WOH	1	1	2	SS-64			189.3 51.0
	186.9	53.4								
185			2	1	5	6	SS-65			184.3 56.0
	181.9	58.4								
180			3	5	6	11	SS-66			180.4 59.9 Boring Terminated at Elevation 180.4 ft IN MEDIUM DENSE SAND
175										
170										
165										

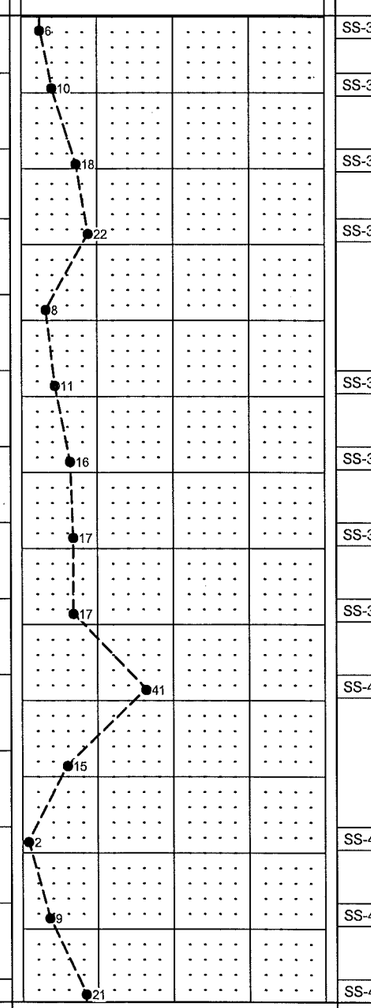
NCDOT BORE DOUBLE BORELOGS.GPJ NC_DOT.GDT 01/10/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** Wrike, C. M.
SITE DESCRIPTION STRUCTURE 1 ON -L- OVER SR 1400 (CLIFFDALE RD.) AT -Y5- STATION 250+05.03			**GROUND WTR (ft)**
BORING NO. EB2-A LT. LN.	**STATION** 766+29	**OFFSET** 77ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 245.1 ft	**TOTAL DEPTH** 64.9 ft	**NORTHING** 478,360	**EASTING** 1,992,773
DRILL MACHINE CME-750	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 11/01/07	**COMP. DATE** 11/01/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

GROUND WTR (ft)	
0 HR.	N/A
24 HR.	7.0

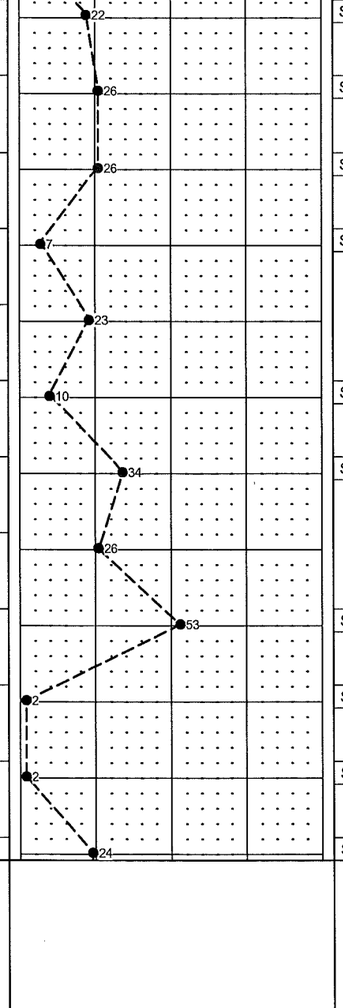
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	SAMP. NO.	MOI	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
	250							
245	245.1	0.0						245.1 / 0.0 GROUND SURFACE
			2	3	3	SS-32		243.3 / 1.8 UNDIVIDED COASTAL PLAIN BROWN SAND, MOIST
	241.3	3.8						UNDIVIDED COASTAL PLAIN ORANGE SANDY CLAY, MOIST
240			3	4	6	SS-33	15%	238.3 / 6.8 UNDIVIDED COASTAL PLAIN ORANGE CLAYEY SAND, MOIST TO SAT.
	236.3	8.8						
235			5	8	10	SS-34		
	231.7	13.4						
230			8	8	14	SS-35		
	226.7	18.4						
225			8	4	4			224.1 / 21.0 UNDIVIDED COASTAL PLAIN ORANGE SILTY CLAY, WET
	221.7	23.4						
220			4	4	7	SS-36		219.1 / 26.0 UNDIVIDED COASTAL PLAIN ORANGE CLAYEY SAND, SAT.
	216.7	28.4						
215			6	7	9	SS-37		214.1 / 31.0 UNDIVIDED COASTAL PLAIN ORANGE SILTY CLAY, WET
	211.7	33.4						
210			4	7	10	SS-38		
	206.7	38.4						
205			2	6	11	SS-39		204.1 / 41.0 UNDIVIDED COASTAL PLAIN ORANGE SAND, SAT.
	201.7	43.4						
200			14	18	23	SS-40		
	196.7	48.4						
195			12	9	6			194.1 / 51.0 UNDIVIDED COASTAL PLAIN TAN CLAYEY SILT, WET
	191.7	53.4						
190			WOH	1	1	SS-41		189.1 / 56.0 UNDIVIDED COASTAL PLAIN TAN SAND, SAT.
	186.7	58.4						
185			2	3	6	SS-42		184.1 / 61.0
	181.7	63.4						
180			7	9	12	SS-43		180.2 / 64.9 Boring Terminated at Elevation 180.2 ft IN MEDIUM DENSE SAND
175								
170								



PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** Wrike, C. M.
SITE DESCRIPTION STRUCTURE 2 ON -L- OVER SR 1400 (CLIFFDALE RD.) AT -Y5- STATION 250+05.03			**GROUND WTR (ft)**
BORING NO. EB2-B RT. LN.	**STATION** 766+07	**OFFSET** 77ft RT	**ALIGNMENT** -L-
COLLAR ELEV. 244.7 ft	**TOTAL DEPTH** 60.1 ft	**NORTHING** 478,332	**EASTING** 1,992,926
DRILL MACHINE CME-750	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 10/31/07	**COMP. DATE** 10/31/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

GROUND WTR (ft)	
0 HR.	N/A
24 HR.	8.7

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	SAMP. NO.	MOI	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
	245 / 244.7	0.0						244.7 / 0.0 GROUND SURFACE
			2	2	3	SS-21		243.2 / 1.5 UNDIVIDED COASTAL PLAIN BROWN SAND, MOIST
	241.2	3.5						UNDIVIDED COASTAL PLAIN ORANGE SILTY CLAY, MOIST
240			6	9	13	SS-22	23%	238.2 / 6.5 UNDIVIDED COASTAL PLAIN ORANGE CLAYEY SAND AND SAND, MOIST TO SAT.
	236.2	8.5						
235			10	12	14	SS-23		
	231.1	13.6						
230			13	15	11	SS-24		228.7 / 16.0
	226.1	18.6						
225			4	4	3	SS-25		
	221.1	23.6						
220			14	13	10			218.7 / 26.0 UNDIVIDED COASTAL PLAIN ORANGE SANDY CLAY, WET
	216.1	28.6						
215			3	3	7	SS-26		213.7 / 31.0 UNDIVIDED COASTAL PLAIN TAN SAND, SAT.
	211.1	33.6						
210			18	17	17	SS-27		
	206.1	38.6						
205			11	14	12			
	201.1	43.6						
200			32	31	22	SS-28		198.7 / 46.0
	196.1	48.6						
195			1	1	1	SS-29		193.7 / 51.0 UNDIVIDED COASTAL PLAIN TAN SANDY CLAY, WET
	191.1	53.6						
190			WOH	1	1	SS-30		188.7 / 56.0 UNDIVIDED COASTAL PLAIN TAN SAND , SAT.
	186.1	58.6						
185			6	11	13	SS-31		184.6 / 60.1 Boring Terminated at Elevation 184.6 ft IN MEDIUM DENSE SAND
180								
175								
170								
165								



NCDOT BORE DOUBLE BORELOGS.GPJ NC_DOT.GDT 01/10/08

U-2519CB
STRUCTURES 1 AND 2 ON -L- OVER SR 1400 (CLIFFDALE RD.) AT -Y5- STATION 250+05.03

HOLE #	SAMPLE #	PASS 10	PASS 40	PASS 200	CSESAND	FINESAND	SI	CL	LL	PI	CLASS	DEPTH	ORG.	MOI.
EB1-B	SS-1	100	78	27	41.4	36.6	12	10.1	9	NP	A-2-4(0)	1.00-1.50		
RT.LN.	SS-2	100	80	46	33.2	24.3	8.3	34.2	37	17	A-6(4)	3.80-5.30		18.4
	SS-3	100	65	26	58.8	16.9	3.2	21.1	33	12	A-2-6(0)	8.80-10.30		
	SS-4	100	87	37	30.8	36.2	8.9	24.1	28	12	A-6(1)	13.50-15.00		
	SS-5	100	76	27	43.1	34.6	5.2	17.1	23	7	A-2-4(0)	23.50-25.00		
	SS-6	99	76	30	39.8	34	2.1	24.1	30	15	A-2-6(1)	33.50-35.00		
	SS-7	100	62	8	68.9	23.9	1.1	6	21	NP	A-3(0)	38.50-40.00		
	SS-8	98	73	13	50.1	38.7	1.2	10.1	20	NP	A-2-4(0)	48.50-50.00		
	SS-9	97	76	17	32	52.6	3.4	12.1	23	NP	A-2-4(0)	53.50-55.00		
	SS-10	87	30	7	79.7	13.8	0.5	6	19	NP	A-1-b(0)	58.50-60.00		
EB1-A	SS-11	100	75	27	45	32.9	11.1	11.1	14	NP	A-2-4(0)	1.00-1.50		
LT.LN.	SS-12	100	80	38	35.9	29.2	7.7	27.1	28	12	A-6(1)	3.70-5.20		14.8
	SS-13	99	71	26	54.6	20.8	0.5	24.1	29	12	A-2-6(0)	8.70-10.20		
	SS-14	78	52	16	55.7	26.2	3	15.1	21	5	A-2-4(0)	13.40-14.90		
	SS-15	100	89	34	24.7	46	3.1	26.1	26	10	A-2-4(0)	18.40-19.90		21.0
	SS-16	100	63	32	54.9	14.1	2.9	28.1	42	23	A-2-7(2)	28.40-29.90		
	SS-17	100	63	14	65.6	21.7	2.6	10.1	19	NP	A-2-4(0)	38.40-39.90		
	SS-18	99	73	11	46.1	44.4	0.4	9	21	NP	A-2-4(0)	48.40-49.90		
	SS-19	98	85	32	19.3	52.5	6.1	22.1	25	6	A-2-4(0)	53.40-54.90		
	SS-20	88	37	5	80.1	15.2	0.7	4	21	NP	A-1-b(0)	58.40-59.90		
EB2-B	SS-21	100	77	30	40.4	35.2	13.4	11.1	13	NP	A-2-4(0)	1.00-1.50		
RT.LN.	SS-22	100	79	48	35.9	18.7	6.2	39.2	54	24	A-7-5(8)	3.50-5.00		22.9
	SS-23	100	64	24	62.1	14.4	0.4	23.1	34	16	A-2-6(1)	8.50-10.00		
	SS-24	95	37	9	82.7	8.8	0.4	8	23	NP	A-1-b(0)	13.60-15.10		
	SS-25	94	65	24	53.6	22.9	11.5	12.1	33	16	A-2-6(1)	18.60-20.10		
	SS-26	100	78	39	43.7	19.7	5.4	31.2	40	23	A-6(4)	28.60-30.10		
	SS-27	99	44	11	75.3	14.6	0.1	10.1	21	3	A-1-b(0)	33.60-35.10		
	SS-28	94	20	5	88	7.2	1.7	3	18	NP	A-1-b(0)	43.60-45.10		
	SS-29	99	75	13	42.7	45.8	1.4	10.1	21	NP	A-2-4(0)	48.60-50.10		
	SS-30	99	92	44	13.5	50.5	11	25.1	31	13	A-6(2)	53.60-55.10		
	SS-31	85	36	5	80.2	14.2	0.6	5	15	NP	A-1-b(0)	58.60-60.10		

U-2519CB
STRUCTURES 1 AND 2 ON -L- OVER SR 1400 (CLIFFDALE RD.) AT -Y5- STATION 250+05.03

HOLE #	SAMPLE #	PASS 10	PASS 40	PASS 200	CSESAND	FINESAND	SI	CL	LL	PI	CLASS	DEPTH	ORG.	MOI.
EB2-A	SS-32	100	77	32	40.6	31.8	11.6	16.1	17	5	A-2-4(0)	1.00-1.50		
LT.LN.	SS-33	99	77	41	36.4	25.6	7.8	30.2	32	14	A-6(2)	3.80-5.30		14.8
	SS-34	99	79	31	39.6	33.3	4	23.1	31	14	A-2-6(1)	8.80-10.30		
	SS-35	85	49	18	60.6	20.4	0.9	18.1	30	12	A-2-6(0)	13.40-14.90		
	SS-36	100	77	41	39.1	22	3.7	35.2	53	32	A-7-6(7)	23.40-24.90		
	SS-37	100	62	19	64	18.1	1.6	16.3	31	15	A-2-6(0)	28.40-29.90		
	SS-38	100	77	45	38.4	19.1	4.8	37.7	51	33	A-7-6(9)	33.40-34.90		
	SS-39	100	88	57	24.6	21.4	9.2	44.8	47	29	A-7-6(13)	38.40-39.90		
	SS-40	100	61	6	71.9	23	1	4.1	20	NP	A-3(0)	43.40-44.90		
	SS-41	100	93	38	11.4	56.8	7.3	24.4	25	4	A-4(0)	53.40-54.90		
	SS-42	86	31	6	79.4	14.3	0.2	6.1	20	NP	A-1-b(0)	58.40-59.90		
	SS-43	85	53	4	74.3	21.6	0.1	4	23	NP	A-3(0)	63.40-64.90		
B1-A	SS-44	100	79	43	34.9	26.1	6.4	32.6	50	29	A-7-6(7)	1.00-1.50		
LT.LN.	SS-45	100	82	28	36.8	40.7	5.2	17.3	23	5	A-2-4(0)	3.60-5.10		
	SS-46	95	58	13	57	33.1	1.7	8.1	20	NP	A-2-4(0)	8.60-10.10		
	SS-47	94	42	7	77.5	16.2	0.2	6.1	20	NP	A-1-b(0)	13.60-15.10		
	SS-48	99	69	29	49.9	22.8	0.8	26.5	43	28	A-2-7(3)	18.60-20.10		18.4
	SS-49	99	59	14	69.2	18.3	0.4	12.2	23	5	A-2-4(0)	23.60-25.10		
	SS-50	100	74	36	45.2	22.8	3.5	28.5	38	22	A-6(3)	28.60-30.10		
	SS-51	100	63	7	64.2	29.5	2.2	4.1	19	NP	A-3(0)	33.60-35.10		
	SS-52	99	72	12	41.7	47.2	1	10.1	22	NP	A-2-4(0)	43.60-45.10		
	SS-53	99	89	37	16.1	54.4	7.1	22.4	27	6	A-4(0)	48.60-50.10		
	SS-54	86	40	4	78	18	0.9	3.1	21	NP	A-1-b(0)	53.60-55.10		
	SS-55	96	51	6	75.2	19.4	0.4	5.1	19	NP	A-3(0)	58.60-60.10		
B1-B	SS-56	100	87	69	20.5	11.8	52.4	15.3	40	17	A-6(11)	1.00-1.50		
RT.LN.	SS-57	100	77	27	47.3	28.3	4.1	20.4	31	13	A-2-6(0)	3.60-5.10		
	SS-58	100	93	19	25.1	62.9	3.9	8.1	23	NP	A-2-4(0)	8.60-10.10		
	SS-59	97	58	19	55.1	29	3.7	12.2	22	4	A-2-4(0)	13.40-14.90		
	SS-60	100	41	11	80.9	8.5	0.5	10.1	25	7	A-2-4(0)	23.40-24.90		
	SS-61	100	70	5	58.5	36.9	2.6	2	22	NP	A-3(0)	33.40-34.90		
	SS-62	97	43	5	77.7	18	0.2	4.1	20	NP	A-1-b(0)	38.40-39.90		
	SS-63	99	78	12	42	47.7	0.2	10.2	22	NP	A-2-4(0)	43.40-44.90		
	SS-64	99	89	24	15.9	63.5	2.2	18.3	21	NP	A-2-4(0)	48.40-49.90		
	SS-65	87	39	7	74.4	18.4	0.1	7.1	21	NP	A-1-b(0)	53.40-54.90		
	SS-66	99	76	10	56.8	34	3.1	6.1	21	NP	A-3(0)	58.40-59.90		

PROJECT: 34817.1.2 ID: U-2519CB

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34817.1.2	1	63

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
U-2519CB	NHF-DPR-0100(001)	P.E.
		CONST.

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

STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 34817.1.2 I.D. NO. U-2519CB
F.A. PROJECT NHF-DPR-0100(001)
COUNTY CUMBERLAND
PROJECT DESCRIPTION FAYETTEVILLE OUTER LOOP FROM SOUTH OF SR 1400 (CLIFFDALE RD) TO EAST OF SR 1415 (CLEARWATER RD)

SITE DESCRIPTION STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS

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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.

DRAWN BY: R. RAHIE

INVESTIGATED BY	MACTEC ENGINEERING & CONSULTING, INC.	PERSONNEL	J. HOWARD
CHECKED BY	S. CRISCENZO		S. LEHMAN
SUBMITTED BY	B. DEOBALD		B. DEOBALD
DATE	04/27/07		D. RHODES
REVISED	05/29/07		E. BURKETT
			T. HAHN

For Letting

NORTH CAROLINA LICENSED SEAL 1730 GEOLOGIST WILLIAM BRIAN DEOBALD

SEAL

SIGNATURE

MACTEC
MACTEC ENGINEERING & CONSULTING, INC.
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ID	PROJECT NO.	SHEET NO.	TOTAL SHEETS
U-2519CB	34817.1.2	2	63

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 WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND 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		N.P.	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

P.I. OF A-7-5 ≤L.L. - 30 : P.I. OF A-7-6 >L.L. - 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 0.5 0.5 TO 1 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	2.0	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, YEL-BRN, 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 ARE 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 30
MODERATELY COMPRESSIBLE	LIQUID LIMIT 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT- CLAY SOILS	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	>10%	>20%	HIGHLY	35% AND ABOVE

GROUND WATER

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

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS
- INFERRED SOIL BOUNDARIES
- 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
- BULK SAMPLE LOCATION
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- REF SPT REFUSAL
- ASPHALT

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

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
C.I. - CAVE IN
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e -VOID RATIO
F. - FINE
FIAD - FILLED IMMEDIATELY AFTER DRILLING
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED
FRAGS. - FRAGMENTS
MED. - MEDIUM
PMT - PRESSUREMETER TEST
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT
V. - VERY
VST - VANE SHEAR TEST
W - MOISTURE CONTENT

EQUIPMENT USED ON SUBJECT PROJECT

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

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [x] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [x] CASING [ ] W/ ADVANCER
- [x] TRICONE 3" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] OTHER _____

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

CORE SIZE:
- [ ] -B _____
- [ ] -N _____
- [ ] -H Q

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

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN 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 FOLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT.
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 ROCKS 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 GEOLOGISTS 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 GEOLOGISTS 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 GEOLOGISTS 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 WHICH 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 IS IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS WHICH 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 (F.P.) - 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 SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (R.Q.D.) - 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 WHICH 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, WHICH 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 B.P.F.) 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 LESS THAN 0.1 FOOT PENETRATION WITH 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 (S.R.Q.D.) - 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 (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BASELINE SURVEY POINTS 29, 31, 32, 33, SET BY NCDOT PERS.

NOTES:
Geotechnical Exploration
Performed By:

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604
(919) 876-0416

Subject: **Geotechnical Report**

Description: **Structures 3 & 4: Dual Bridges on -L- over Wetlands**
Fayetteville Outer Loop

Project Number:	**34817.1.2**
Tip Number:	**U-2519CB**
F.A. Number:	**NHF-DPR-0100 (001)**
MACTEC Project Number:	**6468-07-1682**

Project Information

The purpose of this investigation was to obtain geotechnical information for design and construction of proposed dual bridges over wetlands at Stewart's Creek located on the Fort Bragg Military Reservation, east of the ammunition supply point on Chicken Road, Cumberland County, North Carolina (Drawings 1 and 2). The bridges are part of a proposed segment of the Fayetteville Outer Loop from south of SR 1400 (Cliffdale Road) to east of SR 1415 (Clearwater Road). Our understanding of this project comes from conversations with NCDOT Geotechnical Engineering Unit personnel and from documents and drawings provided by the Geotechnical Engineering Unit, including a Request for Proposal dated February 20, 2007, a Bridge Survey and Hydraulic Design Report (not dated) and electronic drawings obtained via the NCDOT file transfer website.

The proposed bridges are parallel structures, each approximately 1000 feet long and 45 feet wide. Each bridge is to be constructed on eleven bents with ten 100-foot long spans.

We were requested to drill up to three SPT-borings along each bent-line, for a maximum of 33 borings for the project. The initial plan was to drill 22 borings, including all of the "A" borings along the left-lane structure and all of the "B" borings along the right-lane structure. A third boring was to be drilled along selected bent-lines per NCDOT's direction. The need for a third boring was to be based on findings in the initial borings. We were instructed by NCDOT to advance the first boring drilled to the depth of 100 feet. NCDOT would then establish drilling depths for the remaining borings based on findings.

Field Testing

During March and April, 2007, MACTEC advanced 22 borings at locations shown on the Boring Location Plans (Drawings 3 and 18). The borings were drilled with a CME-45 marsh buggy-mounted drill rig and a CME-550 ATV-mounted drill rig. The borings were advanced using rotary-wash drilling techniques.

Boring LL B8-A was advanced to a depth of approximately 100 feet and borings LL B5-A, LL B6-A, and LL B7-A were advanced to a depth of approximately 80 feet. At the direction of the NCDOT, the remaining 18 borings were terminated approximately at a depth of 65 feet. Standard penetration tests (SPT) were conducted and soil samples collected at approximately five-foot intervals. Samples were collected from within the soil profile using split-barrel samplers and 140 lb. manual hammers. Undisturbed samples of shallow cohesive soil were collected with Shelby tubes for consolidation and triaxal shear strength testing and for EFA analyses.

Proposed boring locations were established at the project site utilizing GPS equipment. As-drilled boring location coordinates were captured with GPS equipment. The collected coordinates were corrected as necessary using post-processing differential correction. Conventional survey techniques were used to establish the collar elevations at all boring locations and selected ground surface points depicted on the subsurface profile and cross-section drawings included with this report. U-2519CB Baseline Survey Points 29, 31, 32 and 33, established at the project site by NCDOT, were used as benchmarks.

Laboratory Testing

Laboratory testing consisting of AASHTO classification and grain-size distribution tests were performed on split-barrel samples SS-2 through SS-34 and undisturbed sample ST-4. Sample SS-1 was submitted for organic content testing. Cohesive soils were also tested for moisture content.

Laboratory testing was performed in general accordance with applicable ASTM/AASHTO/ NCDOT specifications. Test results for AASHTO classification, grain-size distribution, and moisture content are included with this report.

Undisturbed samples, ST-1, ST-2, ST-3, and ST-4, were taken in borings RL B7-B, RL B8-B, RL B9-B, and RL EB2-B, respectively. Samples ST-1 and ST-2 were submitted to the NCDOT Geotechnical Engineering Unit for erosion function apparatus testing at their discretion. Sample ST-3 had no recovery. Sample ST-4 was tested for consolidation strength. Consolidation data are provided in a Laboratory Test Results support document.

Physiography

The ground surface along the approaches to the proposed bridges slopes downward gradually toward End Bents 1 and 2. There is approximately 60 feet of relief between the approach to End Bents 1 and the wetland, and approximately 35 feet of relief between the approach to End Bents 2 and the wetland. The ground surface ranges in elevation from 204 to 211± feet mean sea level (msl) along End Bents 1, and from 194 to 205± feet msl along End Bents 2. The wetland area is at elevation 187± feet msl along most of the interior bent locations.

The site is undeveloped. The upland areas, located at the end bents and along the outside flank of the left-lane structure, are wooded with young to mature pine and hardwood trees. The wetland is densely wooded with cypress trees. Stewart's Creek meanders through the cypress trees, crossing the site in braided-channels. Generally, the creek crosses the alignment near Bent 8, flows along the left-lane structure and crosses the alignment again near Bents 4 and 5. A secondary drainage flows generally eastward into Stewart's Creek near left-lane Bent 3. The water surface elevation of Stewart's Creek was measured at 187.7 feet msl on April 18, 2007. Site photographs included in this report show site conditions during our field investigation.

Geology

The project site is located in the western portion of the Carolina Coastal Plain Physiographic Province. The Carolina Coastal Plain is a wedge of mostly marine sediments and sedimentary rocks that gradually thickens to the east, towards the present day coast-line, that were deposited during depositional cycles caused by fluctuating sea-levels. The Coastal Plain sediments

encountered at the project site were deposited at a time when sea-level was much higher than its present condition. The depositional processes that resulted in the sediments encountered at the project site are the same as those in existence today along the current coast-line. Younger sediments lie at the surface near the coast. Older sediments, which underlie these younger sediments, lie at or near the surface further inland. The 1985 Geologic Map of North Carolina, compiled by the N.C. Geologic Survey, indicates that the project site is underlain by the Middendorf and Cape Fear Formations. We encountered the following stratigraphic units at the project site:

- Alluvium
- Middendorf Formation
- Cape Fear Formation

Boring logs describing subsurface conditions at each of the boring locations are included in this report. Generalized profiles, Drawings 4, 5, 6 and 19, 20, 21, depict subsurface conditions along the length of both structures. Generalized cross-sections, Drawings 7 to 17 and 22 to 32 depict subsurface conditions along each bent of both structures.

Soil

Alluvium was encountered in borings located in or near the wetland associated with Stewarts Creek, from approximately Bent 1 to 8 along the Left Lane Structure, and Bent 3 to End Bent 2 along the Right Lane Structure. The alluvial soils typically consist of a surface layer of very soft to medium stiff, sandy muck with wood fragments underlain by very loose to dense, clayey, silty, fine to coarse sand and gravel (A-2-6/A-2-4/A-3/A-1-b) with trace organics and wood fragments, and locally with soft, sandy, silty clay (A-6). Alluvial soils overlie the Middendorf Formation at approximate elevations ranging from 158 to 189± feet msl. The lower alluvial boundaries observed at Left Lane borings B5-A and B7-A, and Right Lane borings B5-A and B8-A may represent older alluvial channels cut into the Middendorf Formation as these locations generally coincide with the current channels of Stewarts Creek.

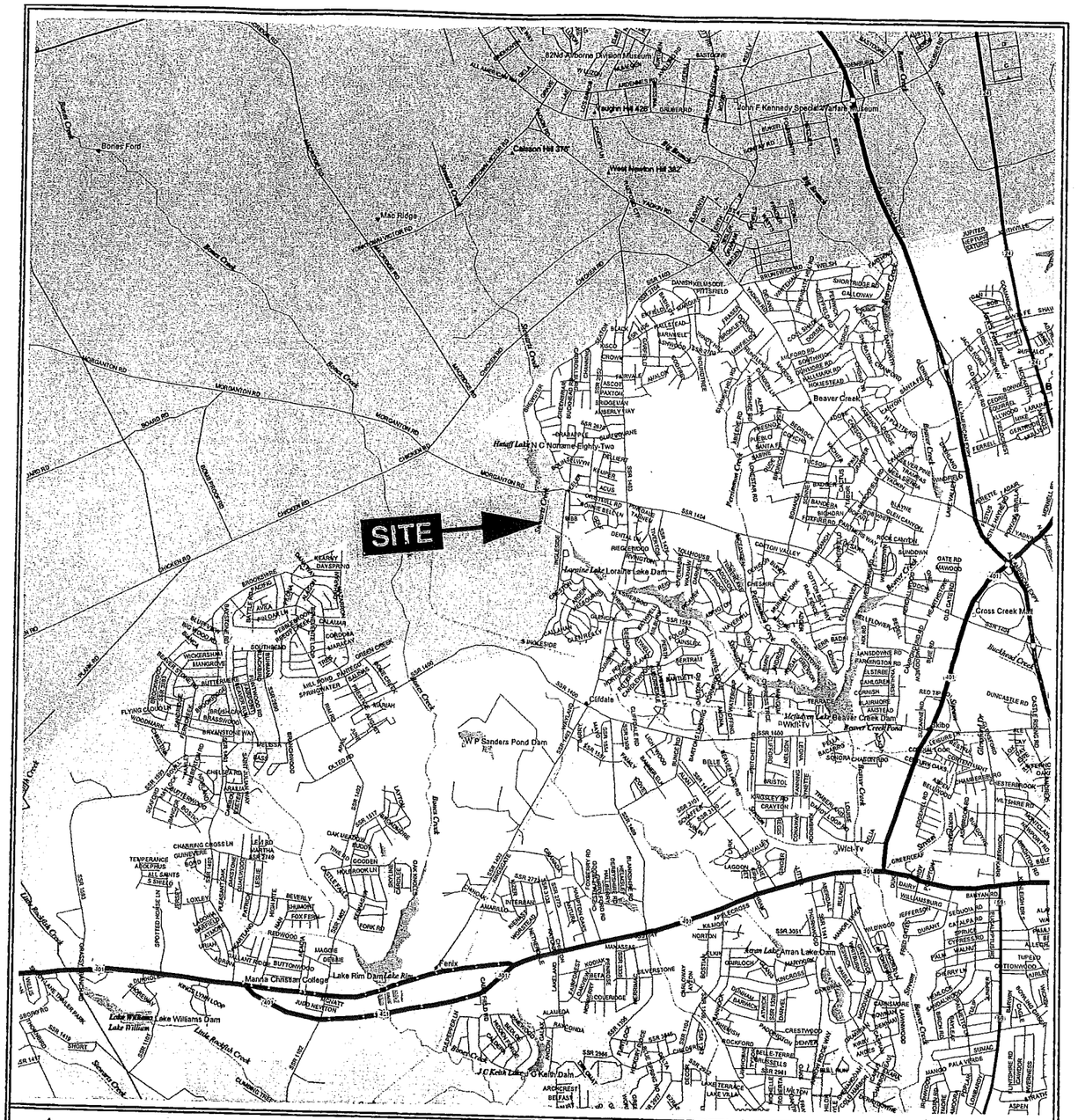
Middendorf Formation soils were encountered at the surface in Left Lane borings EB1-A, B9-A, and EB2-A, and Right Lane borings EB1-B, B1-B, and B2-B, and below alluvium at all other boring locations. The soils typically consist of interbedded, very loose to very dense, locally micaceous, silty, clayey, fine to coarse sand (A-2-6/A-2-7/A-2-4/A-3/A-1-b) and soft to hard, locally micaceous, fine to coarse sandy, silt and clay (A-4/A-6/A-7-6). Middendorf Formation soils are generally colored white, tan, brown, orange, and gray, and are locally mottled. Individual beds are laterally discontinuous. The base of the Middendorf Formation / top of the Cape Fear Formation ranges from elevation 149 to 164± feet msl.

The Cape Fear Formation was encountered underlying the Middendorf Formation and generally consists of interbedded clays and sands; including locally micaceous, stiff to hard, fine to coarse sandy, silt and clay (A-4/A-6/A-7-5/A-7-6), and locally micaceous, medium dense to very dense, silty, clayey, fine to coarse sand (A-2-4/A-2-6) with trace gravel. The clay is typically colored gray to green, mottled with orange, red, maroon, and brown. The sand is typically gray to green in color and locally mottled. Overall, the clay and sand beds vary greatly in thickness and are laterally discontinuous. All borings were terminated in the Cape Fear Formation.

SHEET 4

Groundwater

24-hour groundwater level measurements were obtained in borings at End Bents 1 and 2 and at Bents 1, 2, and 9. Groundwater level elevations ranged from 200 to 201± feet msl at the End Bents, and from 190 to 192± feet msl at Bents 1, 2, and 9. These groundwater elevations are somewhat higher than the surface water elevations observed in the wetland and appear to be a subdued reflection of the site topography.



REFERENCE: Delorme Street Atlas

SCALE: 1 inch = 1 mile

NOTE: SITE LOCATION IS APPROXIMATE

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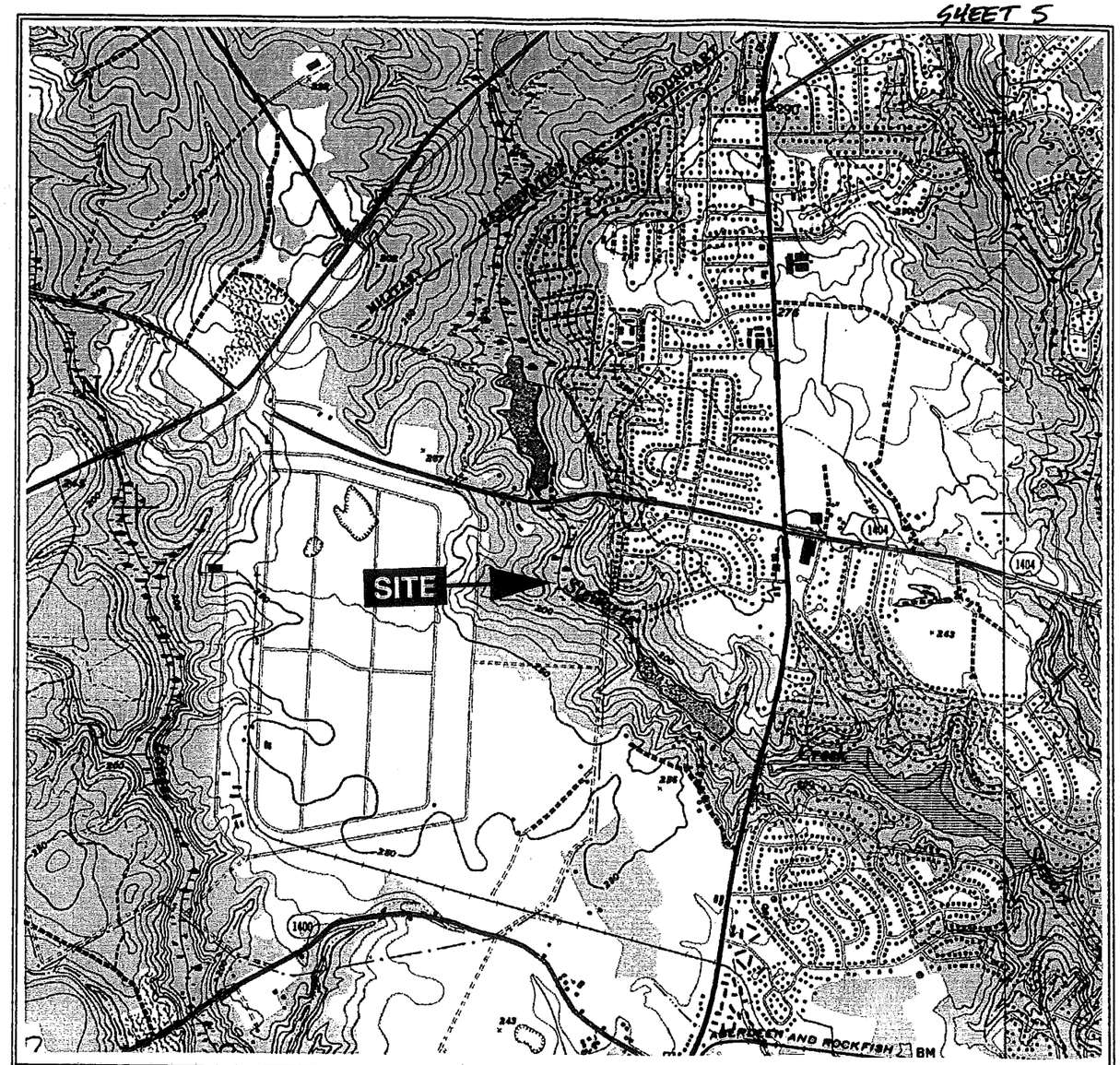
SITE LOCATION MAP
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJ. NO. 34817.1.2 (U-2519CB)
CUMBERLAND COUNTY, NORTH CAROLINA

DRAWN: MBL	DATE: APRIL 2007	DRAWING	
ENG CHECK:	SCALE: 1 : 62500	1	
APPROVAL: SSU	JOB: 6468-07-1682		

SHEET 5



FAYETTEVILLE, N.C.
SW/4 FAYETTEVILLE 15' QUADRANGLE
35078-A8-TF-024
1957
PHOTOREVISED 1987
DMA 5254 III SW – SERIES V842

CLIFDALE, N.C.
SE/4 CLIFDALE 15' QUADRANGLE
N3500-W7900/7.5
1948
PHOTOREVISED 1982
DMA 5154 II SE – SERIES V842

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

GRAPHIC SCALE FEET
2000 1000 0 2000 4000

NOTE: SITE LOCATION IS APPROXIMATE

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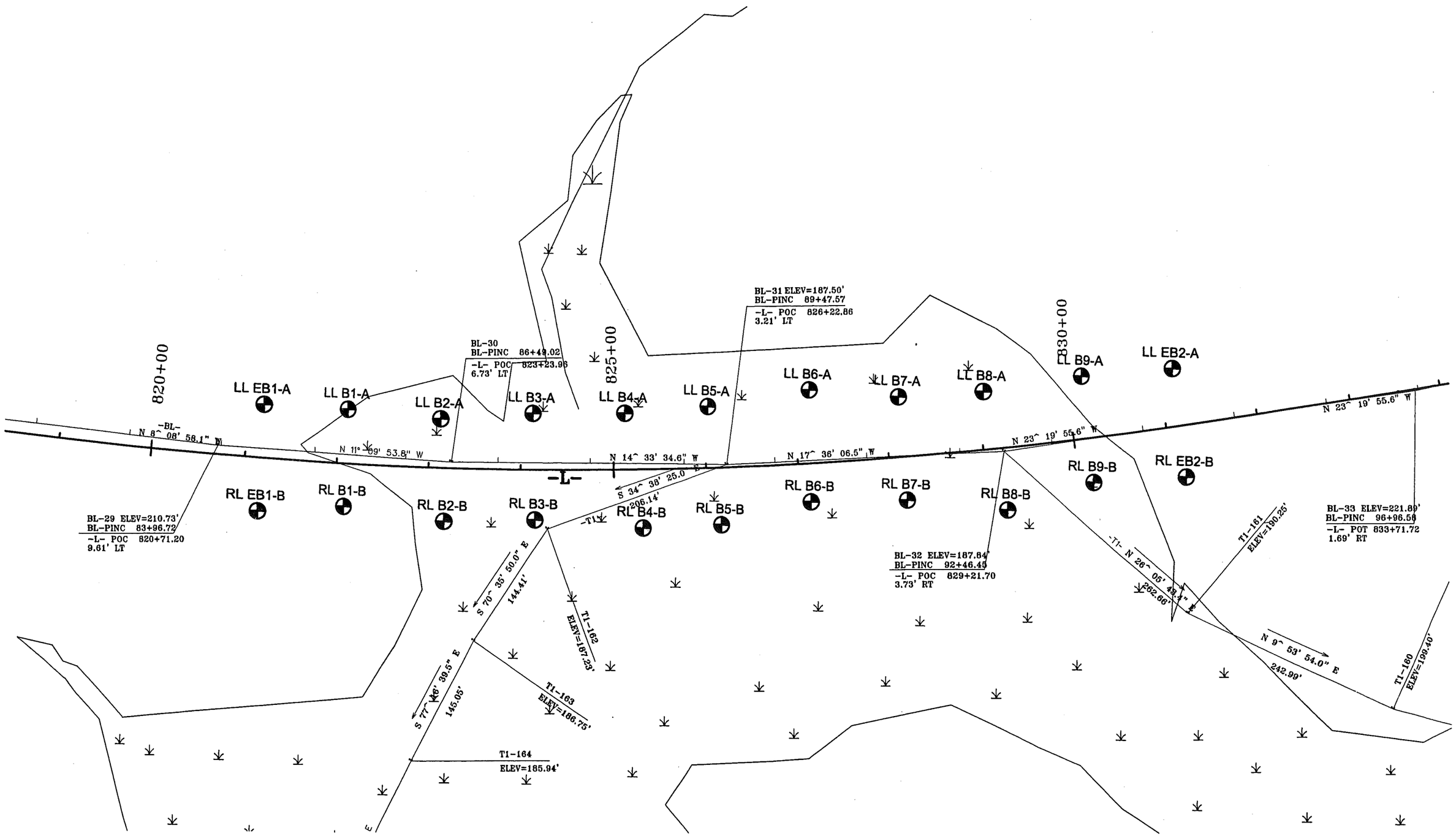
TOPOGRAPHIC SITE MAP
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJ. NO. 34817.1.2 (U-2519CB)
CUMBERLAND COUNTY, NORTH CAROLINA

DRAWN: MBL	DATE: APRIL 2007	DRAWING	
ENG CHECK:	SCALE: 1 : 24000	2	
APPROVAL: SSU	JOB: 6468-07-1682		

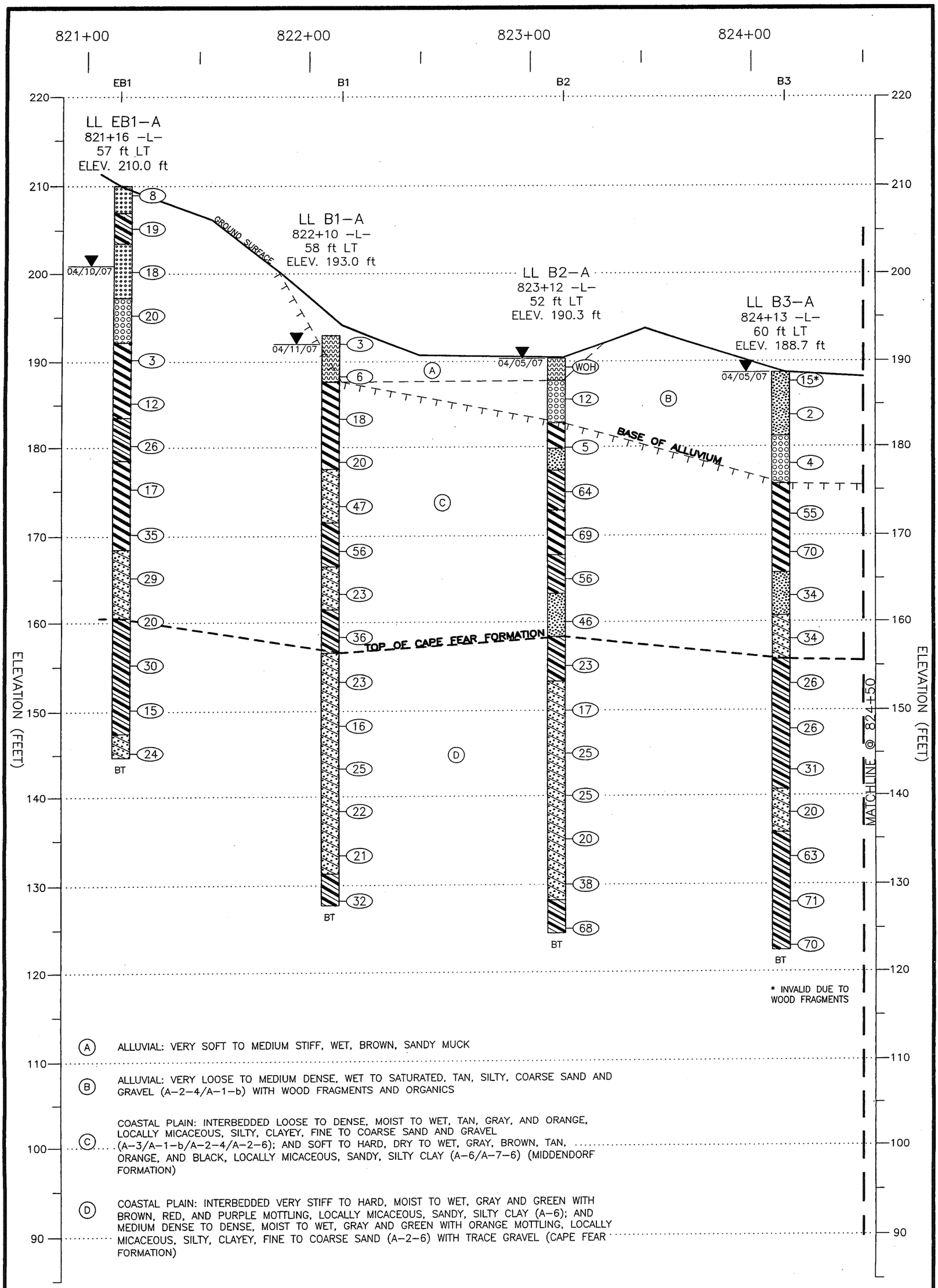
SHEET: 6



BORING LOCATION PLAN
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: W.B.D.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 3



(A) ALLUVIAL: VERY SOFT TO MEDIUM STIFF, WET, BROWN, SANDY MUCK

(B) ALLUVIAL: VERY LOOSE TO MEDIUM DENSE, WET TO SATURATED, TAN, SILTY, COARSE SAND AND GRAVEL (A-2-4/A-1-b) WITH WOOD FRAGMENTS AND ORGANICS

(C) COASTAL PLAIN: INTERBEDDED LOOSE TO DENSE, MOIST TO WET, TAN, GRAY, AND ORANGE, LOCALLY MICACEOUS, SILTY, CLAYEY, FINE TO COARSE SAND AND GRAVEL (A-3/A-1-b/A-2-4/A-2-6); AND SOFT TO HARD, DRY TO WET, GRAY, BROWN, TAN, ORANGE, AND BLACK, LOCALLY MICACEOUS, SANDY, SILTY CLAY (A-6/A-7-6) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED VERY STIFF TO HARD, MOIST TO WET, GRAY AND GREEN WITH BROWN, RED, AND PURPLE MOTTLING, LOCALLY MICACEOUS, SANDY, SILTY CLAY (A-6); AND MEDIUM DENSE TO DENSE, MOIST TO WET, GRAY AND GREEN WITH ORANGE MOTTLING, LOCALLY MICACEOUS, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-6) WITH TRACE GRAVEL (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

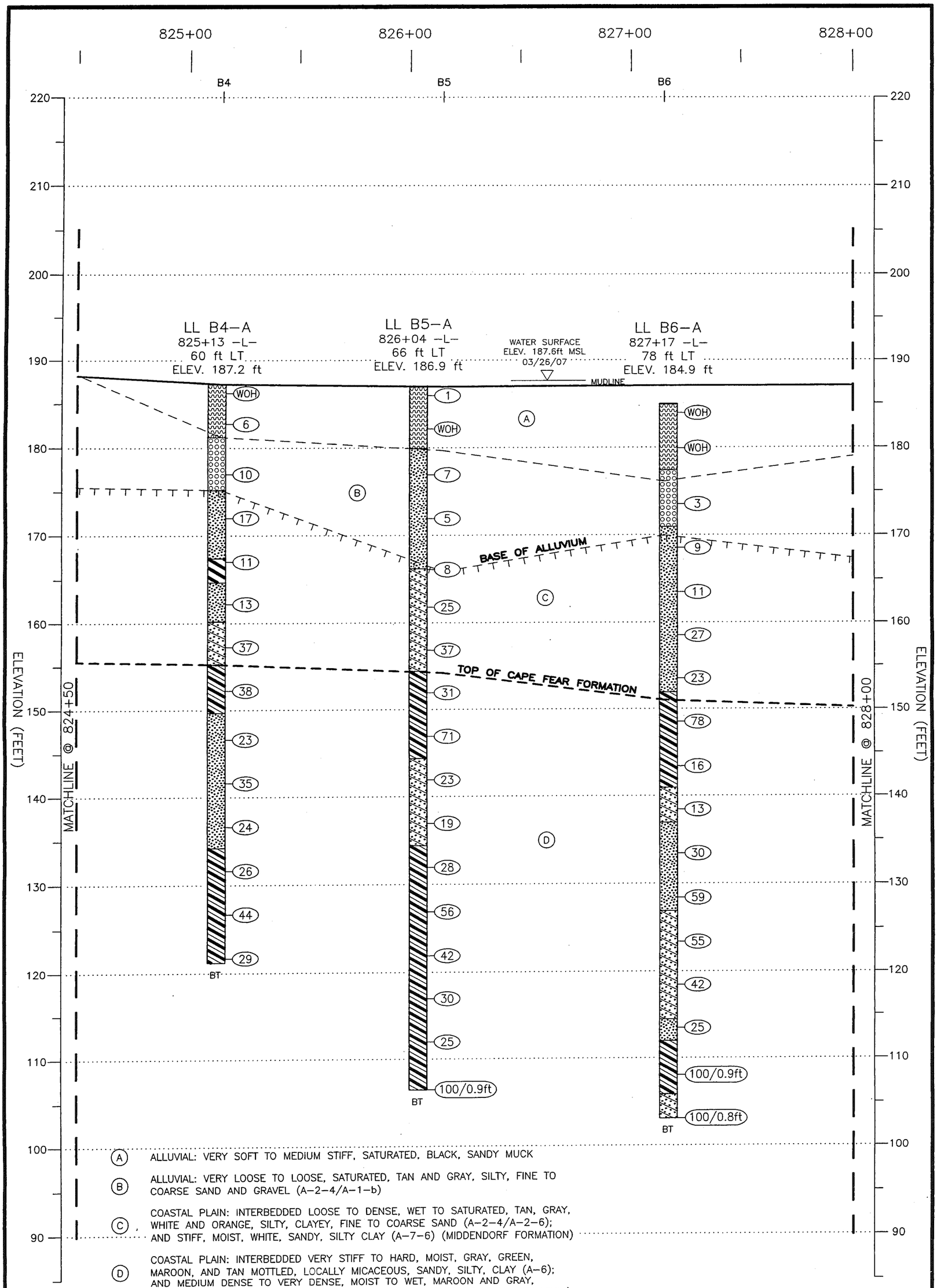
0 20' 40' 80'
HORIZONTAL SCALE IN FEET
1"=40'

PROFILE 59 FT LEFT OF -L-
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: W.B.D.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 4

SHEET: 7



(A) ALLUVIAL: VERY SOFT TO MEDIUM STIFF, SATURATED, BLACK, SANDY MUCK

(B) ALLUVIAL: VERY LOOSE TO LOOSE, SATURATED, TAN AND GRAY, SILTY, FINE TO COARSE SAND AND GRAVEL (A-2-4/A-1-b)

(C) COASTAL PLAIN: INTERBEDDED LOOSE TO DENSE, WET TO SATURATED, TAN, GRAY, WHITE AND ORANGE, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-4/A-2-6); AND STIFF, MOIST, WHITE, SANDY, SILTY CLAY (A-7-6) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED VERY STIFF TO HARD, MOIST, GRAY, GREEN, MAROON, AND TAN MOTTLED, LOCALLY MICACEOUS, SANDY, SILTY, CLAY (A-6); AND MEDIUM DENSE TO VERY DENSE, MOIST TO WET, MAROON AND GRAY, CLAYEY, SILTY, FINE TO COARSE SAND (A-2-4/A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

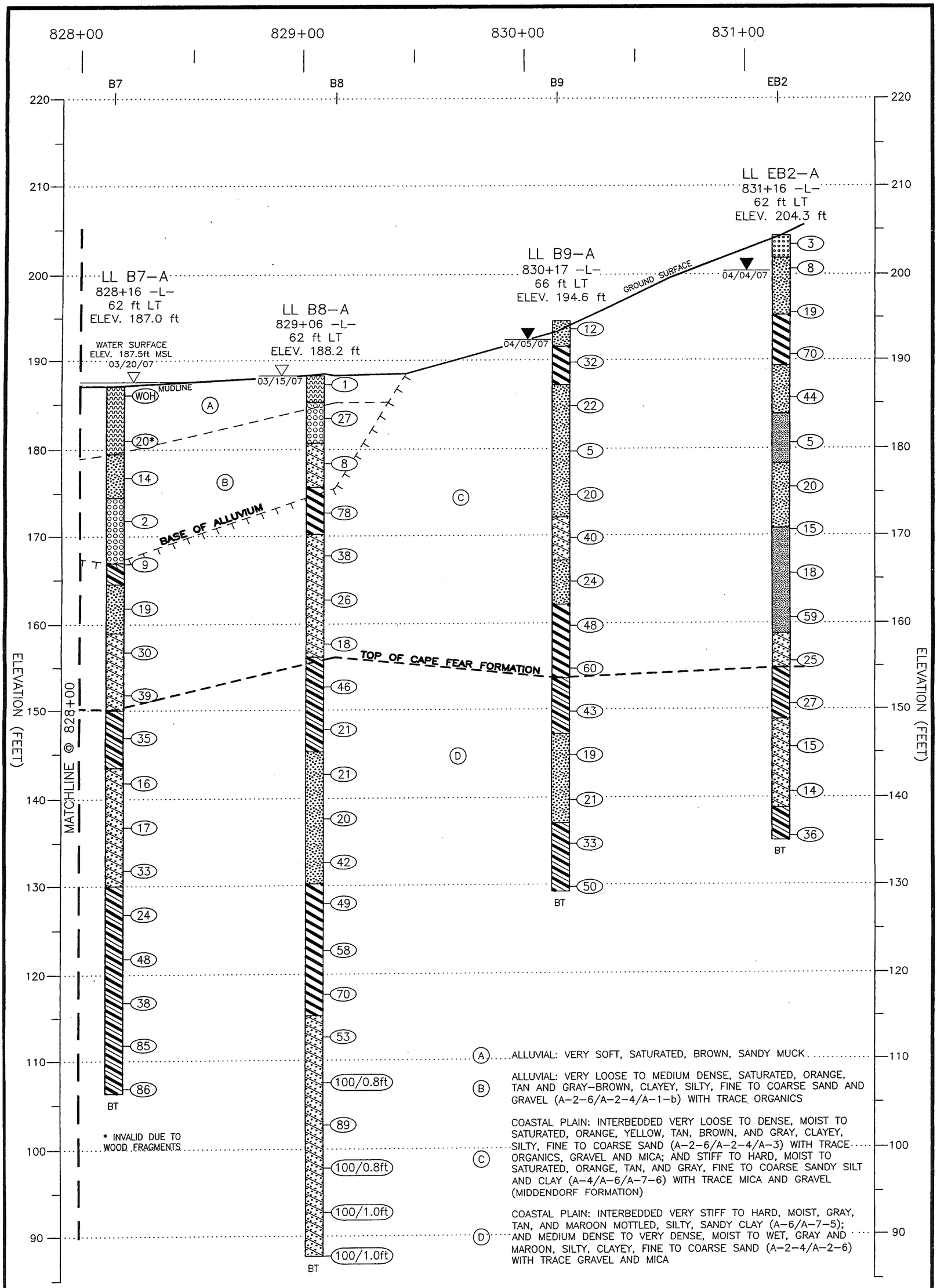
0 20' 40' 80'
HORIZONTAL SCALE IN FEET
1"=40'

PROFILE 59 FT LEFT OF -L-
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: W.B.D.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 5

SHEET: 8



0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 20' 40' 80'
HORIZONTAL SCALE IN FEET
1"=40'

PROFILE 59 FT LEFT OF -L-
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
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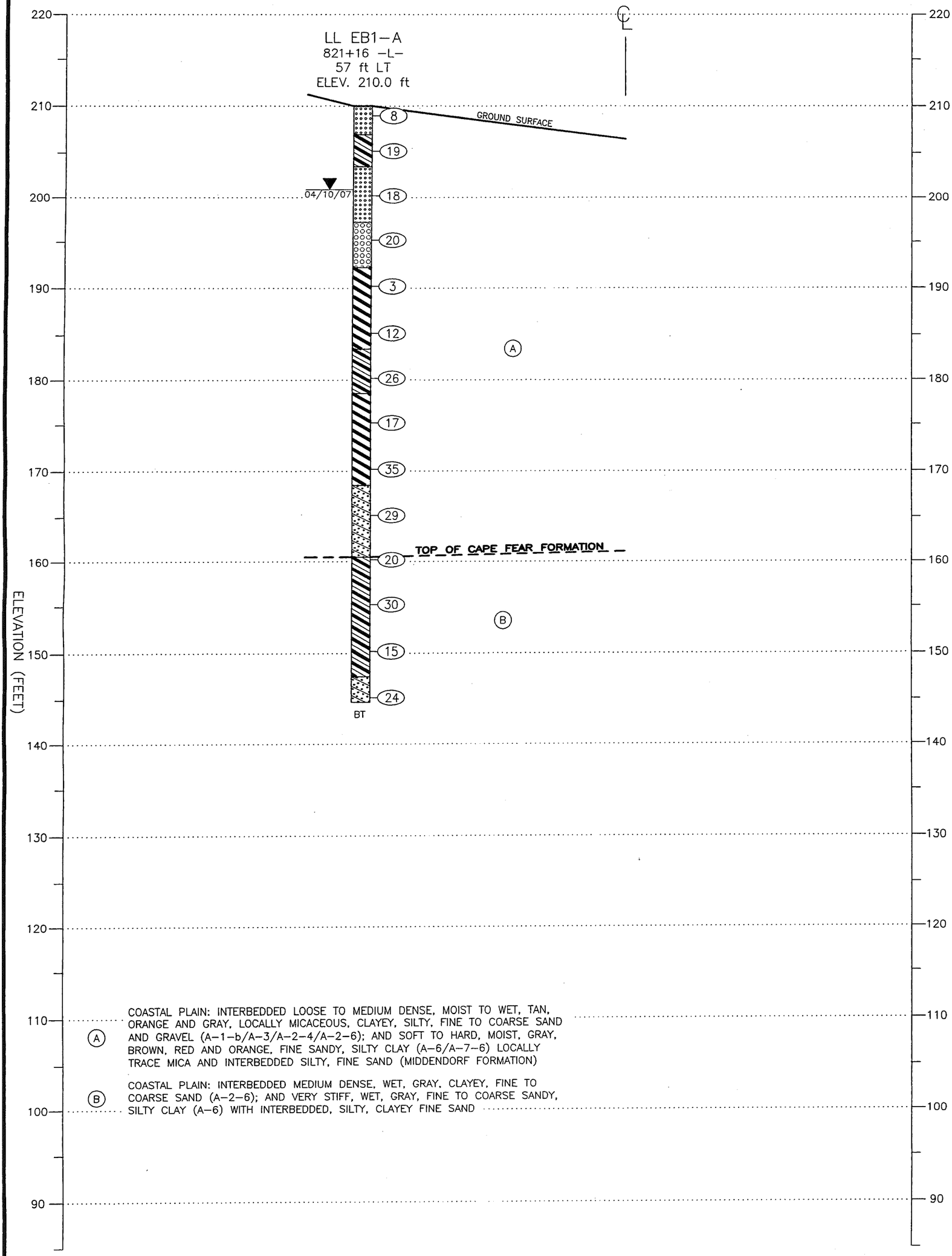
	ENG CHECK: S.J.C.	DWG: 6

SHEET: 9



(A) COASTAL PLAIN: INTERBEDDED LOOSE TO MEDIUM DENSE, MOIST TO WET, TAN, ORANGE AND GRAY, LOCALLY MICACEOUS, CLAYEY, SILTY, FINE TO COARSE SAND AND GRAVEL (A-1-b/A-3/A-2-4/A-2-6); AND SOFT TO HARD, MOIST, GRAY, BROWN, RED AND ORANGE, FINE SANDY, SILTY CLAY (A-6/A-7-6) LOCALLY TRACE MICA AND INTERBEDDED SILTY, FINE SAND (MIDDENDORF FORMATION)

(B) COASTAL PLAIN: INTERBEDDED MEDIUM DENSE, WET, GRAY, CLAYEY, FINE TO COARSE SAND (A-2-6); AND VERY STIFF, WET, GRAY, FINE TO COARSE SANDY, SILTY CLAY (A-6) WITH INTERBEDDED, SILTY, CLAYEY FINE SAND

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE END BENT 1
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
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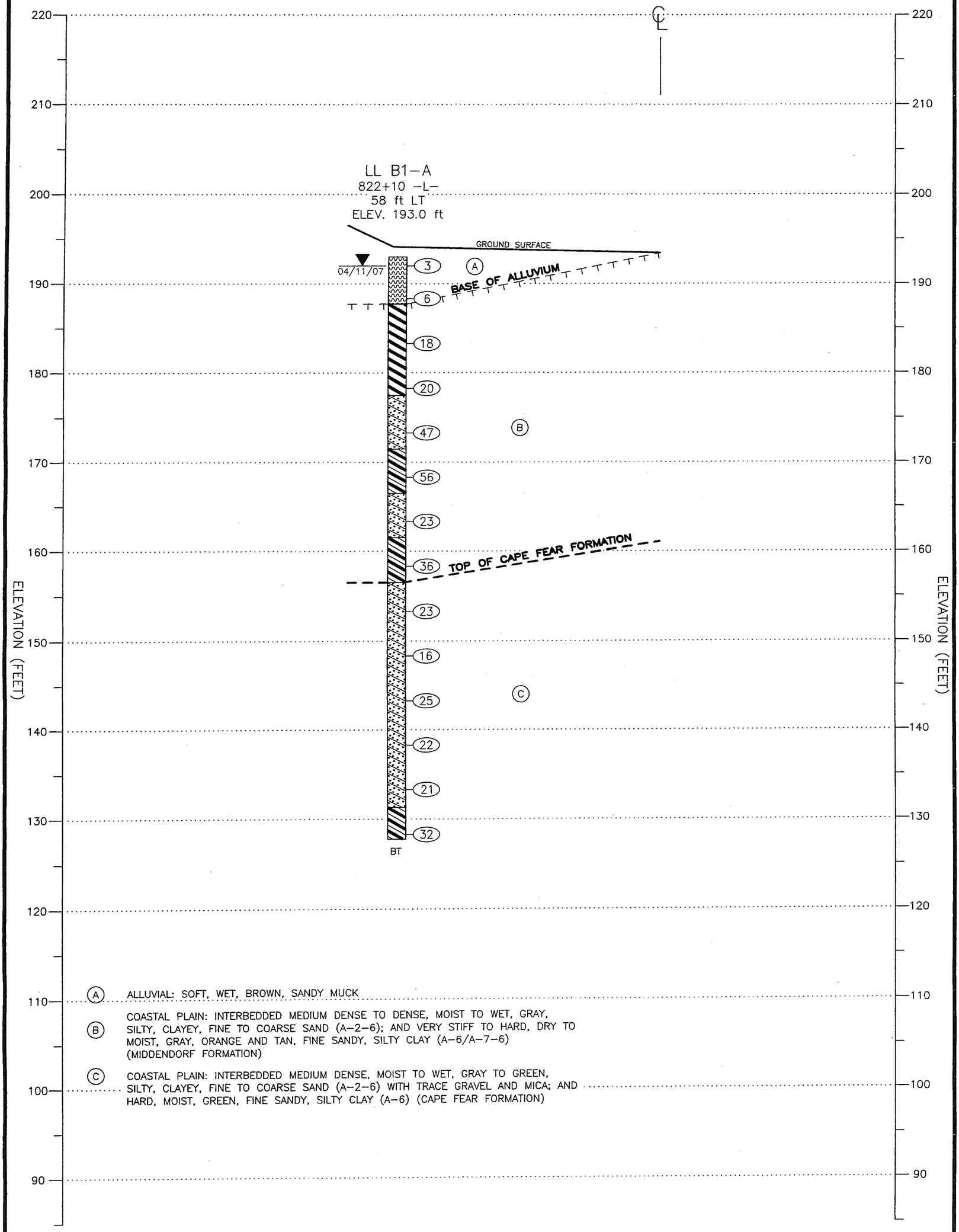
	ENG CHECK: S.J.C.	DWG: 7

SHEET: 10



(A) ALLUVIAL: SOFT, WET, BROWN, SANDY MUCK

(B) COASTAL PLAIN: INTERBEDDED MEDIUM DENSE TO DENSE, MOIST TO WET, GRAY, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-6); AND VERY STIFF TO HARD, DRY TO MOIST, GRAY, ORANGE AND TAN, FINE SANDY, SILTY CLAY (A-6/A-7-6) (MIDDENDORF FORMATION)

(C) COASTAL PLAIN: INTERBEDDED MEDIUM DENSE, MOIST TO WET, GRAY TO GREEN, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-6) WITH TRACE GRAVEL AND MICA; AND HARD, MOIST, GREEN, FINE SANDY, SILTY CLAY (A-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 1
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
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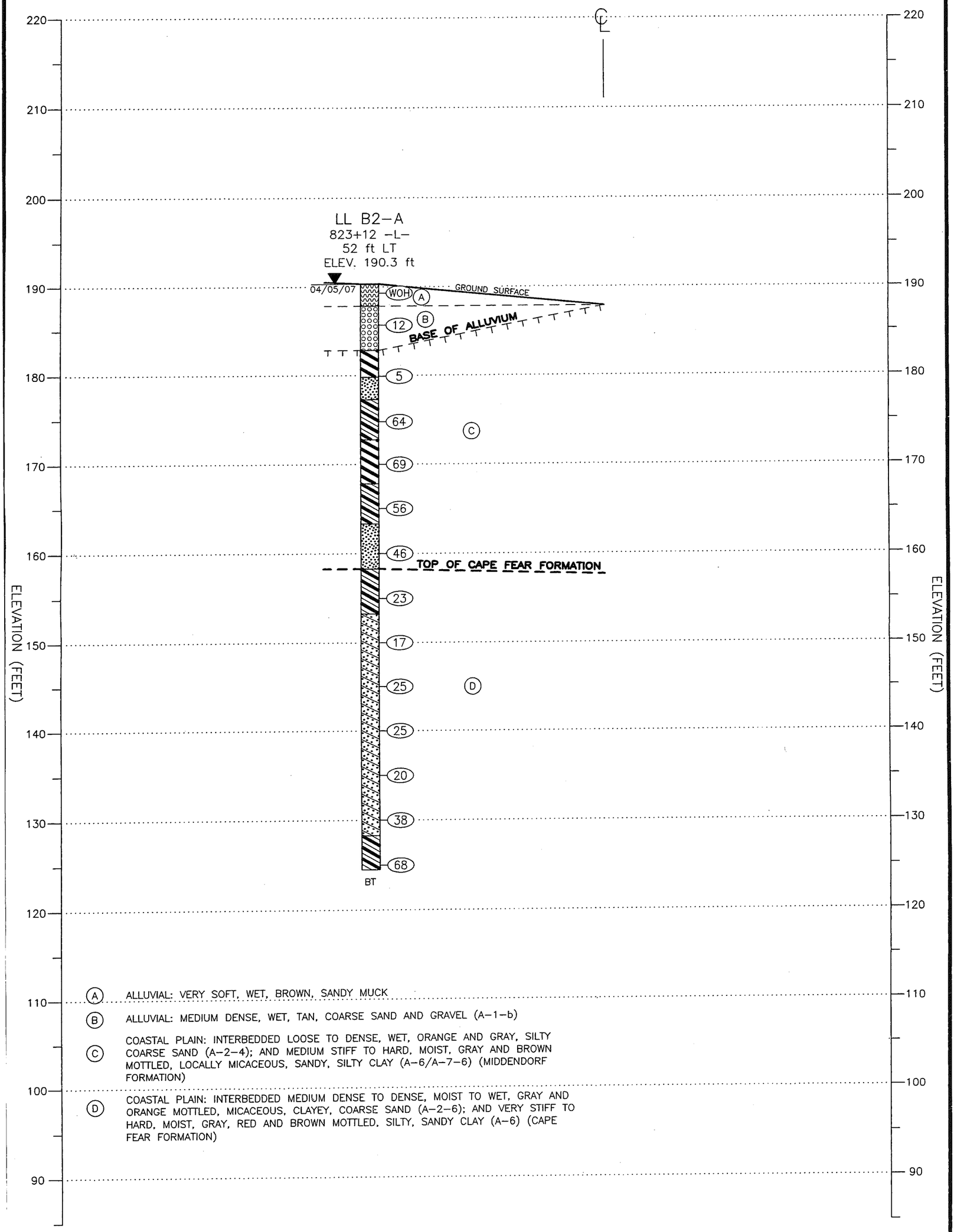
SHEET: 11



(A) ALLUVIAL: VERY SOFT, WET, BROWN, SANDY MUCK

(B) ALLUVIAL: MEDIUM DENSE, WET, TAN, COARSE SAND AND GRAVEL (A-1-b)

(C) COASTAL PLAIN: INTERBEDDED LOOSE TO DENSE, WET, ORANGE AND GRAY, SILTY COARSE SAND (A-2-4); AND MEDIUM STIFF TO HARD, MOIST, GRAY AND BROWN MOTTLED, LOCALLY MICACEOUS, SANDY, SILTY CLAY (A-6/A-7-6) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED MEDIUM DENSE TO DENSE, MOIST TO WET, GRAY AND ORANGE MOTTLED, MICACEOUS, CLAYEY, COARSE SAND (A-2-6); AND VERY STIFF TO HARD, MOIST, GRAY, RED AND BROWN MOTTLED, SILTY, SANDY CLAY (A-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 2
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
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CUMBERLAND COUNTY, NORTH CAROLINA

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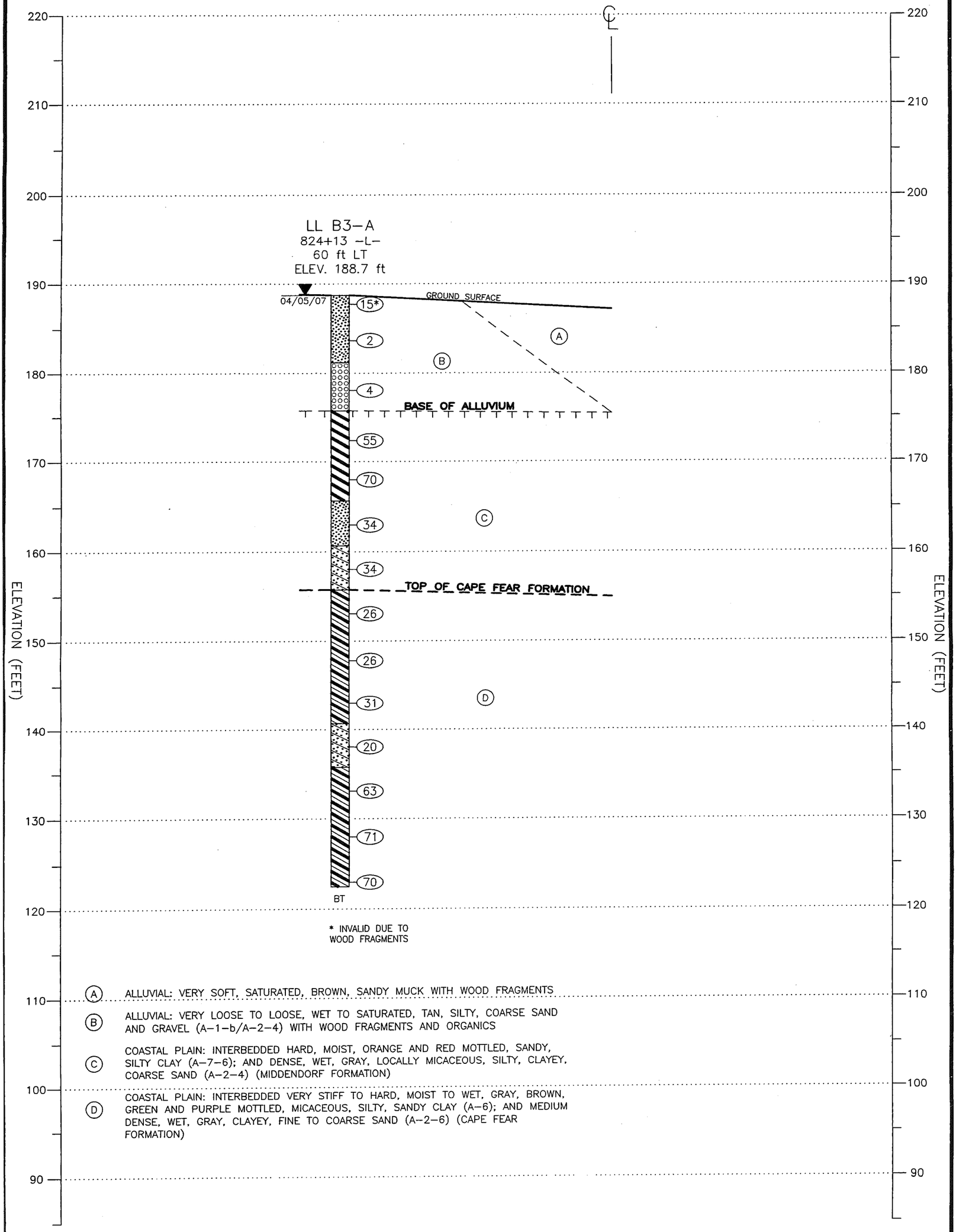
	ENG CHECK: S.J.C.	DWG: 9

SHEET: 12



(A) ALLUVIAL: VERY SOFT, SATURATED, BROWN, SANDY MUCK WITH WOOD FRAGMENTS

(B) ALLUVIAL: VERY LOOSE TO LOOSE, WET TO SATURATED, TAN, SILTY, COARSE SAND AND GRAVEL (A-1-b/A-2-4) WITH WOOD FRAGMENTS AND ORGANICS

(C) COASTAL PLAIN: INTERBEDDED HARD, MOIST, ORANGE AND RED MOTTLED, SANDY, SILTY CLAY (A-7-6); AND DENSE, WET, GRAY, LOCALLY MICACEOUS, SILTY, CLAYEY, COARSE SAND (A-2-4) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED VERY STIFF TO HARD, MOIST TO WET, GRAY, BROWN, GREEN AND PURPLE MOTTLED, MICACEOUS, SILTY, SANDY CLAY (A-6); AND MEDIUM DENSE, WET, GRAY, CLAYEY, FINE TO COARSE SAND (A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 3
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
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CUMBERLAND COUNTY, NORTH CAROLINA

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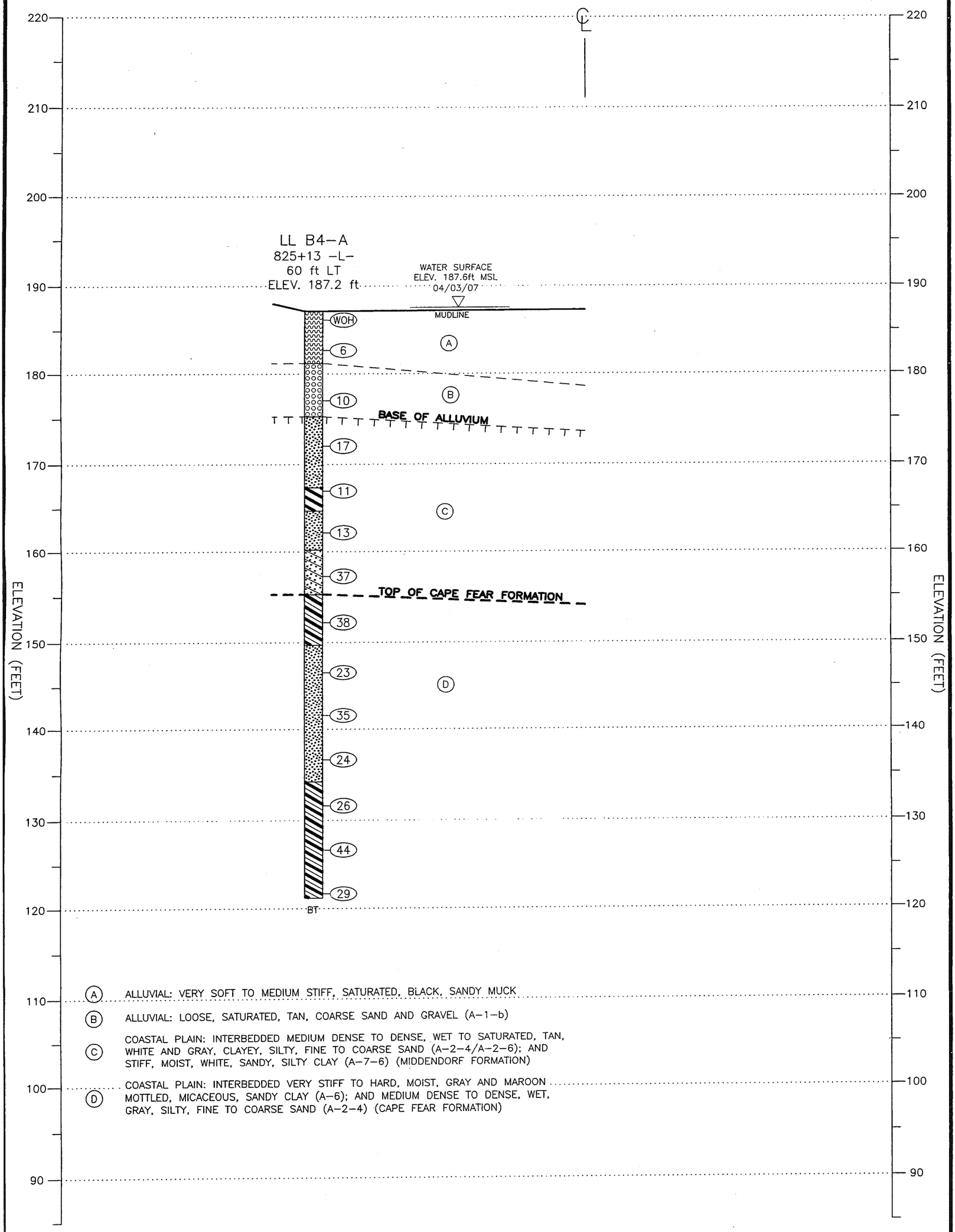
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: W.B.D.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 10

SHEET: 13



(A) ALLUVIAL: VERY SOFT TO MEDIUM STIFF, SATURATED, BLACK, SANDY MUCK

(B) ALLUVIAL: LOOSE, SATURATED, TAN, COARSE SAND AND GRAVEL (A-1-b)

(C) COASTAL PLAIN: INTERBEDDED MEDIUM DENSE TO DENSE, WET TO SATURATED, TAN, WHITE AND GRAY, CLAYEY, SILTY, FINE TO COARSE SAND (A-2-4/A-2-6); AND STIFF, MOIST, WHITE, SANDY, SILTY CLAY (A-7-6) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED VERY STIFF TO HARD, MOIST, GRAY AND MAROON MOTTLED, MICACEOUS, SANDY CLAY (A-6); AND MEDIUM DENSE TO DENSE, WET, GRAY, SILTY, FINE TO COARSE SAND (A-2-4) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 4
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
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CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
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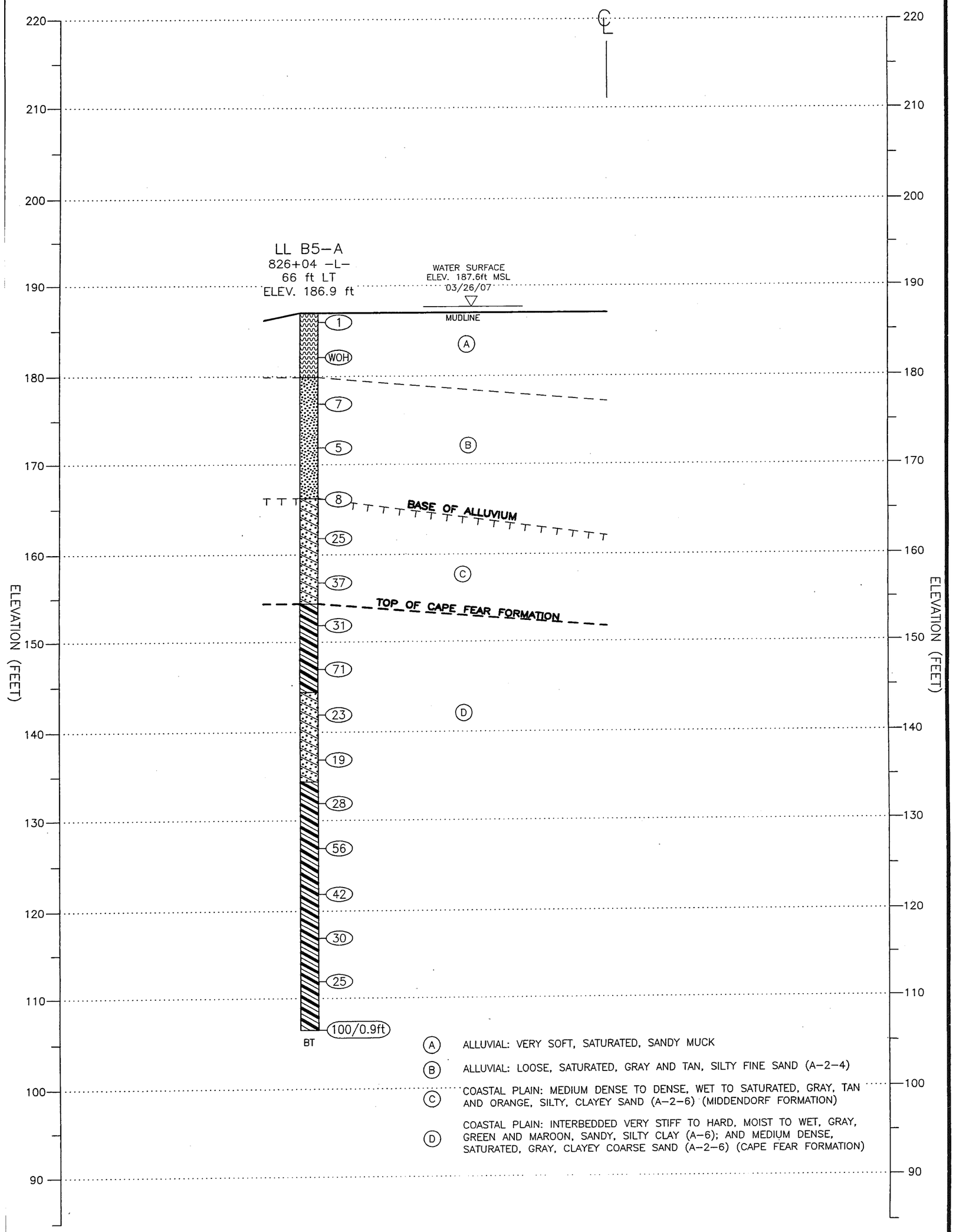
	ENG CHECK: S.J.C.	DWG: 11

SHEET: 14



(A) ALLUVIAL: VERY SOFT, SATURATED, SANDY MUCK

(B) ALLUVIAL: LOOSE, SATURATED, GRAY AND TAN, SILTY FINE SAND (A-2-4)

(C) COASTAL PLAIN: MEDIUM DENSE TO DENSE, WET TO SATURATED, GRAY, TAN AND ORANGE, SILTY, CLAYEY SAND (A-2-6) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED VERY STIFF TO HARD, MOIST TO WET, GRAY, GREEN AND MAROON, SANDY, SILTY CLAY (A-6); AND MEDIUM DENSE, SATURATED, GRAY, CLAYEY COARSE SAND (A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 5
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
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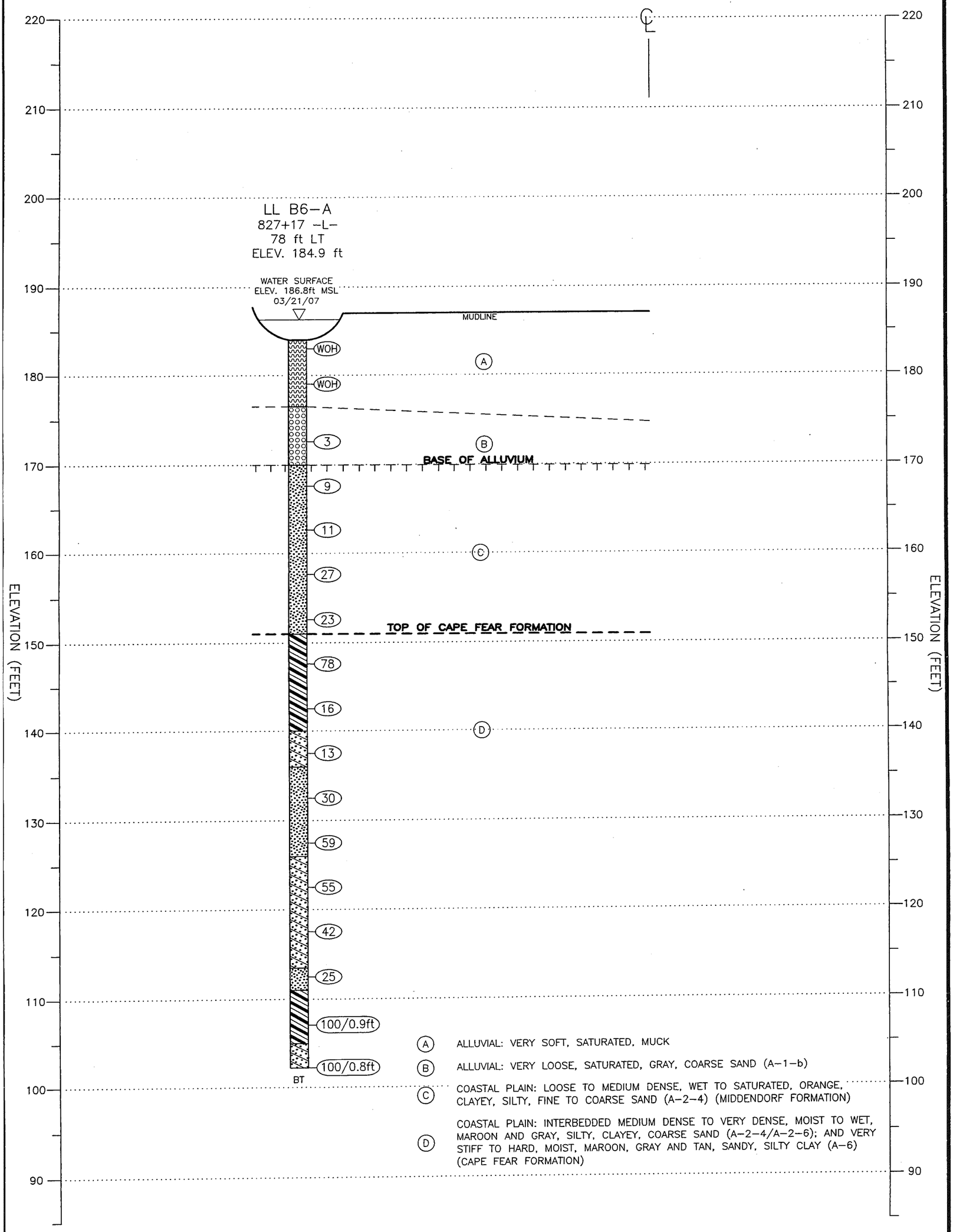
	ENG CHECK: S.J.C.	DWG: 12

SHEET: 15



(A) ALLUVIAL: VERY SOFT, SATURATED, MUCK

(B) ALLUVIAL: VERY LOOSE, SATURATED, GRAY, COARSE SAND (A-1-b)

(C) COASTAL PLAIN: LOOSE TO MEDIUM DENSE, WET TO SATURATED, ORANGE, CLAYEY, SILTY, FINE TO COARSE SAND (A-2-4) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED MEDIUM DENSE TO VERY DENSE, MOIST TO WET, MAROON AND GRAY, SILTY, CLAYEY, COARSE SAND (A-2-4/A-2-6); AND VERY STIFF TO HARD, MOIST, MAROON, GRAY AND TAN, SANDY, SILTY CLAY (A-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 6
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
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RALEIGH, NORTH CAROLINA

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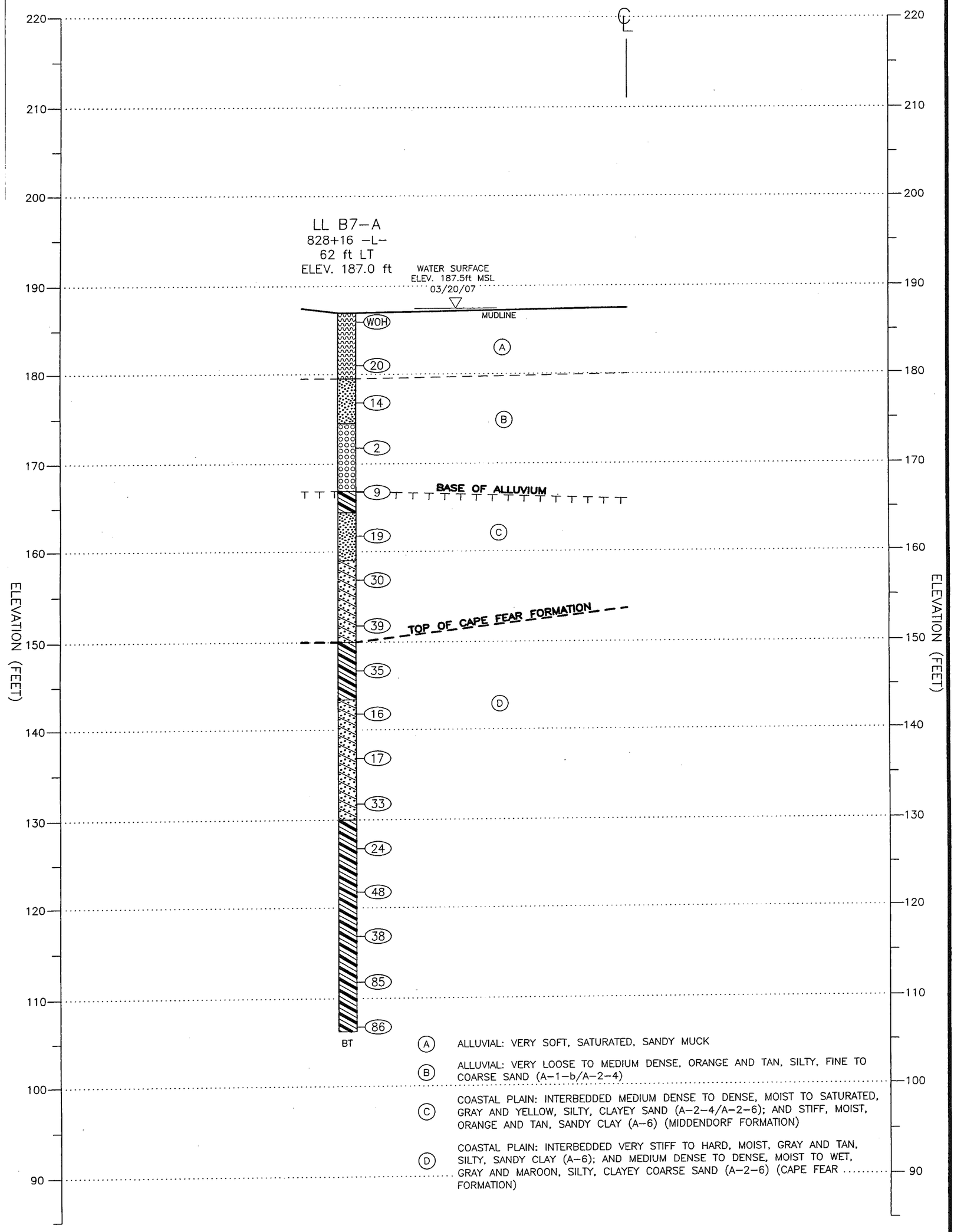
	ENG CHECK: S.J.C.	DWG: 13

SHEET: 16



(A) ALLUVIAL: VERY SOFT, SATURATED, SANDY MUCK

(B) ALLUVIAL: VERY LOOSE TO MEDIUM DENSE, ORANGE AND TAN, SILTY, FINE TO COARSE SAND (A-1-b/A-2-4)

(C) COASTAL PLAIN: INTERBEDDED MEDIUM DENSE TO DENSE, MOIST TO SATURATED, GRAY AND YELLOW, SILTY, CLAYEY SAND (A-2-4/A-2-6); AND STIFF, MOIST, ORANGE AND TAN, SANDY CLAY (A-6) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED VERY STIFF TO HARD, MOIST, GRAY AND TAN, SILTY, SANDY CLAY (A-6); AND MEDIUM DENSE TO DENSE, MOIST TO WET, GRAY AND MAROON, SILTY, CLAYEY COARSE SAND (A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 7
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
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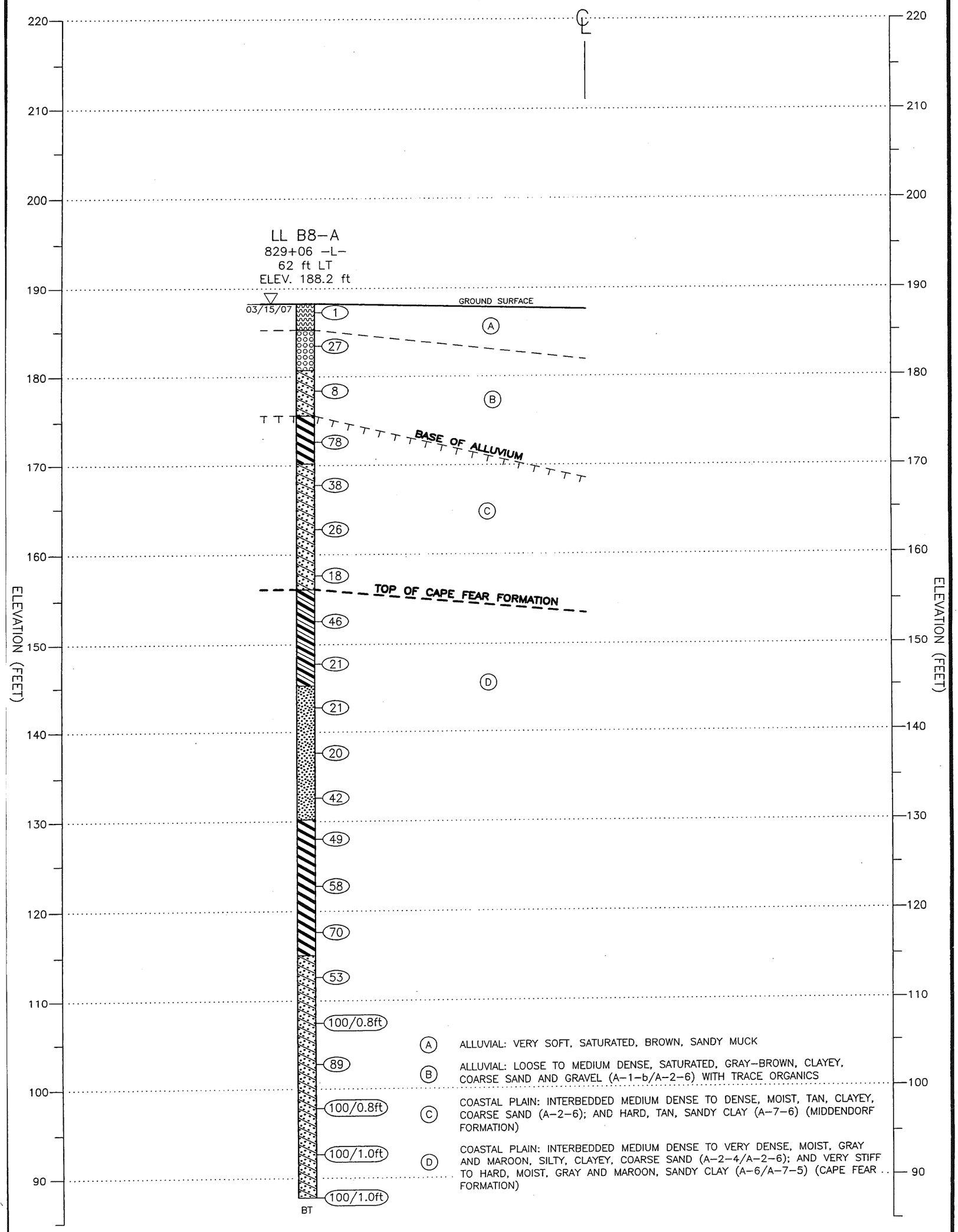
	ENG CHECK: S.J.C.	DWG: 14

SHEET: 17



0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 8
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
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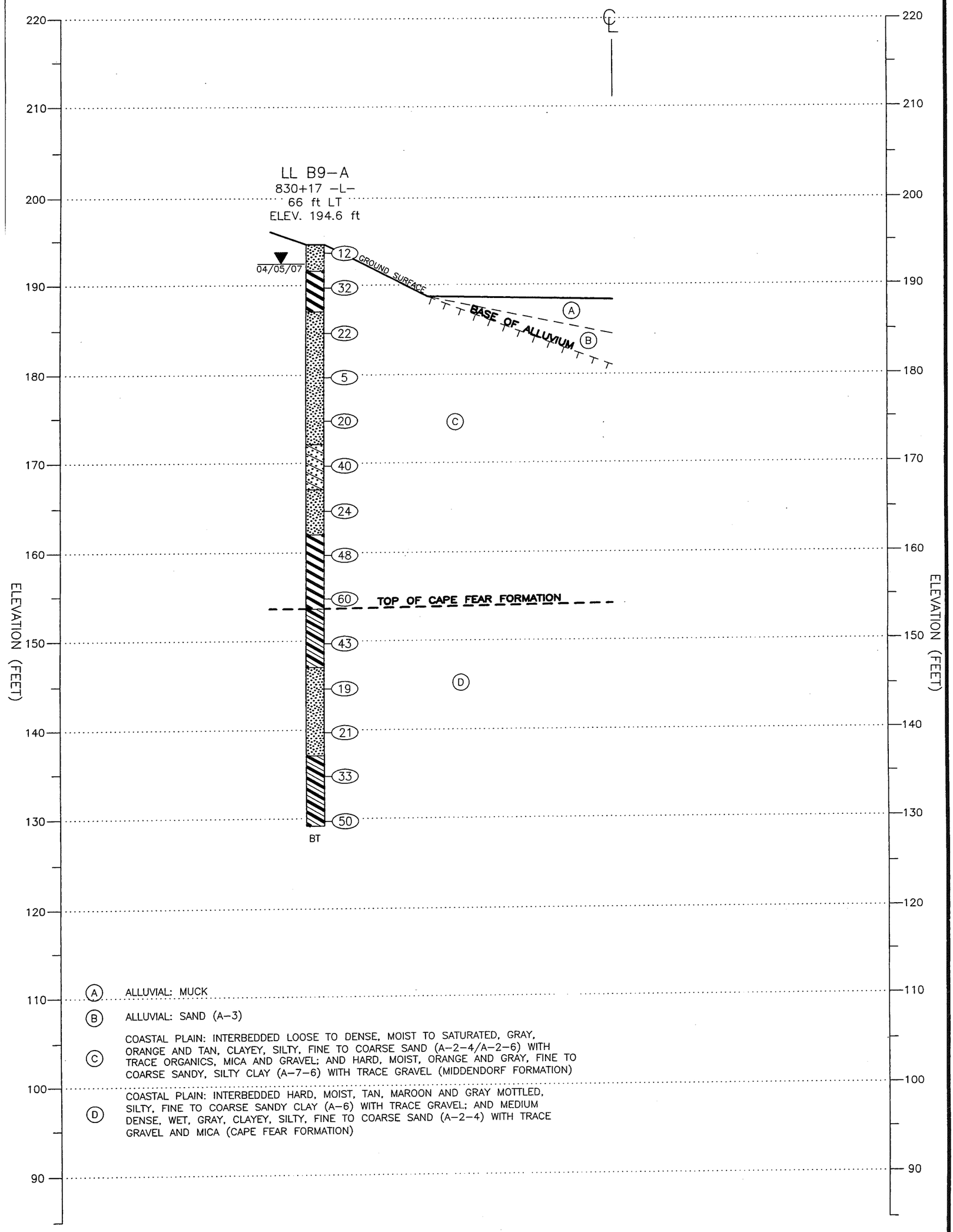
	ENG CHECK: S.J.C.	DWG: 15

SHEET: 18



(A) ALLUVIAL: MUCK

(B) ALLUVIAL: SAND (A-3)

(C) COASTAL PLAIN: INTERBEDDED LOOSE TO DENSE, MOIST TO SATURATED, GRAY, ORANGE AND TAN, CLAYEY, SILTY, FINE TO COARSE SAND (A-2-4/A-2-6) WITH TRACE ORGANICS, MICA AND GRAVEL; AND HARD, MOIST, ORANGE AND GRAY, FINE TO COARSE SANDY, SILTY CLAY (A-7-6) WITH TRACE GRAVEL (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED HARD, MOIST, TAN, MAROON AND GRAY MOTTLED, SILTY, FINE TO COARSE SANDY CLAY (A-6) WITH TRACE GRAVEL; AND MEDIUM DENSE, WET, GRAY, CLAYEY, SILTY, FINE TO COARSE SAND (A-2-4) WITH TRACE GRAVEL AND MICA (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 9
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
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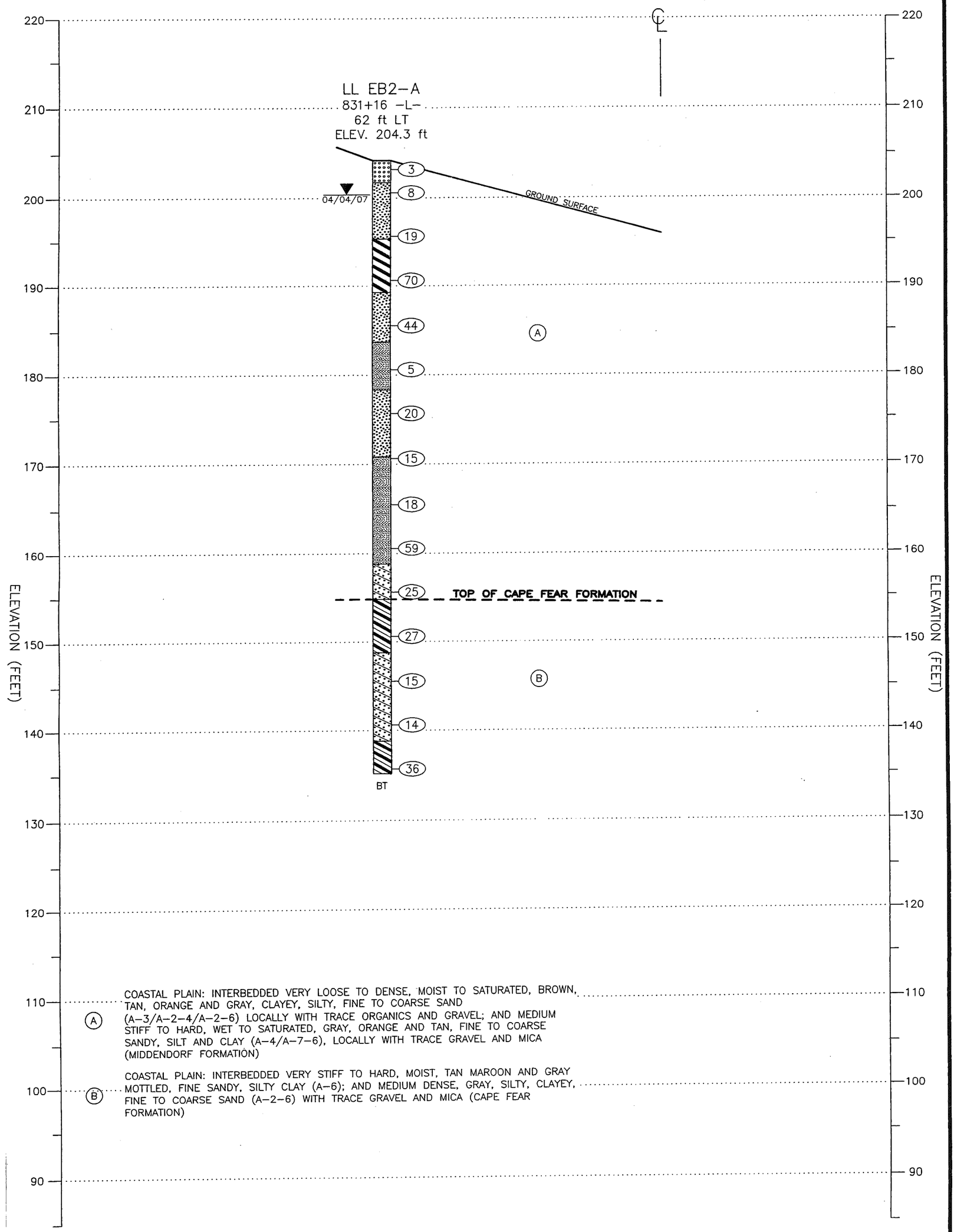
SHEET: 19



0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE END BENT 2
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
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	ENG CHECK: S.J.C.	DWG: 17

SHEET: 20

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST S. Lehman
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. LL EB1-A	STATION 821+16	OFFSET 57ft LT	ALIGNMENT -L-
COLLAR ELEV. 210.0 ft	TOTAL DEPTH 65.3 ft	NORTHING 483,690	EASTING 1,993,728
DRILL MACHINE CME-550	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 04/09/07	COMP. DATE 04/09/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

GROUND WTR (ft): 0 HR. 5.5; 24 HR. C. I. @ 9.1

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))
210.0	0.0	3	4	4	8		M		GROUND SURFACE
206.2	3.8	5	8	11	19		W		COASTAL PLAIN: Tan, silty, fine to coarse SAND (A-3) (Middendorf Formation) — 207.0 / 3.0
201.2	8.8	10	9	9	18		W		COASTAL PLAIN: Light gray with red and orange, fine sandy, silty CLAY (A-6) (Middendorf Formation) — 203.5 / 6.5
196.2	13.8	11	14	6	20		W		COASTAL PLAIN: Gray and orange, silty, fine to coarse SAND (A-3) (Middendorf Formation) — 197.2 / 12.8
191.2	18.8	1	2	1	3		M		COASTAL PLAIN: Tan, silty, fine to coarse SAND and rounded GRAVEL (A-1-b) (Middendorf Formation) — 192.2 / 17.8
186.2	23.8	3	5	7	12		M		COASTAL PLAIN: Light gray, silty, sandy CLAY (A-7-6), trace white mica (Middendorf Formation) — 183.5 / 26.5
181.2	28.8	6	10	16	26		M		COASTAL PLAIN: Gray and black, sandy, silty CLAY (A-6) with trace lignite (Middendorf Formation) — 178.5 / 31.5
176.2	33.8	4	6	11	17		M		COASTAL PLAIN: Light brown and light gray and orange, silty CLAY (A-7-6) with thin to very thinly interbedded orange silty fine sand (Middendorf Formation) — 168.5 / 41.5
171.2	38.8	10	13	22	35		M		COASTAL PLAIN: Light gray with orange and blue gray, micaceous, clayey, fine to coarse SAND (A-2-6) with trace gravel (Middendorf Formation) — 160.5 / 49.5
166.2	43.8	10	13	16	29		W		COASTAL PLAIN: Light gray to dark gray and blue gray, fine to coarse sandy, silty CLAY (A-6) with interbedded, silty, clayey, fine sand (A-2-6) (Cape Fear Formation) — 147.5 / 62.5
161.2	48.8	7	9	11	20		M		COASTAL PLAIN: Blue gray to gray, clayey, fine to coarse SAND (A-2-6) (Cape Fear Formation) — 144.7 / 65.3
156.2	53.8	9	11	19	30		W		Boring Terminated at Elevation 144.7 ft in Cape Fear Fm: Medium Dense, clayey, SAND (A-2-6)
151.2	58.8	5	7	8	15		W		Bits Used: 3" Side-Discharge Finger Bit
146.2	63.8	10	12	12	24		W		Drilling Fluid Properties: 8.4 lbs/gal
									Casing Depth (4"): 3.4 ft

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST S. Lehman
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. LL B1-A	STATION 822+10	OFFSET 58ft LT	ALIGNMENT -L-
COLLAR ELEV. 193.0 ft	TOTAL DEPTH 65.2 ft	NORTHING 483,780	EASTING 1,993,709
DRILL MACHINE CME-550	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 04/10/07	COMP. DATE 04/10/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

GROUND WTR (ft): 0 HR. 0.0; 24 HR. 1.0

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
193.0	0.0						W		GROUND SURFACE
189.3	3.7	1	1	2	3		W		ALLUVIAL: Brown, sandy MUCK — 187.7 / 5.3
184.3	8.7	5	3	3	6		W		COASTAL PLAIN: Light gray with orange, tan, and black, fine sandy, silty, CLAY (A-7-6) (Middendorf Formation) — 177.5 / 15.5
179.3	13.7	5	9	9	18		M		COASTAL PLAIN: Light gray, clayey, fine to coarse SAND (A-2-6) (Middendorf Formation) — 171.5 / 21.5
174.3	18.7	4	8	12	20		M		COASTAL PLAIN: Light gray and dark gray, fine sandy, silty CLAY (A-6) (Middendorf Formation) — 166.5 / 26.5
169.3	23.7	20	21	26	47		M		COASTAL PLAIN: Light gray, silty, clayey, fine SAND (A-2-6) (Middendorf Formation) — 161.5 / 31.5
164.3	28.7	13	21	35	56		M		COASTAL PLAIN: Light gray, fine sandy, silty CLAY (A-6) (Middendorf Formation) — 156.5 / 36.5
159.3	33.7	11	11	12	23		W		COASTAL PLAIN: Light gray to light green, silty, clayey, fine to coarse SAND (A-2-6), trace gravel, white mica (Cape Fear Formation) — 131.3 / 61.7
154.3	38.7	9	15	21	36		D		COASTAL PLAIN: Light green, fine sandy, silty CLAY (A-6) (Cape Fear Formation) — 127.8 / 65.2
149.3	43.7	9	11	12	23		M		Boring Terminated at Elevation 127.8 ft in Cape Fear Fm: Hard, fine sandy, silty, CLAY (A-6)
144.3	48.7	6	9	7	16		M		Bits Used: 3" Side-Discharge Finger Bit
139.3	53.7	9	12	13	25		M		Drilling Fluid Properties: 8.6 lbs/gal
134.3	58.7	11	12	10	22		W		Casing Depth (4"): 3.3 ft
129.3	63.7	6	11	10	21		M		
		12	15	17	32		M		

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. LL B2-A	STATION 823+12	OFFSET 52ft LT	ALIGNMENT -L-	0 HR. 0.0
COLLAR ELEV. 190.3 ft	TOTAL DEPTH 65.8 ft	NORTHING 483,879	EASTING 1,993,692	24 HR. 0.0
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 04/04/07	COMP. DATE 04/04/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

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)
190.3	0.0	WOH	WOH	WOH	0		W		GROUND SURFACE	0.0
186.6	3.7	4	4	8	12		W		ALLUVIAL Brown, sandy MUCK 187.8	2.5
180.9	9.4	1	2	3	5		W		ALLUVIAL Tan, coarse SAND and GRAVEL (A-1-b) 182.8	7.5
175.8	14.5	17	25	39	64		M		COASTAL PLAIN Tan, silty CLAY (A-7-6) (Middendorf Formation) 179.8	10.5
171.0	19.3	22	30	39	69		M		COASTAL PLAIN Orange, silty, coarse SAND (A-2-4) (Middendorf Formation) 177.3	13.0
166.0	24.3	20	26	30	56		M		COASTAL PLAIN Gray, sandy, CLAY (A-6) (Middendorf Formation) 172.8	17.5
161.0	29.3	14	20	26	46		W		COASTAL PLAIN Gray with orange mottling, silty CLAY (A-7-6) (Middendorf Formation) 167.8	22.5
156.0	34.3	10	9	14	23		M		COASTAL PLAIN Dark gray, micaceous, sandy CLAY (A-6) (Middendorf Formation) 163.3	27.0
151.0	39.3	6	7	10	17		W		COASTAL PLAIN Gray, silty, coarse SAND (A-2-4) (Middendorf Formation) 158.3	32.0
146.0	44.3	7	9	16	25		M		COASTAL PLAIN Gray and brown mottled, sandy CLAY (A-6) (Cape Fear Formation) 153.3	37.0
141.0	49.3	9	12	13	25		M		COASTAL PLAIN Gray and dark gray, with orange mottling, micaceous, clayey, coarse SAND (A-2-6) (Cape Fear Formation)	
136.0	54.3	8	6	14	20		M			
131.0	59.3	16	17	21	38		M			
126.0	64.3	20	30	38	68		M		COASTAL PLAIN Gray and red mottled, silty CLAY (A-6) (Cape Fear Formation) 128.3 / 124.5	62.0 / 65.8

Boring Terminated at Elevation 124.5 ft in Cape Fear Fm: Hard, silty, CLAY (A-6)

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: 8.8 lbs/gal

Casing Depth (4"): 10.5 ft

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. LL B3-A	STATION 824+13	OFFSET 60ft LT	ALIGNMENT -L-	0 HR. 0.0
COLLAR ELEV. 188.7 ft	TOTAL DEPTH 66.2 ft	NORTHING 483,975	EASTING 1,993,661	24 HR. 0.0
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 04/03/07	COMP. DATE 04/04/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

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	
188.7	0.0	WOH	3	12	15 (invalid due to wood)		W		GROUND SURFACE	0.0
184.7	4.0	WOH	WOH	2	2		Sat.		ALLUVIAL Tan, silty, coarse SAND (A-2-4) with wood fragments and organics 181.2	7.5
179.0	9.7	2	2	2	4		Sat.		ALLUVIAL Tan, silty, coarse SAND and GRAVEL (A-1-b) 175.7	13.0
173.3	15.4	13	19	36	55		M		COASTAL PLAIN Orange with red mottling, sandy, silty CLAY (A-7-6) (Middendorf Formation) 165.7	23.0
169.0	19.7	14	23	47	70		M		COASTAL PLAIN Gray, silty, coarse SAND (A-2-4) (Middendorf Formation) 160.7	28.0
164.0	24.7	9	13	21	34		W		COASTAL PLAIN Dark gray, micaceous, clayey SAND (A-2-6) (Middendorf Formation) 155.7	33.0
159.0	29.7	11	14	20	34		W		COASTAL PLAIN Gray with brown and purple mottling, micaceous, sandy, CLAY (A-6) (Cape Fear Formation)	
154.0	34.7	9	11	15	26		W			
148.8	39.9	7	12	14	26		M			
144.0	44.7	9	12	19	31		M		COASTAL PLAIN Gray, clayey, fine to coarse SAND (A-2-6) 140.7	48.0
139.0	49.7	8	10	10	20		W		COASTAL PLAIN Gray and green, micaceous, silty, sandy CLAY (A-6) 135.7	53.0
134.0	54.7	13	32	31	63		M			
129.0	59.7	23	28	43	71		M			
124.0	64.7	23	28	42	70		M			

Boring Terminated at Elevation 122.5 ft in Cape Fear Fm: Hard, sandy, CLAY (A-6) 122.5 / 66.2

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: 9.0 lbs/gal

Casing Depth (4"): 21.1 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			**GROUND WTR (ft)**
BORING NO. LL B4-A	**STATION** 825+13	**OFFSET** 60ft LT	**ALIGNMENT** -L-	0 HR. Water
COLLAR ELEV. 187.2 ft	**TOTAL DEPTH** 66.0 ft	**NORTHING** 484,070	**EASTING** 1,993,635	24 HR. Boring
DRILL MACHINE CME-45C	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual	
START DATE 04/03/07	**COMP. DATE** 04/03/07	**SURFACE WATER DEPTH** 0.4ft	**DEPTH TO ROCK** N/A	

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)
190										
187.2	0.0								187.2 MUDLINE	0.0
183.7	3.5	WOH	WOH	WOH	WOH 0		Sat.		**ALLUVIAL** Black, sandy MUCK	
178.0	9.2	3	2	4	6		Sat.		181.2	6.0
173.0	14.2	4	5	5	10		Sat.		**ALLUVIAL** Tan, coarse SAND and GRAVEL (A-1-b) 175.2	12.0
168.0	19.2	3	7	10	17		Sat.		**COASTAL PLAIN** Tan and gray, silty, fine SAND (A-2-4) (Middendorf Formation) 167.4	19.8
163.2	24.0	3	5	6	11		M		**COASTAL PLAIN** White, sandy, silty CLAY (A-7-6) (Middendorf Formation) 164.7	22.5
158.2	29.0	5	5	8	13		W		**COASTAL PLAIN** White, silty, coarse SAND (A-2-4) (Middendorf Formation) 160.2	27.0
153.2	34.0	12	15	22	37		W		**COASTAL PLAIN** Tan, clayey, coarse SAND (A-2-6) (Middendorf Formation) 155.2	32.0
147.6	39.6	13	16	22	38		M		**COASTAL PLAIN** Gray, micaceous, sandy CLAY (A-6) (Cape Fear Formation) 149.7	37.5
142.6	44.6	10	11	12	23		W		**COASTAL PLAIN** Gray, silty, fine SAND (A-2-4) (Cape Fear Formation)	
137.6	49.6	11	15	20	35		W			
132.6	54.6	13	11	13	24		W		134.2	53.0
127.7	59.5	12	11	15	26		M		**COASTAL PLAIN** Gray with maroon mottling, micaceous, sandy CLAY (A-6) (Cape Fear Formation)	
122.7	64.5	13	15	29	44		M			
		9	12	17	29		M		121.2	66.0

Boring Terminated at Elevation 121.2 ft in Cape Fear Fm: Very stiff, micaceous, sandy, CLAY (A-6)

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: 9.0 lbs/gal

Casing Depth (4"): 8.8 ft

NCDOT BORE DOUBLE MACTEC 6468-07-1682.GPJ NC_DOT.GDT 4/26/07

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. LL B5-A	STATION 826+04	OFFSET 66ft LT	ALIGNMENT -L-
COLLAR ELEV. 186.9 ft	TOTAL DEPTH 80.4 ft	NORTHING 484,155	EASTING 1,993,605
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 03/26/07	COMP. DATE 03/26/07	SURFACE WATER DEPTH 0.7ft	DEPTH TO ROCK N/A

GROUND WTR (ft): 0 HR. Water; 24 HR. Boring

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))
190									
186.9	0.0								186.9 / 0.0 MUDLINE
183.1	3.8	WOH	WOH	1	1		Sat.		ALLUVIAL Sandy MUCK
177.9	9.0	WOH	WOH	WOH	WOH 0		Sat.		179.9 / 7.0 ALLUVIAL Gray and tan, silty, fine SAND (A-2-4)
172.9	14.0	3	4	3	7		Sat.		
167.1	19.8	3	2	3	5		Sat.		
162.8	24.1	1	3	5	8		Sat.		166.2 / 20.7 COASTAL PLAIN Gray with tan and orange, silty, clayey, SAND (A-2-6) (Middendorf Formation)
157.8	29.1	4	7	18	25		Sat.		
152.9	34.0	10	16	21	37		W		154.4 / 32.5 COASTAL PLAIN Gray and maroon, silty CLAY (A-6) (Cape Fear Formation)
147.9	39.0	14	10	21	31		M		
142.9	44.0	21	32	39	71		M		144.4 / 42.5 COASTAL PLAIN Gray, clayey, coarse SAND (A-2-6) (Cape Fear Formation)
137.9	49.0	11	11	12	23		Sat.		
132.9	54.0	6	8	11	19		Sat.		134.4 / 52.5 COASTAL PLAIN Gray and green, sandy, silty CLAY (A-6) (Cape Fear Formation)
127.9	59.0	11	12	16	28		M		
122.9	64.0	18	21	35	56		M		
117.9	69.0	12	17	25	42		W		
112.9	74.0	12	16	14	30		W		
		15	13	12	25		W		

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. LL B5-A	STATION 826+04	OFFSET 66ft LT	ALIGNMENT -L-
COLLAR ELEV. 186.9 ft	TOTAL DEPTH 80.4 ft	NORTHING 484,155	EASTING 1,993,605
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 03/26/07	COMP. DATE 03/26/07	SURFACE WATER DEPTH 0.7ft	DEPTH TO ROCK N/A

GROUND WTR (ft): 0 HR. Water; 24 HR. Boring

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
110					Match Line				
107.9	79.0								106.5 / 80.4 COASTAL PLAIN Gray and green, sandy, silty CLAY (A-6) (Cape Fear Formation) *(continued)*
		27	50	50/0.4	100/0.9		M		

Boring Terminated at Elevation 106.5 ft in Cape Fear Fm: Hard, silty CLAY (A-6)

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: 9.1 lbs/gal

Casing Depth (4"): 23.9 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			**GROUND WTR (ft)**
BORING NO. LL B6-A	**STATION** 827+17	**OFFSET** 78ft LT	**ALIGNMENT** -L-	0 HR. Water
COLLAR ELEV. 184.9 ft	**TOTAL DEPTH** 81.8 ft	**NORTHING** 484,257	**EASTING** 1,993,559	24 HR. Boring
DRILL MACHINE CME-45C	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual	
START DATE 03/21/07	**COMP. DATE** 03/22/07	**SURFACE WATER DEPTH** 1.4ft	**DEPTH TO ROCK** N/A	

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))
185									
184.9	0.0	WOH	WOH	WOH	0		Sat.		184.9 / 0.0 MUDLINE
180.9	4.0	WOH	WOH	WOH	0		Sat.		**ALLUVIAL** MUCK-No Recovery
177.4	7.5								**ALLUVIAL** Gray, coarse SAND (A-1-b)
174.5	10.4	3	1	2	3		Sat.		
170.9	14.0								**COASTAL PLAIN** Orange, clayey, silty, fine to coarse SAND (A-2-4) (Middendorf Formation)
169.5	15.4	5	6	4	9	SS-12	Sat.		
164.5	20.4	4	4	7	11		W		
159.5	25.4	8	9	18	27	SS-13	W		
154.5	30.4	10	11	12	23		W		
151.9	33.0								**COASTAL PLAIN** Maroon and light gray, silty, sandy CLAY (A-6) (Cape Fear Formation)
149.5	35.4	18	31	47	78		M		
144.4	40.5	6	8	8	16		M		
140.9	44.0								**COASTAL PLAIN** Light gray, silty, clayey, coarse SAND (A-2-6) (Cape Fear Formation)
139.4	45.5	7	6	7	13	SS-14	Sat.		
136.9	48.0								**COASTAL PLAIN** Light gray, clayey, silty, coarse SAND (A-2-4) (Cape Fear Formation)
134.4	50.5	12	13	17	30		W		
129.4	55.5	29	30	29	59	SS-15	W		
126.9	58.0								**COASTAL PLAIN** Maroon and Gray, silty, clayey, coarse SAND (A-2-6) (Cape Fear Formation)
124.4	60.5	20	22	33	55		M		
119.4	65.5	13	19	23	42	SS-16	18%		
114.4	70.5								**COASTAL PLAIN** Gray, clayey, silty, coarse SAND (A-2-4) (Cape Fear Formation)
111.9	73.0								**COASTAL PLAIN** Gray-tan, sandy, silty CLAY (A-6) (Cape Fear Formation)
109.4	75.5	11	12	13	25	SS-17	W		
105.9	79.0	28	46	54/0.4	100/0.9		M		

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			**GROUND WTR (ft)**
BORING NO. LL B6-A	**STATION** 827+17	**OFFSET** 78ft LT	**ALIGNMENT** -L-	0 HR. Water
COLLAR ELEV. 184.9 ft	**TOTAL DEPTH** 81.8 ft	**NORTHING** 484,257	**EASTING** 1,993,559	24 HR. Boring
DRILL MACHINE CME-45C	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual	
START DATE 03/21/07	**COMP. DATE** 03/22/07	**SURFACE WATER DEPTH** 1.4ft	**DEPTH TO ROCK** N/A	

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
105									
104.4	80.5				Match Line				
		33	50	50/0.3	100/0.8		M		103.1 / 81.8 **COASTAL PLAIN** Gray, clayey, coarse SAND (A-2-6) (Cape Fear Formation) *(continued)*

Boring Terminated at Elevation 103.1 ft in Cape Fear Fm: Very dense, clayey, coarse SAND (A-2-6)

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: 9.0 lbs/gal

Casing Depth (4"): 32.0 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			**GROUND WTR (ft)**
BORING NO. LL B7-A	**STATION** 828+16	**OFFSET** 62ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 187.0 ft	**TOTAL DEPTH** 80.7 ft	**NORTHING** 484,354	**EASTING** 1,993,541
DRILL MACHINE CME-45C	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/20/07	**COMP. DATE** 03/21/07	**SURFACE WATER DEPTH** 0.5ft	**DEPTH TO ROCK** N/A

GROUND WTR (ft)	
0 HR.	Water
24 HR.	Boring

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)
190										
187.0	0.0								187.0 MUDLINE	0.0
		WOH	WOH	WOH WOH	0		Sat.		**ALLUVIAL** Sandy MUCK	
182.0	5.0									
		7	10	10	Invalid 20		Sat.		179.5 **ALLUVIAL** Orange, silty, fine SAND (A-2-4)	7.5
177.8	9.2									
		6	5	9	14	SS-18	Sat.		174.5 **ALLUVIAL** Tan, fine to coarse SAND (A-1-b)	12.5
172.8	14.2									
		1	1	1	2		Sat.			
167.8	19.2									
		1	2	7	9		M		166.9 **COASTAL PLAIN** Orange-tan, sandy CLAY (A-6) (Middendorf Formation)	20.1
162.8	24.2								164.5 **COASTAL PLAIN** Yellow, silty SAND (A-2-4) (Middendorf Formation)	22.5
		7	8	11	19		Sat.			
157.8	29.2								159.0 **COASTAL PLAIN** Gray, clayey, SAND (A-2-6) (Middendorf Formation)	28.0
		10	13	17	30		M			
152.8	34.2									
		10	15	24	39		W		150.0 **COASTAL PLAIN** Gray, sandy CLAY (A-6) (Cape Fear Formation)	37.0
147.8	39.2									
		10	16	19	35		M			
142.8	44.2								143.5 **COASTAL PLAIN** Gray and maroon, silty, clayey, coarse SAND (A-2-6) (Cape Fear Formation)	43.5
		5	7	9	16		M			
137.8	49.2									
		5	8	9	17		W			
132.8	54.2									
		17	13	20	33		M		130.0 **COASTAL PLAIN** Gray-tan and blue-gray, silty, sandy CLAY (A-6) (Cape Fear Formation)	57.0
127.8	59.2									
		9	11	13	24		M			
122.8	64.2									
		16	20	28	48		M			
117.8	69.2									
		15	18	20	38		M			
112.8	74.2									
		16	25	60	85		M			

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			**GROUND WTR (ft)**
BORING NO. LL B7-A	**STATION** 828+16	**OFFSET** 62ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 187.0 ft	**TOTAL DEPTH** 80.7 ft	**NORTHING** 484,354	**EASTING** 1,993,541
DRILL MACHINE CME-45C	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/20/07	**COMP. DATE** 03/21/07	**SURFACE WATER DEPTH** 0.5ft	**DEPTH TO ROCK** N/A

GROUND WTR (ft)	
0 HR.	Water
24 HR.	Boring

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
110					Match Line				
107.8	79.2								**COASTAL PLAIN** Gray-tan and blue-gray, silty, sandy CLAY (A-6) (Cape Fear Formation)*(continued)* 106.3 80.7
		21	35	51	86		M		

Boring Terminated at Elevation 106.3 ft in Cape Fear Fm: Hard, sandy, silty CLAY (A-6)

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: ND

Casing Depth (4"): 10.4 ft

Note: N-value at depth 5.0 feet invalid due to wood fragments.

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. LL B8-A	STATION 829+06	OFFSET 62ft LT	ALIGNMENT -L-
COLLAR ELEV. 188.2 ft	TOTAL DEPTH 100.5 ft	NORTHING 484,438	EASTING 1,993,513
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 03/15/07	COMP. DATE 03/20/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

GROUND WTR (ft): 0 HR. 0.0; 24 HR. ND

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))
190									
188.2	0.0								GROUND SURFACE (188.2 / 0.0)
184.4	3.8	WOH	WOH	1	1	SS-1	Sat.		ALLUVIAL Brown, sandy, MUCK (185.2 / 3.0)
179.4	8.8	4	14	13	27		Sat.		ALLUVIAL Gray-brown, coarse SAND (A-1-b) with trace organics (180.7 / 7.5)
173.7	14.5	3	4	4	8	SS-2	Sat.		ALLUVIAL Gray-brown, clayey, coarse SAND and GRAVEL (A-2-6) with trace organics (175.7 / 12.5)
168.7	19.5	13	29	49	78	SS-3	16%		COASTAL PLAIN Tan, sandy, CLAY (A-7-6) (Middendorf Formation) (170.2 / 18.0)
163.7	24.5	15	17	21	38		M		COASTAL PLAIN Tan, clayey, coarse SAND (A-2-6) (Middendorf Formation)
158.7	29.5	9	12	14	26	SS-4	M		
153.7	34.5	7	8	10	18		M		(156.2 / 32.0)
148.7	39.5	12	18	28	46	SS-5	19%		COASTAL PLAIN Maroon, coarse sandy, CLAY (A-6) (Cape Fear Formation)
143.7	44.5	8	10	11	21	SS-6	M		(145.2 / 43.0)
138.7	49.5	7	10	11	21	SS-7	M		COASTAL PLAIN Light gray and maroon, clayey, silty, coarse SAND (A-2-4) (Cape Fear Formation)
133.7	54.5	8	8	12	20		M		
128.7	59.5	8	18	24	42	SS-8	M		(130.2 / 58.0)
123.7	64.5	15	20	29	49		M		COASTAL PLAIN Light gray and gray, sandy CLAY (A-7-5) (Cape Fear Formation)
118.7	69.5	14	29	29	58	SS-9	31%		
113.7	74.5	11	23	47	70		M		(115.2 / 73.0)
		23	23	30	53		M		COASTAL PLAIN Gray, clayey SAND (A-2-6) (Cape Fear Formation)

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. LL B8-A	STATION 829+06	OFFSET 62ft LT	ALIGNMENT -L-
COLLAR ELEV. 188.2 ft	TOTAL DEPTH 100.5 ft	NORTHING 484,438	EASTING 1,993,513
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 03/15/07	COMP. DATE 03/20/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

GROUND WTR (ft): 0 HR. 0.0; 24 HR. ND

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
110					Match Line				
108.7	79.5	34	60	40/0.3	100/0.8	SS-10	14% M		COASTAL PLAIN Gray, clayey SAND (A-2-6) (Cape Fear Formation) *(continued)*
103.7	84.5	26	38	51	89		M		
98.7	89.5	34	66/0.3		100/0.8		M		
93.7	94.5	36	64/0.5		100/1.0	SS-11	19% M		
88.7	99.5	34	66/0.5		100/1.0		M		(87.7 / 100.5)

Boring Terminated at Elevation 87.7 ft in Cape Fear Fm: Very dense, clayey, SAND (A-2-6)

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: ND

Casing Depth (4"): 5.8 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST B. Deobald
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. LL B9-A	STATION 830+17	OFFSET 66ft LT	ALIGNMENT -L-	0 HR. 3.2
COLLAR ELEV. 194.6 ft	TOTAL DEPTH 65.4 ft	NORTHING 484,538	EASTING 1,993,469	24 HR. 2.2
DRILL MACHINE CME-550	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 04/04/07	COMP. DATE 04/04/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

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))
194.6	0.0								GROUND SURFACE 0.0
		3	4	8	12		M		**COASTAL PLAIN** Orange and tan, silty, fine to coarse SAND (A-2-4) with trace organics (Middendorf Formation)
190.7	3.9								191.6 — 3.0
		6	9	23	32	SS-19	17%		**COASTAL PLAIN** Orange and light gray, fine to coarse sandy, CLAY (A-7-6) with trace gravel (Middendorf Formation)
185.7	8.9								187.1 — 7.5
		9	9	13	22		W		**COASTAL PLAIN** Light gray, orange, and tan, silty, fine to coarse SAND (A-2-4) with trace gravel (Middendorf Formation)
180.7	13.9								
		2	3	2	5		Sat.		
175.7	18.9								
		5	8	12	20		Sat.		
170.7	23.9								172.1 — 22.5
		14	19	21	40	SS-20	M		**COASTAL PLAIN** Tan and light gray, clayey, fine to coarse SAND (A-2-7) with trace gravel and mica (Middendorf Formation)
165.7	28.9								167.1 — 27.5
		9	12	12	24		W		**COASTAL PLAIN** Light gray, orange, and tan, silty, fine to coarse SAND (A-2-4) with trace gravel (Middendorf Formation)
160.7	33.9								162.1 — 32.5
		10	16	32	48		M		**COASTAL PLAIN** Light gray, silty CLAY (A-7-6) (Middendorf Formation)
155.7	38.9								
		16	30	30	60		M		
150.7	43.9								153.6 — 41.0
		15	22	21	43		M		**COASTAL PLAIN** Mottled tan, maroon, and gray, silty, fine sandy, CLAY (A-6) (Cape Fear Formation)
145.7	48.9								147.1 — 47.5
		10	10	9	19		W		**COASTAL PLAIN** Gray, clayey, silty, fine to coarse SAND (A-2-4) with trace gravel and mica (Cape Fear Formation)
140.7	53.9								
		7	8	13	21		W		
135.7	58.9								137.1 — 57.5
		13	15	18	33		M		**COASTAL PLAIN** Gray, fine to coarse sandy, silty, CLAY (A-6) with trace gravel (Cape Fear Formation)
130.7	63.9								
		14	23	27	50		M		129.2 — 65.4

Boring Terminated at Elevation 129.2 ft in Cape Fear Fm: Hard, fine to coarse sandy, silty CLAY (A-6)

Bits Used: 3" Roller Cone

Drilling Fluid Properties: 8.5 lbs/gal

Casing Depth (4"): 3.6 ft

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST B. Deobald
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. LL EB2-A	STATION 831+16	OFFSET 62ft LT	ALIGNMENT -L-	0 HR. 5.0
COLLAR ELEV. 204.3 ft	TOTAL DEPTH 69.2 ft	NORTHING 484,630	EASTING 1,993,436	24 HR. 3.9
DRILL MACHINE CME-550	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 04/03/07	COMP. DATE 04/03/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

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
204.3	0.0								GROUND SURFACE 0.0
		1	1	2	3		M		**COASTAL PLAIN** Brown and gray, fine to coarse SAND (A-3) with trace organics (Middendorf Formation)
201.6	2.7								201.8 — 2.5
		3	3	5	8		M		**COASTAL PLAIN** Light gray and tan, clayey, silty, fine to coarse SAND (A-2-4) with rounded quartz gravel (Middendorf Formation)
196.6	7.7								195.3 — 9.0
		2	2	17	19		M		**COASTAL PLAIN** Light gray, fine sandy, silty CLAY (A-7-6) (Middendorf Formation)
191.6	12.7								
		15	25	45	70				
186.6	17.7								189.3 — 15.0
		16	21	23	44		M/W		**COASTAL PLAIN** Light gray, orange, and tan, silty, fine to coarse SAND (A-2-4) with trace gravel (Middendorf Formation)
181.6	22.7								183.8 — 20.5
		2	2	3	5	SS-21	16%		**COASTAL PLAIN** Orange and tan, fine to coarse sandy, SILT (A-4) with trace gravel (Middendorf Formation)
176.6	27.7								178.3 — 26.0
		2	6	14	20		Sat.		**COASTAL PLAIN** Light gray, orange, and tan, silty, fine to coarse SAND (A-2-4) with trace gravel (Middendorf Formation)
171.6	32.7								170.8 — 33.5
		4	5	10	15		M		**COASTAL PLAIN** Light gray, orange, and tan, clayey, fine to coarse sandy, SILT (A-4) with trace mica and gravel (Middendorf Formation)
166.6	37.7								
		6	8	10	18		W		
161.6	42.7								
		15	25	34	59	SS-22	18%		
156.6	47.7								158.8 — 45.5
		10	13	12	25		W		**COASTAL PLAIN** Light gray and tan, silty, clayey, fine to coarse SAND (A-2-6) (Middendorf Formation)
151.6	52.7								154.8 — 49.5
		8	13	14	27		M		**COASTAL PLAIN** Gray, silty, fine sandy, CLAY (A-6) (Cape Fear Formation)
146.6	57.7								148.8 — 55.5
		5	6	9	15	SS-23	W		**COASTAL PLAIN** Gray, silty, clayey, fine to coarse SAND (A-2-6) with trace gravel and mica (Cape Fear Formation)
141.6	62.7								
		5	6	8	14		W		
136.6	67.7								138.8 — 65.5
		12	14	22	36		M		**COASTAL PLAIN** Mottled tan, maroon, and gray, fine sandy, silty, CLAY (A-6) (Cape Fear Formation)
									135.1 — 69.2

Boring Terminated at Elevation 135.1 ft in Cape Fear Fm: Hard, fine sandy, silty CLAY (A-6)

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: 8.5 lbs/gal

Casing Depth (4"): 2.1 ft

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

N.C.D.O.T./AASHTO CLASSIFICATIONS

REPORT ON SAMPLES OF: SOILS FOR QUALITY

MACTEC PROJECT NAME/ NUMBER: Structures 3 & 4; Dual Bridges on -L- over Wetlands (6468-07-1682)

NCDOT PROJ. NO.: 34817.1.2 (U-2519CB) **COUNTY: Cumberland** **OWNER: N.C.D.O.T.**

DATE SAMPLED: March 2007 **RECEIVED:** 3/27/2007 **REPORTED BY: MACTEC**

SAMPLED FROM: Left Lane B8-A

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-1	SS-2	SS-3	SS-4	SS-5	SS-6
Retained 4.75 mm Sieve	(%)	ND	0.3	0.0	0.0	0.0	0.0
Passing 2.00 mm Sieve	(%)	ND	94.5	99.9	99.0	100.0	100.0
Passing 425 µm Sieve	(%)	ND	28.9	82.3	72.7	96.8	84.4
Passing 75 µm Sieve	(%)	ND	23.4	53.1	12.2	84.2	38.5

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	ND	72.9	33.4	67.8	5.8	30.9
Fine Sand Ret - 53 µm	(%)	ND	2.5	15.1	20.7	14.0	34.5
Silt 0.05 - 0.005 mm	(%)	ND	11.9	3.3	0.2	12.0	5.4
Clay < 0.005 mm	(%)	ND	12.7	48.1	11.3	68.2	29.2

Moisture Content	(%)	714.0	ND	15.9	ND	18.8	ND
Liquid Limit, L.L.		ND	33	48	33	39	29
Plasticity Index, P.I.		ND	15	28	16	21	15
AASHTO Classification		ND	A-2-6(0)	A-7-6(11)	A-2-6(0)	A-6(17)	A-6(2)
Organic Content	(%)	52.1	ND	ND	ND	ND	ND

Boring No.		LL B8-A	LL B8-A	LL B8-A	LL B8-A	LL B8-A	LL B8-A
Station		829+06	829+06	829+06	829+06	829+06	829+06
Offset		62 LT	62 LT	62 LT	62 LT	62 LT	62 LT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (FT)	From	0.0	8.8	14.5	24.5	34.5	39.5
	to	1.5	10.3	16.0	26.0	36.0	41.0

REMARKS: ND=Not Determined, NP=Non-Plastic

Submitted by: LBJ
Laboratory Manager

SHEET 29

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

N.C.D.O.T./AASHTO CLASSIFICATIONS

REPORT ON SAMPLES OF: SOILS FOR QUALITY

MACTEC PROJECT NAME/ NUMBER: Structures 3 & 4; Dual Bridges on -L- over Wetlands (6468-07-1682)

NCDOT PROJ. NO.: 34817.1.2 (U-2519CB) **COUNTY: Cumberland** **OWNER: N.C.D.O.T.**

DATE SAMPLED: March 2007 **RECEIVED:** 3/27/2007 **REPORTED BY: MACTEC**

SAMPLED FROM: Left Lane B8-A and B6-A

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-7	SS-8	SS-9	SS-10	SS-11	SS-12
Retained 4.75 mm Sieve	(%)	0.1	0.0	0.0	0.0	0.0	0.0
Passing 2.00 mm Sieve	(%)	97.9	99.0	99.9	97.1	95.7	98.2
Passing 425 µm Sieve	(%)	63.5	68.0	97.6	59.5	60.9	52.7
Passing 75 µm Sieve	(%)	21.0	18.5	86.8	21.4	29.4	20.9

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	57.4	52.5	3.4	54.3	51.3	67.8
Fine Sand Ret - 53 µm	(%)	22.1	33.0	16.4	27.4	21.7	11.9
Silt 0.05 - 0.005 mm	(%)	4.6	2.6	41.4	1.9	3.4	6.3
Clay < 0.005 mm	(%)	15.9	11.8	38.7	16.5	23.5	14.0

Moisture Content	(%)	ND	ND	30.6	14.0	18.9	ND
Liquid Limit, L.L.		26	25	59	29	39	14
Plasticity Index, P.I.		8	8	26	13	18	NP
AASHTO Classification		A-2-4(0)	A-2-4(0)	A-7-5(27)	A-2-6(0)	A-2-6(1)	A-2-4(0)
Organic Content	(%)	ND	ND	ND	ND	ND	ND

Boring No.		LL B8-A	LL B8-A	LL B8-A	LL B8-A	LL B8-A	LL B6-A
Station		829+06	829+06	829+06	829+06	829+06	827+17
Offset		62 LT	62 LT	62 LT	62 LT	62 LT	78 LT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (FT)	From	44.5	54.5	64.5	79.5	94.5	15.4
	to	46.0	56.0	66.0	81.0	96.0	16.9

REMARKS: ND=Not Determined, NP=Non-Plastic

Submitted by: LBJ
Laboratory Manager

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

N.C.D.O.T./AASHTO CLASSIFICATIONS

REPORT ON SAMPLES OF: SOILS FOR QUALITY

MACTEC PROJECT NAME/ NUMBER: Structures 3 & 4; Dual Bridges on -L- over Wetlands (6468-07-1682)

NCDOT PROJ. NO.: 34817.1.2 (U-2519CB) **COUNTY:** Cumberland **OWNER:** N.C.D.O.T.

DATE SAMPLED: March 2007 **RECEIVED:** 3/27/2007 **REPORTED BY:** MACTEC

SAMPLED FROM: Left Lane B6-A and B7-A

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-13	SS-14	SS-15	SS-16	SS-17	SS-18
Retained 4.75 mm Sieve	(%)	0.0	0.0	0.0	0.2	0.0	0.0
Passing 2.00 mm Sieve	(%)	97.1	99.9	100.0	98.6	99.2	99.9
Passing 425 µm Sieve	(%)	62.0	69.1	80.1	59.7	65.3	99.0
Passing 75 µm Sieve	(%)	24.6	19.2	26.4	14.9	16.3	33.4

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	54.8	53.8	36.8	60.8	62.7	7.5
Fine Sand Ret - 53 µm	(%)	21.3	27.7	40.4	27.5	21.6	63.2
Silt 0.05 - 0.005 mm	(%)	3.1	2.9	2.9	5.3	0.8	14.4
Clay < 0.005 mm	(%)	20.8	15.6	19.9	6.5	14.9	14.9

Moisture Content	(%)	ND	ND	ND	18.4	ND	ND
Liquid Limit, L.L.		27	38	22	32	28	22
Plasticity Index, P.I.		9	20	3	13	9	3
AASHTO Classification		A-2-4(0)	A-2-6(0)	A-2-4(0)	A-2-6(0)	A-2-4(0)	A-2-4(0)
Organic Content	(%)	ND	ND	ND	ND	ND	ND

Boring No.		LL B6-A	LL B6-A	LL B6-A	LL B6-A	LL B6-A	LL B7-A
Station		827+17	827+17	827+17	827+17	827+17	828+16
Offset		78 LT	78 LT	78 LT	78 LT	78 LT	62 LT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (FT)	From	25.4	45.5	55.5	65.5	70.5	9.2
	to	26.9	47.0	57.0	67.0	72.0	10.7

REMARKS: ND=Not Determined, NP=Non-Plastic

Submitted by: Lee Brian Johnson
Laboratory Manager

SHEET 30

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

N.C.D.O.T./AASHTO CLASSIFICATIONS

REPORT ON SAMPLES OF: SOILS FOR QUALITY

MACTEC PROJECT NAME/ NUMBER: Structures 3 & 4; Dual Bridges on -L- over Wetlands (6468-07-1682)

NCDOT PROJ. NO.: 34817.1.2 (U-2519CB) **COUNTY:** Cumberland **OWNER:** N.C.D.O.T.

DATE SAMPLED: April 2007 **RECEIVED:** 4/9/2007 **REPORTED BY:** MACTEC

SAMPLED FROM: Left Lane B9-A and EB2-A

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-19	SS-20	SS-21	SS-22	SS-23	
Retained 4.75 mm Sieve	(%)	3.8	1.4	0.0	0.0	0.0	
Passing 2.00 mm Sieve	(%)	93.9	95.7	99.6	99.9	99.7	
Passing 425 µm Sieve	(%)	71.0	53.9	76.3	98.2	73.2	
Passing 75 µm Sieve	(%)	36.6	20.2	37.4	86.8	25.9	

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	38.3	66.9	38.0	3.1	57.7	
Fine Sand Ret - 53 µm	(%)	27.2	13.1	31.7	17.0	19.7	
Silt 0.05 - 0.005 mm	(%)	15.1	7.2	7.7	30.3	1.0	
Clay < 0.005 mm	(%)	19.4	12.9	22.6	49.5	21.7	

Moisture Content	(%)	17.4	ND	15.8	18.3	ND	
Liquid Limit, L.L.		57	41	21	28	35	
Plasticity Index, P.I.		39	22	5	10	21	
AASHTO Classification		A-7-6(7)	A-2-7(1)	A-4(0)	A-4(7)	A-2-6(1)	
Organic Content	(%)	ND	ND	ND	ND	ND	

Boring No.		LL B9-A	LL B9-A	LL EB2-A	LL EB2-A	LL EB2-A	
Station		830+17	830+17	831+16	831+16	831+16	
Offset		66 LT	66 LT	62 LT	62 LT	62 LT	
Alignment		-L-	-L-	-L-	-L-	-L-	
Depth (FT)	From	3.9	23.9	22.7	42.7	57.7	
	to	5.4	25.4	24.2	44.2	59.2	

REMARKS: ND=Not Determined, NP=Non-Plastic

Submitted by: Lee Brian Johnson
Laboratory Manager

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 34817.1.2 TIP: U-2519CB COUNTY: CUMBERLAND

DESCRIPTION(1): STRUCTURES 3 & 4: DUAL BRIDGES ON -L- OVER WETLANDS

EXISTING BRIDGE

Information from: Field Inspection X Microfilm ____ (reel ____ pos: ____)
Other (explain) Not Applicable: No Existing Bridge

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

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: ____

Interior Bents: ____

Channel Bed: ____

Channel Bank: ____

EXISTING SCOUR PROTECTION

Type(3): ____

Extent(4): ____

Effectiveness(5): ____

Obstructions(6): ____

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.

DESIGN INFORMATION

Channel Bed Material(7): Primarily muck. Other soils in the near subsurface include clayey, silty sand A-2-4, A-2-6; and clay A-7-6.

Channel Bank Material(8): Muck and sand A-2-4, A-3; Other soil in the near subsurface includes clay A-6, A-7-6.

Channel Bank Cover(9): Pine and hardwood trees; brush

Floodplain Width(10): 500 feet

Floodplain Cover(11): Densely wooded; hardwood and cypress trees; brush

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

Channel Migration Tendency(13): None

Observations and Other Comments: Surface water flows in braided-channels; generally crosses the alignment near bent 8, then flows along the left-lane and crosses the alignment again near bent 4.

Reported by: Bill Deobald **Date:** 4/27/2007
MACTEC Engineering and Consulting, Inc.

DESIGN SCOUR ELEVATIONS(14) Feet X Meters ____

BENTS	B1	B2	B3	B4	B5	B6	B7	B8	B9		

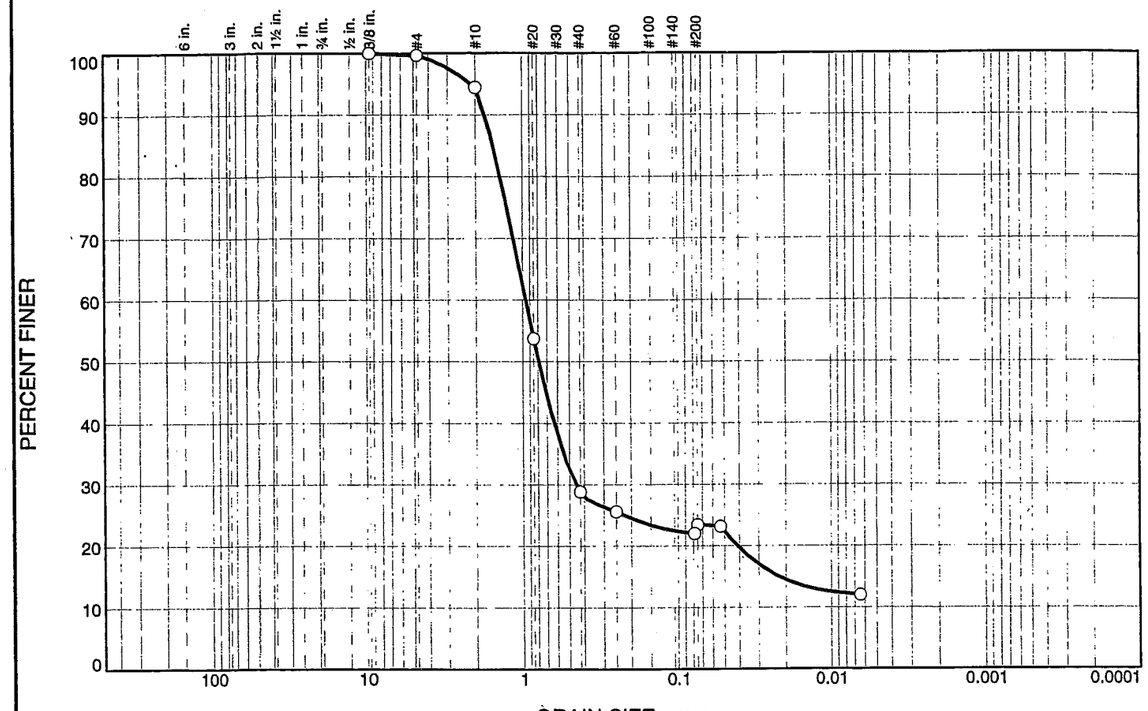
Comparison of DSE to Hydraulics Unit theoretical scour:
There are no scour calculations and scour is listed "N/A" in the Bridge Survey and Hydraulic Report dated 9-29-05.

DSE determined by: ____ **Date:** 5/22/2007
Bradley D. Worley

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank	Bed	Bed	Bed	Bed	Bank		
Sample No.	SS-2	SS-3	SS-12	SS-18	SS-19		
Retained #4	0.3	0	0	0	3.8		
Passed #10	94.5	99.9	98.2	99.9	93.9		
Passed #40	28.9	82.3	52.7	99.9	71		
Passed #200	23.4	53.1	20.9	33.4	36.6		
Coarse Sand	72.9	33.4	67.8	7.5	38.3		
Fine Sand	2.5	15.1	11.9	63.2	27.2		
Silt	11.9	3.3	6.3	14.4	15.1		
Clay	12.7	48.1	14	14.9	19.4		
LL	33	48	14	22	57		
PI	15	28	NP	3	39		
AASHTO	A-2-6(0)	A-7-6(11)	A-2-4(0)	A-2-4(0)	A-7-6(7)		
Station	829+06	829+06	827+17	828+16	830+17		
Offset	62 LT	62 LT	78 LT	62 LT	66 LT		
Depth	8.8-10.3 ft	14.5-16.0 ft	15.4-16.9 ft	9.2-10.7 ft	3.9-5.4 ft		

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	5.2	65.6	5.5	23.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.7		
#10	94.5		
#20	53.7		
#40	28.9		
#60	25.6		
0.0785 mm.	22.0		
#200	23.4		
#270	23.2		
0.0064 mm.	12.0		

* (no specification provided)

Soil Description

YELLOWISH ORANGE CLAYEY SAND

Atterberg Limits

PL= 18 LL= 33 PI= 15

Coefficients

D_{85}= 1.5515 D_{60}= 0.9577 D_{50}= 0.7889
D_{30}= 0.4533 D_{15}= 0.0222 D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

Sample No.: SS-2 **Source of Sample:** BORING LLB8A **Date:** 4/3/07
Location: **Elev./Depth:** 8.87'-10.3

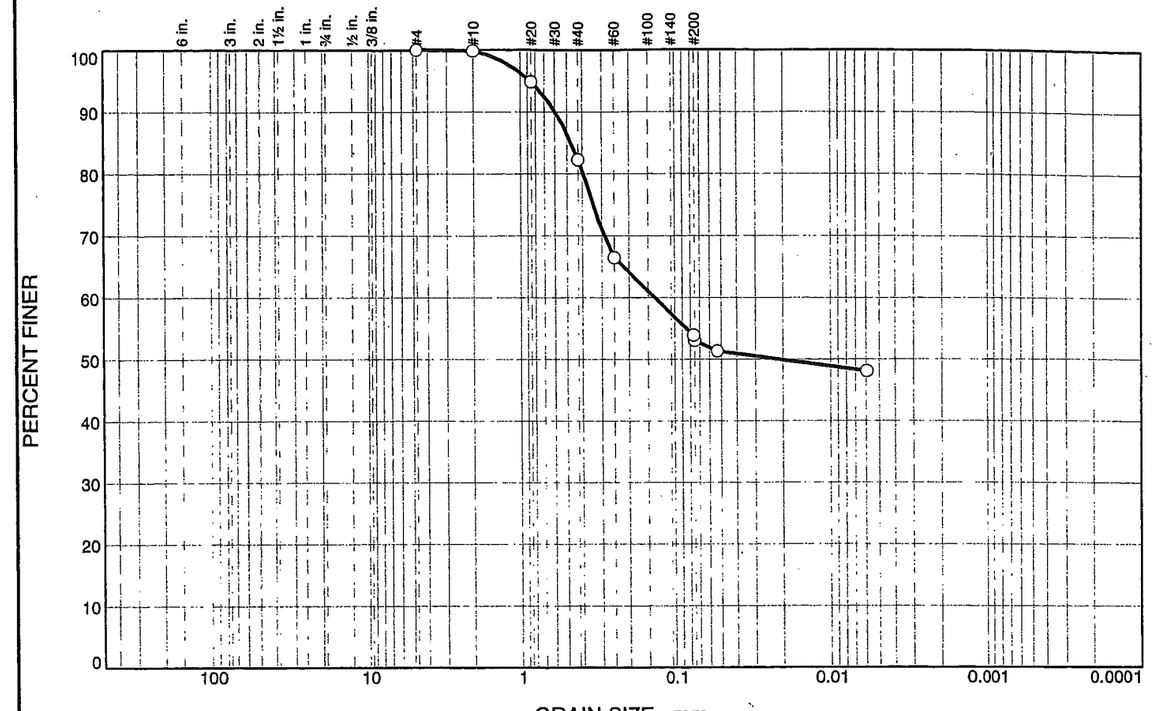
MACTEC, Inc.

Raleigh, North Carolina

Client: NCDOT
Project: DUAL BRIDGES ON LOWER WETLAND STRUCTURE 3&4
Project No: 6468071682.05 **Figure**

SHEET 32

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	17.6	29.2	53.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	94.8		
#40	82.3		
#60	66.5		
0.0764 mm.	53.9		
#200	53.1		
#270	51.4		
0.0059 mm.	48.1		

* (no specification provided)

Soil Description

BROWN SANDY CLAY

Atterberg Limits

PL= 20 LL= 48 PI= 28

Coefficients

D_{85}= 0.4693 D_{60}= 0.1355 D_{50}= 0.0213
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(11)

Remarks

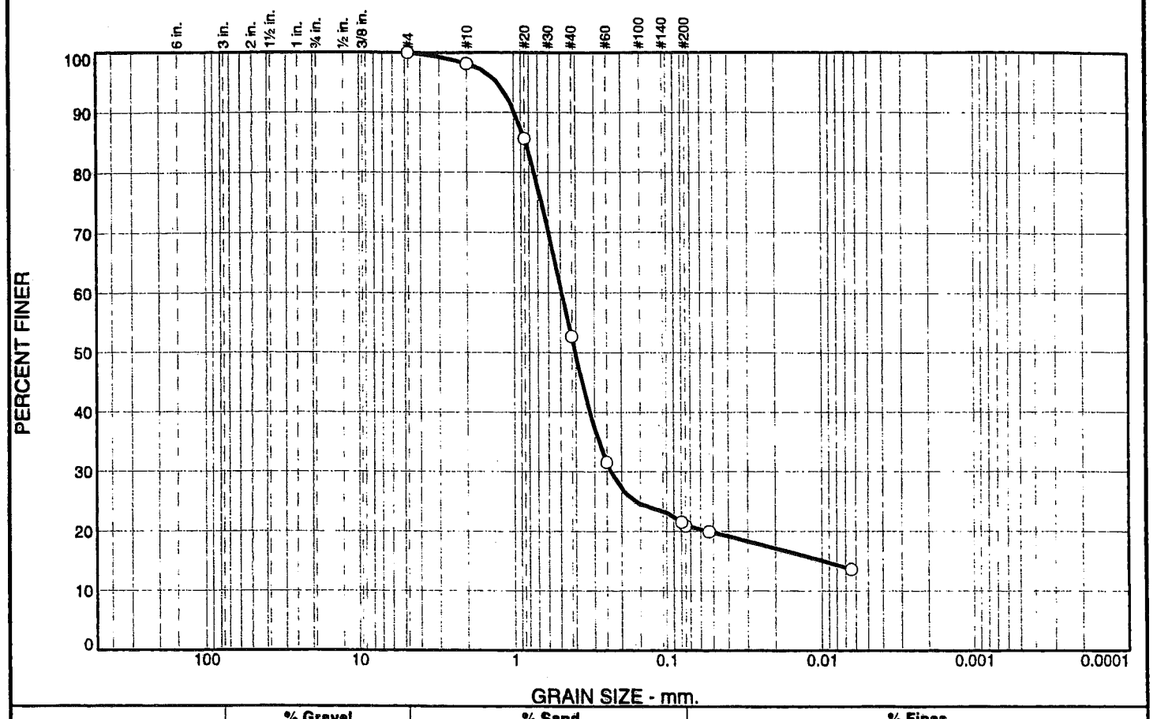
Sample No.: SS-3 **Source of Sample:** BORING LLB8A **Date:**
Location: **Elev./Depth:** 14.5'-16

MACTEC, Inc.

Raleigh, North Carolina

Client: NCDOT
Project: DUAL BRIDGES ON LOWER WETLAND STRUCTURE 3&4
Project No: 6468071682.05 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.8	45.5	31.8	20.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.2		
#20	85.6		
#40	52.7		
#60	31.6		
0.0799 mm.	21.6		
#200	20.9		
#270	19.9		
0.0064 mm.	13.7		

* (no specification provided)

Soil Description

YELLOWISH SILTY SAND

Atterberg Limits

PL= NP LL= 14 PI= NP

Coefficients

D_{85}= 0.8346 D_{60}= 0.4903 D_{50}= 0.4021
D_{30}= 0.2340 D_{15}= 0.0099 D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Sample No.: SS-12 **Source of Sample:** BORING LLB6A **Date:** 4/3/07
Location: **Elev./Depth:** 15.4'-16.9'

MACTEC, Inc.

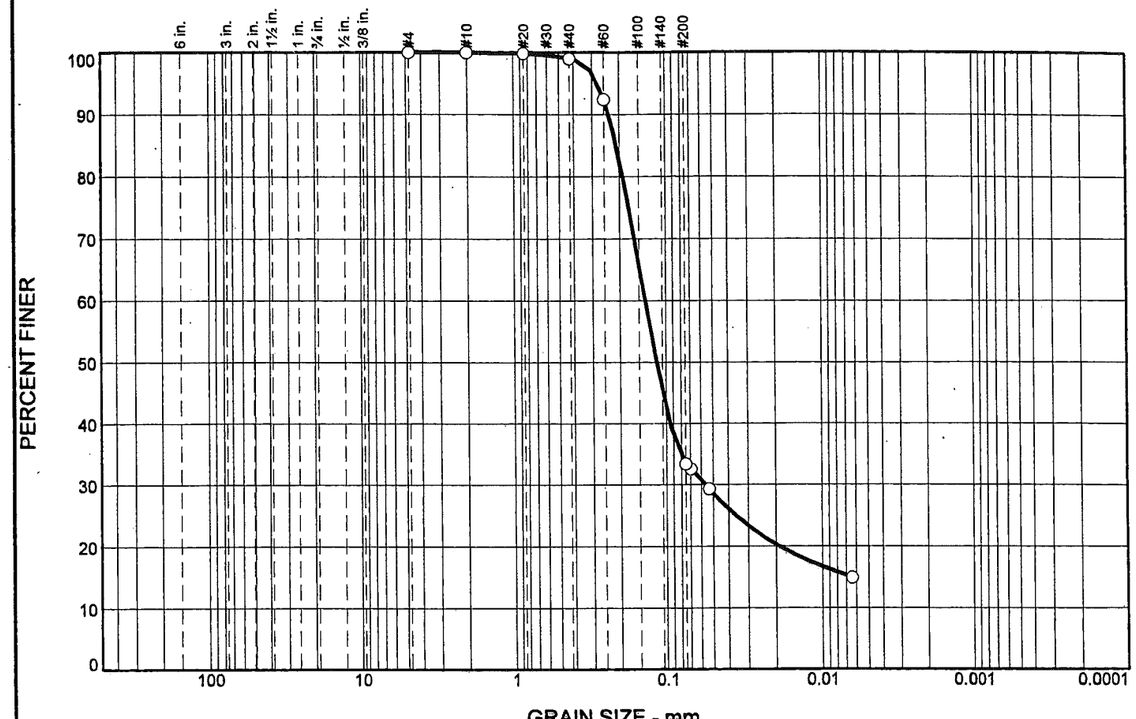
Raleigh, North Carolina

Client: NCDOT
Project: DUAL BRIDGES ON LOWER WETLAND STRUCTURE 3&4
Project No: 6468071682.05 **Figure**

Tested By: CS **Checked By:** LBJ

SHEET 33

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.9	65.6	33.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.8		
#40	99.0		
#60	92.4		
#200	33.4		
0.0694 mm.	32.5		
#270	29.3		
0.0064 mm.	14.9		

* (no specification provided)

Soil Description

YELLOWISH SILTY SAND

Atterberg Limits

PL= NP LL= 18 PI= NP

Coefficients

D_{85}= 0.2090 D_{60}= 0.1366 D_{50}= 0.1155
D_{30}= 0.0560 D_{15}= 0.0065 D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Sample No.: SS-18 **Source of Sample:** BORING LLB7A **Date:** 3/27/07
Location: **Elev./Depth:** 9.2-10.7'

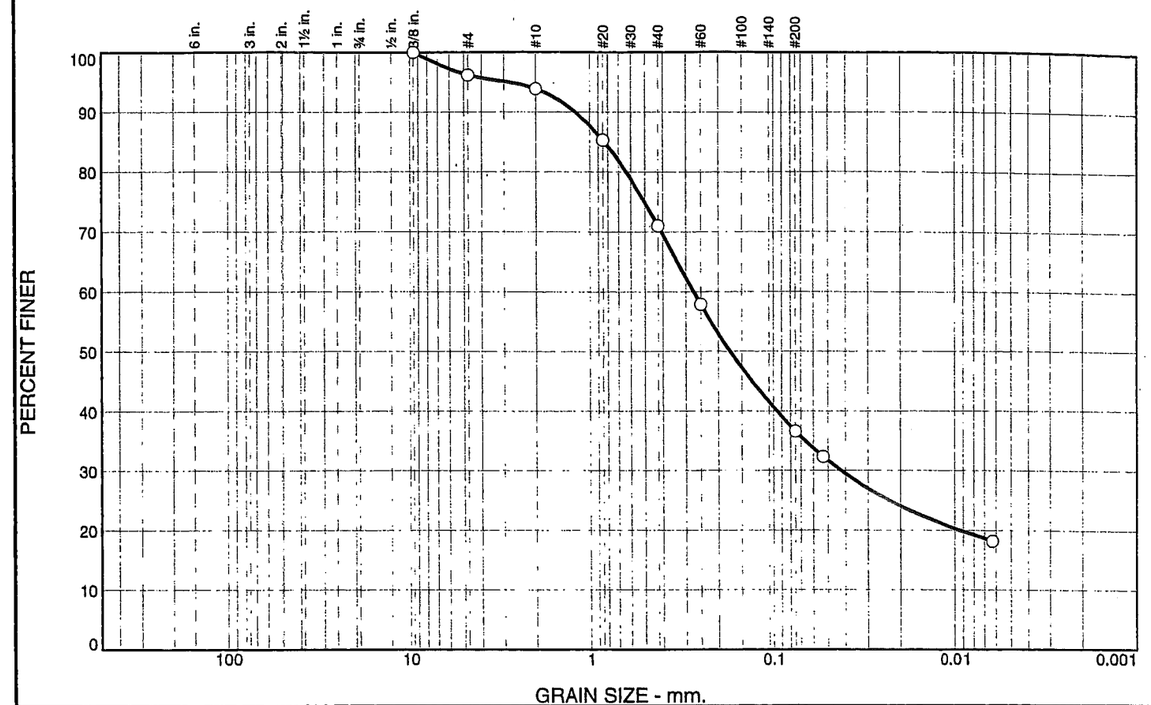
MACTEC, Inc.

Raleigh, North Carolina

Client: NCDOT
Project: STRUCTURES 3 AND 4; DUAL BRIDGES ON -L- OVER WETLANDS
Project No: 6468071682.05 **Figure**

SHEET 34

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.8	2.3	22.9	34.4	36.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	96.2		
#10	93.9		
#20	85.3		
#40	71.0		
#60	57.9		
#200	36.6		
#270	32.4		
0.0063 mm.	18.2		

* (no specification provided)

Soil Description

Yellowish gray sandy clay.

Atterberg Limits

PL= 18 LL= 57 PI= 39

Coefficients

D_{85}= 0.8331 D_{60}= 0.2732 D_{50}= 0.1731
D_{30}= 0.0423 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO= A-7-6(7)

Remarks

Specific gravity is assumed.

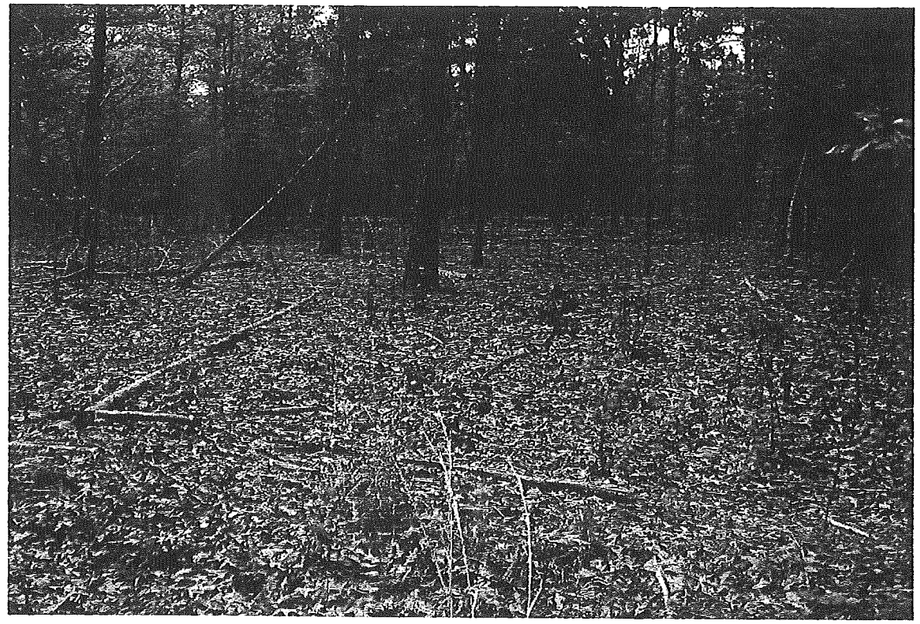
Sample No.: SS-19 **Source of Sample:** Boring B9-A **Date:** 4-04-07
Location: **Elev./Depth:** 3.9-5.4

MACTEC, Inc.

Raleigh, North Carolina

Client: NC DOT
Project: Dual Bridges on - L - Over Wetlands
Project No: 6468071682 **Figure**

Tested By: CS **Checked By:** LBJ



View looking down-station along approach to LL End Bent 1

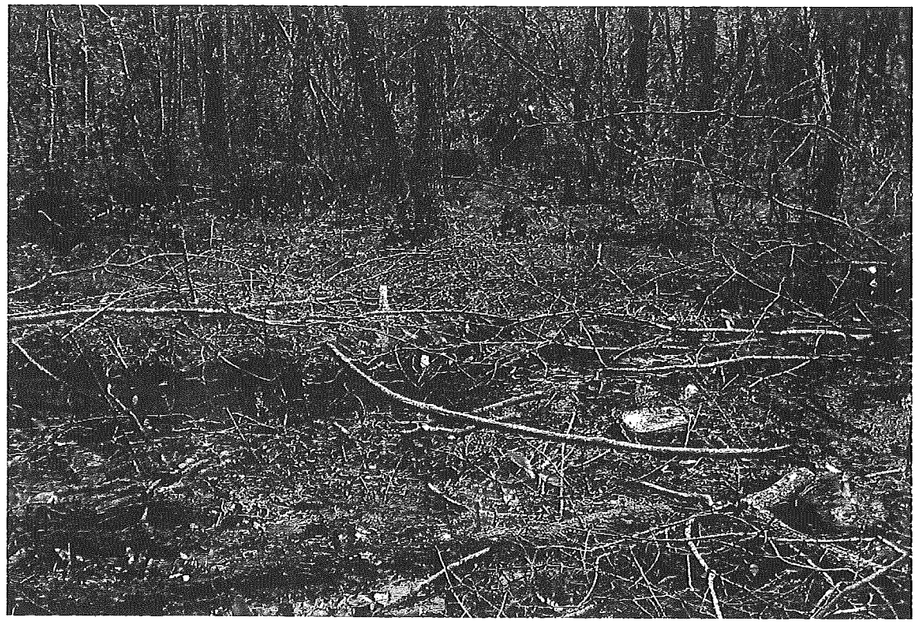
View looking along LL End Bent 1 toward center line and RL

View looking up-station from LL End Bent 1

View looking along LL Bent 1 toward center line and RL

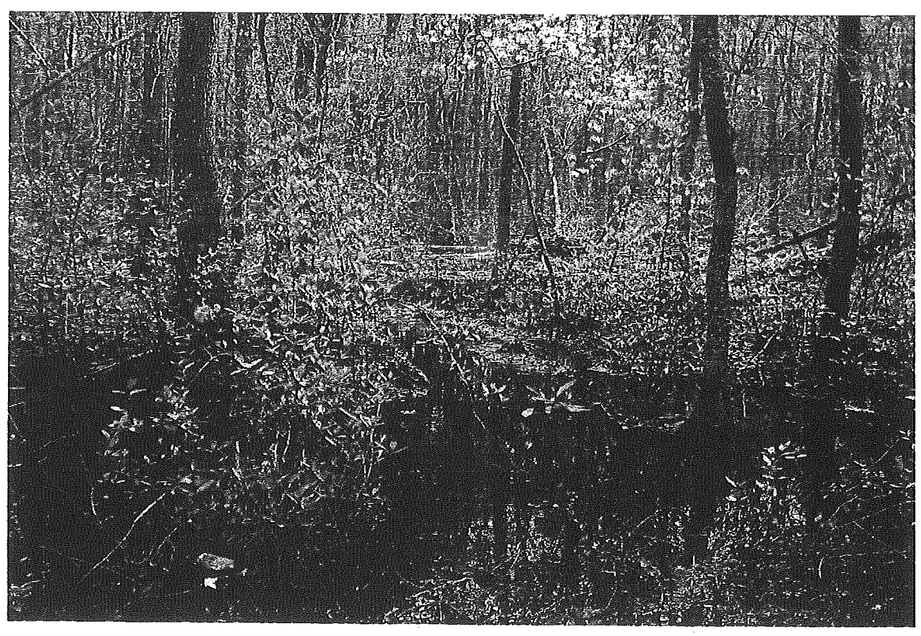
Site Photos
MACTEC Proj. No. 6468-07-1682

Structures 3 & 4; Dual Bridges on -L- over Wetland (Left Lane)
NCDOT Proj. No. 34817.1.2 (U-2519CB)



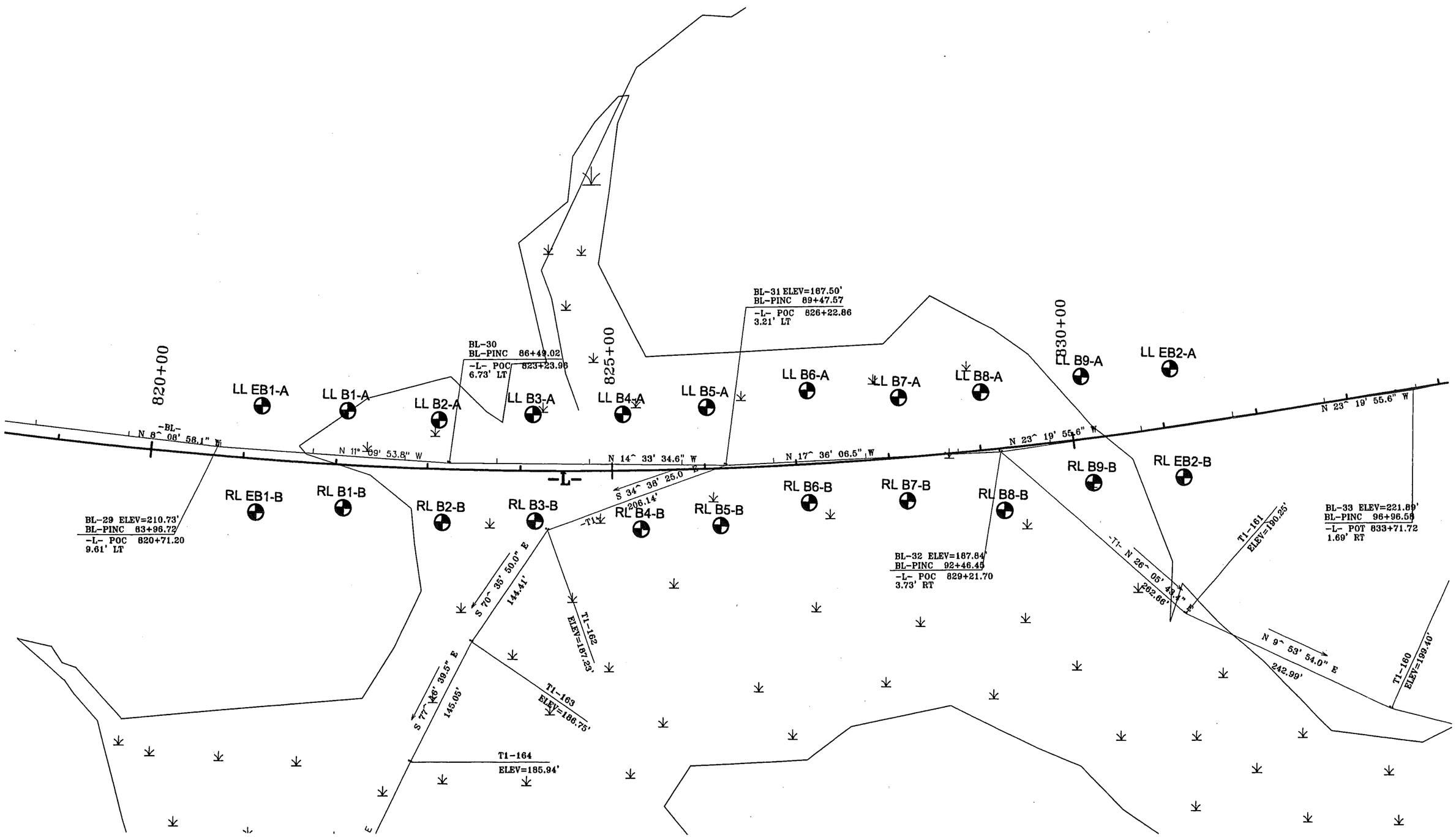
View looking along LL Bent 4 toward center line (typical view along interior bents)

View looking down-station from LL Bent 8 (typical view along structure)



View looking along LL Bent 7 toward center line (typical view along interior bents)

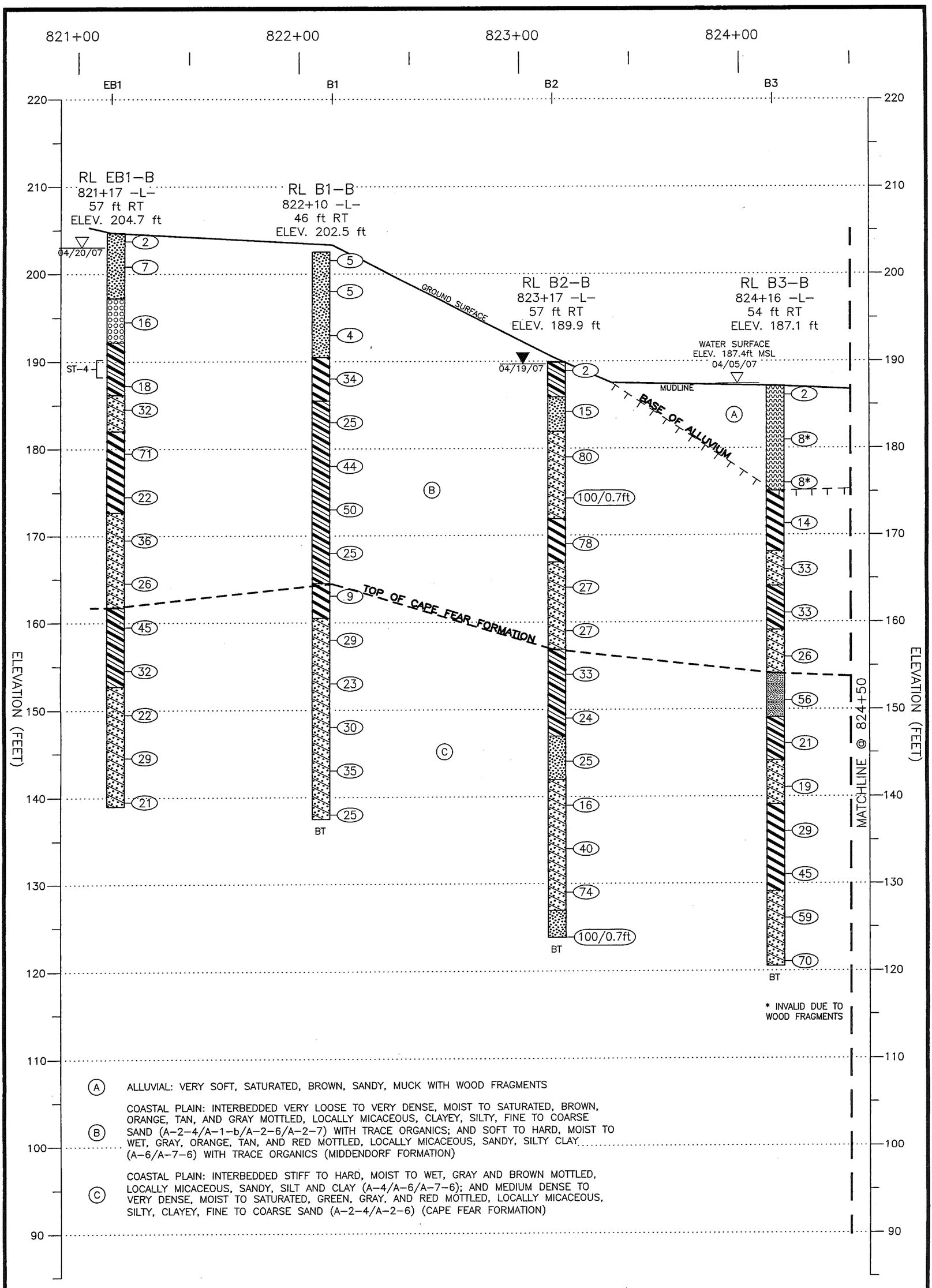
View looking down-station from LL End Bent 2



BORING LOCATION PLAN
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: W.B.D.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 18



(A) ALLUVIAL: VERY SOFT, SATURATED, BROWN, SANDY, MUCK WITH WOOD FRAGMENTS

(B) COASTAL PLAIN: INTERBEDDED VERY LOOSE TO VERY DENSE, MOIST TO SATURATED, BROWN, ORANGE, TAN, AND GRAY MOTTLED, LOCALLY MICACEOUS, CLAYEY, SILTY, FINE TO COARSE SAND (A-2-4/A-1-b/A-2-6/A-2-7) WITH TRACE ORGANICS; AND SOFT TO HARD, MOIST TO WET, GRAY, ORANGE, TAN, AND RED MOTTLED, LOCALLY MICACEOUS, SANDY, SILTY CLAY (A-6/A-7-6) WITH TRACE ORGANICS (MIDDENDORF FORMATION)

(C) COASTAL PLAIN: INTERBEDDED STIFF TO HARD, MOIST TO WET, GRAY AND BROWN MOTTLED, LOCALLY MICACEOUS, SANDY, SILT AND CLAY (A-4/A-6/A-7-6); AND MEDIUM DENSE TO VERY DENSE, MOIST TO SATURATED, GREEN, GRAY, AND RED MOTTLED, LOCALLY MICACEOUS, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-4/A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 20' 40' 80'
HORIZONTAL SCALE IN FEET
1"=40'

PROFILE 59 FT RIGHT OF -L-
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
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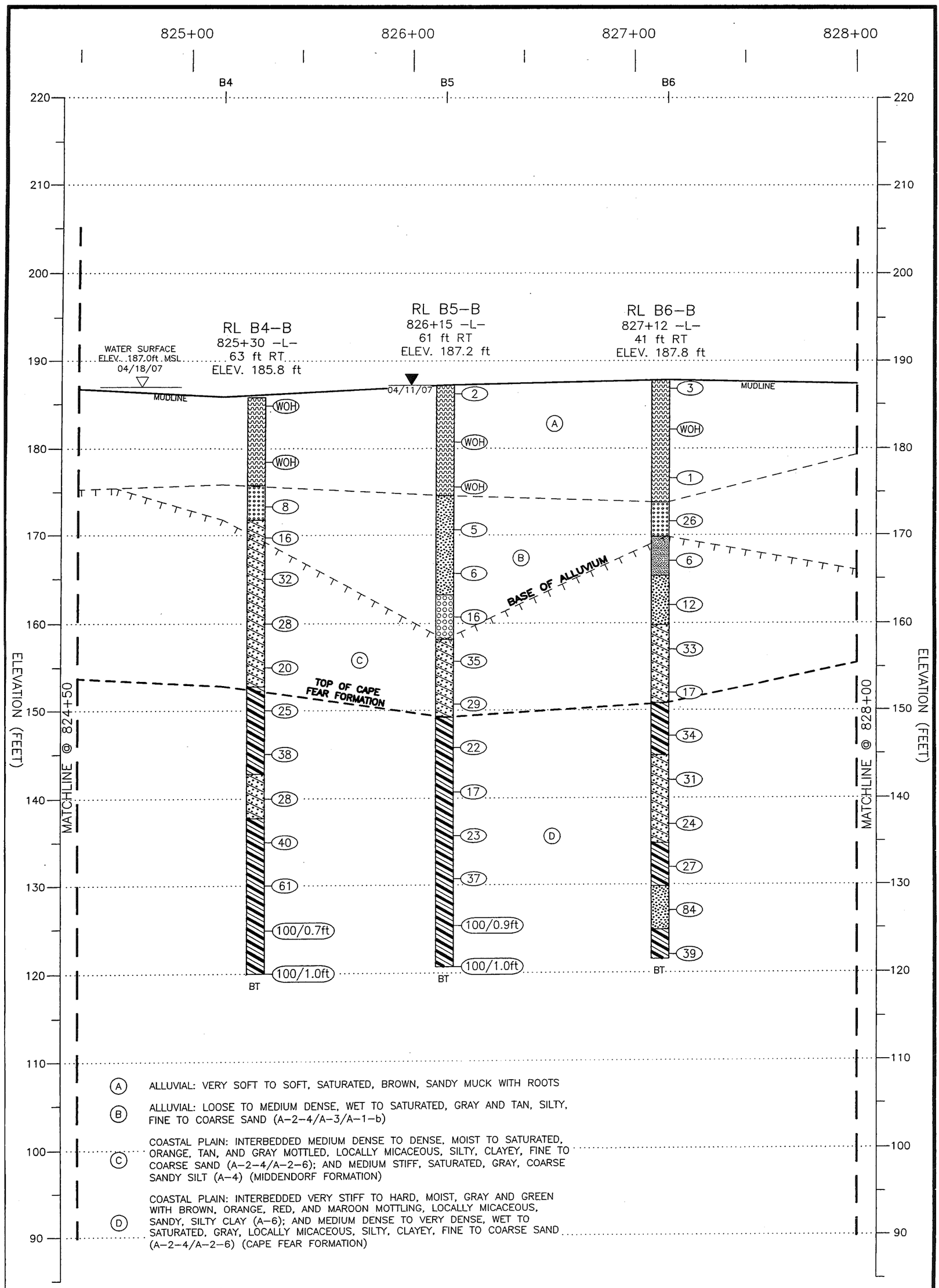
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
05/29/07	DFT CHECK: M.B.L.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 19

SHEET: 38



(A) ALLUVIAL: VERY SOFT TO SOFT, SATURATED, BROWN, SANDY MUCK WITH ROOTS

(B) ALLUVIAL: LOOSE TO MEDIUM DENSE, WET TO SATURATED, GRAY AND TAN, SILTY, FINE TO COARSE SAND (A-2-4/A-3/A-1-b)

(C) COASTAL PLAIN: INTERBEDDED MEDIUM DENSE TO DENSE, MOIST TO SATURATED, ORANGE, TAN, AND GRAY MOTTLED, LOCALLY MICACEOUS, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-4/A-2-6); AND MEDIUM STIFF, SATURATED, GRAY, COARSE SANDY SILT (A-4) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED VERY STIFF TO HARD, MOIST, GRAY AND GREEN WITH BROWN, ORANGE, RED, AND MAROON MOTTLING, LOCALLY MICACEOUS, SANDY, SILTY CLAY (A-6); AND MEDIUM DENSE TO VERY DENSE, WET TO SATURATED, GRAY, LOCALLY MICACEOUS, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-4/A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

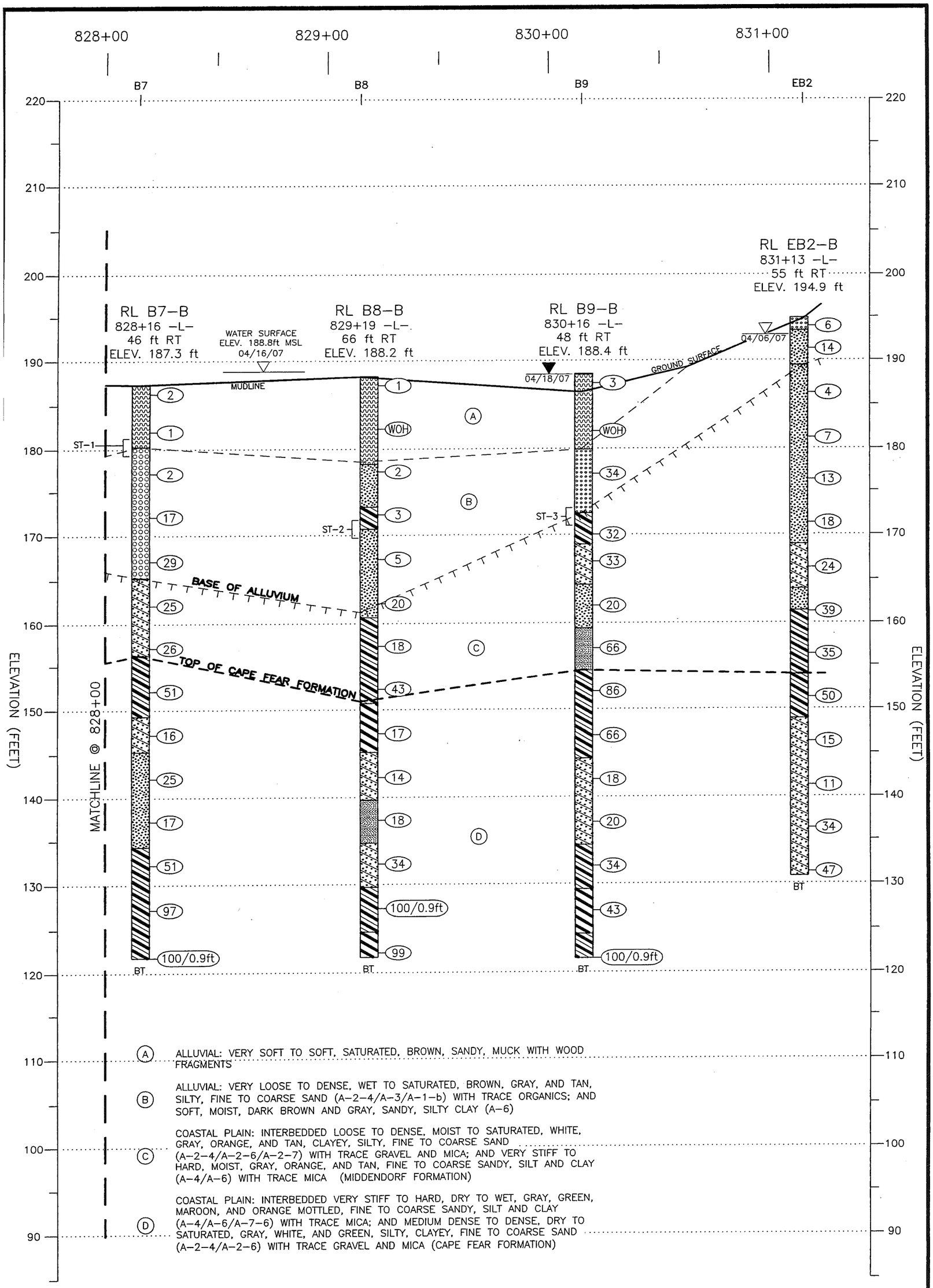
0 20' 40' 80'
HORIZONTAL SCALE IN FEET
1"=40'

PROFILE 59 FT RIGHT OF -L-
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 20

SHEET: 39



(A) ALLUVIAL: VERY SOFT TO SOFT, SATURATED, BROWN, SANDY, MUCK WITH WOOD FRAGMENTS

(B) ALLUVIAL: VERY LOOSE TO DENSE, WET TO SATURATED, BROWN, GRAY, AND TAN, SILTY, FINE TO COARSE SAND (A-2-4/A-3/A-1-b) WITH TRACE ORGANICS; AND SOFT, MOIST, DARK BROWN AND GRAY, SANDY, SILTY CLAY (A-6)

(C) COASTAL PLAIN: INTERBEDDED LOOSE TO DENSE, MOIST TO SATURATED, WHITE, GRAY, ORANGE, AND TAN, CLAYEY, SILTY, FINE TO COARSE SAND (A-2-4/A-2-6/A-2-7) WITH TRACE GRAVEL AND MICA; AND VERY STIFF TO HARD, MOIST, GRAY, ORANGE, AND TAN, FINE TO COARSE SANDY, SILT AND CLAY (A-4/A-6) WITH TRACE MICA (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED VERY STIFF TO HARD, DRY TO WET, GRAY, GREEN, MAROON, AND ORANGE MOTTLED, FINE TO COARSE SANDY, SILT AND CLAY (A-4/A-6/A-7-6) WITH TRACE MICA; AND MEDIUM DENSE TO DENSE, DRY TO SATURATED, GRAY, WHITE, AND GREEN, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-4/A-2-6) WITH TRACE GRAVEL AND MICA (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

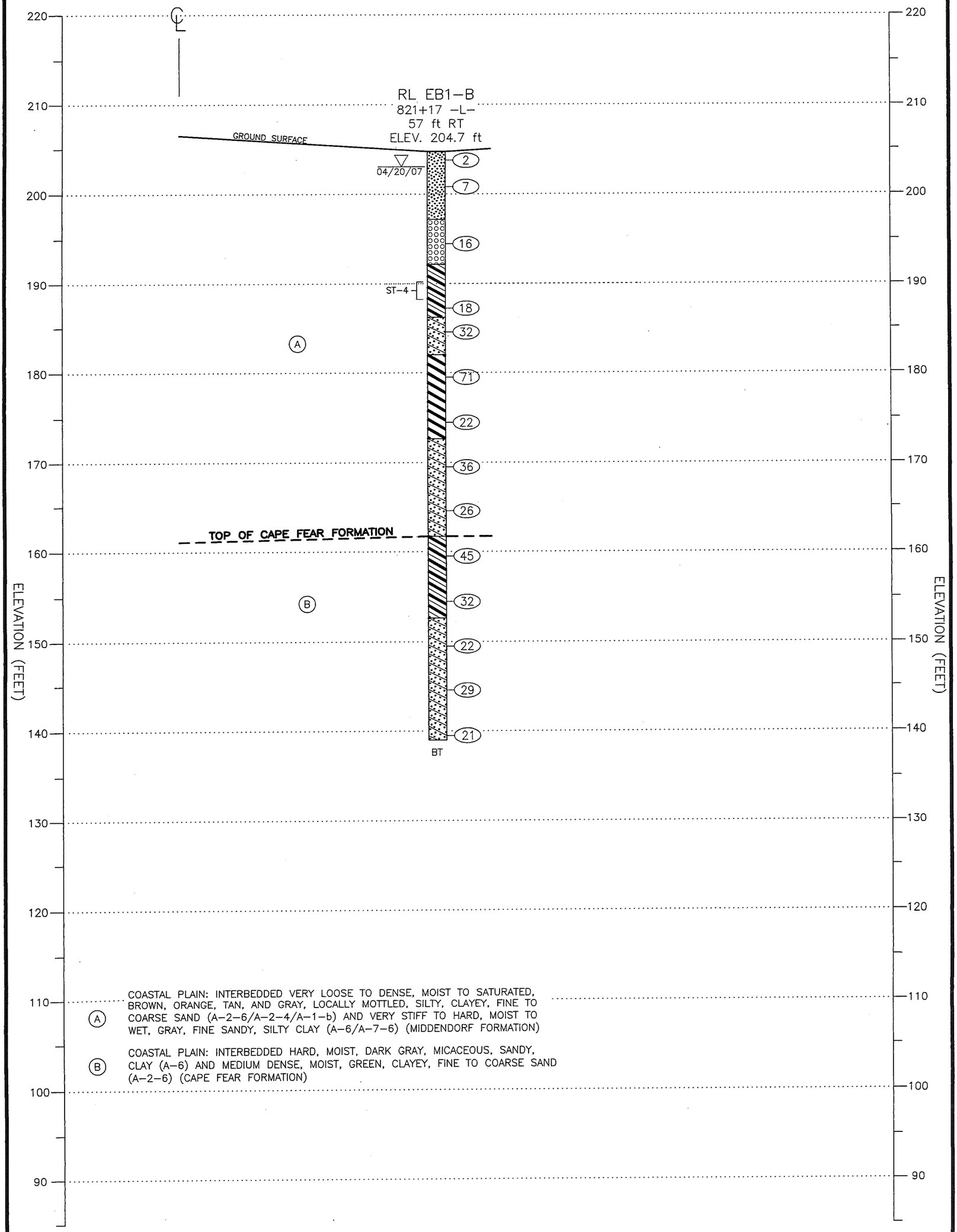
0 20' 40' 80'
HORIZONTAL SCALE IN FEET
1"=40'

PROFILE 59 FT RIGHT OF -L-
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 21

SHEET: 40



(A) COASTAL PLAIN: INTERBEDDED VERY LOOSE TO DENSE, MOIST TO SATURATED, BROWN, ORANGE, TAN, AND GRAY, LOCALLY MOTTLED, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-6/A-2-4/A-1-b) AND VERY STIFF TO HARD, MOIST TO WET, GRAY, FINE SANDY, SILTY CLAY (A-6/A-7-6) (MIDDENDORF FORMATION)

(B) COASTAL PLAIN: INTERBEDDED HARD, MOIST, DARK GRAY, MICACEOUS, SANDY, CLAY (A-6) AND MEDIUM DENSE, MOIST, GREEN, CLAYEY, FINE TO COARSE SAND (A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

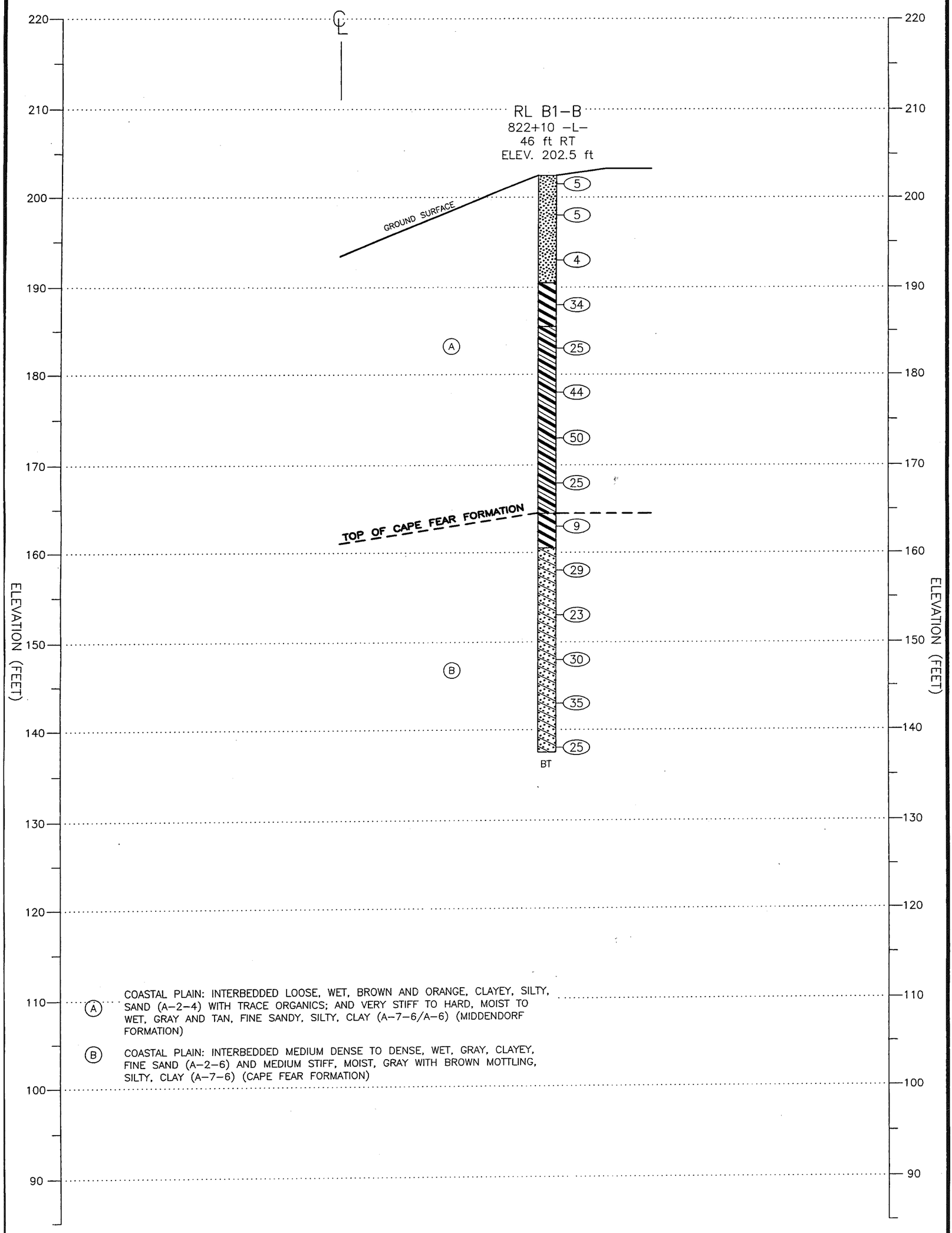
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE END BENT 1
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
05/29/07	DFT CHECK: M.B.L.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 22

SHEET: 41



0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 1
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

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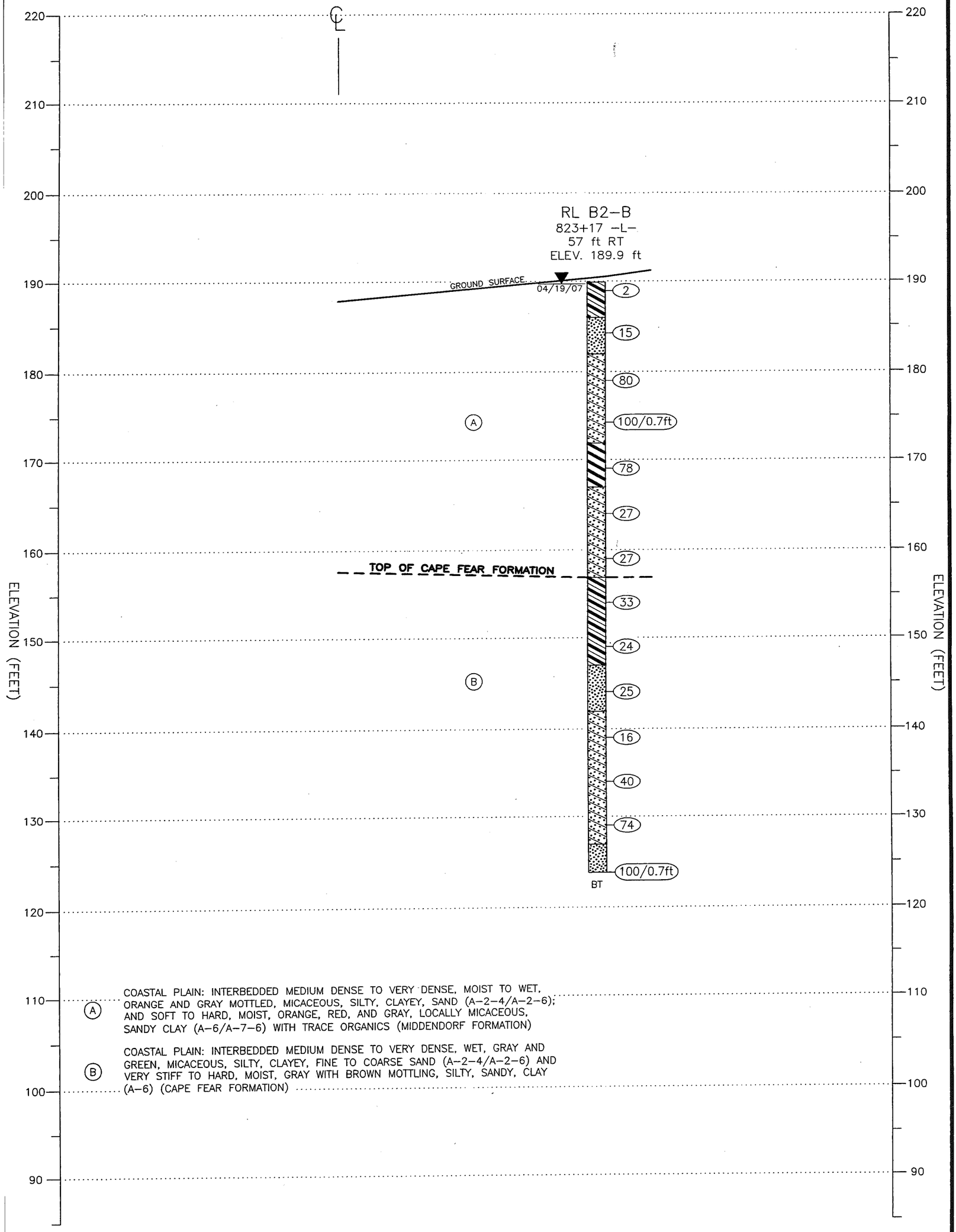
REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 23

SHEET: 42



0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

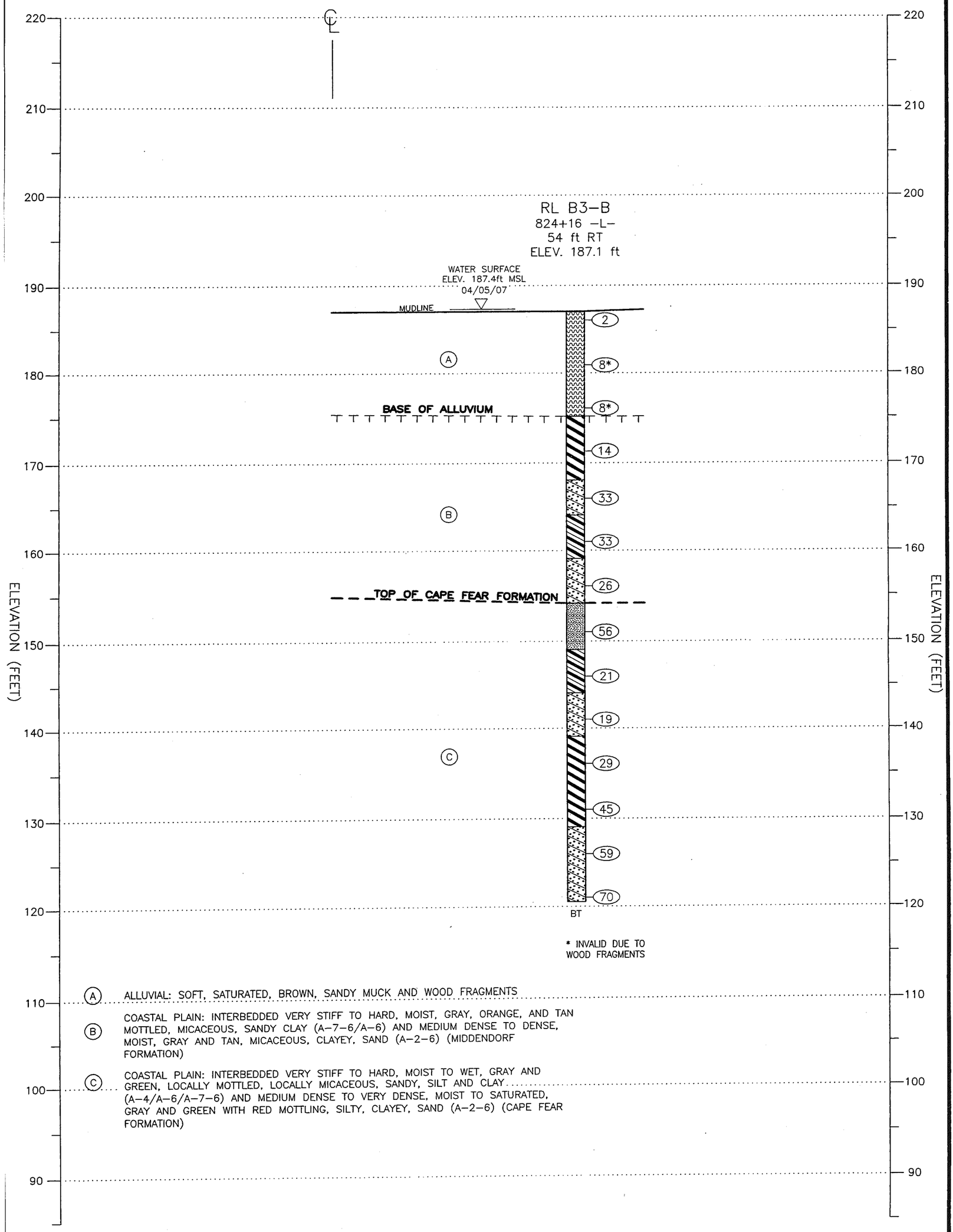
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 2
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 24

SHEET: 43



(A) ALLUVIAL: SOFT, SATURATED, BROWN, SANDY MUCK AND WOOD FRAGMENTS

(B) COASTAL PLAIN: INTERBEDDED VERY STIFF TO HARD, MOIST, GRAY, ORANGE, AND TAN MOTTLED, MICACEOUS, SANDY CLAY (A-7-6/A-6) AND MEDIUM DENSE TO DENSE, MOIST, GRAY AND TAN, MICACEOUS, CLAYEY, SAND (A-2-6) (MIDDENDORF FORMATION)

(C) COASTAL PLAIN: INTERBEDDED VERY STIFF TO HARD, MOIST TO WET, GRAY AND GREEN, LOCALLY MOTTLED, LOCALLY MICACEOUS, SANDY, SILT AND CLAY (A-4/A-6/A-7-6) AND MEDIUM DENSE TO VERY DENSE, MOIST TO SATURATED, GRAY AND GREEN WITH RED MOTTLING, SILTY, CLAYEY, SAND (A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

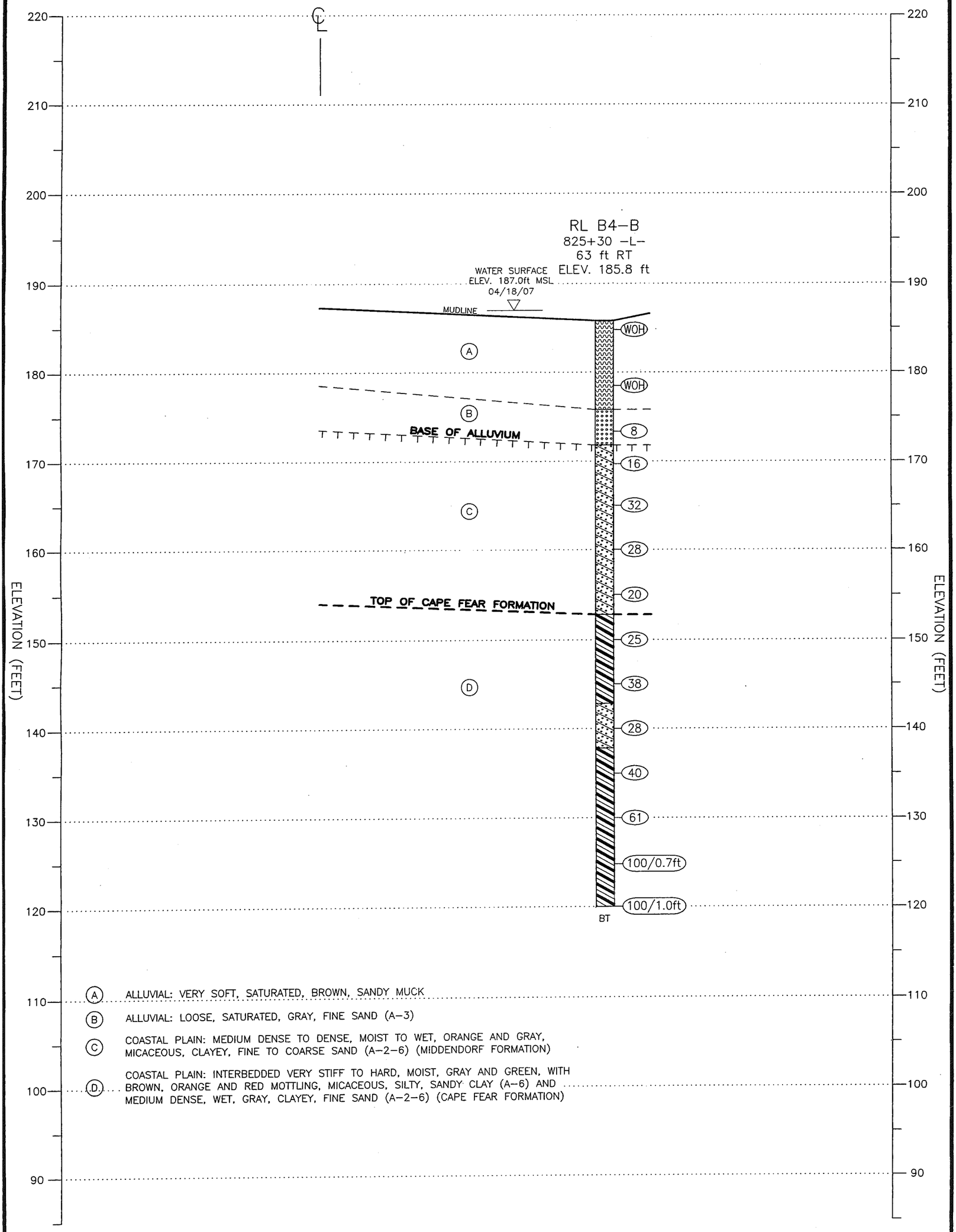
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 3
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 25

SHEET: 44



(A) ALLUVIAL: VERY SOFT, SATURATED, BROWN, SANDY MUCK

(B) ALLUVIAL: LOOSE, SATURATED, GRAY, FINE SAND (A-3)

(C) COASTAL PLAIN: MEDIUM DENSE TO DENSE, MOIST TO WET, ORANGE AND GRAY, MICACEOUS, CLAYEY, FINE TO COARSE SAND (A-2-6) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED VERY STIFF TO HARD, MOIST, GRAY AND GREEN, WITH BROWN, ORANGE AND RED MOTTLING, MICACEOUS, SILTY, SANDY CLAY (A-6) AND MEDIUM DENSE, WET, GRAY, CLAYEY, FINE SAND (A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

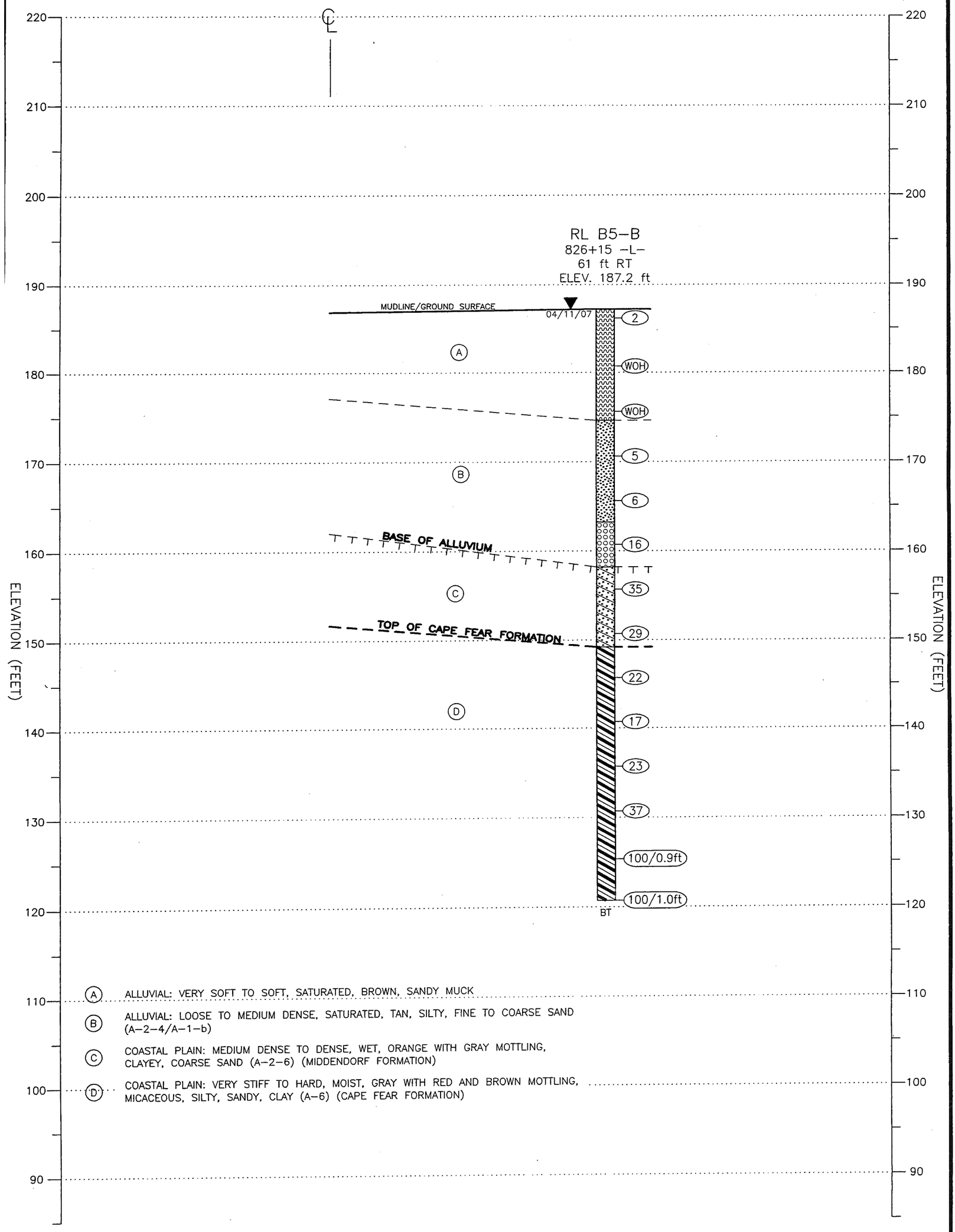
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 4
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 26

SHEET: 45



(A) ALLUVIAL: VERY SOFT TO SOFT, SATURATED, BROWN, SANDY MUCK

(B) ALLUVIAL: LOOSE TO MEDIUM DENSE, SATURATED, TAN, SILTY, FINE TO COARSE SAND (A-2-4/A-1-b)

(C) COASTAL PLAIN: MEDIUM DENSE TO DENSE, WET, ORANGE WITH GRAY MOTTLING, CLAYEY, COARSE SAND (A-2-6) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: VERY STIFF TO HARD, MOIST, GRAY WITH RED AND BROWN MOTTLING, MICACEOUS, SILTY, SANDY, CLAY (A-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

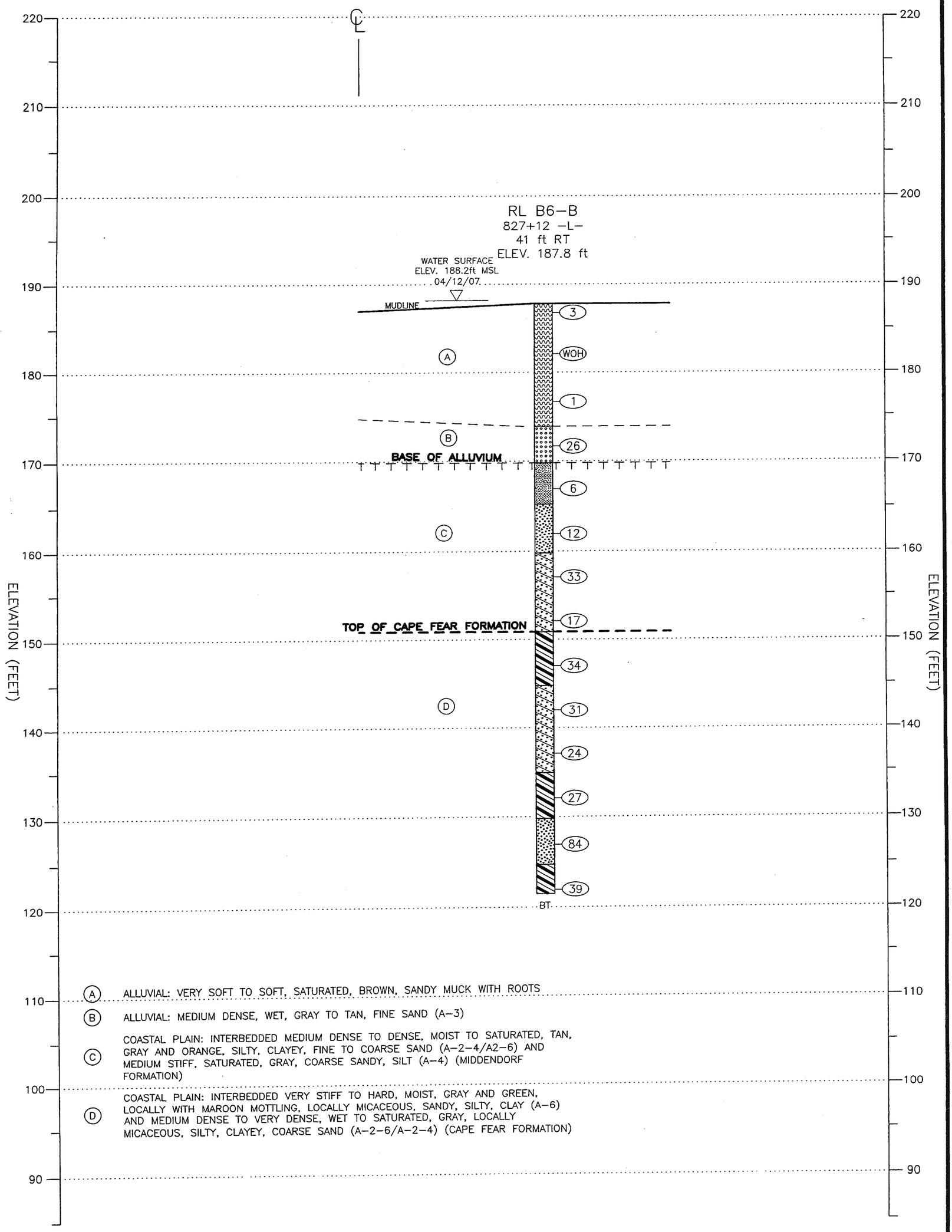
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 5
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 27

SHEET: 46



(A) ALLUVIAL: VERY SOFT TO SOFT, SATURATED, BROWN, SANDY MUCK WITH ROOTS

(B) ALLUVIAL: MEDIUM DENSE, WET, GRAY TO TAN, FINE SAND (A-3)

(C) COASTAL PLAIN: INTERBEDDED MEDIUM DENSE TO DENSE, MOIST TO SATURATED, TAN, GRAY AND ORANGE, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-4/A2-6) AND MEDIUM STIFF, SATURATED, GRAY, COARSE SANDY, SILT (A-4) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED VERY STIFF TO HARD, MOIST, GRAY AND GREEN, LOCALLY WITH MAROON MOTTLING, LOCALLY MICACEOUS, SANDY, SILTY, CLAY (A-6) AND MEDIUM DENSE TO VERY DENSE, WET TO SATURATED, GRAY, LOCALLY MICACEOUS, SILTY, CLAYEY, COARSE SAND (A-2-6/A-2-4) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

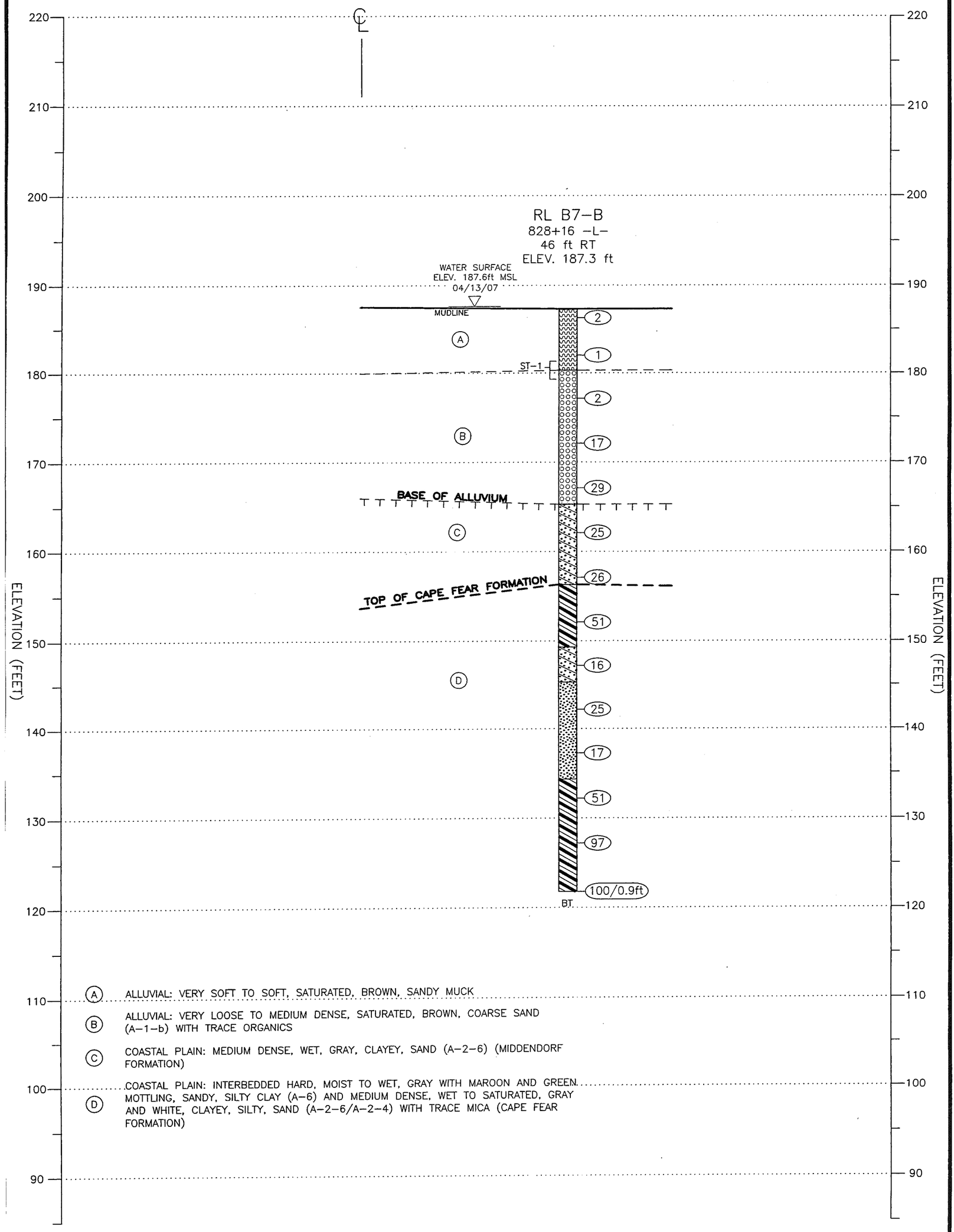
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 6
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 28

SHEET: 47



(A) ALLUVIAL: VERY SOFT TO SOFT, SATURATED, BROWN, SANDY MUCK

(B) ALLUVIAL: VERY LOOSE TO MEDIUM DENSE, SATURATED, BROWN, COARSE SAND (A-1-b) WITH TRACE ORGANICS

(C) COASTAL PLAIN: MEDIUM DENSE, WET, GRAY, CLAYEY, SAND (A-2-6) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED HARD, MOIST TO WET, GRAY WITH MAROON AND GREEN MOTTLING, SANDY, SILTY CLAY (A-6) AND MEDIUM DENSE, WET TO SATURATED, GRAY AND WHITE, CLAYEY, SILTY, SAND (A-2-6/A-2-4) WITH TRACE MICA (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

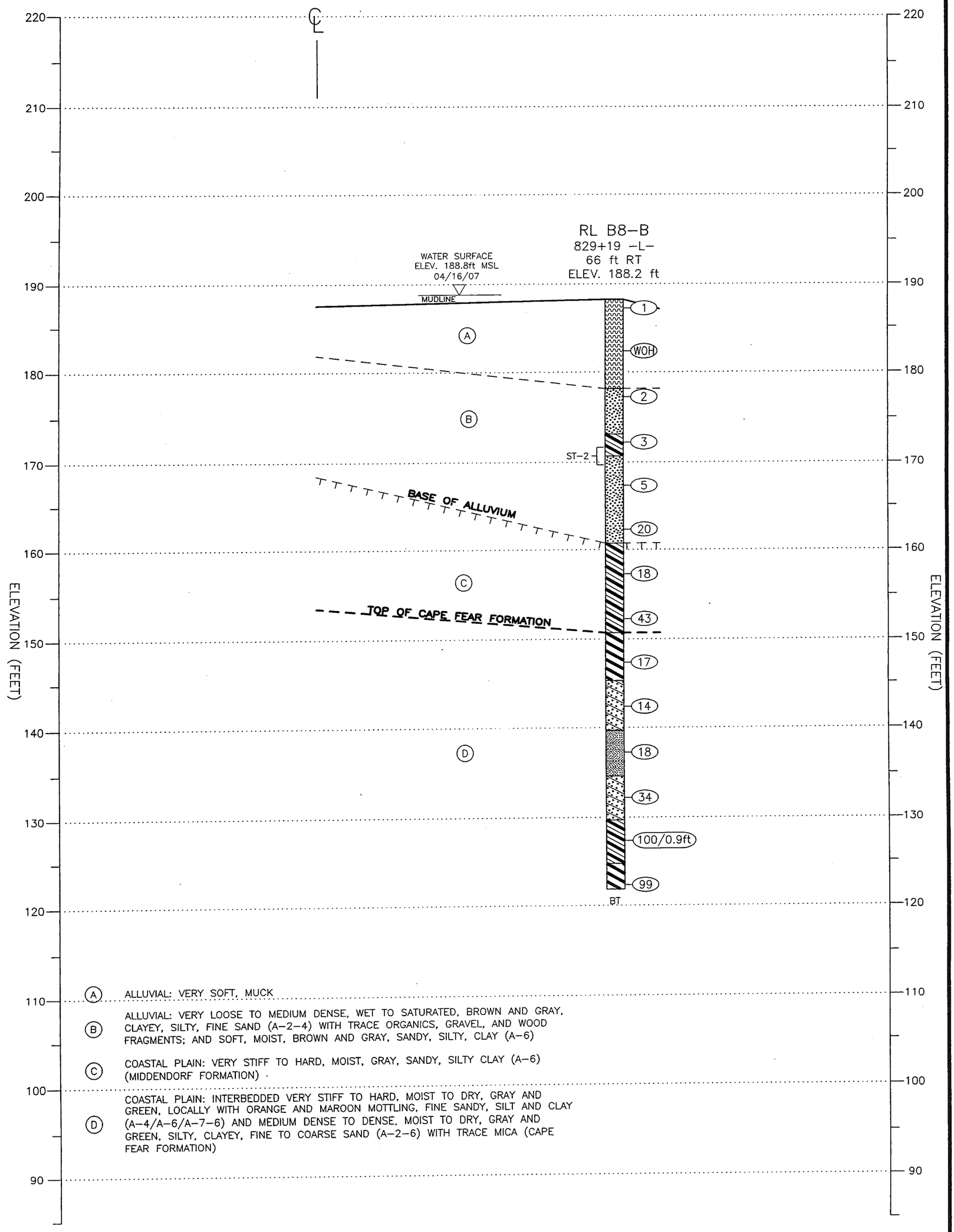
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 7
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 29

SHEET: 48



(A) ALLUVIAL: VERY SOFT, MUCK

(B) ALLUVIAL: VERY LOOSE TO MEDIUM DENSE, WET TO SATURATED, BROWN AND GRAY, CLAYEY, SILTY, FINE SAND (A-2-4) WITH TRACE ORGANICS, GRAVEL, AND WOOD FRAGMENTS; AND SOFT, MOIST, BROWN AND GRAY, SANDY, SILTY, CLAY (A-6)

(C) COASTAL PLAIN: VERY STIFF TO HARD, MOIST, GRAY, SANDY, SILTY CLAY (A-6) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED VERY STIFF TO HARD, MOIST TO DRY, GRAY AND GREEN, LOCALLY WITH ORANGE AND MAROON MOTTLING, FINE SANDY, SILT AND CLAY (A-4/A-6/A-7-6) AND MEDIUM DENSE TO DENSE, MOIST TO DRY, GRAY AND GREEN, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-6) WITH TRACE MICA (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

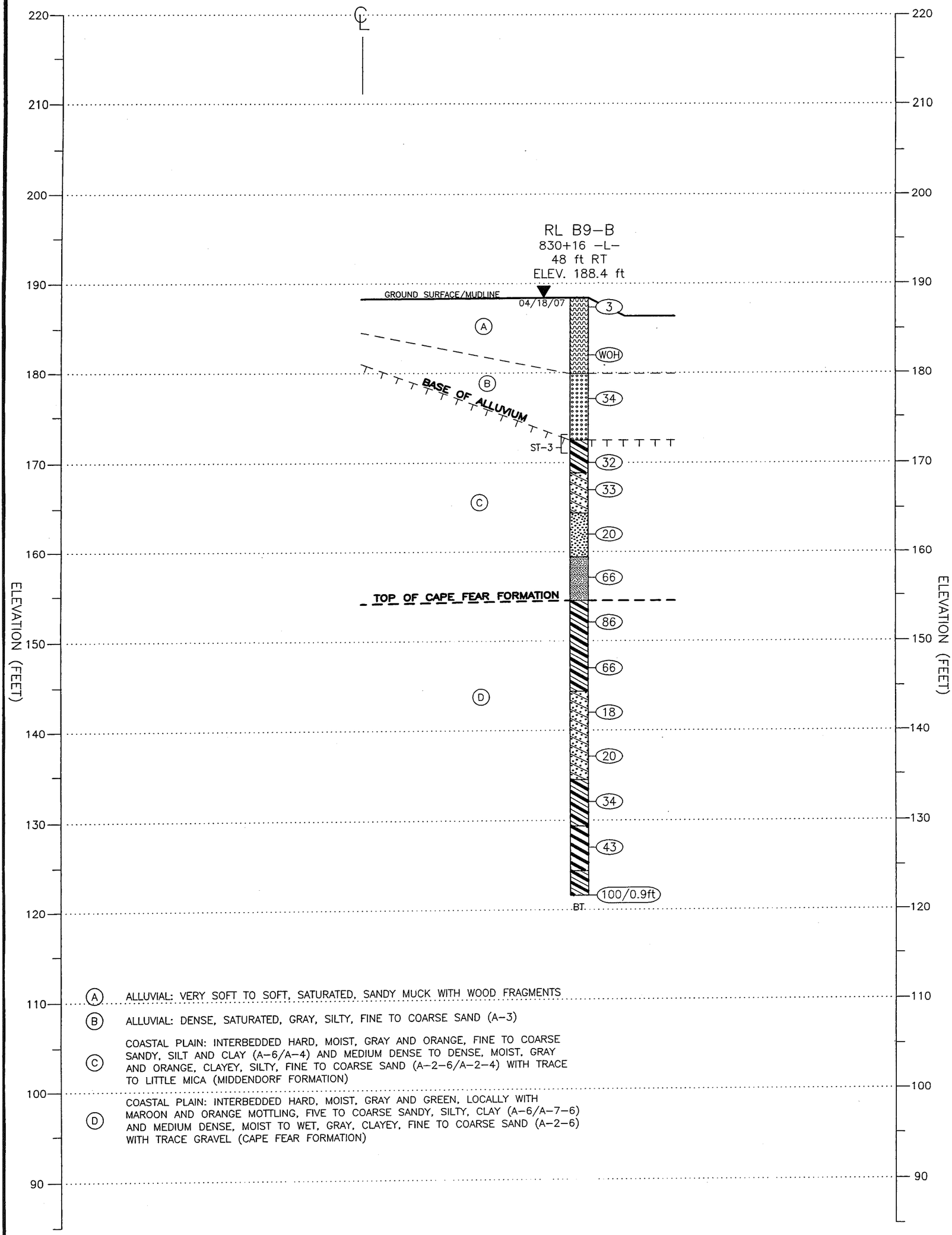
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 8
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 30

SHEET: 49



(A) ALLUVIAL: VERY SOFT TO SOFT, SATURATED, SANDY MUCK WITH WOOD FRAGMENTS

(B) ALLUVIAL: DENSE, SATURATED, GRAY, SILTY, FINE TO COARSE SAND (A-3)

(C) COASTAL PLAIN: INTERBEDDED HARD, MOIST, GRAY AND ORANGE, FINE TO COARSE SANDY, SILT AND CLAY (A-6/A-4) AND MEDIUM DENSE TO DENSE, MOIST, GRAY AND ORANGE, CLAYEY, SILTY, FINE TO COARSE SAND (A-2-6/A-2-4) WITH TRACE TO LITTLE MICA (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED HARD, MOIST, GRAY AND GREEN, LOCALLY WITH MAROON AND ORANGE MOTTLING, FIVE TO COARSE SANDY, SILTY, CLAY (A-6/A-7-6) AND MEDIUM DENSE, MOIST TO WET, GRAY, CLAYEY, FINE TO COARSE SAND (A-2-6) WITH TRACE GRAVEL (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 9
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

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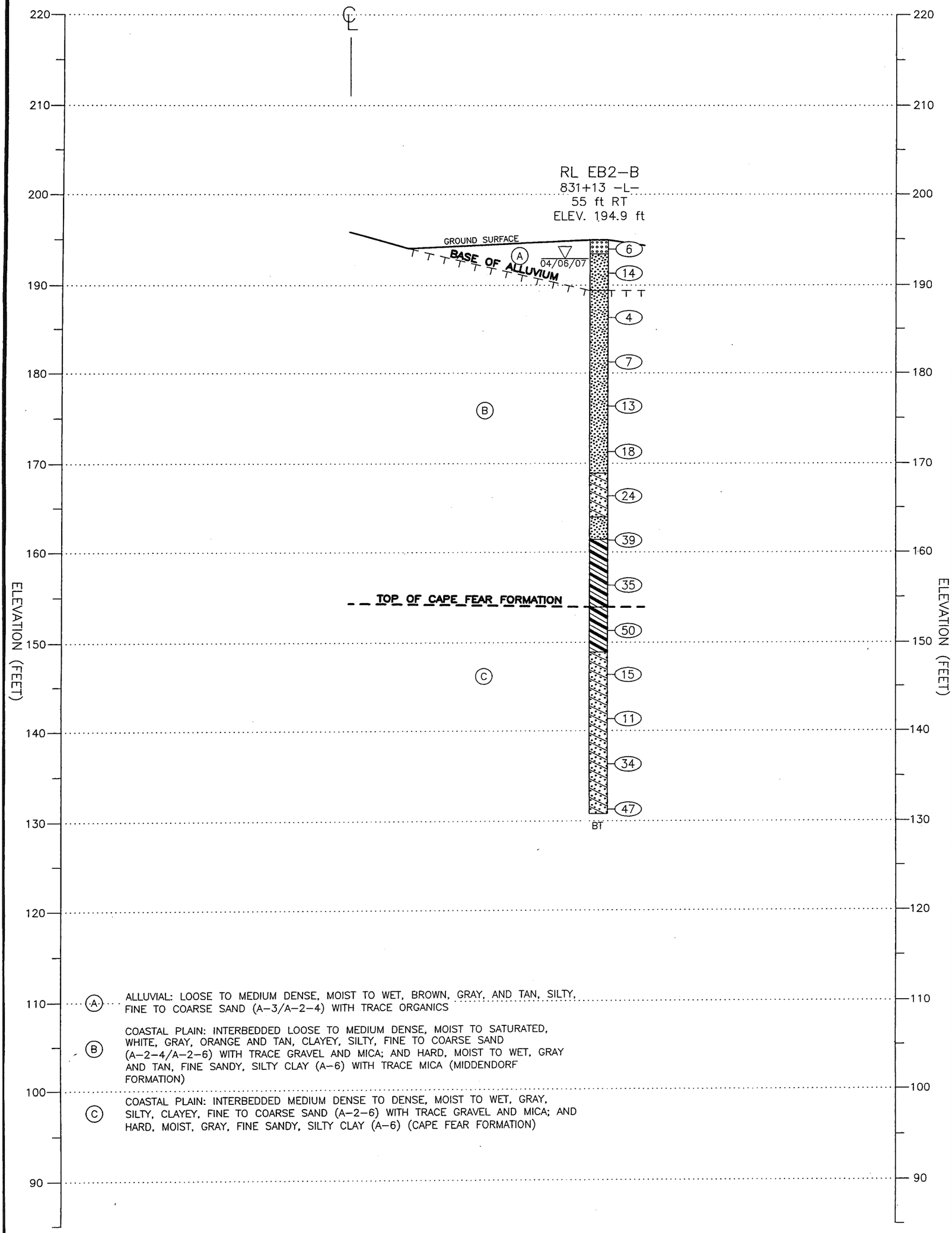
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 31

SHEET: 50



(A) ALLUVIAL: LOOSE TO MEDIUM DENSE, MOIST TO WET, BROWN, GRAY, AND TAN, SILTY, FINE TO COARSE SAND (A-3/A-2-4) WITH TRACE ORGANICS

(B) COASTAL PLAIN: INTERBEDDED LOOSE TO MEDIUM DENSE, MOIST TO SATURATED, WHITE, GRAY, ORANGE AND TAN, CLAYEY, SILTY, FINE TO COARSE SAND (A-2-4/A-2-6) WITH TRACE GRAVEL AND MICA; AND HARD, MOIST TO WET, GRAY AND TAN, FINE SANDY, SILTY CLAY (A-6) WITH TRACE MICA (MIDDENDORF FORMATION)

(C) COASTAL PLAIN: INTERBEDDED MEDIUM DENSE TO DENSE, MOIST TO WET, GRAY, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-6) WITH TRACE GRAVEL AND MICA; AND HARD, MOIST, GRAY, FINE SANDY, SILTY CLAY (A-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE END BENT 2
STRUCTURES 3 & 4; DUAL BRIDGES ON -L- OVER WETLANDS
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 04/27/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1682
	ENG CHECK: S.J.C.	DWG: 32

SHEET: 51

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. RL EB1-B	STATION 821+17	OFFSET 57ft RT	ALIGNMENT -L-	0 HR. 1.7
COLLAR ELEV. 204.7 ft	TOTAL DEPTH 65.7 ft	NORTHING 483,712	EASTING 1,993,840	24 HR. FIAD
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 04/20/07	COMP. DATE 04/20/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

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)
205									
204.7	0.0								204.7 GROUND SURFACE 0.0
201.8	2.9	WOH	1	1	2, 7		M		**COASTAL PLAIN** Brown and orange, silty, fine SAND (A-2-4) with trace organics (Middendorf Formation)
195.5	9.2	3	3	4	16		W		
		6	8	8			Sat.		197.2 7.5 **COASTAL PLAIN** Orange-tan, coarse SAND (A-1-b) (Middendorf Formation)
188.2	16.5				18				192.2 12.5 **COASTAL PLAIN** Dark gray, CLAY (A-6) (Middendorf Formation) Pushed Shelby Tube from 14.5-16.5 ft, recovery=2.0 ft (100%)
185.5	19.2	4	7	11			M		
180.5	24.2	14	14	18	32		Sat.		186.2 18.5 **COASTAL PLAIN** Tan with orange and gray mottling, clayey, fine SAND (A-2-7)
175.5	29.2	25	21	50	71		W		182.0 22.7 **COASTAL PLAIN** Dark gray, fine sandy, silty, CLAY (A-7-6) (Middendorf Formation)
170.5	34.2	9	9	13	22		W		
165.5	39.2	10	10	26	36		W		172.7 32.0 **COASTAL PLAIN** Orange and gray mottled, clayey, fine SAND (A-2-6) (Middendorf Formation)
160.5	44.2	13	11	15	26		W		
155.5	49.2	12	19	26	45		M		161.7 43.0 **COASTAL PLAIN** Dark gray, micaceous, sandy, CLAY (A-6) (Cape Fear Formation)
150.5	54.2	12	14	18	32		M		
145.5	59.2	9	9	13	22		M		152.7 52.0 **COASTAL PLAIN** Green and light green, clayey, fine to coarse SAND (A-2-6) (Cape Fear Formation)
140.5	64.2	12	14	15	29		M		
		8	10	11	21		M		139.0 65.7 Boring Terminated at Elevation 139.0 ft in Cape Fear Fm: Medium dense, clayey, coarse SAND (A-2-6)

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: 9.1 lbs/gal

Casing Depth (4"): 12.5 ft

Other Samples:
ST-4 (14.5 - 16.5)

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. RL B1-B	STATION 822+10	OFFSET 46ft RT	ALIGNMENT -L-	0 HR. ND
COLLAR ELEV. 202.5 ft	TOTAL DEPTH 65.0 ft	NORTHING 483,802	EASTING 1,993,811	24 HR. ND
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 04/18/07	COMP. DATE 04/18/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

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
205									
202.5	0.0								202.5 GROUND SURFACE 0.0
199.0	3.5	1	2	3	5		W		**COASTAL PLAIN** Brown and orange, clayey, silty, SAND (A-2-4) with trace organics (Middendorf Formation)
194.0	8.5	4	3	2	5				
189.0	13.5	3	2	2	4		W		190.5 12.0 **COASTAL PLAIN** Dark gray, silty, CLAY (A-7-6) (Middendorf Formation)
184.0	18.5	11	14	20	34		M		
179.0	23.5	12	10	15	25		W		185.5 17.0 **COASTAL PLAIN** Light gray and tan, fine sandy, silty CLAY (A-6) (Middendorf Formation)
174.0	28.5	7	21	23	44		M		
169.0	33.5	11	22	28	50		M		
164.0	38.5	8	13	12	25		M		
159.0	43.5	3	3	6	9		M		164.5 38.0 **COASTAL PLAIN** Dark gray with brown mottling, silty, CLAY (A-7-6) (Cape Fear Formation)
154.0	48.5	13	12	17	29		W		160.5 42.0 **COASTAL PLAIN** Light gray to gray, clayey, fine SAND (A-2-6) (Cape Fear Formation)
149.0	53.5	10	11	12	23		W		
144.0	58.5	11	13	17	30		W		
139.0	63.5	16	16	19	35		W		
		14	12	13	25		W		137.5 65.0 Boring Terminated at Elevation 137.5 ft in Cape Fear Fm: Medium dense, clayey, fine SAND (A-2-6)

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: 9.0 lbs/gal

Casing Depth (4"): 5.2 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. RL B2-B	STATION 823+17	OFFSET 57ft RT	ALIGNMENT -L-	0 HR. 0.0
COLLAR ELEV. 189.9 ft	TOTAL DEPTH 66.1 ft	NORTHING 483,910	EASTING 1,993,797	24 HR. 0.2
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual	
START DATE 04/18/07	COMP. DATE 04/18/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A	

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))
190									
189.9	0.0	1	1	1	2		M		GROUND SURFACE 0.0
									COASTAL PLAIN Orange and red mottled, sandy, CLAY (A-6) with trace organics (Middendorf Formation)
185.2	4.7	4	7	8	15		W		185.9 — 4.0 **COASTAL PLAIN** Orange and gray mottled, silty, coarse SAND (A-2-4) (Middendorf Formation)
180.0	9.9	8	25	55	80		M		181.9 — 8.0 **COASTAL PLAIN** Gray and orange mottled, micaceous, clayey, SAND (A-2-6) (Middendorf Formation)
175.0	14.9	42	58/0.2		100/0.7		M		
170.0	19.9	17	25	53	78		M		171.9 — 18.0 **COASTAL PLAIN** Dark gray, micaceous, sandy, CLAY (A-7-6)
165.0	24.9	8	12	15	27		W		166.9 — 23.0 **COASTAL PLAIN** Light gray, micaceous, silty, clayey, SAND (A-2-6) (Middendorf Formation)
160.0	29.9	7	12	15	27		W		
155.0	34.9	6	16	17	33		M		156.9 — 33.0 **COASTAL PLAIN** Dark gray with brown mottling, and gray, silty, sandy, CLAY (A-6) (Cape Fear Formation)
150.0	39.9	9	10	14	24		M		
145.0	44.9	10	12	13	25		W		146.9 — 43.0 **COASTAL PLAIN** Gray, clayey, silty SAND (A-2-4) (Cape Fear Formation)
140.0	49.9	9	8	8	16		W		141.9 — 48.0 **COASTAL PLAIN** Gray and green, micaceous, clayey, coarse SAND (A-2-6) (Cape Fear Formation)
135.0	54.9	14	17	23	40		W		
130.0	59.9	15	21	53	74		W		
125.0	64.9	33	55	45/0.2	100/0.7		M		126.9 — 63.0 **COASTAL PLAIN** Gray, micaceous, silty, fine SAND (A-2-4) (Cape Fear Formation)
									123.8 — 66.1 Boring Terminated at Elevation 123.8 ft in Cape Fear Fm: Very dense, silty, fine SAND (A-2-4)

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: 9.0 lbs/gal

Casing Depth (4"): 5.5 ft

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. RL B3-B	STATION 824+16	OFFSET 54ft RT	ALIGNMENT -L-	0 HR. Water
COLLAR ELEV. 187.1 ft	TOTAL DEPTH 66.6 ft	NORTHING 484,006	EASTING 1,993,770	24 HR. Boring
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual	
START DATE 04/05/07	COMP. DATE 04/05/07	SURFACE WATER DEPTH 0.3ft	DEPTH TO ROCK N/A	

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
190									
187.1	0.0								187.1 — 0.0 MUDLINE
		3	1	1	2		Sat.		**ALLUVIAL** Brown, sandy, MUCK and wood fragments
181.9	5.2	7	5	3	Invalid 8				
177.0	10.1	4	4	4	Invalid 8				175.1 — 12.0 **COASTAL PLAIN** Gray with orange mottling, sandy CLAY (A-7-6) (Middendorf Formation)
172.3	14.8	4	5	9	14	SS-24	19%		
167.0	20.1	8	15	18	33	SS-25	17%		168.1 — 19.0 **COASTAL PLAIN** Gray with tan mottling, micaceous, clayey, SAND (A-2-6) (Middendorf Formation)
162.0	25.1	13	13	20	33	SS-26	18%		164.1 — 23.0 **COASTAL PLAIN** Orange with tan mottling, micaceous, sandy CLAY (A-6) (Middendorf Formation)
157.0	30.1	10	11	15	26		M		159.1 — 28.0 **COASTAL PLAIN** Dark gray, micaceous, clayey, fine SAND (A-2-6) (Middendorf Formation)
152.0	35.1	17	25	31	56	SS-27	16%		154.1 — 33.0 **COASTAL PLAIN** Dark gray, clayey SILT (A-4) (Cape Fear Formation)
147.0	40.1	7	9	12	21		W		149.1 — 38.0 **COASTAL PLAIN** Dark gray, micaceous, sandy CLAY (A-6) (Cape Fear Formation)
142.0	45.1	11	10	9	19	SS-28	Sat.		144.1 — 43.0 **COASTAL PLAIN** Gray, clayey, fine SAND (A-2-6) (Cape Fear Formation)
137.0	50.1	10	14	15	29	SS-29	24%		139.1 — 48.0 **COASTAL PLAIN** Green with gray mottling, sandy, CLAY (A-7-6) (Cape Fear Formation)
132.0	55.1	15	20	25	45		M		
127.0	60.1	16	19	40	59	SS-30	18%		129.1 — 58.0 **COASTAL PLAIN** Green with red mottling, silty, clayey, SAND (A-2-6) (Cape Fear Formation)
122.0	65.1	27	32	38	70		M		120.5 — 66.6 Boring Terminated at Elevation 120.5 ft in Cape Fear Fm: Very dense, clayey, SAND (A-2-6)

Bits Used: 3" Side-Discharge Finger Bit
Drilling Fluid Properties: 9.1 lbs/gal
Casing Depth (4"): 15.4 ft

Note: N-values at depth 5.2 and 10.1 feet are invalid due to wood fragments.

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. RL B4-B	STATION 825+30	OFFSET 63ft RT	ALIGNMENT -L-	0 HR. Water
COLLAR ELEV. 185.8 ft	TOTAL DEPTH 65.8 ft	NORTHING 484,120	EASTING 1,993,749	24 HR. Boring
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 04/09/07	COMP. DATE 04/10/07	SURFACE WATER DEPTH 0.2ft	DEPTH TO ROCK N/A

ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	SAMP. NO.	MOI	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
185.8	0.0						MUDLINE 0.0
		WOH	WOH	WOH		Sat.	ALLUVIAL Brown, sandy MUCK
179.5	6.3						
		WOH	WOH	WOH		Sat.	
174.4	11.4						175.8 10.0 ALLUVIAL Gray, fine SAND (A-3)
		3	3	5		Sat.	
170.7	15.1						171.8 14.0 COASTAL PLAIN Orange and gray, micaceous, clayey, fine to coarse SAND (A-2-6) (Middendorf Formation)
		7	5	11		W	
166.0	19.8						
		8	13	19		W	
161.0	24.8						
		9	13	15		M	
156.0	29.8						
		6	8	12		W	
151.0	34.8						152.8 33.0 COASTAL PLAIN Dark gray with brown mottling, and gray, micaceous, silty, sandy CLAY (A-6) (Cape Fear Formation)
		9	12	13		M	
146.0	39.8						
		9	16	22		M	
141.0	44.8						142.8 43.0 COASTAL PLAIN Light gray, clayey, fine SAND (A-2-6) (Cape Fear Formation)
		10	12	16		W	
136.0	49.8						137.8 48.0 COASTAL PLAIN Gray, green, and gray with orange, red, and brown mottling, micaceous, sandy, CLAY (A-6) (Cape Fear Formation)
		15	16	24		M	
131.0	54.8						
		18	23	38		M	
126.0	59.8						
		38	45	55/0.2		M	
121.0	64.8						
		31	69/0.5			M	120.0 65.8

Boring Terminated at Elevation 120.0 ft in Cape Fear Fm: Hard, sandy, CLAY (A-6)

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: 8.9 lbs/gal

Casing Depth (4"): 17.3 ft

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. RL B5-B	STATION 826+15	OFFSET 61ft RT	ALIGNMENT -L-	0 HR. 0.0
COLLAR ELEV. 187.2 ft	TOTAL DEPTH 66.5 ft	NORTHING 484,202	EASTING 1,993,723	24 HR. 0.0
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 04/10/07	COMP. DATE 04/10/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	SAMP. NO.	MOI	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
187.2	0.0						GROUND SURFACE 0.0
		WOH	1	1		Sat.	ALLUVIAL Brown, sandy MUCK
181.7	5.5						
		WOH	WOH	WOH			
176.6	10.6						174.6 12.6 ALLUVIAL Tan, silty, fine SAND (A-2-4)
		WOH	WOH	WOH			
171.6	15.6						
		3	2	3		Sat.	
166.6	20.6						
		1	2	4		Sat.	
161.7	25.5						163.2 24.0 ALLUVIAL Tan, coarse SAND (A-1-b)
		10	8	8		Sat.	
156.7	30.5						158.2 29.0 COASTAL PLAIN Orange with gray mottling, clayey, coarse SAND (A-2-6) (Middendorf Formation)
		11	15	20		W	
151.7	35.5						
		9	13	16		W	
146.7	40.5						149.2 38.0 COASTAL PLAIN Dark gray and gray with red and brown mottling, micaceous, silty, sandy, CLAY (A-6) (Cape Fear Formation)
		5	9	13		M	
141.7	45.5						
		7	7	10		M	
136.7	50.5						
		10	10	13		M	
131.7	55.5						
		11	18	19		M	
126.7	60.5						
		21	45	55/0.4		M	
121.7	65.5						
		43	57/0.5			M	120.7 66.5

Boring Terminated at Elevation 120.7 ft in Cape Fear Fm: Hard, silty, CLAY (A-6)

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: 9.1 lbs/gal

Casing Depth (4"): 16.0 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. RL B6-B	STATION 827+12	OFFSET 41ft RT	ALIGNMENT -L-
COLLAR ELEV. 187.8 ft	TOTAL DEPTH 66.3 ft	NORTHING 484,289	EASTING 1,993,674
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 04/12/07	COMP. DATE 04/12/07	SURFACE WATER DEPTH 0.4ft	DEPTH TO ROCK N/A

GROUND WTR (ft): 0 HR. Water; 24 HR. Boring

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))
190									
187.8	0.0								187.8 MUDLINE 0.0
		1	2	1	3		Sat.		**ALLUVIAL** Brown, sandy MUCK with roots
183.1	4.7	WOH	WOH	WOH WOH	0		Sat.		
177.6	10.2	WOH	WOH	1	1		Sat.		
172.6	15.2	13	13	13	26		W		173.8 14.0 **ALLUVIAL** Gray and tan, fine SAND (A-3)
168.0	19.8	2	2	4	6		Sat.		169.8 18.0 **COASTAL PLAIN** Gray, coarse sandy, SILT (A-4) (Middendorf Formation)
163.0	24.8	4	5	7	12		Sat.		165.3 22.5 **COASTAL PLAIN** Tan and gray, silty, fine to coarse SAND (A-2-4) (Middendorf Formation)
158.0	29.8	8	16	17	33		M		159.8 28.0 **COASTAL PLAIN** Orange, clayey, fine SAND (A-2-6) (Middendorf Formation)
153.0	34.8	9	8	9	17		M		150.8 37.0 **COASTAL PLAIN** Dark gray with maroon mottling, silty, CLAY (A-6) (Cape Fear Formation)
148.0	39.8	12	14	20	34		M		144.8 43.0 **COASTAL PLAIN** Gray, micaceous, clayey, coarse SAND (A-2-6) (Cape Fear Formation)
143.0	44.8	10	15	16	31		W		
138.0	49.8	7	11	13	24		Sat.		134.8 53.0 **COASTAL PLAIN** Green, micaceous, sandy, CLAY (A-6) (Cape Fear Formation)
133.0	54.8	10	11	16	27		M		129.8 58.0 **COASTAL PLAIN** Gray, silty, coarse SAND (A-2-4) (Cape Fear Formation)
128.0	59.8	29	33	51	84		Sat.		124.8 63.0 **COASTAL PLAIN** Green and dark gray, sandy, silty CLAY (A-6) (Cape Fear Formation)
123.0	64.8	12	19	20	39		M		121.5 66.3 Boring Terminated at Elevation 121.5 ft in Cape Fear Fm: Hard, silty, CLAY (A-6)

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: 8.9 lbs/gal

Casing Depth (4"): 11.6 ft

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. RL B7-B	STATION 828+16	OFFSET 46ft RT	ALIGNMENT -L-
COLLAR ELEV. 187.3 ft	TOTAL DEPTH 65.5 ft	NORTHING 484,391	EASTING 1,993,645
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 04/13/07	COMP. DATE 04/13/07	SURFACE WATER DEPTH 0.3ft	DEPTH TO ROCK N/A

GROUND WTR (ft): 0 HR. Water; 24 HR. Boring

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))
190									
187.3	0.0								187.3 MUDLINE 0.0
		WOH	WOH	2	2		Sat.		**ALLUVIAL** Brown sandy MUCK
183.0	4.3	WOH	1	WOH	1		Sat.		180.3 7.0 **ALLUVIAL** Brown, coarse SAND (A-1-b) with trace organics Pushed Shelby Tube from 6.0-8.0 ft, recovery=2.0 ft (100%)
178.1	9.2	1	1	1	2		Sat.		
173.1	14.2	5	6	11	17		Sat.		
168.1	19.2	9	13	16	29		Sat.		165.3 22.0 **COASTAL PLAIN** Light gray, clayey SAND (A-2-6) (Middendorf Formation)
163.1	24.2	9	10	15	25		W		
158.1	29.2	8	10	16	26		W		156.3 31.0 **COASTAL PLAIN** Mottled dark gray and maroon, silty CLAY (A-6) (Cape Fear Formation)
153.1	34.2	13	20	31	51		M		149.3 38.0 **COASTAL PLAIN** Light gray, clayey SAND (A-2-6) with trace mica (Cape Fear Formation)
148.2	39.1	6	8	8	16		W		145.3 42.0 **COASTAL PLAIN** White to light gray, silty, coarse SAND (A-2-4) with trace mica (Cape Fear Formation)
143.2	44.1	10	11	14	25		Sat.		
138.2	49.1	7	8	9	17		W		134.3 53.0 **COASTAL PLAIN** Mottled gray and green, sandy, silty CLAY (A-6) with trace mica (Cape Fear Formation)
133.2	54.1	13	24	27	51		W		
128.2	59.1	25	44	53	97		M		
123.2	64.1	21	47	53/0.4	100/0.9		M		121.8 65.5 Boring Terminated at Elevation 121.8 ft in Cape Fear Fm: Hard, silty, CLAY (A-6)

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: 9.0 lbs/gal

Casing Depth (4"): 9.2 ft

Other Samples:
ST-1 (6.0 - 8.0)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST S. Lehman
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. RL B8-B	STATION 829+19	OFFSET 66ft RT	ALIGNMENT -L-	0 HR. Water
COLLAR ELEV. 188.2 ft	TOTAL DEPTH 66.4 ft	NORTHING 484,495	EASTING 1,993,628	24 HR. Boring
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 04/16/07	COMP. DATE 04/17/07	SURFACE WATER DEPTH 0.6ft	DEPTH TO ROCK N/A

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))
190									
188.2	0.0								188.2 MUDLINE 0.0
		WOH	WOH	1	1				**ALLUVIAL** MUCK
183.3	4.9								
		WOH	WOH	WOH	0				
178.3	9.9								178.2 10.0
		1	1	1	2		Sat.		**ALLUVIAL** Brown, clayey, silty, fine SAND (A-2-4) with trace organics
173.3	14.9								173.2 15.0
		WOH	WOH	3	3		M		**ALLUVIAL** Dark brown and gray, sandy, silty CLAY (A-6)
168.3	19.9								170.7 17.5 Pushed Shelby Tube from 16.5-18.5 ft, recovery=0.6ft (30%)
		6	3	2	5		W		**ALLUVIAL** Gray, clayey, silty, fine SAND (A-2-4) with trace gravel and wood fragments
163.3	24.9								
		3	9	11	20		W		
158.3	29.9								160.7 27.5
		4	7	11	18		M		**COASTAL PLAIN** Gray, sandy, silty CLAY (A-6) (Middendorf Formation)
153.3	34.9								
		8	17	26	43		M		
148.3	39.9								150.7 37.5
		5	7	10	17		M		**COASTAL PLAIN** Gray with orange mottling, fine sandy, silty CLAY (A-7-6) with trace mica (Cape Fear Formation)
143.3	44.9								145.2 43.0
		6	7	7	14		M		**COASTAL PLAIN** Light gray, silty, clayey, fine SAND (A-2-6) with trace mica (Cape Fear Formation)
138.3	49.9								139.7 48.5
		6	8	10	18		M		**COASTAL PLAIN** Light green, fine sandy, clayey, SILT (A-4) with trace mica (Cape Fear Formation)
133.3	54.9								134.7 53.5
		13	12	22	34		D		**COASTAL PLAIN** Light green, silty, clayey, fine to coarse SAND (A-2-6) (Cape Fear Formation)
128.3	59.9								129.7 58.5
		17	45	55/0.4	100/0.9		D		**COASTAL PLAIN** Light green, fine sandy, silty CLAY (A-6) (Cape Fear Formation)
123.3	64.9								124.7 63.5
		33	39	60	99		D		**COASTAL PLAIN** Mottled light green, maroon and orange, silty CLAY (A-7-6) (Cape Fear Formation)
									121.8 66.4

Boring Terminated at Elevation 121.8 ft in Cape Fear Fm: Hard, silty, CLAY (A-7-6)

Bits Used: 3" Side-Discharge Finger Bit
Drilling Fluid Properties: 8.6 lbs/gal
Casing Depth (4"): 13.5 ft

Other Samples:
ST-2 (16.5 - 18.5)

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST S. Lehman
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			GROUND WTR (ft)
BORING NO. RL B9-B	STATION 830+16	OFFSET 48ft RT	ALIGNMENT -L-	0 HR. 0.0
COLLAR ELEV. 188.4 ft	TOTAL DEPTH 66.8 ft	NORTHING 484,580	EASTING 1,993,575	24 HR. 0.0
DRILL MACHINE CME-45C	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 04/17/07	COMP. DATE 04/17/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

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))
190									
188.4	0.0								188.4 GROUND SURFACE 0.0
		1	2	1	3		Sat.		**ALLUVIAL** Sandy MUCK with wood fragments
183.0	5.4								
		WOH	WOH	WOH	0		Sat.		
178.0	10.4								179.9 8.5
		9	17	17	34		Sat.		**ALLUVIAL** Gray, silty, fine to coarse SAND (A-3) Pushed Shelby Tube from 15.4-17.4 ft, recovery=0.0 ft (0%)
171.0	17.4								172.4 16.0
		7	13	19	32		M		**COASTAL PLAIN** Light gray and orange, silty, fine to coarse sandy CLAY (A-6) (Middendorf Formation)
168.0	20.4								168.9 19.5
		12	15	18	33		M		**COASTAL PLAIN** Light gray and orange, clayey, fine to coarse SAND (A-2-6) with little mica (Middendorf Formation)
163.0	25.4								164.4 24.0
		7	8	12	20		M		**COASTAL PLAIN** Light gray and orange, clayey, silty, fine to coarse SAND (A-2-4) with trace mica (Middendorf Formation)
158.0	30.4								159.4 29.0
		32	30	36	66		M		**COASTAL PLAIN** Light gray, fine sandy SILT (A-4) (Middendorf Formation)
153.0	35.4								154.4 34.0
		28	30	56	86		M		**COASTAL PLAIN** Light to dark gray, fine sandy, silty CLAY (A-6) (Cape Fear Formation)
148.0	40.4								
		16	24	42	66		M		
143.0	45.4								144.4 44.0
		7	8	10	18		M		**COASTAL PLAIN** Gray, clayey, fine to coarse SAND (A-2-6) with trace gravel (Cape Fear Formation)
138.0	50.4								
		9	9	11	20		W		
133.0	55.4								134.4 54.0
		11	13	21	34		M		**COASTAL PLAIN** Light green, silty, fine to coarse sandy CLAY (A-6) (Cape Fear Formation)
128.0	60.4								129.4 59.0
		18	18	25	43		M		**COASTAL PLAIN** Light green, fine sandy, silty CLAY (A-7-6) (Cape Fear Formation)
123.0	65.4								124.4 64.0
		28	47	53/0.4	100/0.9		M		**COASTAL PLAIN** Mottled light green, maroon and orange, silty CLAY (A-6) (Cape Fear Formation)
									121.6 66.8

Boring Terminated at Elevation 121.6 ft in Cape Fear Fm: Hard, silty, CLAY (A-6)

Bits Used: 3" Side-Discharge Finger Bit
Drilling Fluid Properties: 8.6 lbs/gal
Casing Depth (4"): 19.4 ft

Other Samples:
ST-3 (15.4 - 17.4)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** B. Deobald
SITE DESCRIPTION Structures 3 and 4; Dual Bridges on -L- Over Wetlands (MACTEC PROJECT NO. 6468-07-1682)			**GROUND WTR (ft)**
BORING NO. RL EB2-B	**STATION** 831+13	**OFFSET** 55ft RT	**ALIGNMENT** -L-	0 HR. 2.0
COLLAR ELEV. 194.9 ft	**TOTAL DEPTH** 64.1 ft	**NORTHING** 484,674	**EASTING** 1,993,544	24 HR. FIAD
DRILL MACHINE CME-550	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual	
START DATE 04/06/07	**COMP. DATE** 04/06/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
195								
194.9	0.0	2	3	3				194.9 GROUND SURFACE 0.0
192.3	2.6					M		193.4 **ALLUVIAL** Brown and gray, fine to coarse SAND (A-3) with trace organics 1.5
		8	5	9	SS-31	W		**ALLUVIAL** Brown and tan, silty, fine to coarse SAND (A-2-4) 189.4 5.5
187.3	7.6							**COASTAL PLAIN** White, light gray, orange and tan, silty, fine to coarse SAND (A-2-4) with trace gravel (Middendorf Formation)
		3	2	2		Sat.		
182.3	12.6							
		4	2	5		Sat.		
177.3	17.6							
		2	5	8		Sat.		
172.3	22.6							
		6	7	11		Sat.		
167.3	27.6							168.9 26.0 **COASTAL PLAIN** Tan and light gray, clayey, fine to coarse SAND (A-2-7) with trace gravel and mica (Middendorf Formation)
		8	11	13	SS-32	M		
162.3	32.6							163.9 31.0 **COASTAL PLAIN** Light gray, orange and tan, silty, fine to coarse SAND (A-2-4) (Middendorf Formation) 161.4 33.5
		7	12	27		M/W		**COASTAL PLAIN** Light gray and tan, fine sandy, silty CLAY (A-6) with trace mica (Middendorf Formation)
157.3	37.6							
		11	17	18	SS-33	18%		
152.3	42.6							153.9 41.0 **COASTAL PLAIN** Gray, fine sandy, silty CLAY (A-6) (Cape Fear Formation)
		11	21	29		M		
147.3	47.6							148.9 46.0 **COASTAL PLAIN** Gray, silty, clayey, fine to coarse SAND (A-2-6) with trace gravel and mica (Cape Fear Formation)
		6	7	8		M/W		
142.3	52.6							
		5	6	5		W		
137.3	57.6							
		9	16	18	SS-34	21%		
132.3	62.6							
		12	19	28		M		130.8 64.1

Boring Terminated at Elevation 130.8 ft in Cape Fear Fm: Dense, clayey, fine to coarse SAND (A-2-6) with trace gravel

Bits Used: 3" Side-Discharge Finger Bit

Drilling Fluid Properties: 8.4 lbs/gal

Casing Depth (4"): 3.2 ft

SHEET 58

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

N.C.D.O.T./AASHTO CLASSIFICATIONS

REPORT ON SAMPLES OF: SOILS FOR QUALITY

MACTEC PROJECT NAME/ NUMBER: Structures 3 & 4; Dual Bridges on -L- over Wetlands (6468-07-1682)

NCDOT PROJ. NO.: 34817.1.2 (U-2519CB) **COUNTY:** Cumberland **OWNER:** N.C.D.O.T.

DATE SAMPLED: April 2007 **RECEIVED:** 4/9/2007 **REPORTED BY:** MACTEC

SAMPLED FROM: Right Lane B3-B

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-24	SS-25	SS-26	SS-27	SS-28	SS-29
Retained 4.75 mm Sieve	(%)	0.1	0.0	1.2	0.0	0.0	0.0
Passing 2.00 mm Sieve	(%)	98.1	99.2	97.4	99.8	99.6	99.9
Passing 425 µm Sieve	(%)	74.4	79.3	83.5	91.4	51.2	91.0
Passing 75 µm Sieve	(%)	50.7	30.4	43.9	71.5	20.7	51.0

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	38.8	38.2	21.9	14.8	69.5	19.8
Fine Sand Ret - 53 µm	(%)	12.4	33.1	41.2	17.7	10.7	34.7
Silt 0.05 - 0.005 mm	(%)	12.5	6.9	4.1	3.0	5.6	23.8
Clay < 0.005 mm	(%)	36.2	21.9	32.9	64.4	14.2	21.6

Moisture Content	(%)	19.1	17.1	18.4	16.2	ND	23.9
Liquid Limit, L.L.		58	36	30	23	36	46
Plasticity Index, P.I.		36	14	15	8	20	18
AASHTO Classification		A-7-6(14)	A-2-6(1)	A-6(3)	A-4(3)	A-2-6(1)	A-7-6(7)
Organic Content	(%)	ND	ND	ND	ND	ND	ND

Boring No.		RL B3-B	RL B3-B	RL B3-B	RL B3-B	RL B3-B	RL B3-B
Station		824+16	824+16	824+16	824+16	824+16	824+16
Offset		54 RT	54 RT	54 RT	54 RT	54 RT	54 RT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (FT)	From	14.8	20.1	25.1	35.1	45.1	50.1
	to	16.3	21.6	26.6	36.6	46.6	51.6

REMARKS: ND=Not Determined, NP=Non-Plastic

Submitted by: _____
Laboratory Manager

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

N.C.D.O.T./AASHTO CLASSIFICATIONS

REPORT ON SAMPLES OF: SOILS FOR QUALITY

MACTEC PROJECT NAME/ NUMBER: Structures 3 & 4; Dual Bridges on -L- over Wetlands (6468-07-1682)

NCDOT PROJ. NO.: 34817.1.2 (U-2519CB) **COUNTY:** Cumberland **OWNER:** N.C.D.O.T.

DATE SAMPLED: April 2007 **RECEIVED:** 4/9/2007 **REPORTED BY:** MACTEC

SAMPLED FROM: Right Lane B3-B, EB2-B, EB1-B

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-30	SS-31	SS-32	SS-33	SS-34	ST-4
Retained 4.75 mm Sieve	(%)	0.1	0.4	0.0	0.0	0.0	0.1
Passing 2.00 mm Sieve	(%)	98.9	98.6	99.8	100.0	97.4	99.7
Passing 425 µm Sieve	(%)	70.2	72.6	56.9	97.1	61.6	95.7
Passing 75 µm Sieve	(%)	31.3	18.2	30.9	63.8	18.6	58.0

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	49.0	47.4	60.5	7.8	51.1	9.7
Fine Sand Ret - 53 µm	(%)	21.6	37.3	9.4	38.8	37.5	37.6
Silt 0.05 - 0.005 mm	(%)	6.3	7.4	1.9	20.8	0.5	20.2
Clay < 0.005 mm	(%)	23.1	7.9	28.2	32.6	10.9	32.5

Moisture Content	(%)	18.2	ND	ND	18.4	21.3	ND
Liquid Limit, L.L.		40	17	46	27	34	24
Plasticity Index, P.I.		15	NP	18	12	14	11
AASHTO Classification		A-2-6(1)	A-2-4(0)	A-2-7(3)	A-6(5)	A-2-6(0)	A-6(2)
Organic Content	(%)	ND	ND	ND	ND	ND	ND

Boring No.		RL B3-B	RL EB2-B	RL EB2-B	RL EB2-B	RL EB2-B	RL EB1-B
Station		824+16	831+13	831+13	831+13	831+13	821+17
Offset		54 RT	55 RT	55 RT	55 RT	55 RT	57 RT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (FT)	From	60.1	2.6	27.6	37.6	57.6	14.5
	to	61.6	4.1	29.1	39.1	59.1	16.5

REMARKS: ND=Not Determined, NP=Non-Plastic

Submitted by: _____
Laboratory Manager

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 34817.1.2 TIP: U-2519CB COUNTY: CUMBERLAND

DESCRIPTION(1): STRUCTURES 3 & 4: DUAL BRIDGES ON -L- OVER WETLANDS

EXISTING BRIDGE

Information from: Field Inspection X Microfilm ____ (reel ____ pos: ____)
Other (explain) Not Applicable: No Existing Bridge

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

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: ____

Interior Bents: ____

Channel Bed: ____

Channel Bank: ____

EXISTING SCOUR PROTECTION

Type(3): ____

Extent(4): ____

Effectiveness(5): ____

Obstructions(6): ____

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.

DESIGN INFORMATION

Channel Bed Material(7): Primarily muck. Other soils in the near subsurface include clayey, silty sand A-2-4, A-2-6; and clay A-7-6.

Channel Bank Material(8): Muck and sand A-2-4, A-3; Other soil in the near subsurface includes clay A-6, A-7-6.

Channel Bank Cover(9): Pine and hardwood trees; brush

Floodplain Width(10): 500 feet

Floodplain Cover(11): Densely wooded; hardwood and cypress trees; brush

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

Channel Migration Tendency(13): None

Observations and Other Comments: Surface water flows in braided-channels; generally crosses the alignment near bent 8, then flows along the left-lane and crosses the alignment again near bent 4.

Reported by: Bill Deaderick **Date:** 4/27/2007
MACTEC Engineering and Consulting, Inc.

DESIGN SCOUR ELEVATIONS(14) Feet X Meters ____

BENTS	B1	B2	B3	B4	B5	B6	B7	B8	B9		

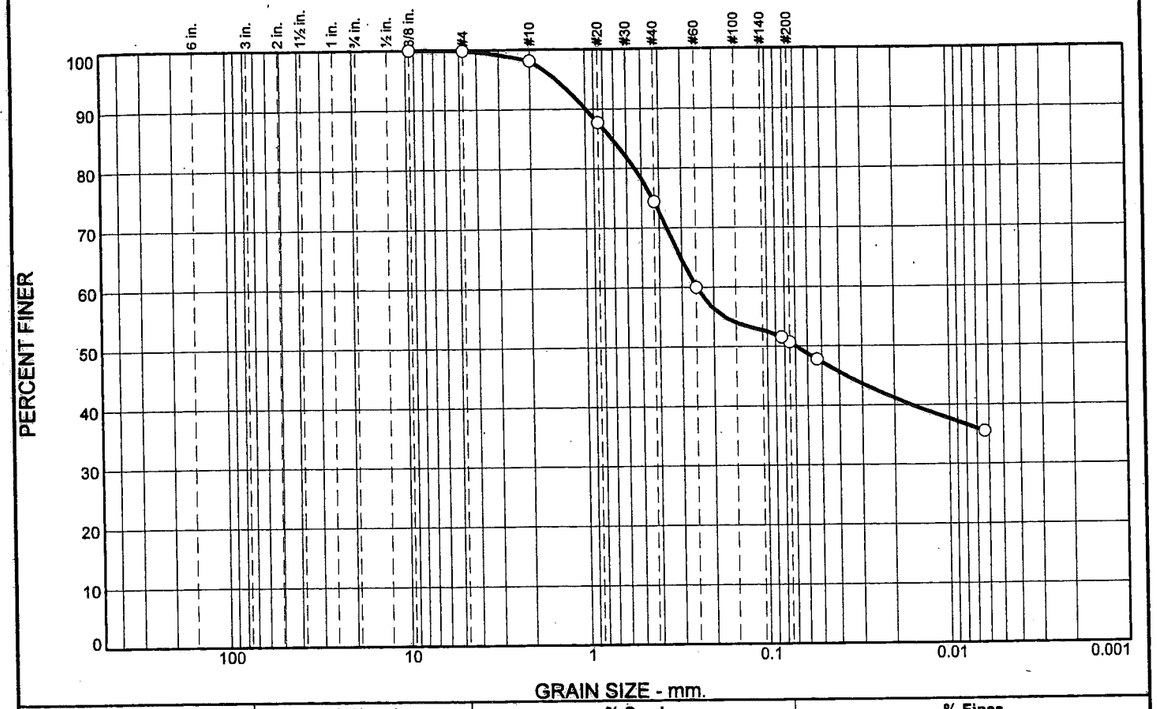
Comparison of DSE to Hydraulics Unit theoretical scour:
There is no scour calculated and scour is listed "N/A" in the Bridge Survey and Hydraulic Report dated 9-29-05.

DSE determined by: ____ **Date:** 5/22/2007
Bradley D. Worley

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank	Bed	Bed	Bank				
Sample No.	SS-24	SS-25	SS-31				
Retained #4	0.1	0	0.4				
Passed #10	98.1	99.2	98.6				
Passed #40	74.4	79.3	72.6				
Passed #200	50.7	30.4	18.2				
Coarse Sand	38.8	38.2	47.4				
Fine Sand	12.4	33.1	37.3				
Silt	12.5	6.9	7.4				
Clay	36.2	21.9	7.9				
LL	58	36	17				
PI	36	14	NP				
AASHTO	A-7-6(14)	A-2-6(1)	A-2-4(0)				
Station	824+16	824+16	831+13				
Offset	54 RT	54 RT	55 RT				
Depth	14.8-16.3 ft	14.8-16.3 ft	2.6-4.1 ft				

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	1.8	23.7	23.7	50.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.9		
#10	98.1		
#20	87.7		
#40	74.4		
#60	60.0		
0.0834 mm.	51.5		
#200	50.7		
#270	47.8		
0.0063 mm.	35.5		

* (no specification provided)

Soil Description

Yellowish gray silty clay.

Atterberg Limits

PL= 22 LL= 58 PI= 36

Coefficients

D_{85}= 0.7137 D_{60}= 0.2503 D_{50}= 0.0691
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(14)

Remarks

Specific gravity is assumed.

Sample No.: SS-24 **Source of Sample:** BORING RL B3-B **Date:** 4-05-07
Location: **Elev./Depth:** 14.8-16.3

MACTEC, Inc.

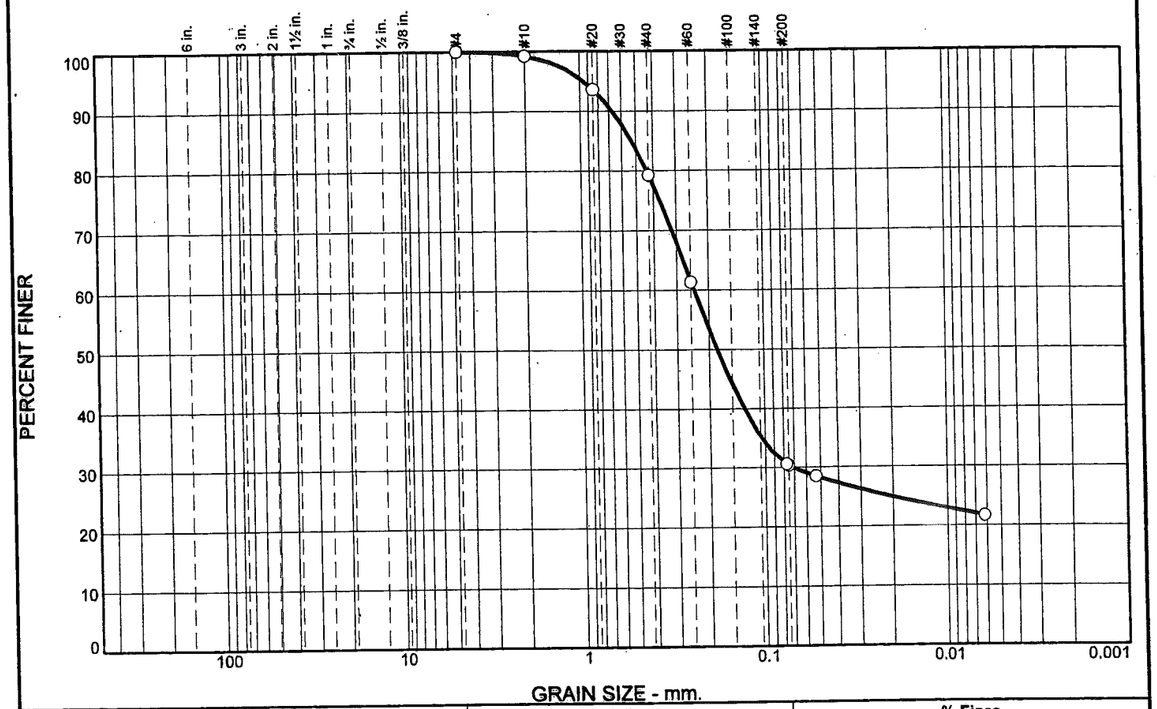
Raleigh, North Carolina

Client: NC DOT
Project: Dual Bridges on - L - Over Wetlands
Project No: 6468071682 **Figure**

Tested By: CS **Checked By:** LBJ

SHEET 60

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.8	19.9	48.9	30.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.2		
#20	93.6		
#40	79.3		
#60	61.3		
0.0771 mm.	30.6		
#200	30.4		
#270	28.5		
0.0062 mm.	21.7		

* (no specification provided)

Soil Description

Yellowish tan sandy silty clay.

Atterberg Limits

PL= 22 LL= 36 PI= 14

Coefficients

D_{85}= 0.5277 D_{60}= 0.2409 D_{50}= 0.1807
D_{30}= 0.0709 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(1)

Remarks

Specific gravity is assumed.

Sample No.: SS-25 **Source of Sample:** BORING RL B3-B **Date:** 4-05-07
Location: **Elev./Depth:** 20.1-21.6

MACTEC, Inc.

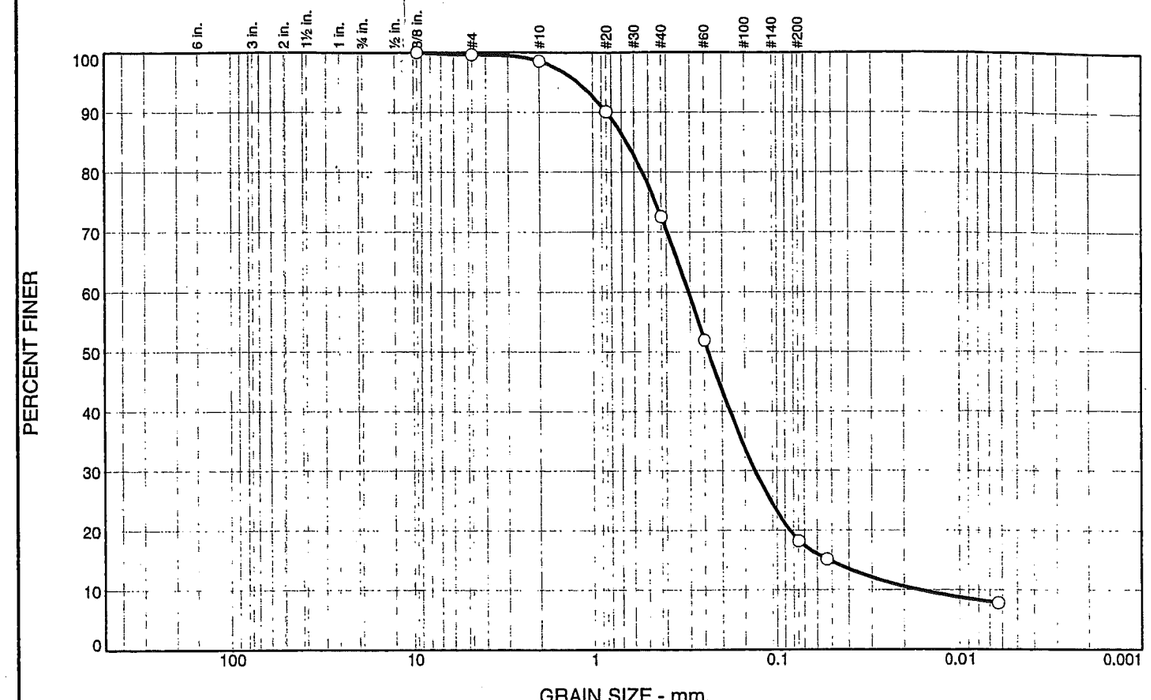
Raleigh, North Carolina

Client: NC DOT
Project: Dual Bridges on - L - Over Wetlands
Project No: 6468071682 **Figure**

Tested By: CS **Checked By:** LBJ

SHEET 61

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	1.0	26.0	54.4	18.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.6		
#10	98.6		
#20	90.1		
#40	72.6		
#60	51.9		
#200	18.2		
#270	15.1		
0.0063 mm.	7.8		

* (no specification provided)

Soil Description

Yellowish gray sandy clay.

Atterberg Limits

PL= NP LL= 17 PI= NP

Coefficients

D_{85}= 0.6570 D_{60}= 0.3057 D_{50}= 0.2379
D_{30}= 0.1320 D_{15}= 0.0519 D_{10}= 0.0166
C_u= 18.38 C_c= 3.43

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Specific gravity is assumed.

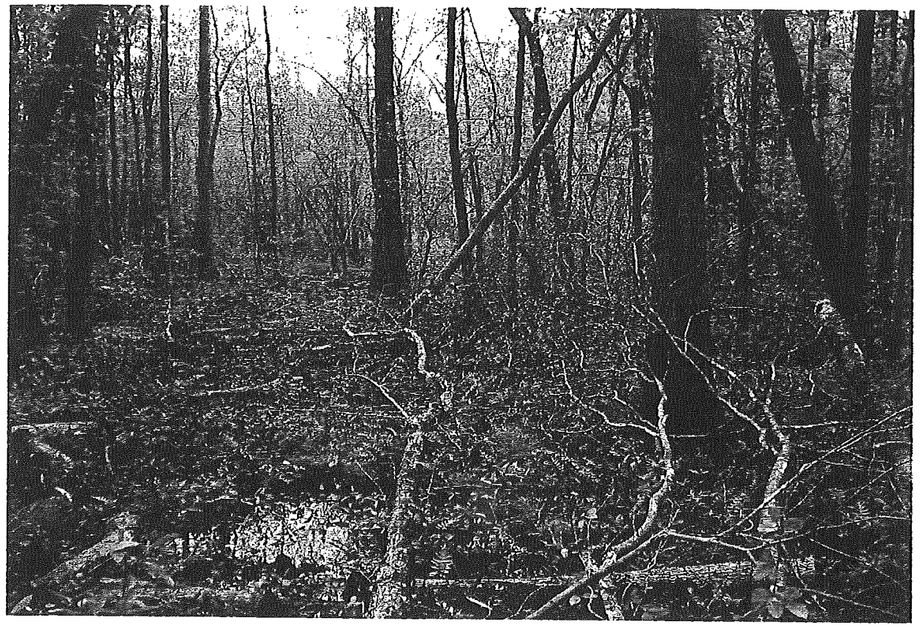
Sample No.: SS-31 **Source of Sample:** BORING RL EB2-B **Date:** 4-06-07
Location: **Elev./Depth:** 2.6-4.1

MACTEC, Inc.

Raleigh, North Carolina

Client: NC DOT
Project: Dual Bridges on - L - Over Wetlands
Project No: 6468071682 **Figure**

Tested By: CS **Checked By:** LBJ

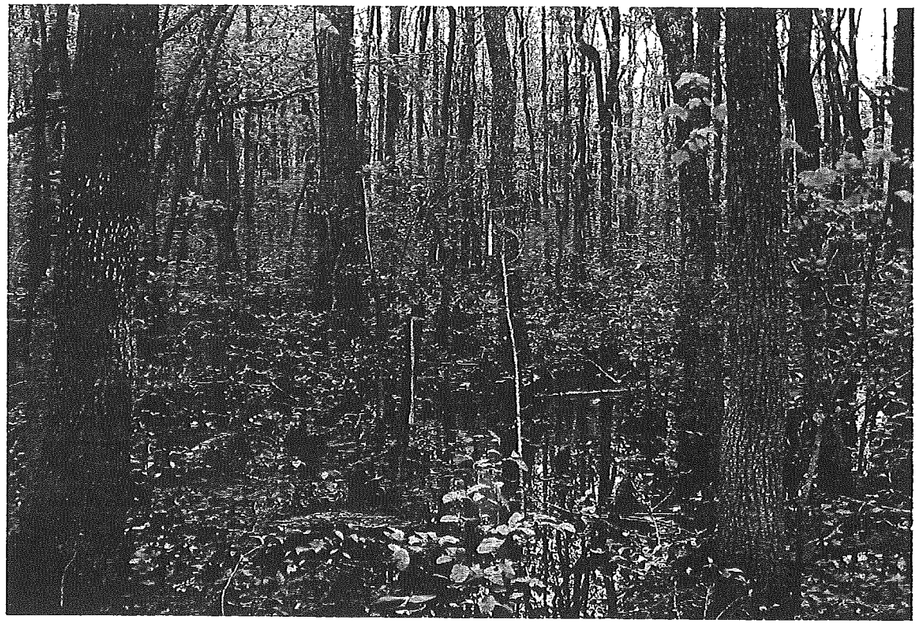


View looking down-station from RL Bent 4 (typical view along structure)

View looking down-station from RL Bent 9 (typical view along structure)

View looking down-station from RL Bent 6 (typical view along structure)

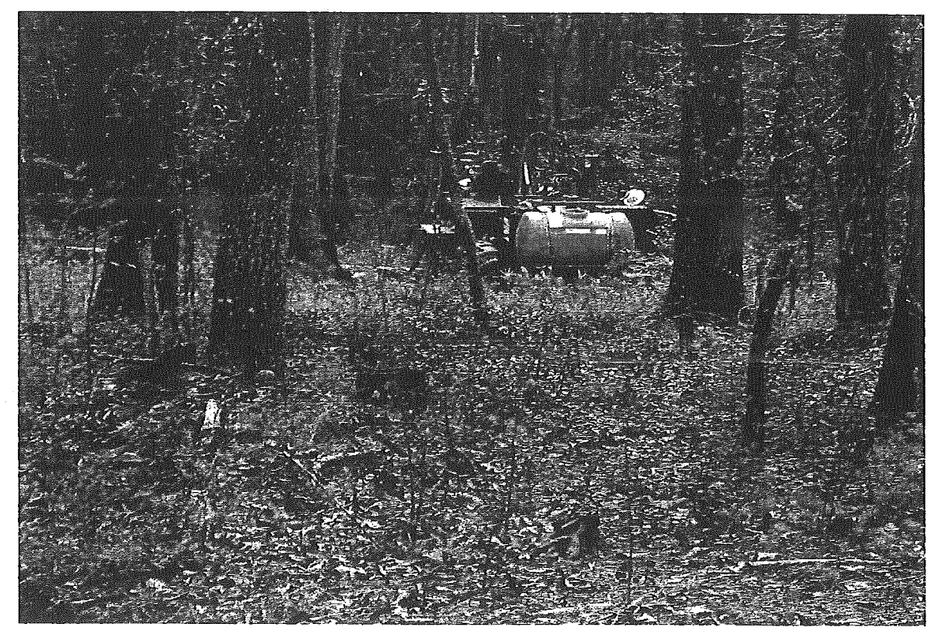
View looking up-station from RL Bent 9



View looking at Baseline Point BL-31 (typical view along center line)

View looking along RL Bent 8 (typical view along interior bents)
Baseline Point BL-32 right of center of photo

View looking along RL Bent 5 (typical view along interior bents)
Baseline Point BL-31 at center of photo



View looking down-station along approach to RL End Bent 2

PROJECT: 34817.1.2 ID: U-2519CB

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34817.1.2	1	61

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
U-2519CB	NHF-DPR-0100(001)	P.E.
		CONST.

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

STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 34817.1.2 I.D. NO. U-2519CB

F.A. PROJECT NHF-DPR-0100(001)

COUNTY CUMBERLAND

PROJECT DESCRIPTION FAYETTEVILLE OUTER LOOP FROM SOUTH OF SR 1400 (CLIFFDALE RD) TO EAST OF SR 1415 (CLEARWATER RD)

SITE DESCRIPTION STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK

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CAUTION NOTICE

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U-2519CB	34817.1.2	2	61

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 WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND 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		N.P.	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

P.I. OF A-7-5 ≤L.L. - 30 : P.I. OF A-7-6 >L.L. - 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 0.5 0.5 TO 1 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	2.0	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, YEL-BRN, 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 ARE 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 30
MODERATELY COMPRESSIBLE	LIQUID LIMIT 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 SEEPAGE

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS
- INFERRED SOIL BOUNDARIES
- 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
- BULK SAMPLE LOCATION
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- REF SPT REFUSAL
- ASPHALT

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

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
C.I. - CAVE IN
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F. - FINE
FIAD - FILLED IMMEDIATELY AFTER DRILLING
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED
FRAGS. - FRAGMENTS
MED. - MEDIUM
PMT - PRESSUREMETER TEST
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT
V. - VERY
VST - VANE SHEAR TEST
W - MOISTURE CONTENT

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B- ___
- [ ] BK-51
- [X] CME-55 LC
- [X] CME-45 B
- [ ] PORTABLE HOIST
- [ ] OTHER _____
- [ ] OTHER _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [X] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 3" AND 4" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] OTHER _____

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

CORE SIZE:
- [ ] -B _____
- [ ] -N _____
- [ ] -H Q

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

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN 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 FOLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT.
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 ROCKS 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 GEOLOGISTS 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 GEOLOGISTS 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 GEOLOGISTS 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 WHICH 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 IS IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS WHICH 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 (F.P.) - 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 SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (R.Q.D.) - 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 WHICH 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, WHICH 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 B.P.F.) 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 LESS THAN 0.1 FOOT PENETRATION WITH 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 (S.R.Q.D.) - 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 (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BASELINE SURVEY POINTS 46, 47, 48, AND T2-430 SET BY NCDOT PERS.

NOTES:
Geotechnical Exploration
Performed By:

MACTEC

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Subject: **Revised Geotechnical Report**

Description: **Structures 5 & 6: Dual Bridges on -L- over Stewart's Creek**
Fayetteville Outer Loop

Project Number:	**34817.1.2**
Tip Number:	**U-2519CB**
F.A. Number:	**NHF-DPR-0100 (001)**
MACTEC Project Number:	**6468-07-1685**

Project Information

The purpose of this investigation was to obtain geotechnical information for design and construction of proposed dual bridges over Stewart's Creek located on the Fort Bragg Military Reservation, east of the controlled access point on Chicken Road, Cumberland County, North Carolina (Drawings 1 and 2). The bridges are part of a proposed segment of the Fayetteville Outer Loop from south of SR 1400 (Cliffdale Road) to east of SR 1415 (Clearwater Road). Our understanding of this project comes from conversations with NCDOT Geotechnical Engineering Unit personnel and from documents and drawings provided by the Geotechnical Engineering Unit, including a Request for Proposal dated February 20, 2007, a Bridge Survey and Hydraulic Design Report dated October 3, 2005, and electronic drawings obtained via the NCDOT file transfer system.

The proposed bridges are parallel structures, each approximately 840 feet long and 45 feet wide. Each bridge is to be constructed on nine bents, skewed 130° to the alignment (-L-), with eight 105-foot long spans.

We were requested to drill up to three SPT-borings along each bent-line, for a maximum of 27 borings for the project. The initial plan was to drill 18 borings, including all of the "A" borings along the left-lane structure and all of the "B" borings along the right-lane structure. A third boring was to be drilled along selected bent-lines per NCDOT's direction. The need for a third boring was to be based on findings in the initial borings. We were instructed by NCDOT to advance the first boring drilled to the depth of 100 feet. NCDOT would then establish drilling depths for the remaining borings based on findings.

Field Testing

During May and June, 2007, MACTEC advanced 18 borings at locations shown on the Boring Location Plans (Drawings 3 and 16). The borings were drilled with a CME-45B marsh buggy-mounted drill rig equipped with a 140 pound manual hammer, and a CME-55LC track-mounted ATV drill rig equipped with a 140 pound automatic hammer. The borings were advanced using mud rotary drilling techniques.

Boring LL B7-A was advanced to a depth of approximately 100 feet and borings LL B2-A, LL EB2-A, RL B6-B, RL B7-B, and RL EB2-B were advanced to a depth of approximately 80 feet. At the direction of the NCDOT, the remaining 12 borings were terminated at an approximate depth of 65 feet. Standard penetration tests (SPT) were conducted and soil samples collected at approximately five-foot intervals. Samples were collected from within the soil profile using split-barrel samplers and the 140 lb. manual or automatic hammers. Undisturbed samples of shallow cohesive soil were collected with Shelby tubes for consolidation testing and for Erosion Function Apparatus (EFA) analyses.

Proposed boring locations were established at the project site utilizing GPS equipment. As-drilled boring location coordinates were captured with GPS equipment. The collected coordinates were corrected as necessary using post-processing differential correction. Conventional survey techniques were used to establish the collar elevations at all boring locations and selected ground surface points depicted on the subsurface profile and cross-section drawings included with this report. U-2519CB Baseline Survey Points 46, 47, and 48 and point T2-430, established at the project site by the NCDOT, were used as benchmarks.

Laboratory Testing

Laboratory testing consisting of AASHTO classification, grain-size distribution, and/or organic content tests were performed on split-barrel samples SS-1 through SS-42. Cohesive soils were also tested for moisture content.

Laboratory testing was performed in general accordance with applicable ASTM/AASHTO/ NCDOT specifications. Test results for AASHTO classification, grain-size distribution, organic content, and moisture content are included with this report.

Undisturbed samples, ST-1 and ST-2, ST-3, ST-4, and ST-5, were collected in borings RL EB2-B, RL B5-B, LL B6-A, and LL B3-A, respectively. ST-2, ST-4, and ST-5 are available to the NCDOT Geotechnical Engineering Unit for EFA testing at their discretion. Sample ST-3 was not recovered from the boring due to mechanical failure of Shelby tube. Sample ST-1 was tested for consolidation strength. Test results for ST-1 are included under separate cover with this report.

Physiography

The ground surface along the approaches to the proposed structures slopes gradually down toward End Bents 1 and 2. There is approximately 20 feet of relief between the approach to End Bents 1 and 2 and the flood plain of Stewart's Creek. The ground surface is at elevation 204± feet mean sea level (msl) along End Bents 1, and 210± feet msl along End Bents 2. The ground surface ranges from 203 to 207± msl at interior bent locations.

The site is currently undeveloped. The upland areas, located at the end bents and along portions of the left-lane and right lane structures, are moderately wooded with young to mature pine and hardwood trees. The flood plain of Stewart's Creek is moderately to densely wooded with mature hardwood and cypress trees, and areas of thick brush. Stewart's Creek enters the site from the north where it passes under Chicken Road via a culvert and spreads laterally across the site submerging much of the flood plain. Generally, the main channel of the creek crosses the alignment between bents 4 and 5. The water surface elevation of Stewart's Creek was measured at 204.1 feet msl on May 17, 2007. Site photographs included in this report show site conditions during our field investigation.

Geology

The project site is located in the western portion of the Carolina Coastal Plain Physiographic Province. The Carolina Coastal Plain is a wedge of mostly marine sediments and sedimentary rocks that gradually thickens to the east (towards the present day coast-line) that were deposited during depositional cycles caused by fluctuating sea-levels. The Coastal Plain sediments encountered at the project site were deposited at a time when sea-level was much higher than its present condition. The depositional processes that resulted in the sediments encountered at the project site are similar to those in existence today along the current coast-line. Younger sediments lie at the surface near the coast. Older sediments, which underlie these younger sediments, lie at or near the surface further inland. The 1985 Geologic Map of North Carolina, compiled by the N.C. Geologic Survey, indicates that the project site is underlain by the Middendorf and Cape Fear Formations. We encountered the following stratigraphic units at the project site:

- Alluvium
- Middendorf Formation
- Cape Fear Formation

Boring logs describing subsurface conditions at each of the boring locations are included in this report. Profiles, Drawings 4 to 6 and 17 to 19, depict generalized subsurface conditions along the length of both structures. Cross-sections, Drawings 7 to 15 and 20 to 28, depict generalized subsurface conditions along each bent of both structures.

Soil

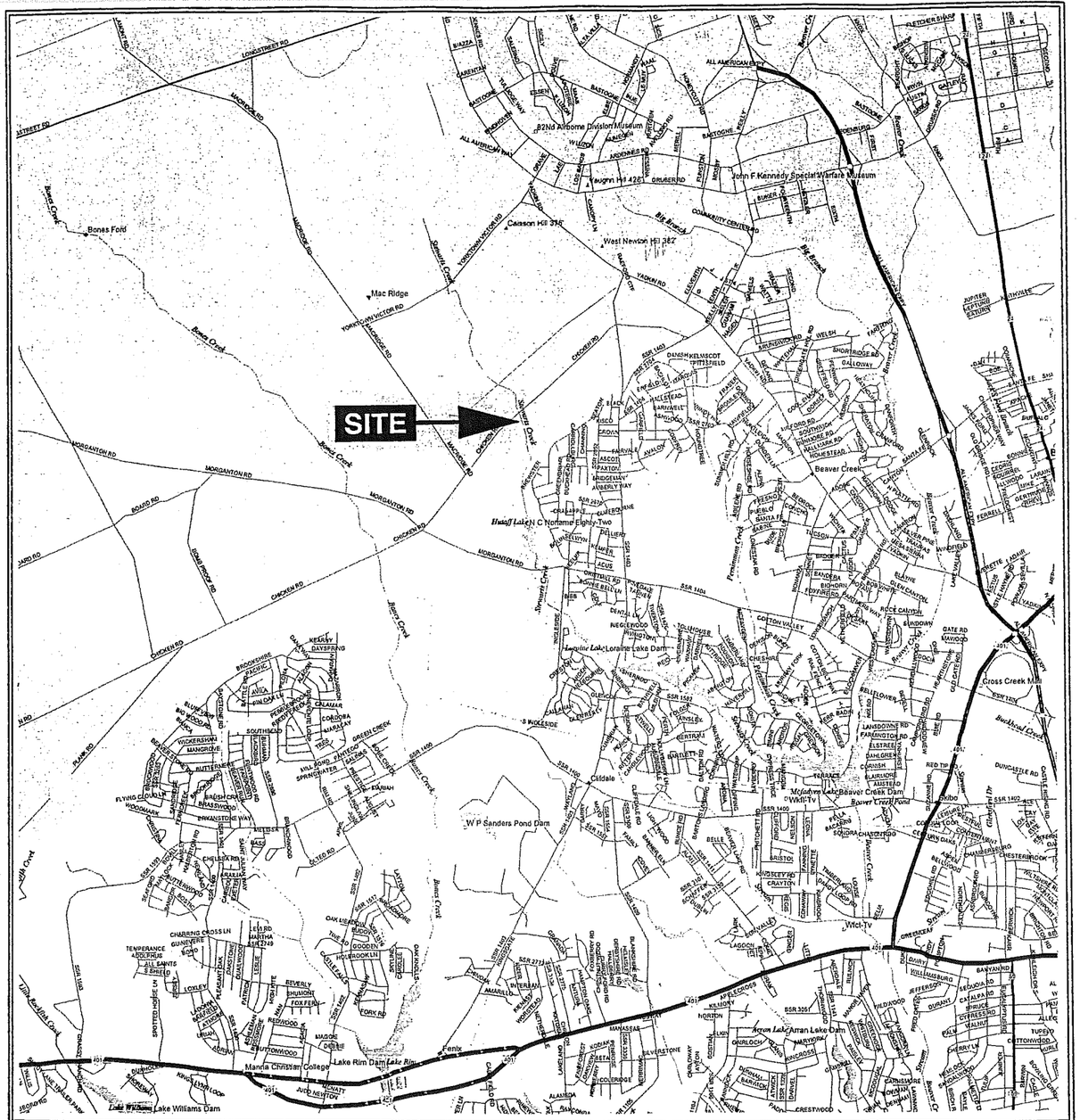
Alluvium was encountered in borings located in or near the flood plain associated with Stewart's Creek, from approximately End Bent 1 to Bent 7 along the Left and Right Lane Structures. Alluvial soils encountered at the surface typically consist of very soft, sandy muck with wood fragments; very loose to loose, locally moderately organic, clayey, silty, fine to coarse sand (A-2-4) with roots and organic debris; and soft, fine to coarse sandy, silt and clay (A-4/A-6) with trace organics. These surficial soils are underlain by alluvial soils consisting of very soft to medium stiff, sandy, silt and clay (A-4/A-6) with trace to little organics, and very loose to medium dense, locally moderately organic, silty, fine to coarse sand (A-2-4/A-3/A-1-b). Alluvial soils overlie the Middendorf Formation at approximate elevations ranging from 175 to 205± feet msl. The lower alluvial boundaries observed at Left Lane boring B4-A and Right Lane boring B4-A may represent an older alluvial channel cut into the Middendorf Formation as these locations generally coincide with the current channel of Stewart's Creek.

Middendorf Formation soils were encountered at the surface in End Bent 2 borings LL EB2-A and RL EB2-A, and below alluvium at all other boring locations. The soils typically consist of interbedded, very loose to very dense, locally micaceous, silty, clayey, fine to coarse sand and gravel (A-1-b/A-3/A-2-4/A-2-6/A-2-7) and very soft to hard, locally micaceous, fine to coarse sandy, silt and clay (A-4/A-6/A-7-6). Middendorf Formation soils are generally lightly colored white, tan, brown, orange, and gray, commonly mottled or streaked with maroon, red, or orange, and locally contain hematite cemented concretions. Individual beds are laterally discontinuous. The base of the Middendorf Formation / top of the Cape Fear Formation ranges from elevation 144 to 156± feet msl.

The Cape Fear Formation was encountered underlying the Middendorf Formation and generally consists of interbedded clays and sands; including stiff to hard, locally micaceous, fine to coarse sandy, silty clay (A-6/A-7-6) and medium dense to very dense, locally micaceous, silty, clayey, fine to coarse sand (A-1-b/A-3/A-2-4/A-2-6/A-2-7). The clay is typically darkly colored gray to green, mottled or streaked with yellow, orange, red, maroon, and brown. The sand is typically colored gray to green and locally mottled with orange, red, and maroon. Overall, the clay and sand beds vary greatly in thickness and are laterally discontinuous. All borings were terminated in the Cape Fear Formation.

Groundwater

24-hour groundwater level measurements were obtained in borings at Left Lane Bent 2, and Left and Right Lane Bents 6, 7, and End Bent 2. Groundwater elevations ranged from 206 to 208± feet msl at End Bent 2, and from 204 to 205± feet msl at Bents 2, 6, and 7. These groundwater elevations coincide with or are slightly higher than the surface water elevations observed for Stewart's Creek and appear to be a subdued reflection of the site topography.



REFERENCE: Delorme Street Atlas

SCALE: 1 inch = 1 mile

NOTE: SITE LOCATION IS APPROXIMATE

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SITE LOCATION MAP
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWARTS CREEK
NCDOT PROJ. NO. 34817.1.2 (U-2519CB)
CUMBERLAND COUNTY, NORTH CAROLINA

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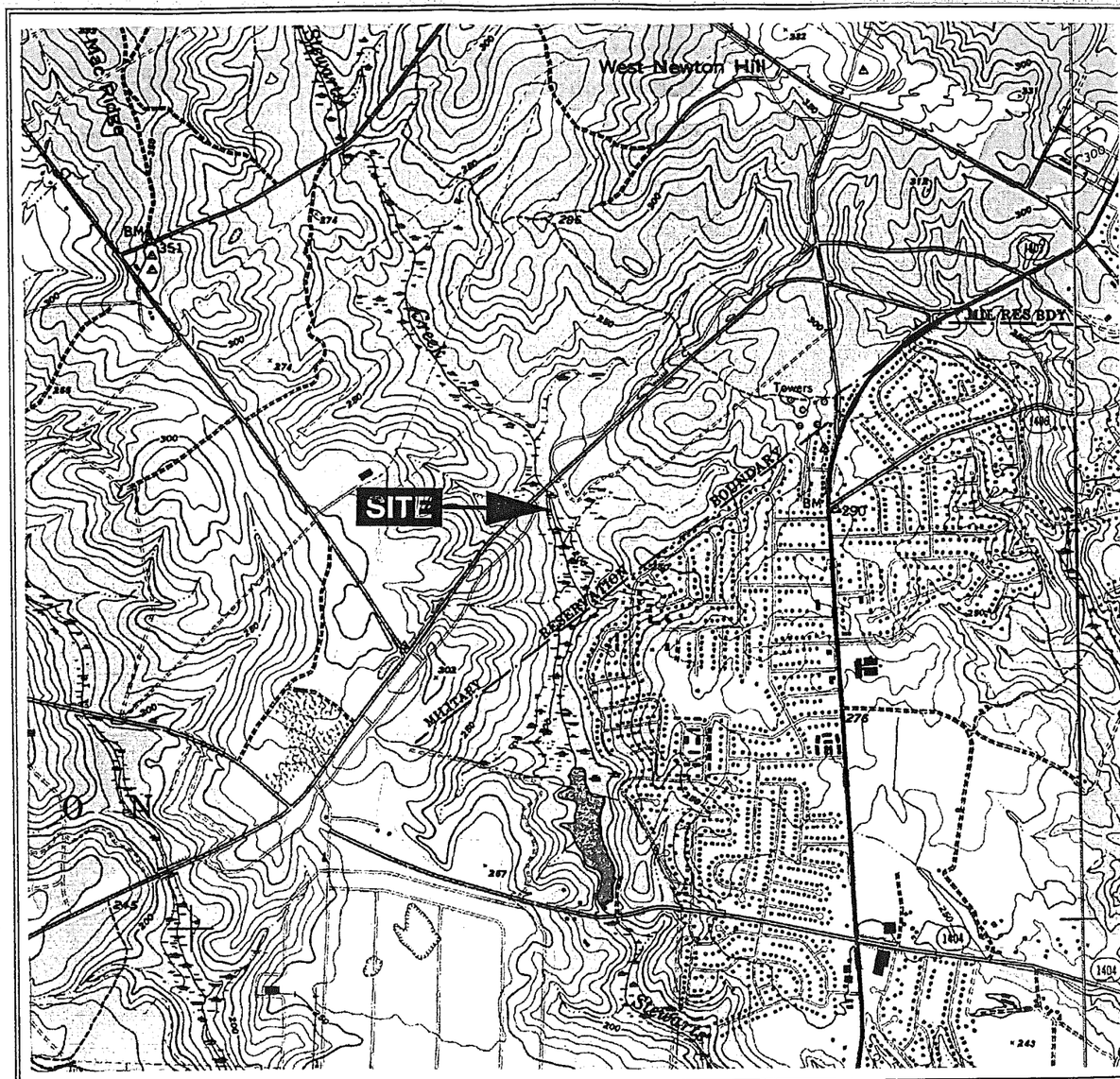

FAYETTEVILLE, N.C.
SW/4 FAYETTEVILLE 15'
QUADRANGLE
35078-A8-TF-024
1957
PHOTOREVISED 1987
DMA 5254 III SW – SERIES V842

CLIFDALE, N.C.
SE/4 CLIFDALE 15'
QUADRANGLE
N3500-W7900/7.5
1948
PHOTOREVISED 1982
DMA 5154 II SE – SERIES V842

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

GRAPHIC SCALE FEET
2000 1000 0 2000 4000

NOTE: SITE LOCATION IS APPROXIMATE

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TOPOGRAPHIC SITE MAP
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWARTS CREEK
NCDOT PROJ. NO. 34817.1.2 (U-2519CB)
CUMBERLAND COUNTY, NORTH CAROLINA

DRAWN: MBL	DATE: JUNE 2007	DRAWING	
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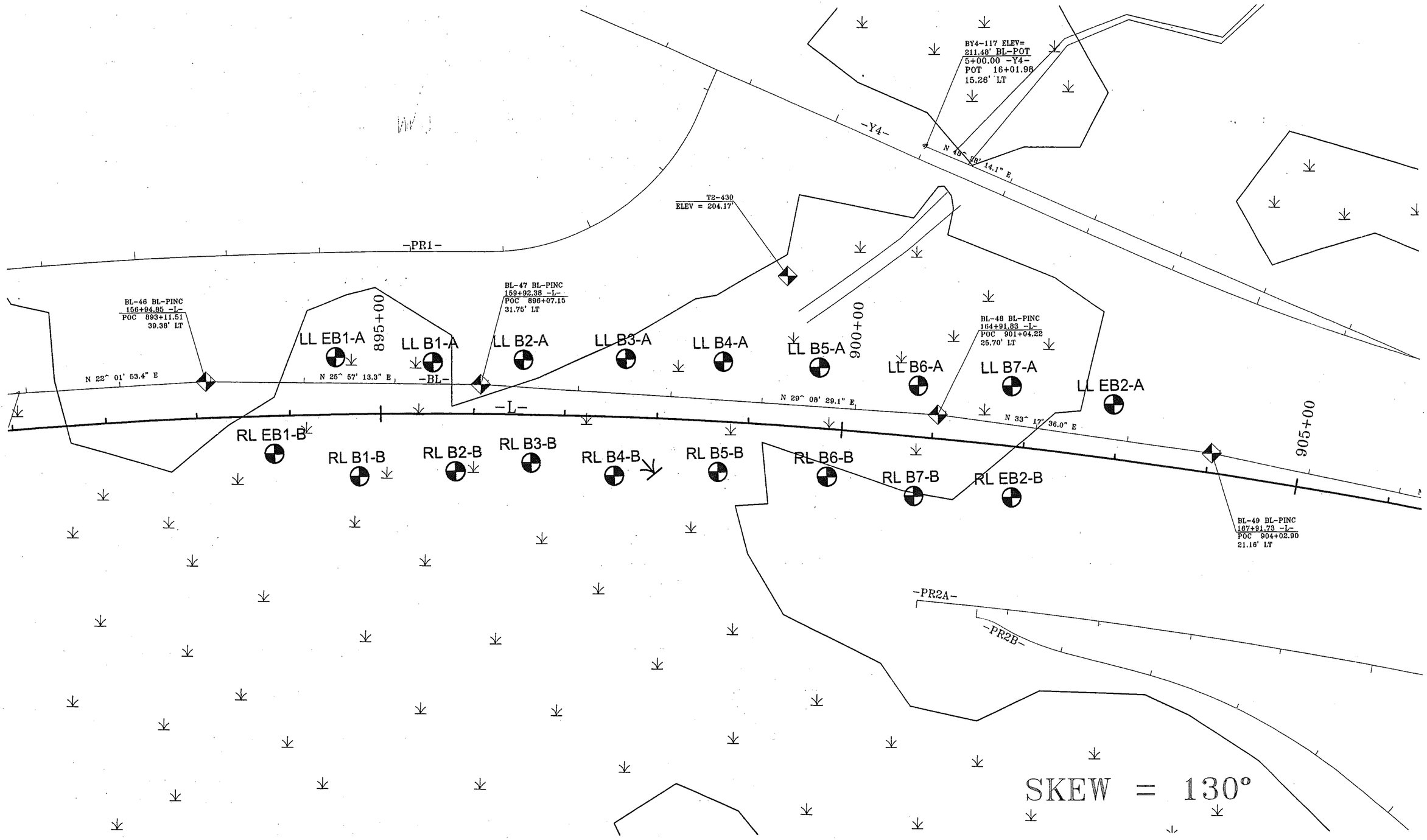

BORING LOCATION PLAN
STRUCTURES 5 & 6: DUAL BRIDGES ON -L- OVER STEWART'S CREEK
PROJECT NCDOT NO. 34817.1.2 (U-2519CB)
F.A. PROJECT NO. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

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RALEIGH, NORTH CAROLINA

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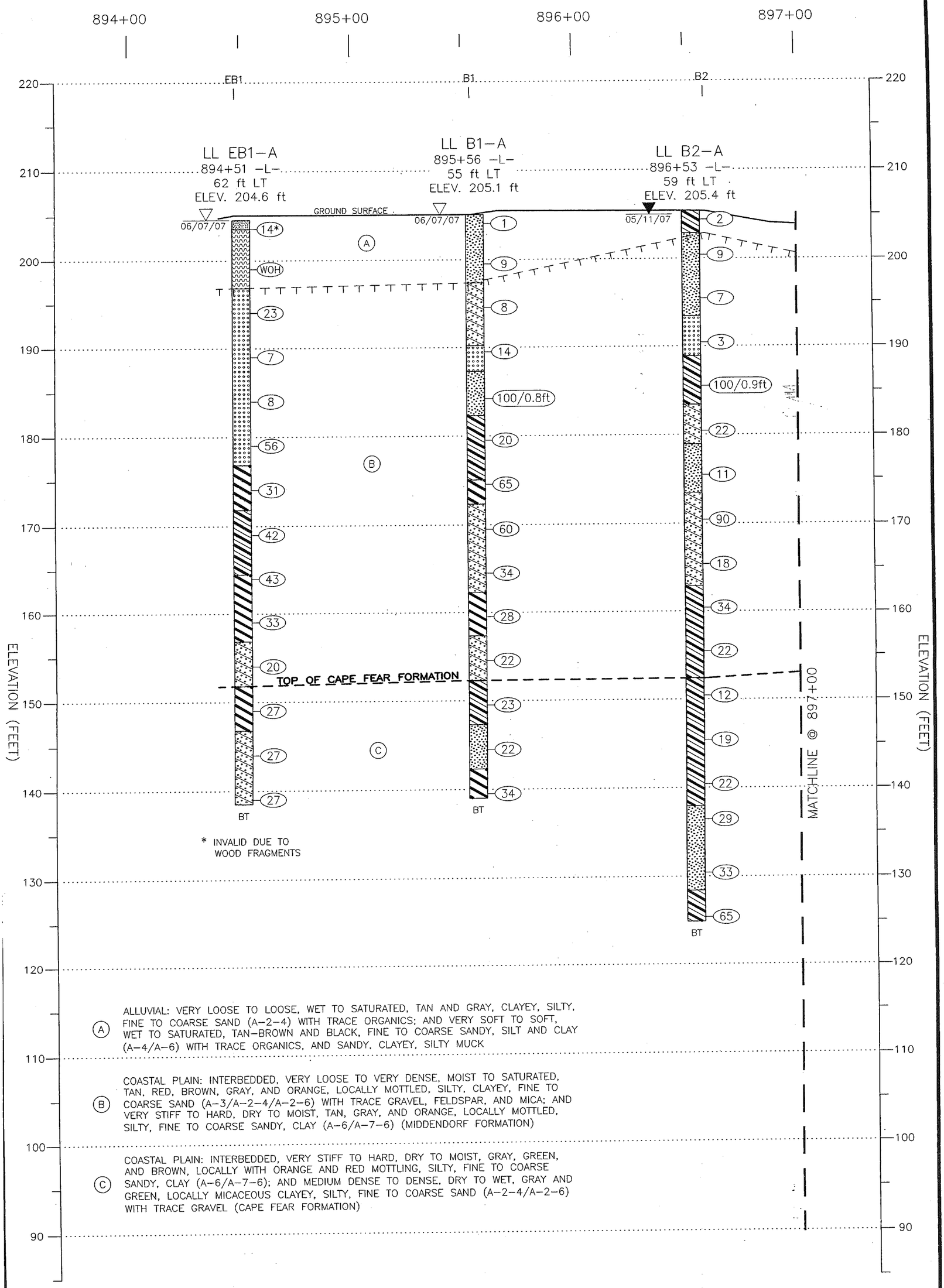
	ENG CHECK: S.J.C.	DWG: 3



(A) ALLUVIAL: VERY LOOSE TO LOOSE, WET TO SATURATED, TAN AND GRAY, CLAYEY, SILTY, FINE TO COARSE SAND (A-2-4) WITH TRACE ORGANICS; AND VERY SOFT TO SOFT, WET TO SATURATED, TAN-BROWN AND BLACK, FINE TO COARSE SANDY, SILT AND CLAY (A-4/A-6) WITH TRACE ORGANICS, AND SANDY, CLAYEY, SILTY MUCK

(B) COASTAL PLAIN: INTERBEDDED, VERY LOOSE TO VERY DENSE, MOIST TO SATURATED, TAN, RED, BROWN, GRAY, AND ORANGE, LOCALLY MOTTLED, SILTY, CLAYEY, FINE TO COARSE SAND (A-3/A-2-4/A-2-6) WITH TRACE GRAVEL, FELDSPAR, AND MICA; AND VERY STIFF TO HARD, DRY TO MOIST, TAN, GRAY, AND ORANGE, LOCALLY MOTTLED, SILTY, FINE TO COARSE SANDY, CLAY (A-6/A-7-6) (MIDDENDORF FORMATION)

(C) COASTAL PLAIN: INTERBEDDED, VERY STIFF TO HARD, DRY TO MOIST, GRAY, GREEN, AND BROWN, LOCALLY WITH ORANGE AND RED MOTTLING, SILTY, FINE TO COARSE SANDY, CLAY (A-6/A-7-6); AND MEDIUM DENSE TO DENSE, DRY TO WET, GRAY AND GREEN, LOCALLY MICACEOUS CLAYEY, SILTY, FINE TO COARSE SAND (A-2-4/A-2-6) WITH TRACE GRAVEL (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 20' 40' 80'
HORIZONTAL SCALE IN FEET
1"=40'

PROFILE 59 FT LEFT OF -L-
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
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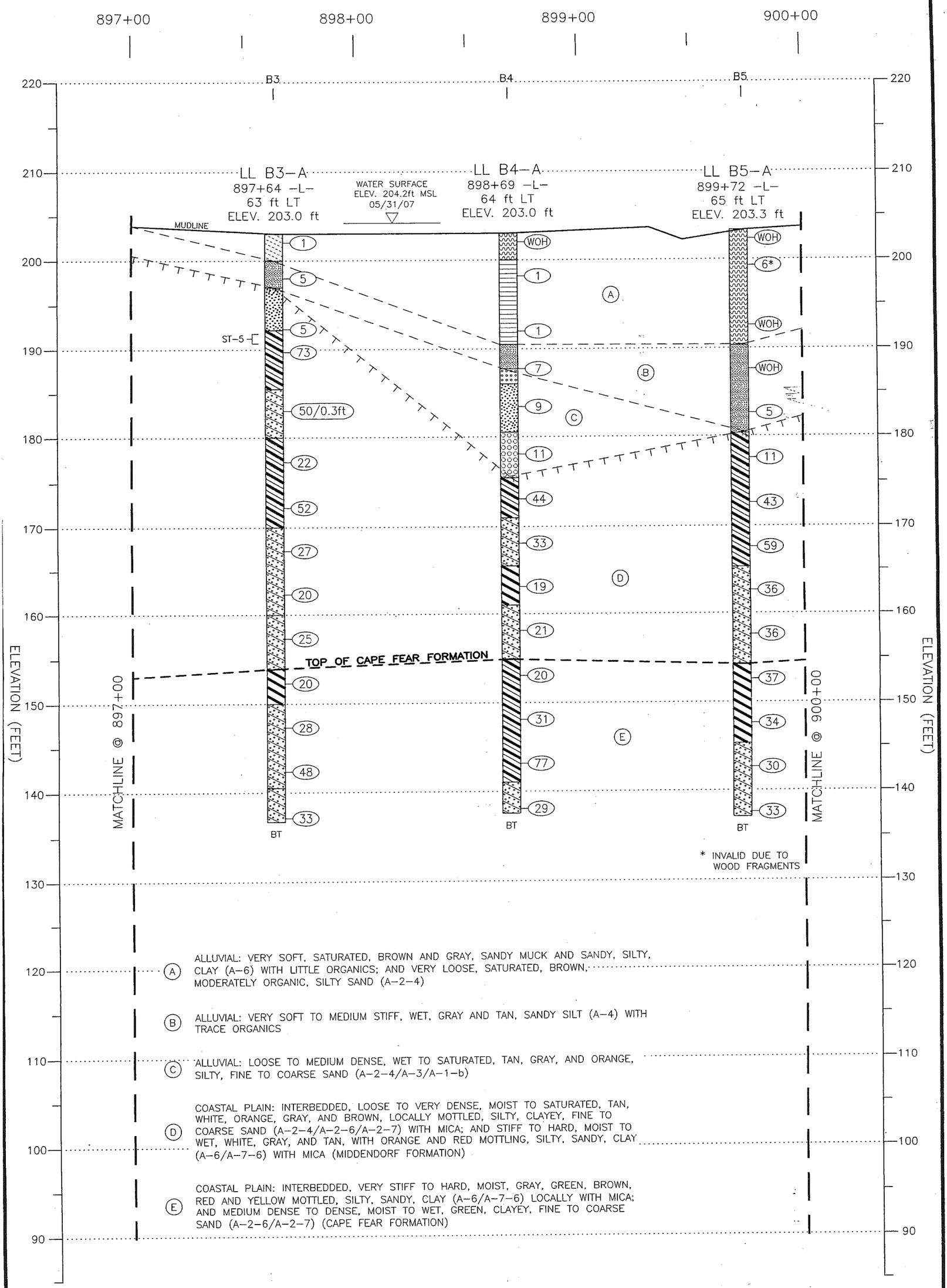
	ENG CHECK: S.J.C.	DWG: 4

SHEET: 7



(A) ALLUVIAL: VERY SOFT, SATURATED, BROWN AND GRAY, SANDY MUCK AND SANDY, SILTY, CLAY (A-6) WITH LITTLE ORGANICS; AND VERY LOOSE, SATURATED, BROWN, MODERATELY ORGANIC, SILTY SAND (A-2-4)

(B) ALLUVIAL: VERY SOFT TO MEDIUM STIFF, WET, GRAY AND TAN, SANDY SILT (A-4) WITH TRACE ORGANICS

(C) ALLUVIAL: LOOSE TO MEDIUM DENSE, WET TO SATURATED, TAN, GRAY, AND ORANGE, SILTY, FINE TO COARSE SAND (A-2-4/A-3/A-1-b)

(D) COASTAL PLAIN: INTERBEDDED, LOOSE TO VERY DENSE, MOIST TO SATURATED, TAN, WHITE, ORANGE, GRAY, AND BROWN, LOCALLY MOTTLED, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-4/A-2-6/A-2-7) WITH MICA; AND STIFF TO HARD, MOIST TO WET, WHITE, GRAY, AND TAN, WITH ORANGE AND RED MOTTLING, SILTY, SANDY, CLAY (A-6/A-7-6) WITH MICA (MIDDENDORF FORMATION)

(E) COASTAL PLAIN: INTERBEDDED, VERY STIFF TO HARD, MOIST, GRAY, GREEN, BROWN, RED AND YELLOW MOTTLED, SILTY, SANDY, CLAY (A-6/A-7-6) LOCALLY WITH MICA; AND MEDIUM DENSE TO DENSE, MOIST TO WET, GREEN, CLAYEY, FINE TO COARSE SAND (A-2-6/A-2-7) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 20' 40' 80'
HORIZONTAL SCALE IN FEET
1"=40'

PROFILE 59 FT LEFT OF -L-
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
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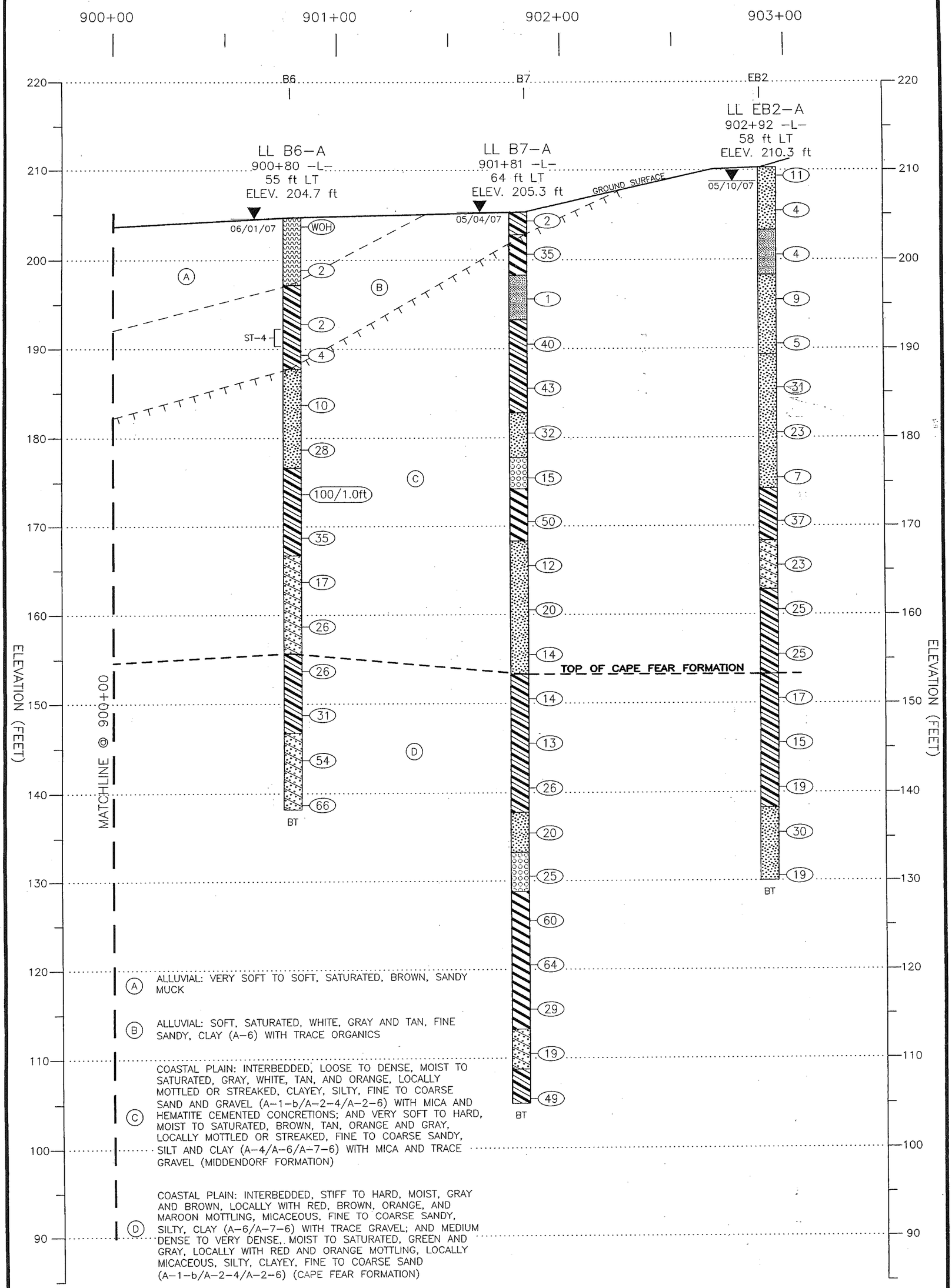

(A) ALLUVIAL: VERY SOFT TO SOFT, SATURATED, BROWN, SANDY MUCK

(B) ALLUVIAL: SOFT, SATURATED, WHITE, GRAY AND TAN, FINE SANDY, CLAY (A-6) WITH TRACE ORGANICS

(C) COASTAL PLAIN: INTERBEDDED, LOOSE TO DENSE, MOIST TO SATURATED, GRAY, WHITE, TAN, AND ORANGE, LOCALLY MOTTLED OR STREAKED, CLAYEY, SILTY, FINE TO COARSE SAND AND GRAVEL (A-1-b/A-2-4/A-2-6) WITH MICA AND HEMATITE CEMENTED CONCRETIONS; AND VERY SOFT TO HARD, MOIST TO SATURATED, BROWN, TAN, ORANGE AND GRAY, LOCALLY MOTTLED OR STREAKED, FINE TO COARSE SANDY, SILT AND CLAY (A-4/A-6/A-7-6) WITH MICA AND TRACE GRAVEL (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED, STIFF TO HARD, MOIST, GRAY AND BROWN, LOCALLY WITH RED, BROWN, ORANGE, AND MAROON MOTTLING, MICACEOUS, FINE TO COARSE SANDY, SILTY, CLAY (A-6/A-7-6) WITH TRACE GRAVEL; AND MEDIUM DENSE TO VERY DENSE, MOIST TO SATURATED, GREEN AND GRAY, LOCALLY WITH RED AND ORANGE MOTTLING, LOCALLY MICACEOUS, SILTY, CLAYEY, FINE TO COARSE SAND (A-1-b/A-2-4/A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 20' 40' 80'
HORIZONTAL SCALE IN FEET
1"=40'

PROFILE 59 FT LEFT OF -L-
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
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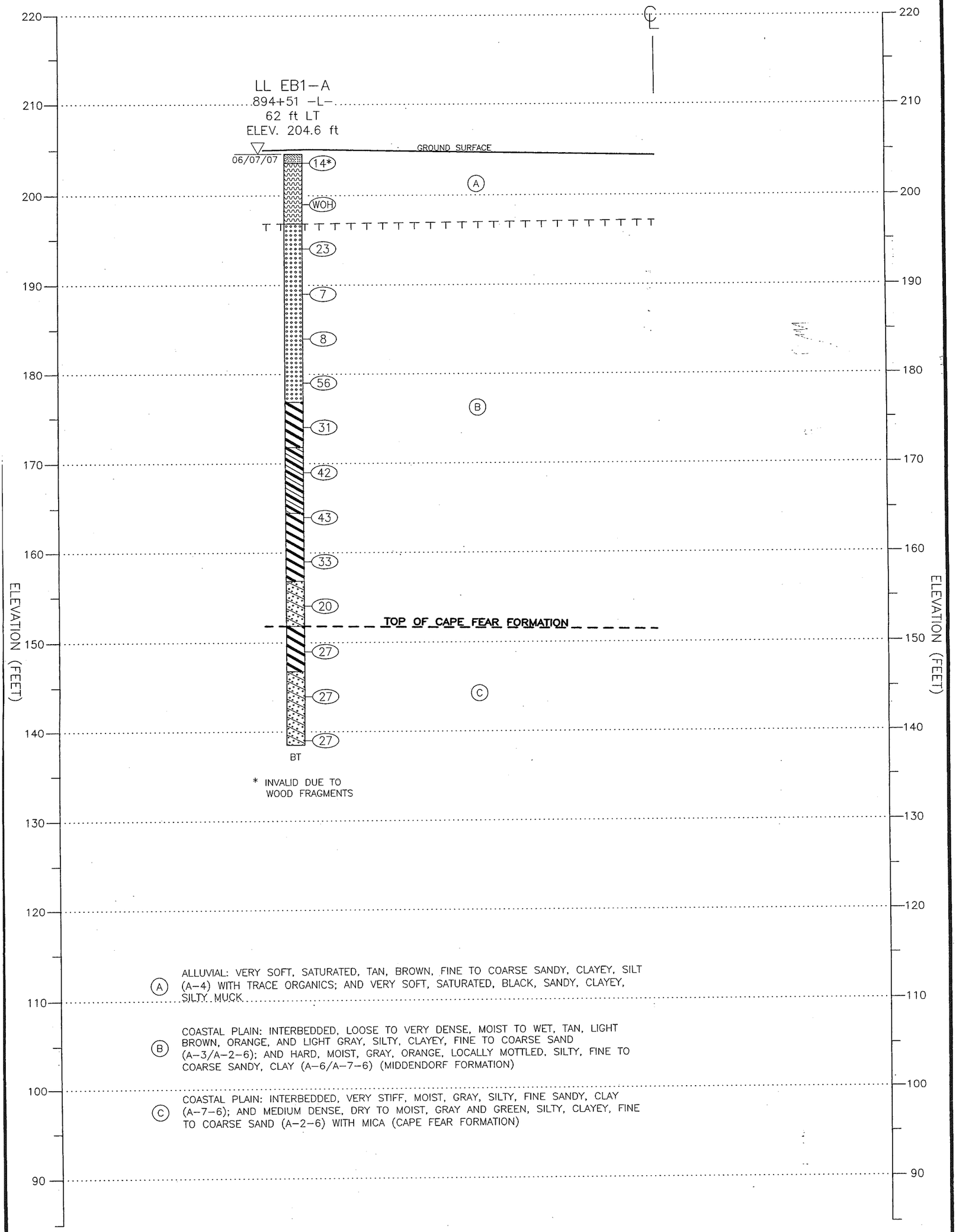

(A) ALLUVIAL: VERY SOFT, SATURATED, TAN, BROWN, FINE TO COARSE SANDY, CLAYEY, SILT (A-4) WITH TRACE ORGANICS; AND VERY SOFT, SATURATED, BLACK, SANDY, CLAYEY, SILTY MUCK

(B) COASTAL PLAIN: INTERBEDDED, LOOSE TO VERY DENSE, MOIST TO WET, TAN, LIGHT BROWN, ORANGE, AND LIGHT GRAY, SILTY, CLAYEY, FINE TO COARSE SAND (A-3/A-2-6); AND HARD, MOIST, GRAY, ORANGE, LOCALLY MOTTLED, SILTY, FINE TO COARSE SANDY, CLAY (A-6/A-7-6) (MIDDENDORF FORMATION)

(C) COASTAL PLAIN: INTERBEDDED, VERY STIFF, MOIST, GRAY, SILTY, FINE SANDY, CLAY (A-7-6); AND MEDIUM DENSE, DRY TO MOIST, GRAY AND GREEN, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-6) WITH MICA (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE END BENT 1
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
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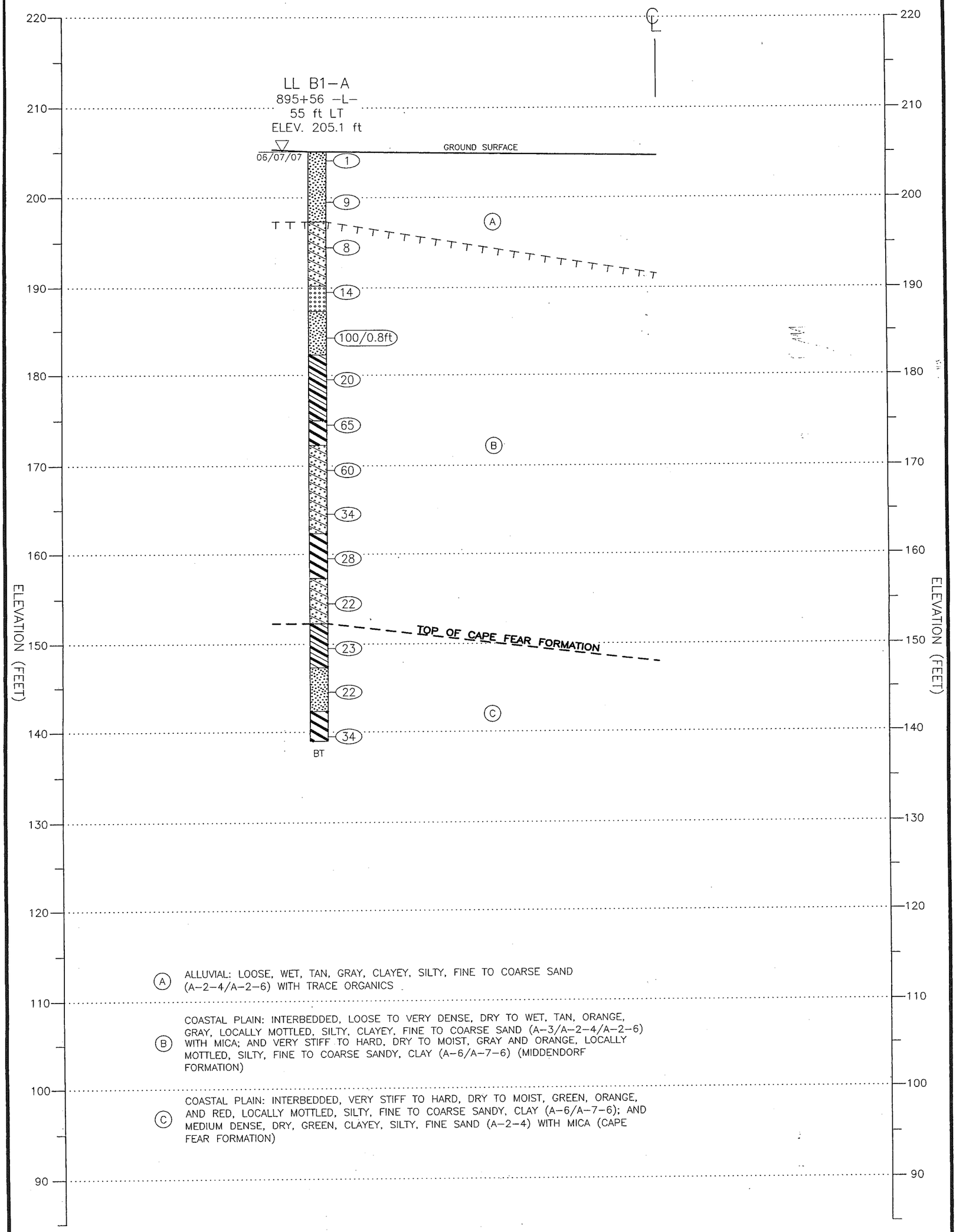

(A) ALLUVIAL: LOOSE, WET, TAN, GRAY, CLAYEY, SILTY, FINE TO COARSE SAND (A-2-4/A-2-6) WITH TRACE ORGANICS

(B) COASTAL PLAIN: INTERBEDDED, LOOSE TO VERY DENSE, DRY TO WET, TAN, ORANGE, GRAY, LOCALLY MOTTLED, SILTY, CLAYEY, FINE TO COARSE SAND (A-3/A-2-4/A-2-6) WITH MICA; AND VERY STIFF TO HARD, DRY TO MOIST, GRAY AND ORANGE, LOCALLY MOTTLED, SILTY, FINE TO COARSE SANDY, CLAY (A-6/A-7-6) (MIDDENDORF FORMATION)

(C) COASTAL PLAIN: INTERBEDDED, VERY STIFF TO HARD, DRY TO MOIST, GREEN, ORANGE, AND RED, LOCALLY MOTTLED, SILTY, FINE TO COARSE SANDY, CLAY (A-6/A-7-6); AND MEDIUM DENSE, DRY, GREEN, CLAYEY, SILTY, FINE SAND (A-2-4) WITH MICA (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 1
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
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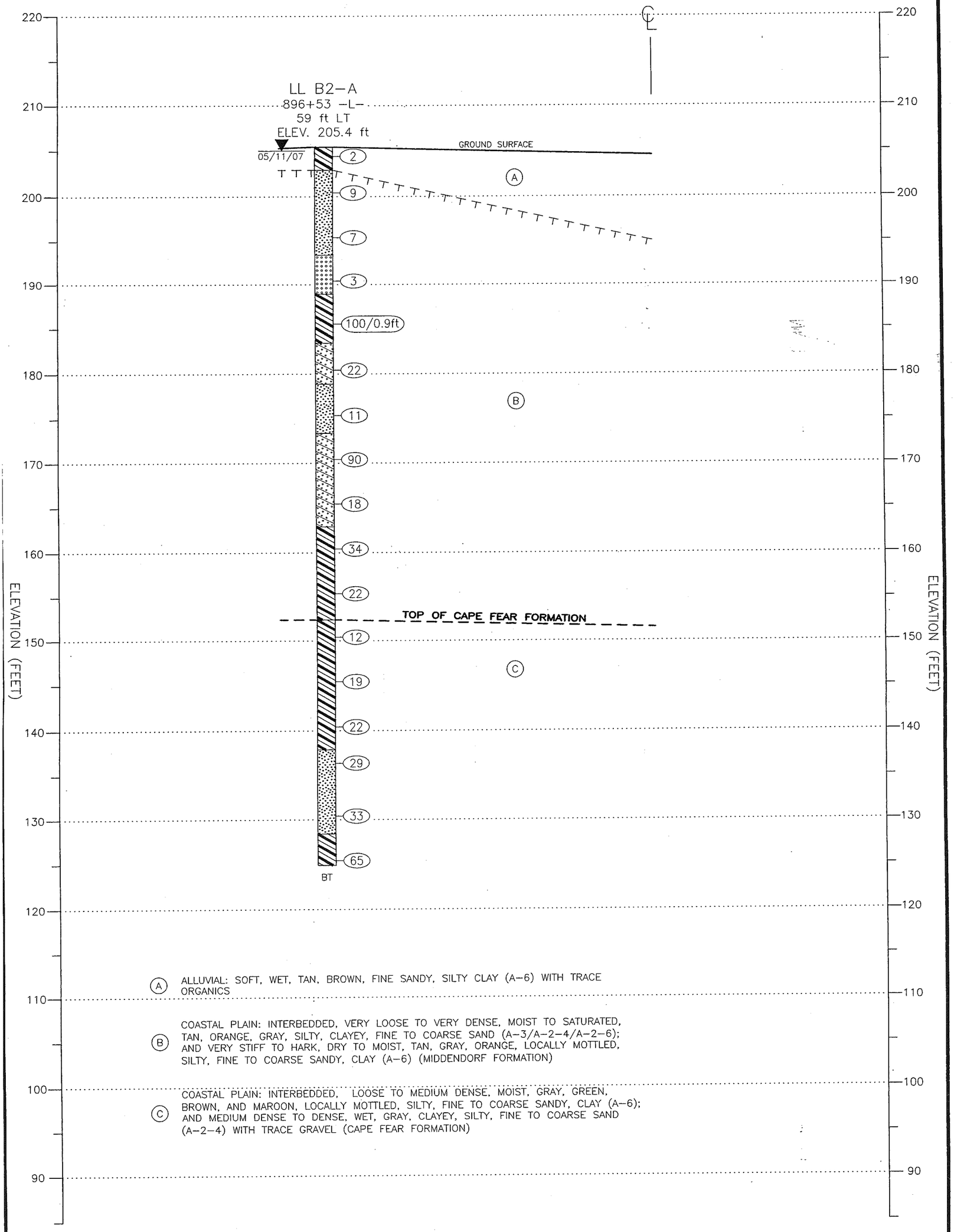
SHEET: 11



(A) ALLUVIAL: SOFT, WET, TAN, BROWN, FINE SANDY, SILTY CLAY (A-6) WITH TRACE ORGANICS

(B) COASTAL PLAIN: INTERBEDDED, VERY LOOSE TO VERY DENSE, MOIST TO SATURATED, TAN, ORANGE, GRAY, SILTY, CLAYEY, FINE TO COARSE SAND (A-3/A-2-4/A-2-6); AND VERY STIFF TO HARK, DRY TO MOIST, TAN, GRAY, ORANGE, LOCALLY MOTTLED, SILTY, FINE TO COARSE SANDY, CLAY (A-6) (MIDDENDORF FORMATION)

(C) COASTAL PLAIN: INTERBEDDED, LOOSE TO MEDIUM DENSE, MOIST, GRAY, GREEN, BROWN, AND MAROON, LOCALLY MOTTLED, SILTY, FINE TO COARSE SANDY, CLAY (A-6); AND MEDIUM DENSE TO DENSE, WET, GRAY, CLAYEY, SILTY, FINE TO COARSE SAND (A-2-4) WITH TRACE GRAVEL (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 2
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
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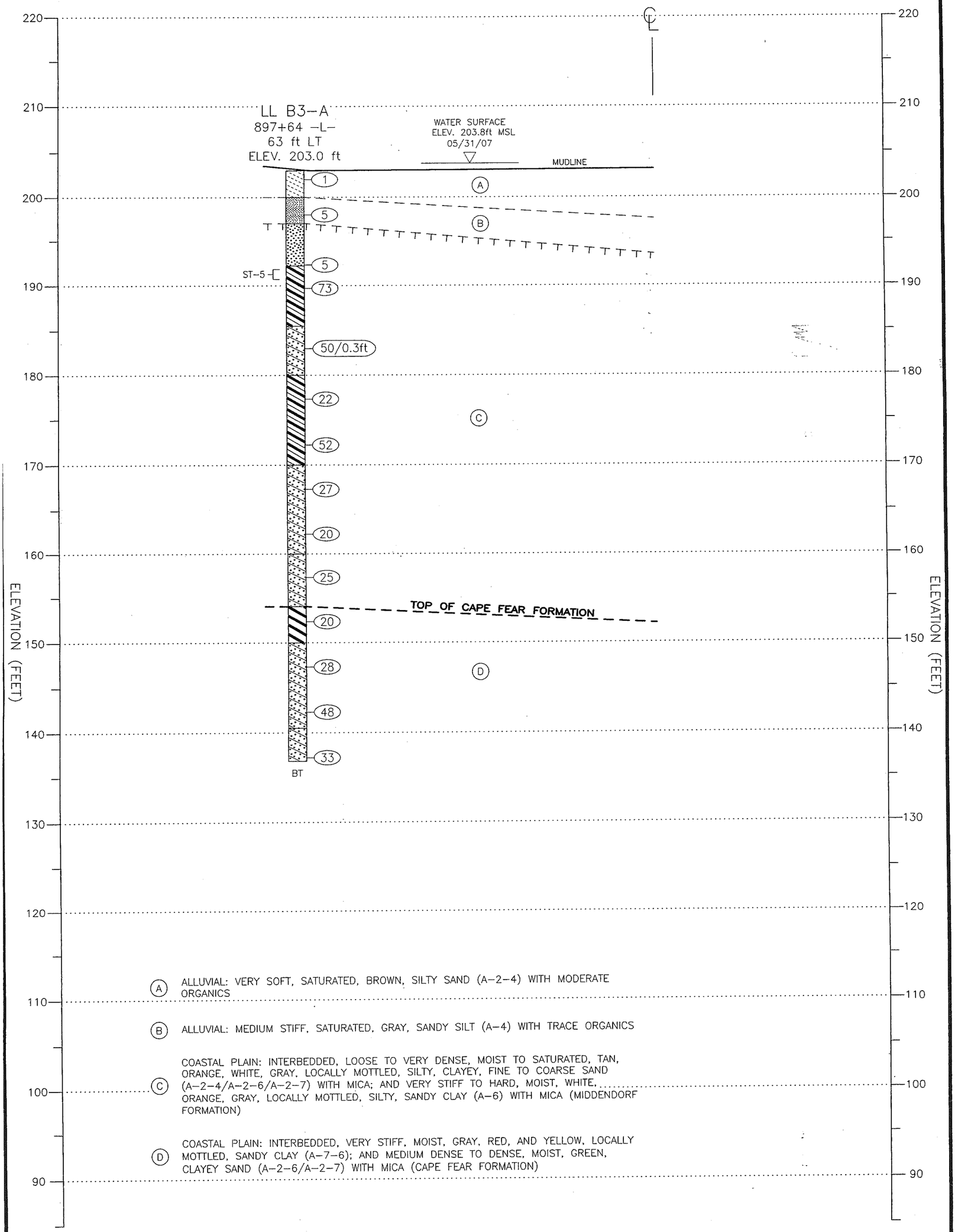
SHEET: 12



(A) ALLUVIAL: VERY SOFT, SATURATED, BROWN, SILTY SAND (A-2-4) WITH MODERATE ORGANICS

(B) ALLUVIAL: MEDIUM STIFF, SATURATED, GRAY, SANDY SILT (A-4) WITH TRACE ORGANICS

(C) COASTAL PLAIN: INTERBEDDED, LOOSE TO VERY DENSE, MOIST TO SATURATED, TAN, ORANGE, WHITE, GRAY, LOCALLY MOTTLED, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-4/A-2-6/A-2-7) WITH MICA; AND VERY STIFF TO HARD, MOIST, WHITE, ORANGE, GRAY, LOCALLY MOTTLED, SILTY, SANDY CLAY (A-6) WITH MICA (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED, VERY STIFF, MOIST, GRAY, RED, AND YELLOW, LOCALLY MOTTLED, SANDY CLAY (A-7-6); AND MEDIUM DENSE TO DENSE, MOIST, GREEN, CLAYEY SAND (A-2-6/A-2-7) WITH MICA (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

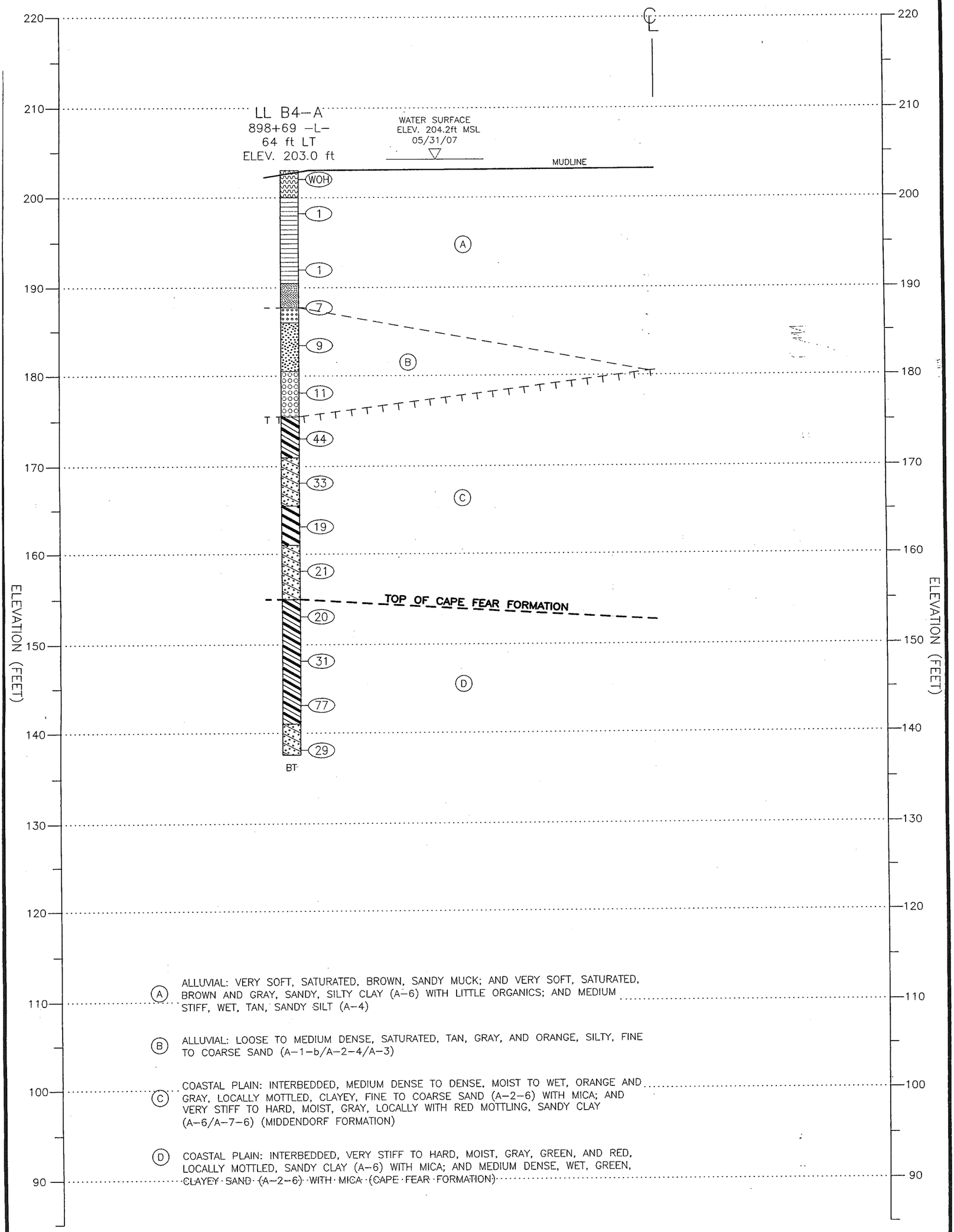
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 3
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 06/22/07
	DFT CHECK: W.B.D.	JOB: 6468-07-1685
	ENG CHECK: S.J.C.	DWG: 10

SHEET: 13



(A) ALLUVIAL: VERY SOFT, SATURATED, BROWN, SANDY MUCK; AND VERY SOFT, SATURATED, BROWN AND GRAY, SANDY, SILTY CLAY (A-6) WITH LITTLE ORGANICS; AND MEDIUM STIFF, WET, TAN, SANDY SILT (A-4)

(B) ALLUVIAL: LOOSE TO MEDIUM DENSE, SATURATED, TAN, GRAY, AND ORANGE, SILTY, FINE TO COARSE SAND (A-1-b/A-2-4/A-3)

(C) COASTAL PLAIN: INTERBEDDED, MEDIUM DENSE TO DENSE, MOIST TO WET, ORANGE AND GRAY, LOCALLY MOTTLED, CLAYEY, FINE TO COARSE SAND (A-2-6) WITH MICA; AND VERY STIFF TO HARD, MOIST, GRAY, LOCALLY WITH RED MOTTLING, SANDY CLAY (A-6/A-7-6) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED, VERY STIFF TO HARD, MOIST, GRAY, GREEN, AND RED, LOCALLY MOTTLED, SANDY CLAY (A-6) WITH MICA; AND MEDIUM DENSE, WET, GREEN, CLAYEY SAND (A-2-6) WITH MICA (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

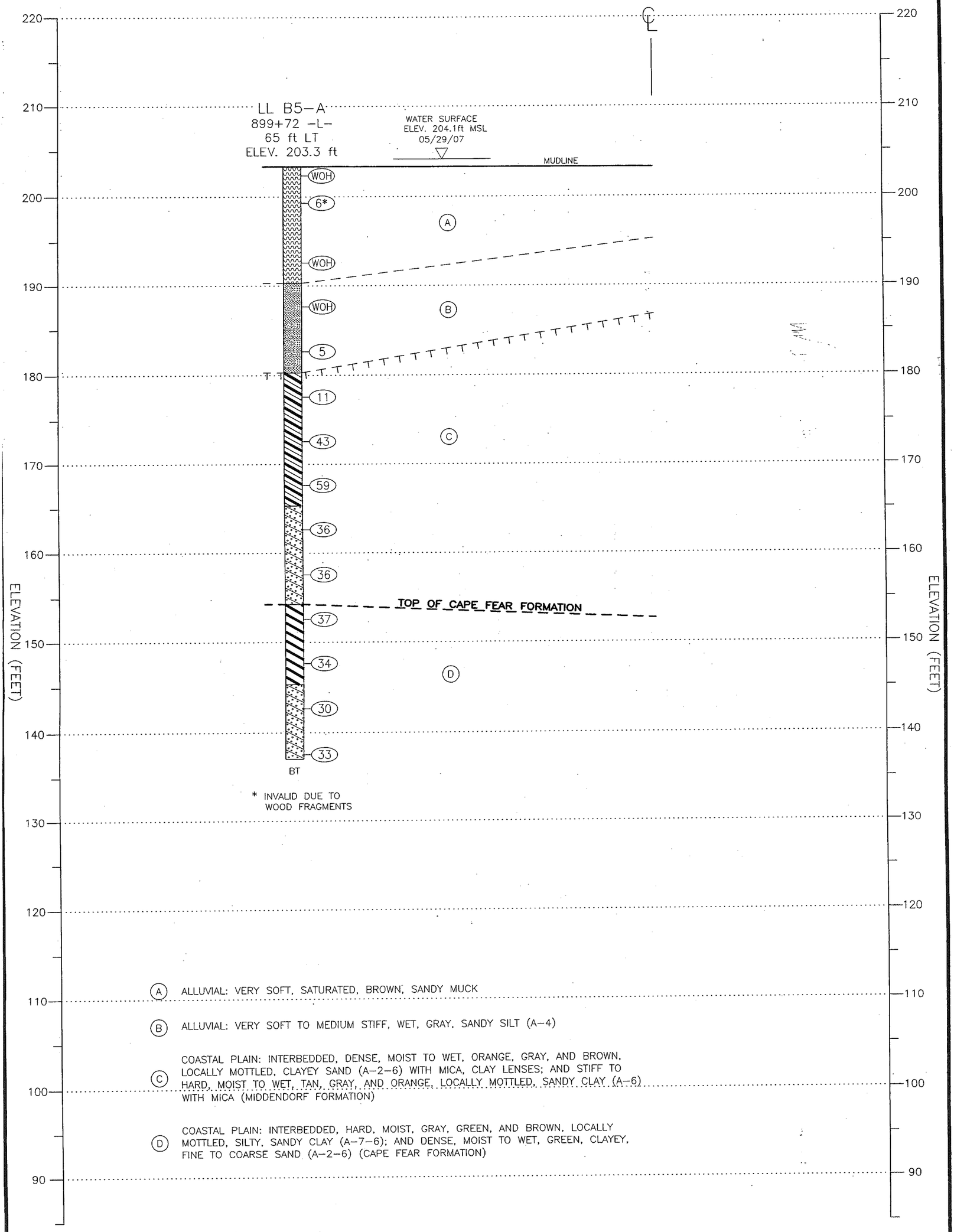
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 4
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 06/22/07
	DFT CHECK: W.B.D.	JOB: 6468-07-1685
	ENG CHECK: S.J.C.	DWG: 11

SHEET: 14



(A) ALLUVIAL: VERY SOFT, SATURATED, BROWN, SANDY MUCK

(B) ALLUVIAL: VERY SOFT TO MEDIUM STIFF, WET, GRAY, SANDY SILT (A-4)

(C) COASTAL PLAIN: INTERBEDDED, DENSE, MOIST TO WET, ORANGE, GRAY, AND BROWN, LOCALLY MOTTLED, CLAYEY SAND (A-2-6) WITH MICA, CLAY LENSES; AND STIFF TO HARD, MOIST TO WET, TAN, GRAY, AND ORANGE, LOCALLY MOTTLED, SANDY CLAY (A-6) WITH MICA (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED, HARD, MOIST, GRAY, GREEN, AND BROWN, LOCALLY MOTTLED, SILTY, SANDY CLAY (A-7-6); AND DENSE, MOIST TO WET, GREEN, CLAYEY, FINE TO COARSE SAND (A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

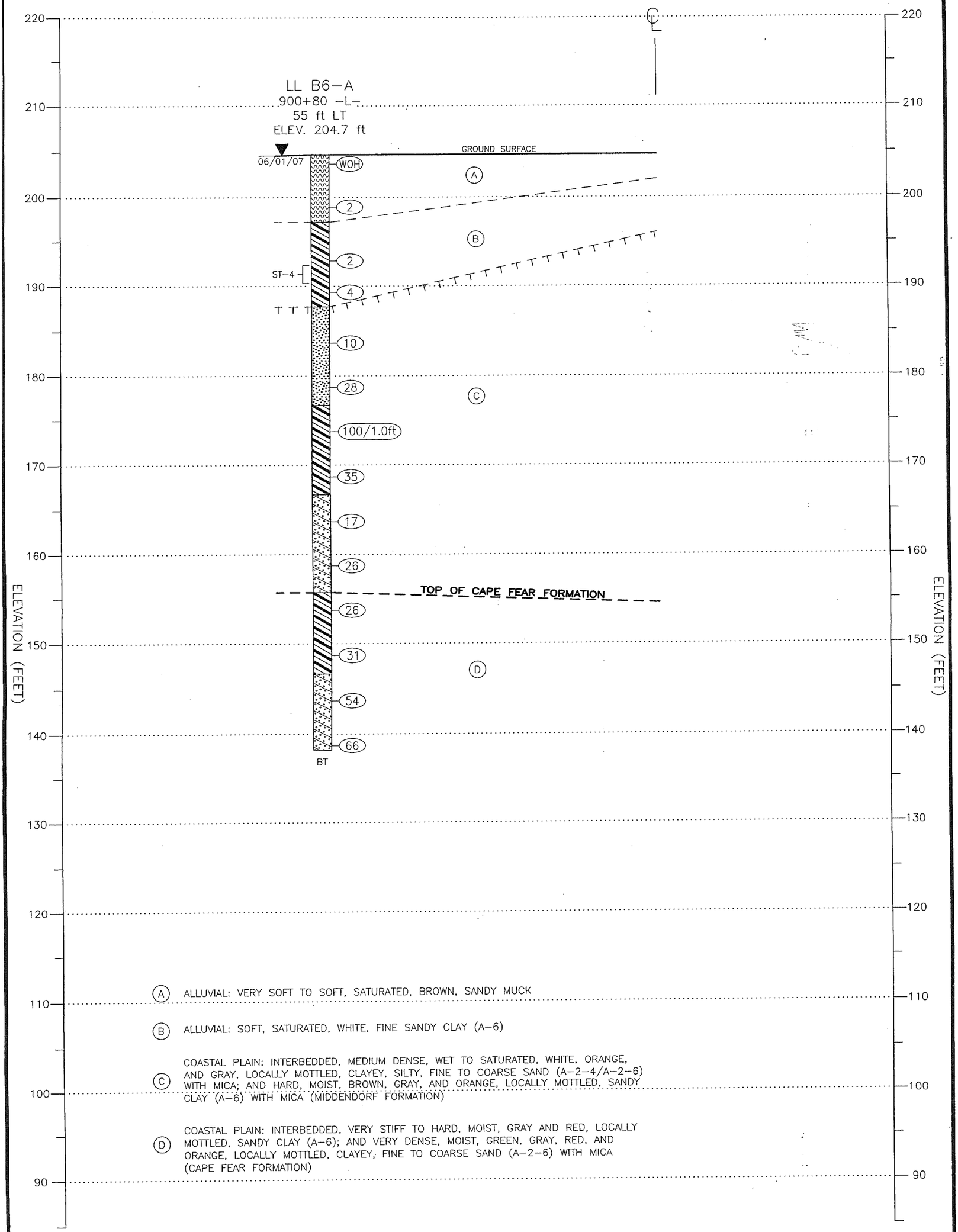
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 5
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 06/22/07
	DFT CHECK: W.B.D.	JOB: 6468-07-1685
	ENG CHECK: S.J.C.	DWG: 12

SHEET: 15



(A) ALLUVIAL: VERY SOFT TO SOFT, SATURATED, BROWN, SANDY MUCK

(B) ALLUVIAL: SOFT, SATURATED, WHITE, FINE SANDY CLAY (A-6)

(C) COASTAL PLAIN: INTERBEDDED, MEDIUM DENSE, WET TO SATURATED, WHITE, ORANGE, AND GRAY, LOCALLY MOTTLED, CLAYEY, SILTY, FINE TO COARSE SAND (A-2-4/A-2-6) WITH MICA; AND HARD, MOIST, BROWN, GRAY, AND ORANGE, LOCALLY MOTTLED, SANDY CLAY (A-6) WITH MICA (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED, VERY STIFF TO HARD, MOIST, GRAY AND RED, LOCALLY MOTTLED, SANDY CLAY (A-6); AND VERY DENSE, MOIST, GREEN, GRAY, RED, AND ORANGE, LOCALLY MOTTLED, CLAYEY, FINE TO COARSE SAND (A-2-6) WITH MICA (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

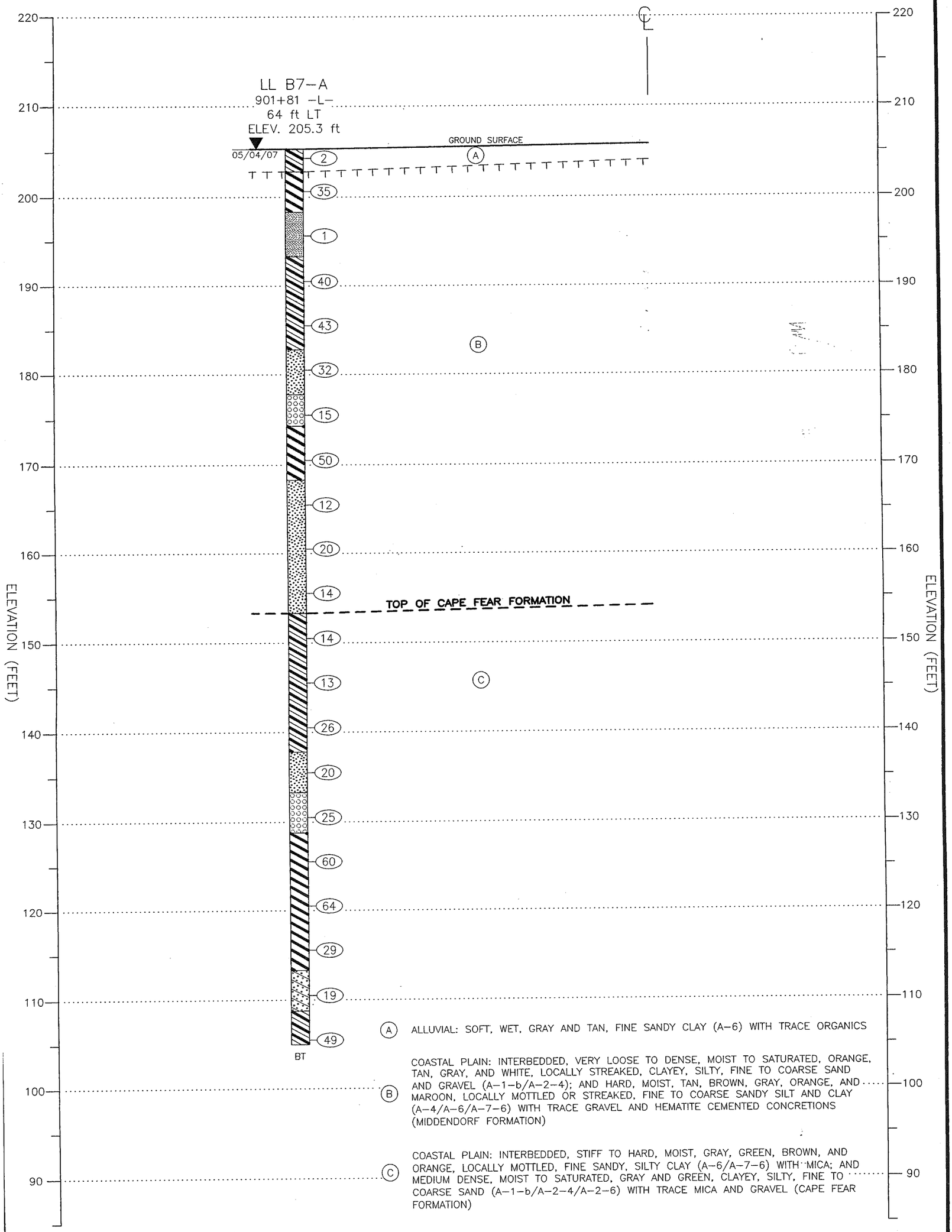
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 6
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 06/22/07
	DFT CHECK: W.B.D.	JOB: 6468-07-1685
	ENG CHECK: S.J.C.	DWG: 13

SHEET: 16



(A) ALLUVIAL: SOFT, WET, GRAY AND TAN, FINE SANDY CLAY (A-6) WITH TRACE ORGANICS

(B) COASTAL PLAIN: INTERBEDDED, VERY LOOSE TO DENSE, MOIST TO SATURATED, ORANGE, TAN, GRAY, AND WHITE, LOCALLY STREAKED, CLAYEY, SILTY, FINE TO COARSE SAND AND GRAVEL (A-1-b/A-2-4); AND HARD, MOIST, TAN, BROWN, GRAY, ORANGE, AND MAROON, LOCALLY MOTTLED OR STREAKED, FINE TO COARSE SANDY SILT AND CLAY (A-4/A-6/A-7-6) WITH TRACE GRAVEL AND HEMATITE CEMENTED CONCRETIONS (MIDDENDORF FORMATION)

(C) COASTAL PLAIN: INTERBEDDED, STIFF TO HARD, MOIST, GRAY, GREEN, BROWN, AND ORANGE, LOCALLY MOTTLED, FINE SANDY, SILTY CLAY (A-6/A-7-6) WITH MICA; AND MEDIUM DENSE, MOIST TO SATURATED, GRAY AND GREEN, CLAYEY, SILTY, FINE TO COARSE SAND (A-1-b/A-2-4/A-2-6) WITH TRACE MICA AND GRAVEL (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

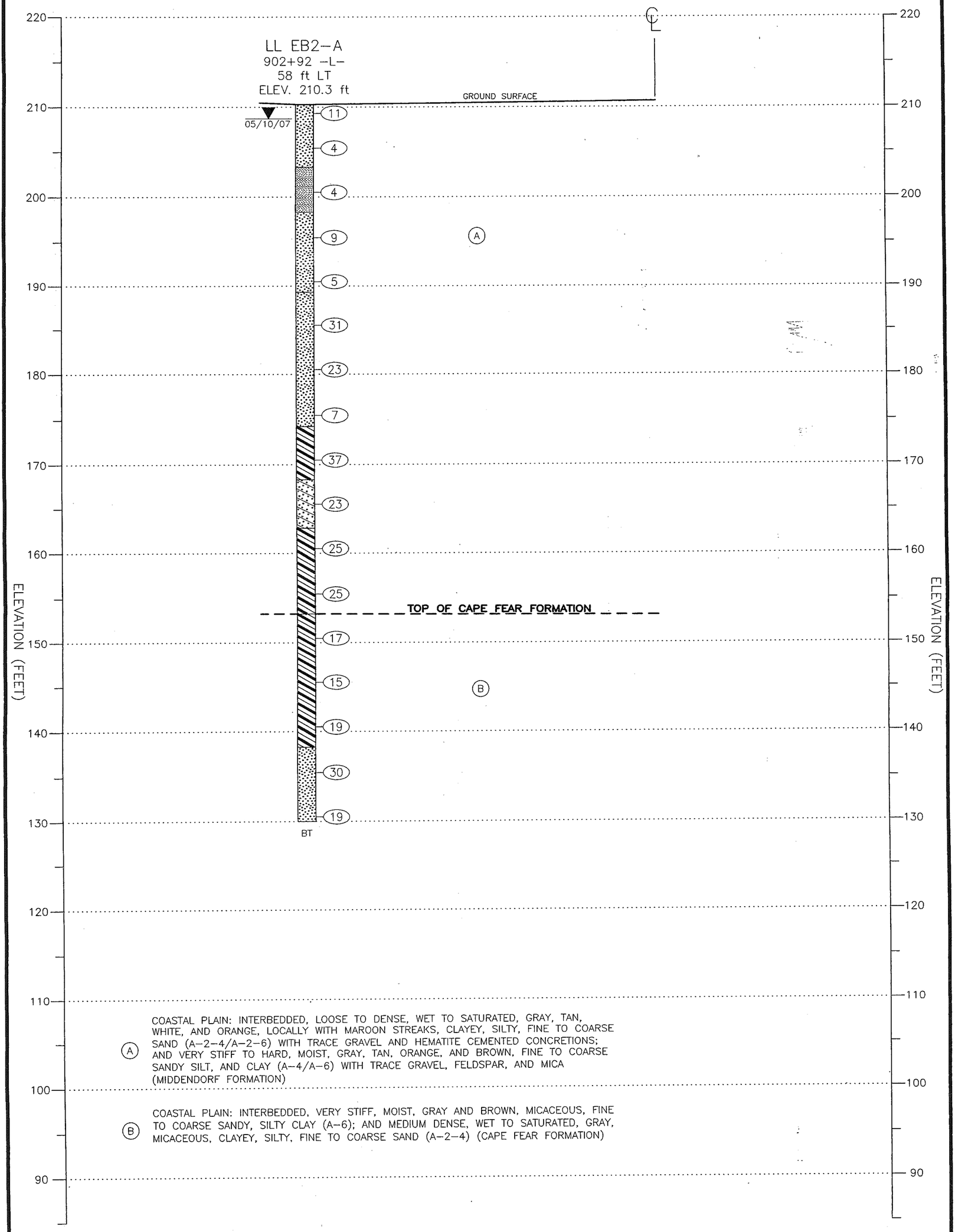
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE BENT 7
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 06/22/07
	DFT CHECK: W.B.D.	JOB: 6468-07-1685
	ENG CHECK: S.J.C.	DWG: 14

SHEET: 17



0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG LEFT LANE END BENT 2
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 06/22/07
	DFT CHECK: W.B.D.	JOB: 6468-07-1685
	ENG CHECK: S.J.C.	DWG: 15

SHEET: 18

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			**GROUND WTR (ft)**
BORING NO. LL EB1-A	**STATION** 894+51	**OFFSET** 62ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 204.6 ft	**TOTAL DEPTH** 66.1 ft	**NORTHING** 490,671	**EASTING** 1,992,551
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 06/07/07	**COMP. DATE** 06/07/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

GROUND WTR (ft): 0 HR. 0.0; 24 HR. ND

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))
205									
204.6	0.0	2	7	7	Invalid due to wood 14		Sat.		204.6 / 0.0 GROUND SURFACE
									203.6 / 1.0 ALLUVIAL: Tan-brown, fine to coarse sandy, clayey, SILT (A-4) with trace organics
200.0	4.6	WOH	WOH	WOH	WOH 0		Sat.		ALLUVIAL: Black, sandy, clayey, silty MUCK
									196.8 / 7.8 COASTAL PLAIN: Tan-orange to light brown-orange, silty, clayey, fine to coarse SAND (A-3) (Middendorf Formation)
195.0	9.6	10	11	12	23		W		
190.0	14.6	1	3	4	7		W		
185.0	19.6	3	4	4	8		W		
180.0	24.6	15	26	30	56		W		
									176.8 / 27.8 COASTAL PLAIN: Light gray, silty, fine to coarse sandy, CLAY (A-7-6) (Middendorf Formation)
175.0	29.6	4	6	25	31		M		
									171.8 / 32.8 COASTAL PLAIN: Gray with orange mottling, silty, fine to coarse sandy, CLAY (A-6) (Middendorf Formation)
170.0	34.6	11	18	24	42		M		
165.0	39.6	12	16	27	43		M		
									164.5 / 40.1 COASTAL PLAIN: Dark gray to light gray, silty, fine sandy CLAY (A-7-6) (Middendorf Formation)
160.0	44.6	8	13	20	33		M		
									156.8 / 47.8 COASTAL PLAIN: Light gray, silty, clayey, fine to coarse SAND (A-2-6) (Middendorf Formation)
155.0	49.6	8	10	10	20		M		
									151.8 / 52.8 COASTAL PLAIN: Light gray, silty, fine sandy, CLAY (A-7-6) (Cape Fear Formation)
150.0	54.6	7	12	15	27		M		
									146.8 / 57.8 COASTAL PLAIN: Light greenish gray to green, micaceous, silty, clayey, fine to coarse SAND (A-2-6) (Cape Fear Formation)
145.0	59.6	7	11	16	27		M		
140.0	64.6	17	13	14	27		D		138.5 / 66.1 Boring Terminated at Elevation 138.5 ft in Coastal Plain: Medium dense, silty, clayey, fine to coarse SAND (A-2-6) (Cape Fear Formation)

Bits Used: 3" Side Discharge
Drilling Fluid Properties: 9.0 lbs/gal
Casing Depth (4"): 14.6 ft

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			**GROUND WTR (ft)**
BORING NO. LL B1-A	**STATION** 895+56	**OFFSET** 55ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 205.1 ft	**TOTAL DEPTH** 66.1 ft	**NORTHING** 490,765	**EASTING** 1,992,603
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 06/07/07	**COMP. DATE** 06/07/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

GROUND WTR (ft): 0 HR. 0.0; 24 HR. ND

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))
210									
205.1	0.0								205.1 / 0.0 GROUND SURFACE
		1	WOH	1	1		W		ALLUVIAL: Tan and gray, clayey, silty, fine to coarse SAND (A-2-4) with trace organics
200.5	4.6	6	6	3	9		W		
									197.3 / 7.8 COASTAL PLAIN: Tan, silty, clayey, fine SAND (A-2-6) (Middendorf Formation)
195.5	9.6	5	5	3	8		W		
190.5	14.6	5	6	8	14		W		190.2 / 14.9 COASTAL PLAIN: Orange, silty, fine to coarse SAND (A-3) (Middendorf Formation)
									187.3 / 17.8 COASTAL PLAIN: Light gray with orange and red mottling, clayey, silty, fine SAND (A-2-4) (Middendorf Formation)
185.5	19.6	24	49	51/0.3	100/0.8		M		
									182.3 / 22.8 COASTAL PLAIN: Light gray with orange mottling, silty, sandy, CLAY (A-6) (Middendorf Formation)
180.5	24.6	8	9	11	20		M		
175.5	29.6	5	23	42	65		D		175.0 / 30.1 COASTAL PLAIN: Dark gray with orange mottling, silty, fine sandy CLAY (A-7-6) (Middendorf Formation)
									172.3 / 32.8 COASTAL PLAIN: Light gray with orange mottling, micaceous, silty, clayey, fine to coarse SAND (A-2-6) (Middendorf Formation)
170.5	34.6	29	30	30	60		D		
165.5	39.6	15	17	17	34		M		
									162.3 / 42.8 COASTAL PLAIN: Dark gray, micaceous, silty, fine to coarse sandy CLAY (A-7-6) (Middendorf Formation)
160.5	44.6	8	12	16	28		M		
									157.3 / 47.8 COASTAL PLAIN: Light gray, silty, clayey, fine to coarse SAND (A-2-6) (Middendorf Formation)
155.5	49.6	9	11	11	22		W		
									152.3 / 52.8 COASTAL PLAIN: Light green with orange mottling, silty, fine to coarse sandy, CLAY (A-6) (Cape Fear Formation)
150.5	54.6	10	10	13	23		M		
									147.3 / 57.8 COASTAL PLAIN: Light green, micaceous, clayey, silty, fine SAND (A-2-4) (Cape Fear Formation)
145.5	59.6	7	10	12	22		D		
									142.3 / 62.8 COASTAL PLAIN: Green with orange and red mottling, fine sandy, silty CLAY (A-7-6) (Cape Fear Formation)
140.5	64.6	14	16	18	34		D		139.0 / 66.1 Boring Terminated at Elevation 139.0 ft in Coastal Plain: Hard, fine sandy, silty CLAY (A-7-6) (Cape Fear Formation)

Bits Used: 3" Side Discharge
Drilling Fluid Properties: 9.2 lbs/gal
Casing Depth (4"): 10.2 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST M. Lear
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			GROUND WTR (ft)
BORING NO. LL B2-A	STATION 896+53	OFFSET 59ft LT	ALIGNMENT -L-
COLLAR ELEV. 205.4 ft	TOTAL DEPTH 80.5 ft	NORTHING 490,855	EASTING 1,992,642
DRILL MACHINE CME-55LC	DRILL METHOD Mud Rotary		HAMMER TYPE Automatic
START DATE 05/09/07	COMP. DATE 05/10/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

GROUND WTR (ft)	
0 HR.	1.8
24 HR.	0.4

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)
210										
205.4	0.0						W		205.4 GROUND SURFACE	0.0
201.4	4.0	1	1	1	2		W		**ALLUVIAL** Tan-brown, fine sandy, silty CLAY (A-6) with trace organics 202.9	2.5
196.4	9.0	3	4	5	9		Sat.		**COASTAL PLAIN** Tan-orange and gray, silty, fine to coarse SAND (A-2-4) (Middendorf Formation)	
191.4	14.0	4	4	3	7		Sat.		193.4	12.0
186.4	19.0	3	1	2	3		Sat.		**COASTAL PLAIN** Orange and tan, silty, fine to coarse SAND (A-3) with trace gravel (Middendorf Formation) 188.9	16.5
181.4	24.0	33	67/0.4		100/0.9		D/M		**COASTAL PLAIN** Tan, fine sandy, silty CLAY (A-6) (Middendorf Formation) 183.4	22.0
176.4	29.0	13	12	10	22		M		**COASTAL PLAIN** Gray and tan, silty, clayey, fine to coarse SAND (A-2-6) (Middendorf Formation) 178.9	26.5
171.4	34.0	4	5	6	11		W		**COASTAL PLAIN** Tan and orange, clayey, silty, fine to coarse SAND (A-2-4) with trace gravel (Middendorf Formation) 173.4	32.0
166.4	39.0	21	36	54	90		W		**COASTAL PLAIN** Tan, gray, and orange, silty, clayey, fine to coarse SAND (A-2-6) with trace gravel (Middendorf Formation)	
161.4	44.0	8	9	9	18		W		162.9	42.5
156.4	49.0	8	14	20	34		M		**COASTAL PLAIN** Gray with tan and orange streaks, silty, fine to coarse sandy, CLAY (A-6) with trace gravel, feldspar, mica (Middendorf Formation)	
151.4	54.0	6	11	11	22		M		152.4	53.0
146.4	59.0	4	5	7	12		M		**COASTAL PLAIN** Dark gray, gray-green, gray, and brown, locally with maroon streaks or mottling, silty, fine to coarse sandy, CLAY (A-6) (Cape Fear Formation)	
141.4	64.0	6	9	10	19		M			
137.4	68.0	11	11	11	22		M		137.9	67.5
131.4	74.0	7	12	17	29		W		**COASTAL PLAIN** Gray, clayey, silty, fine to coarse SAND (A-2-4) with trace gravel (Cape Fear Formation)	
		11	16	17	33		W			

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST M. Lear
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			GROUND WTR (ft)
BORING NO. LL B2-A	STATION 896+53	OFFSET 59ft LT	ALIGNMENT -L-
COLLAR ELEV. 205.4 ft	TOTAL DEPTH 80.5 ft	NORTHING 490,855	EASTING 1,992,642
DRILL MACHINE CME-55LC	DRILL METHOD Mud Rotary		HAMMER TYPE Automatic
START DATE 05/09/07	COMP. DATE 05/10/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

GROUND WTR (ft)	
0 HR.	1.8
24 HR.	0.4

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
130					Match Line				
126.4	79.0	13	27	38	65		M		128.4 **COASTAL PLAIN** Dark gray, sandy, silty, CLAY (A-6) (Cape Fear Formation) 124.9 — 77.0 / 80.5

Boring Terminated at Elevation 124.9 ft in Coastal Plain: Hard, sandy, silty, CLAY (A-6) (Cape Fear Formation)

Bits Used: 3" Roller Cone
Drilling Fluid Properties: 8.6 lbs/gal
Casing Depth (3"): 18.5 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** J. Howard
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			**GROUND WTR (ft)**
BORING NO. LL B3-A	**STATION** 897+64	**OFFSET** 63ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 203.0 ft	**TOTAL DEPTH** 66.2 ft	**NORTHING** 490,956	**EASTING** 1,992,689
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 05/31/07	**COMP. DATE** 05/31/07	**SURFACE WATER DEPTH** 0.8ft	**DEPTH TO ROCK** N/A

GROUND WTR (ft)	
0 HR.	Water
24 HR.	Boring

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))
205									
203.0	0.0								MUDLINE 0.0
		WOH	WOH	1	1	SS-1	Sat.		**ALLUVIAL** Brown, moderately organic, silty SAND (A-2-4) Organic Content (SS-1)= 8.3% — 200.0 / 3.0
199.0	4.0								**ALLUVIAL** Light gray, sandy SILT (A-4) with trace organics — 197.0 / 6.0
		WOH	2	3	5	SS-2	21%		**COASTAL PLAIN** Tan-orange, silty, fine to coarse SAND (A-2-4) (Middendorf Formation)
193.3	9.7								192.2 / 10.8
190.7	12.3	1	2	3	5		W		**COASTAL PLAIN** White, with orange mottling, sandy CLAY (A-6) (Middendorf Formation)
		20	31	42	73		M		Pushed Shelby tube ST-5 from 11.2 to 12.3 feet, recovery=100% — 185.5 / 17.5
183.3	19.7								**COASTAL PLAIN** White, clayey, fine to coarse SAND (A-2-6) (Middendorf Formation)
		50/0.3			50/0.3		M		180.0 / 23.0
178.3	24.7								**COASTAL PLAIN** Light gray, with orange mottling, silty, sandy CLAY (A-6) with mica (Middendorf Formation)
		6	11	11	22	SS-3	25%		
173.3	29.7								
		15	23	29	52	SS-4	23%		
168.3	34.7								170.0 / 33.0
		14	11	16	27	SS-5	15%		**COASTAL PLAIN** Gray, with orange mottling, clayey, coarse SAND (A-2-6) with mica (Middendorf Formation)
163.3	39.7								
		9	8	12	20		Sat.		
158.3	44.7								160.0 / 43.0
		10	11	14	25	SS-6	18%		**COASTAL PLAIN** Dark gray, clayey SAND (A-2-7) (Middendorf Formation)
153.3	49.7								154.0 / 49.0
		6	8	12	20	SS-7	23%		**COASTAL PLAIN** Gray with red and yellow mottling, sandy, CLAY (A-7-6) (Cape Fear Formation)
148.3	54.7								150.0 / 53.0
		9	12	16	28	SS-8	20%		**COASTAL PLAIN** Green, clayey SAND (A-2-7) with mica (Cape Fear Formation)
143.3	59.7								
		16	19	29	48		M		140.5 / 62.5
138.3	64.7								**COASTAL PLAIN** Green, clayey SAND (A-2-6) with mica (Cape Fear Formation)
		16	15	18	33	SS-9	27%		136.8 / 66.2

Boring Terminated at Elevation 136.8 ft in Coastal Plain: Dense, clayey SAND (A-2-6) with mica (Cape Fear Formation)

Bits Used: 3" Side-Discharge Finger Bit
Drilling Fluid Properties: 8.9 lbs/gal
Casing Depth (4"): 9.0 ft

Other Samples:
ST-5 (11.2 - 12.3)

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** J. Howard
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			**GROUND WTR (ft)**
BORING NO. LL B4-A	**STATION** 898+69	**OFFSET** 64ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 203.0 ft	**TOTAL DEPTH** 65.4 ft	**NORTHING** 491,051	**EASTING** 1,992,738
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 05/31/07	**COMP. DATE** 05/31/07	**SURFACE WATER DEPTH** 1.2ft	**DEPTH TO ROCK** N/A

GROUND WTR (ft)	
0 HR.	Water
24 HR.	Boring

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))
205									
203.0	0.0								MUDLINE 0.0
		WOH	WOH	WOH	WOH 0		Sat.		**ALLUVIAL** Brown, sandy MUCK — 200.0 / 3.0
199.2	3.8								**ALLUVIAL** Brown and gray brown, sandy, silty CLAY (A-6) with little organics
		WOH	WOH	1	1	SS-10	Sat.		Organic Content (SS-10)=7.5% Organic Content (SS-11)=10.8%
193.0	10.0								
		WOH	1	WOH	1	SS-11	Sat.		
188.7	14.3								190.5 / 12.5
		6	5	2	7		W		**ALLUVIAL** Tan, sandy SILT (A-4) — 187.7 / 15.3
184.4	18.6								**ALLUVIAL** Tan, fine SAND (A-3) — 186.0 / 17.0
		1	4	5	9		Sat.		**ALLUVIAL** Tan gray, silty, fine to coarse SAND (A-2-4)
179.1	23.9								180.5 / 22.5
		4	5	6	11	SS-12	Sat.		**ALLUVIAL** Tan and orange, silty, fine to coarse SAND (A-1-b)
174.1	28.9								175.5 / 27.5
		11	22	22	44		M		**COASTAL PLAIN** Gray, sandy CLAY (A-6) with mica (Middendorf)
169.1	33.9								171.0 / 32.0
		20	17	16	33		W		**COASTAL PLAIN** Orange, clayey, coarse SAND (A-2-6) (Middendorf Formation)
164.1	38.9								165.5 / 37.5
		5	9	10	19		M		**COASTAL PLAIN** Gray, with red mottling, sandy CLAY (A-7-6) (Middendorf Formation)
159.1	43.9								161.0 / 42.0
		6	9	12	21		M		**COASTAL PLAIN** Orange, with gray mottling, clayey, fine SAND (A-2-6) with mica (Middendorf Formation)
154.1	48.9								155.0 / 48.0
		5	9	11	20		M		**COASTAL PLAIN** Dark gray, green, and red, with red mottling, sandy CLAY (A-6) with mica (Cape Fear Formation)
149.1	53.9								
		9	14	17	31		M		
144.1	58.9								
		16	33	44	77		M		
139.1	63.9								141.0 / 62.0
		13	13	16	29		W		**COASTAL PLAIN** Green, clayey SAND (A-2-6) with mica (Cape Fear Formation) — 137.6 / 65.4

Boring Terminated at Elevation 137.6 ft in Coastal Plain: Medium dense, clayey SAND (A-2-6) (Cape Fear Formation)

Bits Used: 3" Side-Discharge Finger Bit
Drilling Fluid Properties: 9.1 lbs/gal
Casing Depth (4"): 13.8 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** J. Howard
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			**GROUND WTR (ft)**
BORING NO. LL B5-A	**STATION** 899+72	**OFFSET** 65ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 203.3 ft	**TOTAL DEPTH** 66.2 ft	**NORTHING** 491,142	**EASTING** 1,992,787
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 05/29/07	**COMP. DATE** 05/29/07	**SURFACE WATER DEPTH** 0.8ft	**DEPTH TO ROCK** N/A

GROUND WTR (ft)	
0 HR.	Water
24 HR.	Boring

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)
205									
203.3	0.0								203.3 / 0.0 MUDLINE
		WOH	WOH	WOH	0		Sat.		**ALLUVIAL** Brown, sandy MUCK
200.3	3.0								
		8	3	3	6		Sat.		Invalid due to wood fragments
193.6	9.7								
		WOH	WOH	WOH	0		Sat.		
190.3	13.0								**ALLUVIAL** Gray, sandy SILT (A-4) -No recovery, based on drill cuttings
188.6	14.7								
		WOH	WOH	WOH	0		W		
183.6	19.7								
		5	3	2	5		W		
180.3	23.0								**COASTAL PLAIN** Tan and gray, with orange mottling, sandy CLAY (A-6) with mica (Middendorf Formation)
178.6	24.7								
		7	5	6	11		W		
173.6	29.7								
		12	19	24	43		M		
168.6	34.7								
		17	23	36	59		M		
165.3	38.0								**COASTAL PLAIN** Orange and gray, with brown mottling, clayey SAND (A-2-6) with mica, clay lenses (Middendorf Formation)
163.6	39.7								
		9	19	17	36		W		
158.6	44.7								
		11	16	20	36		M		
154.3	49.0								**COASTAL PLAIN** Gray and green, with brown mottling, silty, sandy CLAY (A-7-6) (Cape Fear Formation)
153.6	49.7								
		9	14	23	37		M		
148.6	54.7								
		8	14	20	34		M		
145.3	58.0								**COASTAL PLAIN** Green, clayey, fine to coarse SAND (A-2-6) (Cape Fear Formation)
143.6	59.7								
		10	14	16	30		M		
138.6	64.7								
		23	15	18	33		W		
137.1	66.2								Boring Terminated at Elevation 137.1 ft in Coastal Plain: Dense, silty, clayey, fine SAND (A-2-6) (Cape Fear Formation)

Bits Used: 3" Side-Discharge Finger Bit
Drilling Fluid Properties: 9.0 lbs/gal
Casing Depth (4"): 4.9 ft

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** J. Howard
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			**GROUND WTR (ft)**
BORING NO. LL B6-A	**STATION** 900+80	**OFFSET** 55ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 204.7 ft	**TOTAL DEPTH** 66.5 ft	**NORTHING** 491,231	**EASTING** 1,992,851
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 05/30/07	**COMP. DATE** 05/31/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

GROUND WTR (ft)	
0 HR.	0.0
24 HR.	0.1

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)
205									
204.7	0.0								204.7 / 0.0 GROUND SURFACE
		WOH	WOH	WOH	0		Sat.		**ALLUVIAL** Brown, sandy MUCK
199.9	4.8								
		WOH	1	1	2		Sat.		
197.2	7.5								**ALLUVIAL** White, fine sandy CLAY (A-6)
193.8	10.9								
		1	1	1	2	SS-13	Sat.		Pushed Shelby tube ST-4 from 12.4 to 14.4 feet, recovery=100%
190.3	14.4								
		1	3	1	4		Sat.		
187.7	17.0								**COASTAL PLAIN** White and orange, clayey, silty, fine to coarse SAND (A-2-4) (Middendorf Formation)
184.7	20.0								
		3	3	7	10	SS-14	Sat.		
179.7	25.0								
		11	13	15	28		Sat.		
176.7	28.0								**COASTAL PLAIN** Light brown to light gray, with orange mottling, sandy CLAY (A-6) with mica (Middendorf Formation)
174.7	30.0								
		36	64/0.5		100/1.0		M		
169.7	35.0								
		11	18	17	35		M		
166.7	38.0								**COASTAL PLAIN** Orange, with gray mottling, clayey, fine to coarse SAND (A-2-6) with mica (Middendorf Formation)
164.7	40.0								
		6	8	9	17		W		
159.7	45.0								
		11	11	15	26		W		
155.7	49.0								**COASTAL PLAIN** Dark gray, with red mottling, sandy CLAY (A-6) (Cape Fear Formation)
154.7	50.0								
		9	11	15	26		M		
149.7	55.0								
		12	14	17	31		M		
146.7	58.0								**COASTAL PLAIN** Green and gray, with red and orange mottling, clayey, fine to coarse SAND (A-2-6) with mica (Cape Fear Formation)
144.7	60.0								
		14	23	31	54		M		
139.7	65.0								
		25	28	38	66		M		
138.2	66.5								Boring Terminated at Elevation 138.2 ft in Coastal Plain: Very dense, clayey, fine SAND (A-2-6) with mica (Cape Fear Formation)

Bits Used: 3" Side-Discharge Finger Bit
Drilling Fluid Properties: 9.0 lbs/gal
Casing Depth (4"): 14.8 ft

Other Samples:
ST-4 (12.4 - 14.4)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** M. Lear
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			**GROUND WTR (ft)**
BORING NO. LL B7-A	**STATION** 901+81	**OFFSET** 64ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 205.3 ft	**TOTAL DEPTH** 100.3 ft	**NORTHING** 491,323	**EASTING** 1,992,896
DRILL MACHINE CME-55LC	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 05/02/07	**COMP. DATE** 05/03/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

GROUND WTR (ft)	
0 HR.	0.5
24 HR.	0.0

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))
210									
205.3	0.0						▼		205.3 / 0.0 GROUND SURFACE
		1	1	1	2	SS-15	31%		**ALLUVIAL** Gray and tan, fine sandy, CLAY (A-6) with trace organics
201.6	3.7								202.8 / 2.5
		7	16	19	35	SS-16	12%		**COASTAL PLAIN** Tan with brown mottling, fine sandy, silty, CLAY (A-7-6) with trace roots (Middendorf Formation)
196.6	8.7								198.3 / 7.0
		WOH	WOH	1	1	SS-17	Sat.		**COASTAL PLAIN** Orange, tan, and gray, clayey, fine to coarse sandy, SILT (A-4) (Middendorf Formation)
191.5	13.8								193.3 / 12.0
		8	18	22	40		M		**COASTAL PLAIN** Tan and gray with maroon and orange streaks, fine to coarse sandy, CLAY (A-6) with trace gravel (Middendorf Formation)
186.5	18.8								
		11	20	23	43	SS-18	7%		
181.5	23.8								182.8 / 22.5
		12	16	16	32	SS-19	W		**COASTAL PLAIN** Gray-white with orange streaks, clayey, silty, fine to coarse SAND (A-2-4) with trace gravel (Middendorf Formation)
176.5	28.8								177.8 / 27.5
		3	9	6	15	SS-20	Sat.		**COASTAL PLAIN** Orange-tan, silty, fine to coarse SAND and GRAVEL (A-1-b) with hematite cemented concretions (Middendorf Formation)
171.5	33.8								174.3 / 31.0
		12	21	29	50	SS-21	28%		**COASTAL PLAIN** Gray with orange streaks, fine sandy, silty CLAY (A-7-6) (Middendorf Formation)
166.5	38.8								168.3 / 37.0
		5	6	6	12	SS-22	M		**COASTAL PLAIN** Orange-tan, silty, clayey, fine to coarse SAND (A-2-4) with trace mica, feldspar (Middendorf Formation)
161.5	43.8								
		6	9	11	20		M		
156.5	48.8								
		4	6	8	14		M		
151.5	53.8								153.3 / 52.0
		5	7	7	14	SS-23	22%		**COASTAL PLAIN** Dark gray, blue-gray, and gray, locally with brown and orange mottling and micaceous, fine sandy, silty, CLAY (A-6) (Cape Fear Formation)
146.5	58.8								
		5	6	7	13		M		
141.5	63.8								
		10	10	16	26		M		
136.5	68.8								137.8 / 67.5
		5	7	13	20	SS-24	W		**COASTAL PLAIN** Gray, micaceous, silty, fine SAND (A-2-4) (Cape Fear Formation)
131.5	73.8								133.3 / 72.0
		11	11	14	25	SS-25	Sat.		**COASTAL PLAIN** Gray, silty, fine to coarse SAND (A-1-b) with trace mica and gravel (Cape Fear Formation)

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** M. Lear
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			**GROUND WTR (ft)**
BORING NO. LL B7-A	**STATION** 901+81	**OFFSET** 64ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 205.3 ft	**TOTAL DEPTH** 100.3 ft	**NORTHING** 491,323	**EASTING** 1,992,896
DRILL MACHINE CME-55LC	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 05/02/07	**COMP. DATE** 05/03/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

GROUND WTR (ft)	
0 HR.	0.5
24 HR.	0.0

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
130					Match Line				
126.5	78.8								128.8 / 76.5 **COASTAL PLAIN** Dark gray and gray-green with brown mottling, fine sandy, silty, CLAY (A-7-6) with trace to little mica (Cape Fear Formation)
		14	26	34	60	SS-26	50%		
121.5	83.8								
		16	28	36	64		M		
116.5	88.8								
		10	12	17	29		M		
111.5	93.8								113.3 / 92.0 **COASTAL PLAIN** Gray-green, micaceous, silty, clayey, fine SAND (A-2-6) with trace gravel and coarse sand (Cape Fear Formation)
		7	9	10	19		M		
106.5	98.8								108.8 / 96.5 **COASTAL PLAIN** Gray and maroon mottled, micaceous, fine sandy, silty, CLAY (A-6) with trace gravel (Cape Fear Formation)
		13	22	27	49		M		105.0 / 100.3 Boring Terminated at Elevation 105.0 ft in Coastal Plain: Hard, micaceous, fine sandy, silty, CLAY (A-6) with trace gravel (Cape Fear Formation)

Bits Used: 3" Roller Cone
Drilling Fluid Properties: 8.6 lbs/gal
Casing Depth (3"): 3.4 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** M. Lear
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			**GROUND WTR (ft)**
BORING NO. LL EB2-A	**STATION** 902+92	**OFFSET** 58ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 210.3 ft	**TOTAL DEPTH** 80.3 ft	**NORTHING** 491,415	**EASTING** 1,992,961
DRILL MACHINE CME-55LC	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 05/08/07	**COMP. DATE** 05/09/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

GROUND WTR (ft): 0 HR. 3.7; 24 HR. 1.6

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))
215									
210.3	0.0								210.3 / 0.0 GROUND SURFACE
206.4	3.9	4	6	5	11		M		**COASTAL PLAIN** Gray and tan, clayey, silty, fine SAND (A-2-4) with trace organics (Middendorf Formation)
201.5	8.8	2	2	2	4		W		203.3 / 7.0 **COASTAL PLAIN** Gray, clayey, fine sandy, SILT (A-4) (Middendorf Formation)
196.5	13.8	2	2	2	4	SS-27	33%		198.3 / 12.0 **COASTAL PLAIN** Gray, white, and orange, silty, fine to coarse SAND (A-2-4) with trace gravel and hematite cemented concretions (Middendorf Formation)
191.5	18.8	5	4	5	9		Sat.		
186.5	23.8	2	2	3	5		Sat.		189.3 / 21.0 **COASTAL PLAIN** Gray, tan, and orange, with orange and maroon streaks, clayey, silty, fine to coarse SAND (A-2-4) with very thinly bedded CLAY (A-6) layers and trace gravel and hematite cemented concretions (Middendorf Formation)
181.5	28.8	12	15	16	31		Sat.		
176.5	33.8	6	10	13	23		Sat.		
171.5	38.8	4	2	5	7		Sat.		174.3 / 36.0 **COASTAL PLAIN** Gray-tan with orange, fine sandy, silty CLAY (A-6) (Middendorf Formation)
166.5	43.8	11	17	20	37		M		168.3 / 42.0 **COASTAL PLAIN** Gray-tan, silty, clayey, fine SAND (A-2-6) (Middendorf Formation)
161.5	48.8	6	10	13	23	SS-28	W		162.8 / 47.5 **COASTAL PLAIN** Gray, tan, and brown, silty, fine to coarse sandy, CLAY (A-6) with trace gravel, feldspar, mica (Middendorf Formation)
156.5	53.8	6	10	15	25		M		
151.5	58.8	7	12	13	25		M		153.3 / 57.0 **COASTAL PLAIN** Dark gray, gray, and brown, micaceous, fine to coarse sandy, silty CLAY (A-6) (Cape Fear Formation)
146.5	63.8	6	8	9	17		M		
141.5	68.8	5	6	9	15		M		
136.5	73.8	7	9	10	19		M		138.3 / 72.0 **COASTAL PLAIN** Gray, micaceous, clayey, silty, fine to coarse SAND (A-2-4) (Cape Fear Formation)
		7	15	15	30		W		

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** M. Lear
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			**GROUND WTR (ft)**
BORING NO. LL EB2-A	**STATION** 902+92	**OFFSET** 58ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 210.3 ft	**TOTAL DEPTH** 80.3 ft	**NORTHING** 491,415	**EASTING** 1,992,961
DRILL MACHINE CME-55LC	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 05/08/07	**COMP. DATE** 05/09/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

GROUND WTR (ft): 0 HR. 3.7; 24 HR. 1.6

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
135					Match Line				
131.5	78.8	7	9	10	19		Sat.		**COASTAL PLAIN** Gray, micaceous, clayey, silty, fine to coarse SAND (A-2-4) (Cape Fear Formation) *(continued)* 130.0 / 80.3

Boring Terminated at Elevation 130.0 ft in Coastal Plain: Medium dense, clayey, silty, fine to coarse SAND (A-2-4) (Cape Fear Formation)

Bits Used: 3" Roller Cone
Drilling Fluid Properties: 8.5 lbs/gal
Casing Depth (3"): 23.4 ft

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MACTEC ENGINEERING AND CONSULTING, INC.

3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

N.C.D.O.T./AASHTO CLASSIFICATIONS

REPORT ON SAMPLES OF: SOILS FOR QUALITY

MACTEC PROJECT NAME/ NUMBER: Structures 5 & 6; Dual Bridges on -L- over Stewart's Creek (6468-07-1685)

NCDOT PROJ. NO.: 34817.1.2 (U-2519CB) COUNTY: Cumberland OWNER: N.C.D.O.T.

DATE SAMPLED: May 2007 RECEIVED: 6/5/2007 REPORTED BY: MACTEC

SAMPLED FROM: LL B3-A

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-1	SS-2	SS-3	SS-4	SS-5	SS-6
Retained 4.75 mm Sieve	(%)	ND	0.0	0.4	0.0	0.6	0.2
Passing 2.00 mm Sieve	(%)	ND	100.0	98.0	100.0	96.2	98.6
Passing 425 µm Sieve	(%)	ND	94.0	68.7	97.7	58.0	52.6
Passing 75 µm Sieve	(%)	ND	40.8	36.1	82.8	28.7	27.9

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	ND	17.4	46.2	4.3	55.8	61.3
Fine Sand Ret - 53 µm	(%)	ND	49.9	18.3	19.9	15.5	10.6
Silt 0.05 - 0.005 mm	(%)	ND	10.7	4.9	31.4	10.1	3.9
Clay < 0.005 mm	(%)	ND	22.0	30.6	44.4	18.6	24.2

Moisture Content	(%)	ND	21.0	24.8	22.6	14.9	18.3
Liquid Limit, L.L.		ND	21	32	37	39	44
Plasticity Index, P.I.		ND	4	15	15	23	27
AASHTO Classification		ND	A-4(0)	A-6(1)	A-6(12)	A-2-6(2)	A-2-7(2)
Organic Content	(%)	8.3	ND	ND	ND	ND	ND

Boring No.		LL B3-A	LL B3-A	LL B3-A	LL B3-A	LL B3-A	LL B3-A
Station		897+64	897+64	897+64	897+64	897+64	897+64
Offset		63 LT	63 LT	63 LT	63 LT	63 LT	63 LT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (FT)	From	0.0	4.0	24.7	29.7	34.7	44.7
	to	1.5	5.5	26.2	31.2	36.2	46.2

REMARKS: ND=Not Determined, NP=Non-Plastic

Submitted by: Laboratory Manager

SHEET 25

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

N.C.D.O.T./AASHTO CLASSIFICATIONS

REPORT ON SAMPLES OF: SOILS FOR QUALITY

MACTEC PROJECT NAME/ NUMBER: Structures 5 & 6; Dual Bridges on -L- over Stewart's Creek (6468-07-1685)

NCDOT PROJ. NO.: 34817.1.2 (U-2519CB) COUNTY: Cumberland OWNER: N.C.D.O.T.

DATE SAMPLED: May 2007 RECEIVED: 6/5/2007 REPORTED BY: MACTEC

SAMPLED FROM: LL B3-A and LL B4-A

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-7	SS-8	SS-9	SS-10	SS-11	SS-12
Retained 4.75 mm Sieve	(%)	0.0	0.0	0.0	ND	0.0	3.3
Passing 2.00 mm Sieve	(%)	100.0	99.9	100.0	ND	100.0	90.5
Passing 425 µm Sieve	(%)	97.7	73.0	68.8	ND	96.7	35.3
Passing 75 µm Sieve	(%)	87.2	35.3	18.7	ND	90.6	3.3

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	3.9	46.9	65.3	ND	5.8	81.9
Fine Sand Ret - 53 µm	(%)	15.2	18.9	16.8	ND	5.8	15.4
Silt 0.05 - 0.005 mm	(%)	26.7	7.6	6.1	ND	27.9	-0.7
Clay < 0.005 mm	(%)	54.2	26.5	11.8	ND	60.5	3.4

Moisture Content	(%)	23.4	20.0	26.5	ND	ND	ND
Liquid Limit, L.L.		54	43	35	ND	ND	20
Plasticity Index, P.I.		35	25	15	ND	ND	NP
AASHTO Classification		A-7-6(32)	A-2-7(3)	A-2-6(0)	ND	ND	A-1-b
Organic Content	(%)	ND	ND	ND	7.5	10.8	ND

Boring No.		LL B3-A	LL B3-A	LL B3-A	LL B4-A	LL B4-A	LL B4-A
Station		897+64	897+64	897+64	898+69	898+69	898+69
Offset		63 LT	63 LT	63 LT	64 LT	64 LT	64 LT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (FT)	From	49.7	54.7	64.7	3.8	10.0	23.9
	to	51.2	56.2	66.2	5.3	11.5	25.4

REMARKS: ND=Not Determined, NP=Non-Plastic

Submitted by: Laboratory Manager

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

N.C.D.O.T./AASHTO CLASSIFICATIONS

REPORT ON SAMPLES OF: SOILS FOR QUALITY

MACTEC PROJECT NAME/ NUMBER: Structures 5 & 6; Dual Bridges on -L- over Stewart's Creek (6468-07-1685)

NCDOT PROJ. NO.: 34817.1.2 (U-2519CB) COUNTY: Cumberland OWNER: N.C.D.O.T.

DATE SAMPLED: May 2007 RECEIVED: 6/5/2007 REPORTED BY: MACTEC

SAMPLED FROM: LL B6-A and LL B7-A

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-13	SS-14	SS-15	SS-16	SS-17	SS-18
Retained 4.75 mm Sieve	(%)	0.0	0.0	0.6	0.0	0.0	0.0
Passing 2.00 mm Sieve	(%)	99.2	97.9	98.7	99.8	99.6	99.2
Passing 425 µm Sieve	(%)	81.8	60.3	86.2	97.9	87.5	78.2
Passing 75 µm Sieve	(%)	35.5	32.0	42.3	79.5	36.7	36.9

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	31.8	50.2	25.2	4.6	27.1	42.8
Fine Sand Ret - 53 µm	(%)	39.8	18.5	37.6	19.7	38.6	21.2
Silt 0.05 - 0.005 mm	(%)	10.4	7.6	13.0	17.2	7.1	3.4
Clay < 0.005 mm	(%)	18.0	23.8	24.2	58.4	27.2	32.6

Moisture Content	(%)	ND	ND	31.2	11.8	ND	6.5
Liquid Limit, L.L.		36	17	26	53	25	39
Plasticity Index, P.I.		18	4	11	30	9	22
AASHTO Classification		A-6(2)	A-2-4(0)	A-6(1)	A-7-6(25)	A-4(0)	A-6(3)
Organic Content	(%)	ND	ND	ND	ND	ND	ND

Boring No.		LL B6-A	LL B6-A	LL B7-A	LL B7-A	LL B7-A	LL B7-A
Station		900+80	900+80	901+81	901+81	901+81	901+81
Offset		55 LT	55 LT	64 LT	64 LT	64 LT	64 LT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (FT)	From	10.9	20.0	0.0	3.7	8.7	18.8
	to	12.4	21.5	1.5	5.2	10.2	20.3

REMARKS: ND=Not Determined, NP=Non-Plastic

Submitted by: _____
Laboratory Manager

SHEET 26

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

N.C.D.O.T./AASHTO CLASSIFICATIONS

REPORT ON SAMPLES OF: SOILS FOR QUALITY

MACTEC PROJECT NAME/ NUMBER: Structures 5 & 6; Dual Bridges on -L- over Stewart's Creek (6468-07-1685)

NCDOT PROJ. NO.: 34817.1.2 (U-2519CB) COUNTY: Cumberland OWNER: N.C.D.O.T.

DATE SAMPLED: May 2007 RECEIVED: 6/5/2007 REPORTED BY: MACTEC

SAMPLED FROM: LL B7-A

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-19	SS-20	SS-21	SS-22	SS-23	SS-24
Retained 4.75 mm Sieve	(%)	0.0	3.9	0.0	0.4	0.0	0.0
Passing 2.00 mm Sieve	(%)	99.7	86.6	99.6	96.6	99.9	100.0
Passing 425 µm Sieve	(%)	68.0	28.3	89.8	55.1	86.7	87.6
Passing 75 µm Sieve	(%)	15.3	11.1	67.7	23.2	53.4	19.4

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	65.9	77.6	16.2	59.7	25.6	49.3
Fine Sand Ret - 53 µm	(%)	19.5	10.5	19.0	19.8	24.6	32.6
Silt 0.05 - 0.005 mm	(%)	1.6	3.9	16.1	0.3	11.0	6.4
Clay < 0.005 mm	(%)	13.0	8.0	48.8	20.2	38.7	11.7

Moisture Content	(%)	ND	ND	28.4	ND	21.5	ND
Liquid Limit, L.L.		19	18	42	36	38	29
Plasticity Index, P.I.		NP	4	22	8	24	8
AASHTO Classification		A-2-4(0)	A-1-b	A-7-6(13)	A-2-4(0)	A-6(9)	A-2-4(0)
Organic Content	(%)	ND	ND	ND	ND	ND	ND

Boring No.		LL B7-A	LL B7-A	LL B7-A	LL B7-A	LL B7-A	LL B7-A
Station		901+81	901+81	901+81	901+81	901+81	901+81
Offset		64 LT	64 LT	64 LT	64 LT	64 LT	64 LT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (FT)	From	23.8	28.8	33.8	38.8	53.8	68.8
	to	25.3	30.3	35.3	40.3	55.3	70.3

REMARKS: ND=Not Determined, NP=Non-Plastic

Submitted by: _____
Laboratory Manager

SHEET 27

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

N.C.D.O.T./AASHTO CLASSIFICATIONS

REPORT ON SAMPLES OF: SOILS FOR QUALITY

MACTEC PROJECT NAME/ NUMBER: Structures 5 & 6; Dual Bridges on -L- over Stewart's Creek (6468-07-1685)

NCDOT PROJ. NO.: 34817.1.2 (U-2519CB) COUNTY: Cumberland OWNER: N.C.D.O.T.

DATE SAMPLED: May 2007 RECEIVED: 6/5/2007 REPORTED BY: MACTEC

SAMPLED FROM: LL B7-A and LL EB2-A

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-25	SS-26	SS-27	SS-28		
Retained 4.75 mm Sieve	(%)	0.0	0.0	0.0	0.0		
Passing 2.00 mm Sieve	(%)	99.0	99.7	100.0	99.8		
Passing 425 µm Sieve	(%)	46.1	83.0	99.2	56.9		
Passing 75 µm Sieve	(%)	8.5	56.0	47.1	24.5		

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	70.2	28.4	2.7	64.3		
Fine Sand Ret - 53 µm	(%)	22.5	18.6	61.3	12.2		
Silt 0.05 - 0.005 mm	(%)	5.1	13.3	18.8	5.2		
Clay < 0.005 mm	(%)	2.2	39.7	17.2	18.2		

Moisture Content	(%)	ND	49.9	32.6	ND		
Liquid Limit, L.L.		20	55	20	33		
Plasticity Index, P.I.		NP	29	3	18		
AASHTO Classification		A-1-b	A-7-6(14)	A-4(0)	A-2-6(1)		
Organic Content	(%)	ND	ND	ND	ND		

Boring No.		LL B7-A	LLB7-A	LL EB2-A	LL EB2-A		
Station		901+81	901+81	902+92	902+92		
Offset		64 LT	64 LT	58 LT	58 LT		
Alignment		-L-	-L-	-L-	-L-		
Depth (FT)	From	73.8	78.8	8.8	43.8		
	to	75.2	80.2	10.3	45.3		

REMARKS: ND=Not Determined, NP=Non-Plastic

Submitted by: _____
Laboratory Manager

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 34817.1.2 TIP: U-2519CB COUNTY: CUMBERLAND

DESCRIPTION(1): STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK

EXISTING BRIDGE

Information from: Field Inspection X Microfilm ____ (reel ____ pos: ____)
Other (explain) Not Applicable: No Existing Bridge

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

EVIDENCE OF SCOUR(2)
Abutments or End Bent Slopes: ____

Interior Bents: ____

Channel Bed: ____

Channel Bank: ____

EXISTING SCOUR PROTECTION
Type(3): ____

Extent(4): ____

Effectiveness(5): ____

Obstructions(6): ____

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.

DESIGN INFORMATION

Channel Bed Material(7): Alluvial: Muck, SILT (A-4), CLAY (A-6), SAND and GRAVEL (A-1-b)

Channel Bank Material(8): Alluvial: CLAY (A-6); other soils in the near subsurface include SAND (A-3) Silty SAND (A-2-4) and Clayey SAND (A-2-6)

Channel Bank Cover(9): Pine and hardwood trees; brush

Floodplain Width(10): Approximately 850 feet.

Floodplain Cover(11): Moderately to densely wooded; hardwood, pine, and cypress trees; brush

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

Channel Migration Tendency(13): None

Observations and Other Comments: Surface water flows into the site along a channel that crosses the alignment between bents 3 and 4 and spreads laterally, flooding the majority of the site.

Reported by: [signature] **Date:** 6/19/2007
MACTEC Engineering and Consulting, Inc.

DESIGN SCOUR ELEVATIONS(14) Feet X Meters ____

	BENTS B1	B2	B3	B4	B5	B6	B7				
100-year DSE	204.2	202.6	200.8	200.7	200.8	202.5	205.3				
500-year DSE	203	202.1	200.5	200.5	200.6	202.3	203.3				

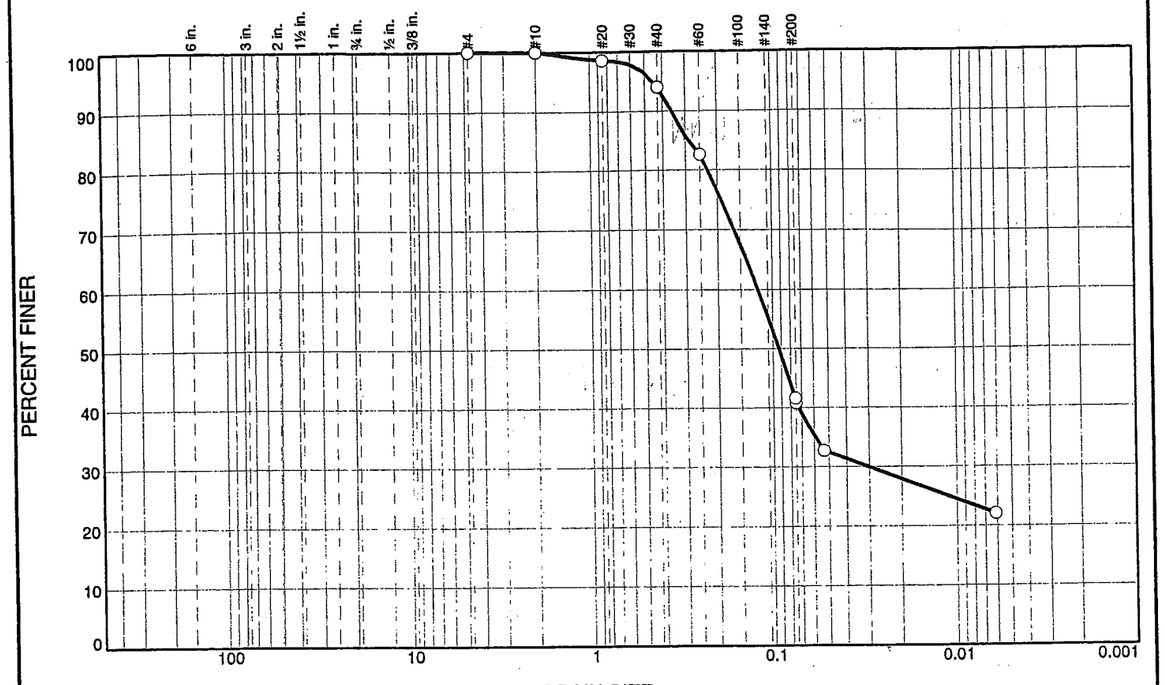
Comparison of DSE to Hydraulics Unit theoretical scour:
We agree with the scour calculations presented in the Bridge Survey & Hydraulic Report, dated 10/3/05.

DSE determined by: [signature] **Date:** 7/3/2007
B. D. Worley

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank	BED	BED	BED	BED	BANK		
Sample No.	SS-2	SS-11	SS-12	SS-13	SS-15		
Retained #4	0	0	3.3	0	0.6		
Passed #10	100	100	90.5	99.2	98.7		
Passed #40	94	96.7	35.3	81.8	86.2		
Passed #200	40.8	90.6	3.3	35.5	42.3		
Coarse Sand	17.4	5.8	81.9	31.8	25.2		
Fine Sand	49.9	5.8	15.4	39.8	37.6		
Silt	10.7	27.9	-0.7	10.4	13		
Clay	22	60.5	3.4	18	24.2		
LL	21	ND	20	36	26		
PI	4	ND	NP	18	11		
AASHTO	A-4(0)	ND	A-1-b	A-6(2)	A-6(1)		
Station	897+64	898+69	898+69	900+80	901+81		
Offset	63ft LT	64ft LT	64ft LT	55ft LT	64ft LT		
Depth	4.0-5.5 ft	10.9-12.4 ft	23.9-25.4 ft	10.9-12.4 ft	0.0-1.5 ft		

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	6.0	53.2	40.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	98.6		
#40	94.0		
#60	82.6		
0.0755 mm.	41.6		
#200	40.8		
#270	32.7		
0.0061 mm.	22.0		

* (no specification provided)

Soil Description

Light Gray Sandy SILT

Atterberg Limits

PL= 17 LL= 21 PI= 4

Coefficients

D_{85}= 0.2896 D_{60}= 0.1201 D_{50}= 0.0924
D_{30}= 0.0305 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC-SM AASHTO= A-4(0)

Remarks

Entire sample was tested.

Sample No.: SS-2 **Source of Sample:** LL B3-A **Date:** 5-31-07
Location: **Elev./Depth:** 4.0-5.5'

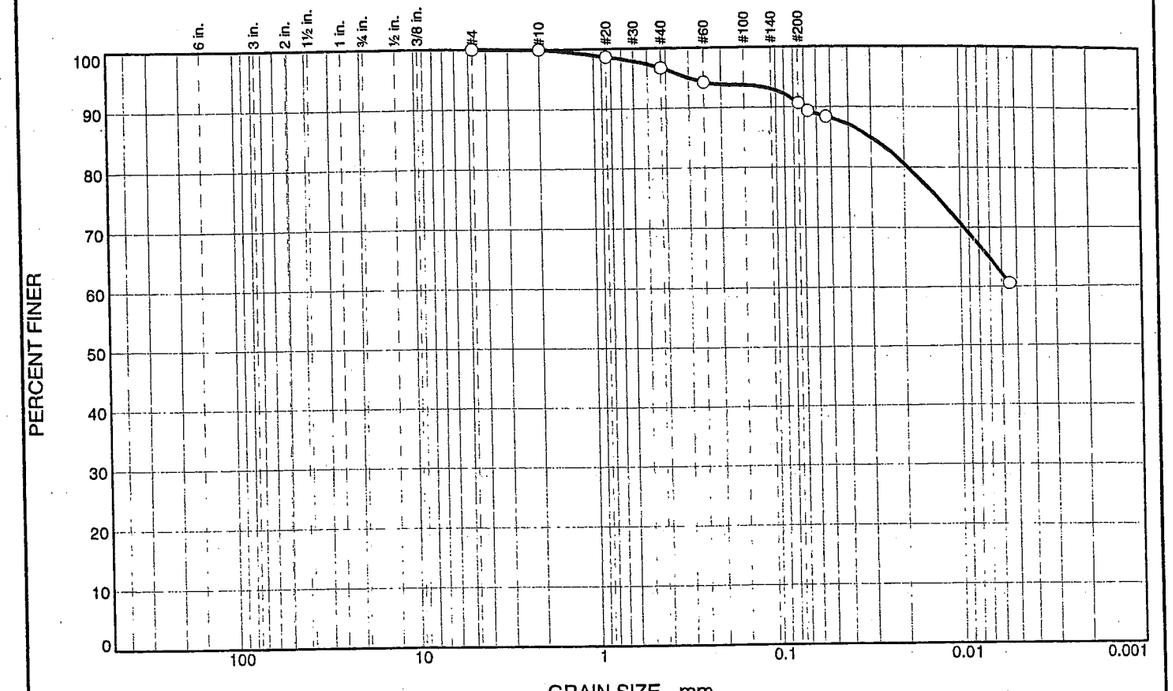
MACTEC, Inc.
Raleigh, North Carolina

Client: NCDOT
Project: Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek
Project No: 6468071685 Task 05 **Figure**

Tested By: CS **Checked By:** LBJ

SHEET 29

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	3.3	6.1	90.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	98.6		
#40	96.7		
#60	94.2		
#200	90.6		
0.0666 mm.	89.4		
#270	88.4		
0.0054 mm.	60.5		

* (no specification provided)

Soil Description

Dark Gray Sandy Silty CLAY With Organics

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0303 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Entire sample was tested.
Insufficent material for limits testing.

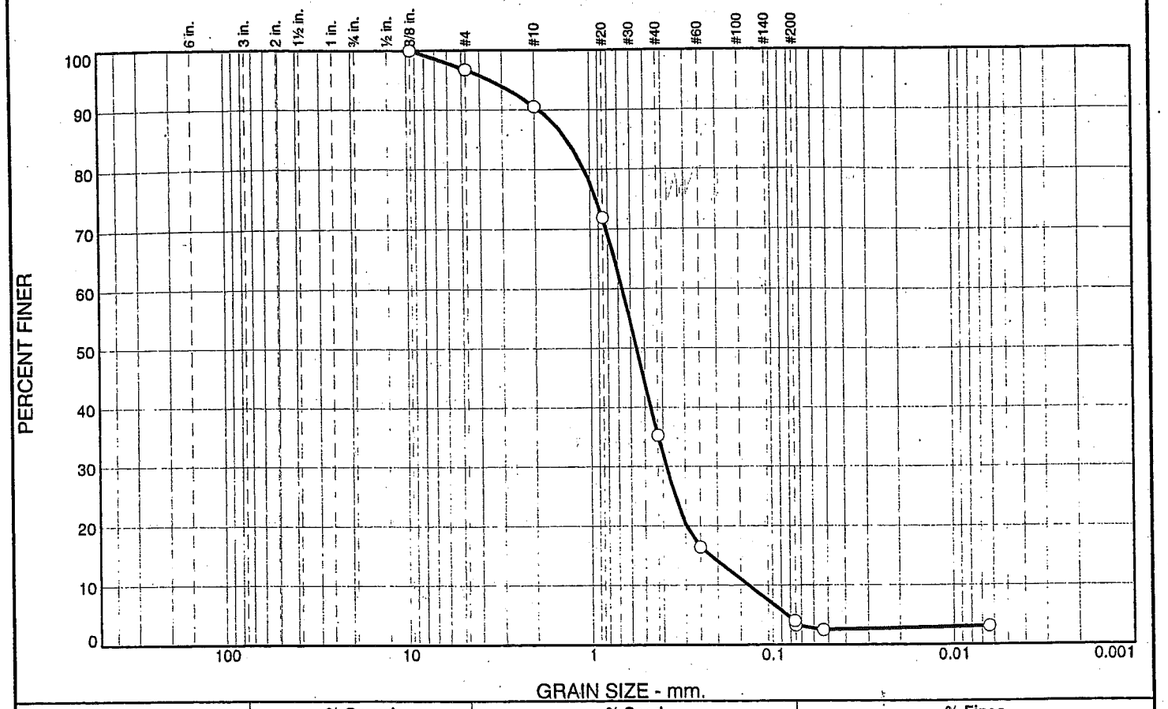
Sample No.: SS-11 **Source of Sample:** LL B4-A **Date:** 5-31-07
Location: **Elev./Depth:** 10-11.5'

MACTEC, Inc.
Raleigh, North Carolina

Client: NCDOT
Project: Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek
Project No: 6468071685 Task 05 **Figure**

Tested By: CS **Checked By:** LBJ

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.3	6.2	55.2	32.0	3.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	96.7		
#10	90.5		
#20	71.9		
#40	35.3		
#60	16.4		
0.0756 mm.	4.0		
#200	3.3		
#270	2.5		
0.0064 mm.	3.1		

* (no specification provided)

Soil Description

Tan Silty SAND

Atterberg Limits

PL= NP LL= 20 PI= NP

Coefficients

D_{85}= 1.3292 D_{60}= 0.6639 D_{50}= 0.5544
D_{30}= 0.3829 D_{15}= 0.2188 D_{10}= 0.1350
C_u= 4.92 C_c= 1.64

Classification

USCS= SP AASHTO= A-1-b

Remarks

Entire sample sample was tested.

Sample No.: SS-12 **Source of Sample:** LL B4-A **Date:** 5-31-07
Location: **Elev./Depth:** 23.9-25.4

MACTEC, Inc.

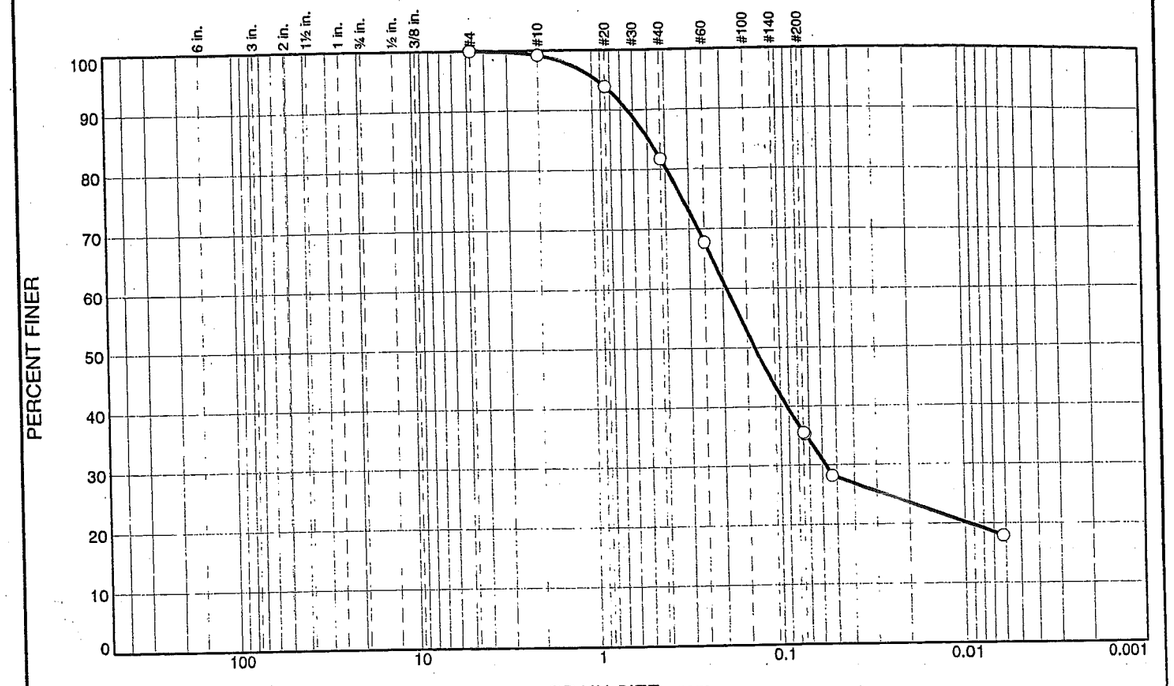
Raleigh, North Carolina

Client: NCDOT
Project: Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek
Project No: 6468071685 Task 05 **Figure**

Tested By: CS **Checked By:** LBJ

SHEET 30

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.8	17.4	46.3	35.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.2		
#20	93.9		
#40	81.8		
#60	67.7		
#200	35.5		
0.0739 mm.	35.3		
#270	28.2		
0.0062 mm.	17.9		

* (no specification provided)

Soil Description

Light Gray Sandy Silty CLAY

Atterberg Limits

PL= 18 LL= 36 PI= 18

Coefficients

D_{85}= 0.4927 D_{60}= 0.1922 D_{50}= 0.1363
D_{30}= 0.0577 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO= A-6(2)

Remarks

Entire sample was tested.

Sample No.: SS-13 **Source of Sample:** LL B6-A **Date:** 5-30-07
Location: **Elev./Depth:** 10.9-12.4'

MACTEC, Inc.

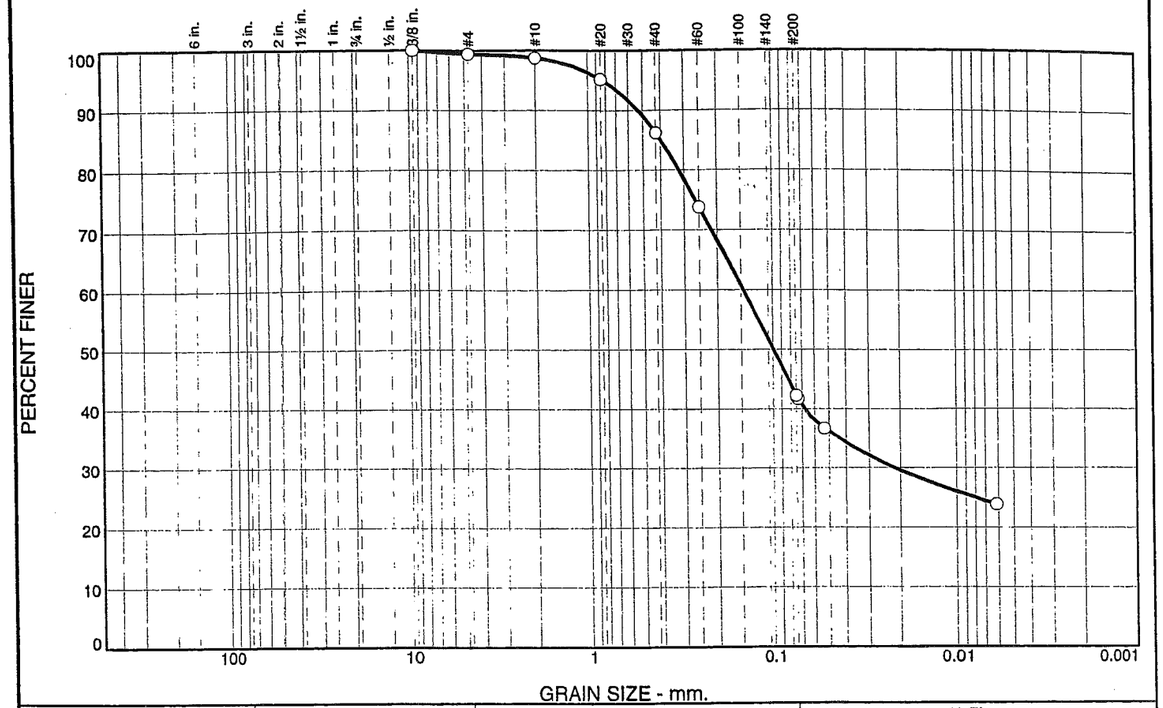
Raleigh, North Carolina

Client: NCDOT
Project: Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek
Project No: 6468071685 Task 05 **Figure**

Tested By: CS **Checked By:** LBJ

SHEET 31

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.6	0.7	12.5	43.9	42.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.4		
#10	98.7		
#20	95.2		
#40	86.2		
#60	73.8		
#200	42.3		
0.0735 mm.	41.7		
#270	36.7		
0.0061 mm.	23.9		

* (no specification provided)

Soil Description

Yellowish Gray Sandy CLAY

Atterberg Limits

PL= 15 LL= 26 PI= 11

Coefficients

D_{85}= 0.3999 D_{60}= 0.1458 D_{50}= 0.0997
D_{30}= 0.0217 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO= A-6(1)

Remarks

Entire sample was tested.

Sample No.: SS-15 **Source of Sample:** LL B7-A **Date:** 5-2-07
Location: **Elev./Depth:** 0.0-1.5'

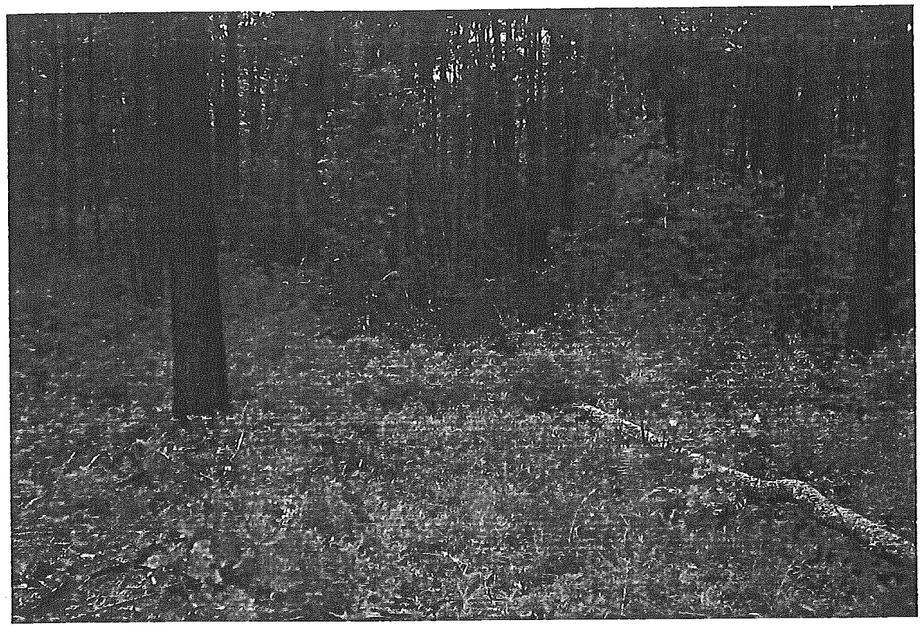
MACTEC, Inc.

Raleigh, North Carolina

Client: NCDOT
Project: Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek
Project No: 6468071685 Task 05 **Figure**

Tested By: CS **Checked By:** LBJ

Site Photos
MACTEC Proj. No. 6468-07-1685



View looking upstation along Left Lane towards LL EB1-A.

View looking upstation along Left Lane towards LL B2-A.

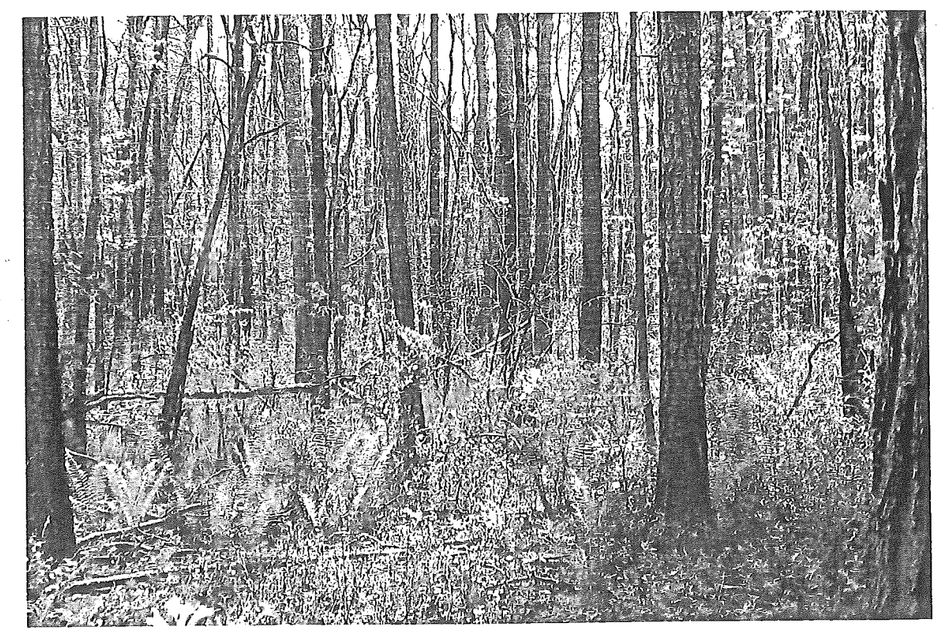
View looking along Left Lane End Bent 1 toward center line.

View looking along Left Lane Bent 1 toward center line.

View looking upstation along Left Lane towards LL B3-A.

View looking upstation along Left Lane towards LL B4-A.

View looking along Left Lane Bent 2 toward center line.

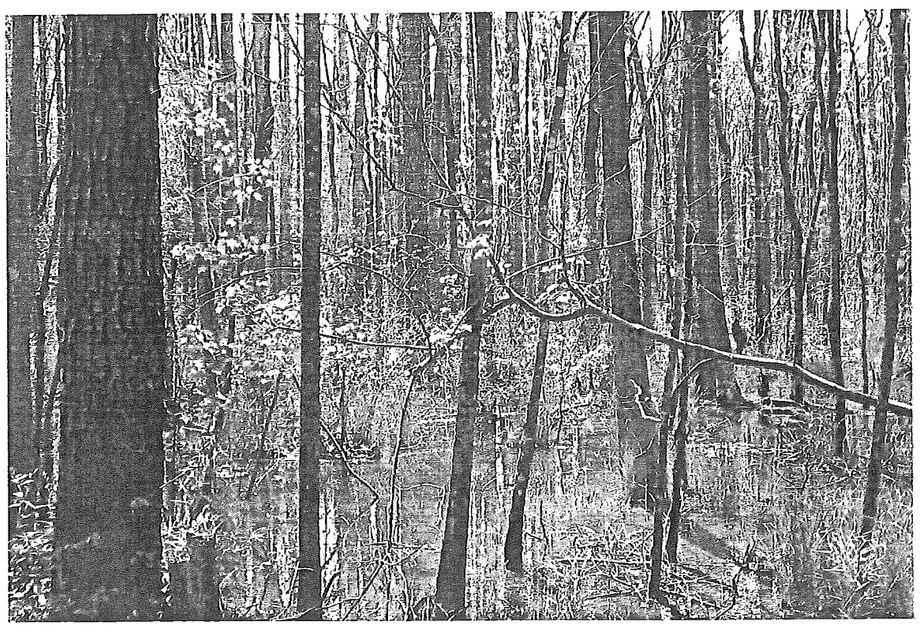


View looking along Left Lane Bent 3 toward center line.

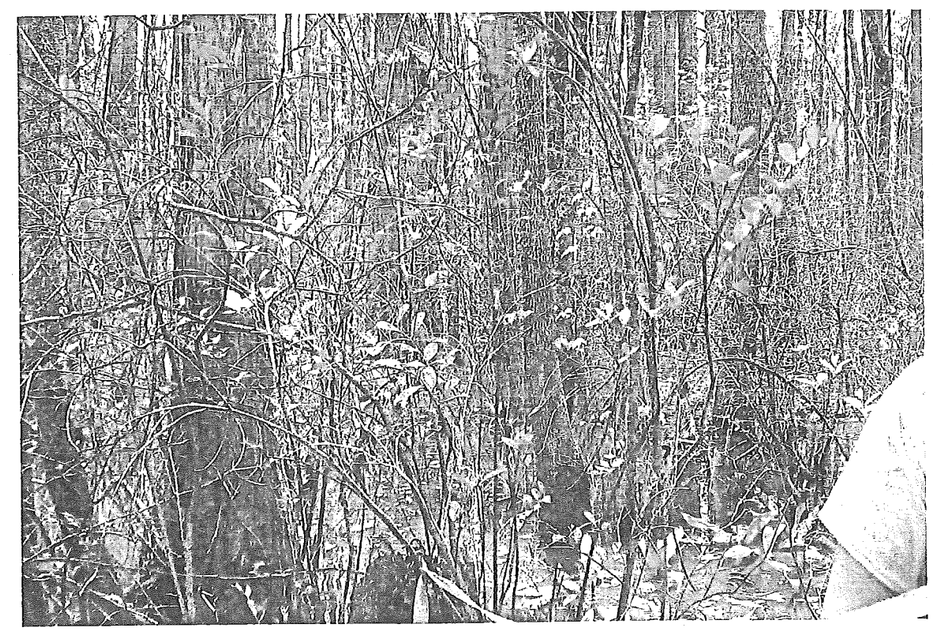
Site Photos
MACTEC Proj. No. 6468-07-1685

View looking upstation along Left Lane towards LL B5-A.

View looking upstation along Left Lane towards LL B6-A.



View looking along Left Lane Bent 4 toward center line.



View looking along Left Lane Bent 5 toward center line.

Site Photos
MACTEC Proj. No. 6468-07-1685

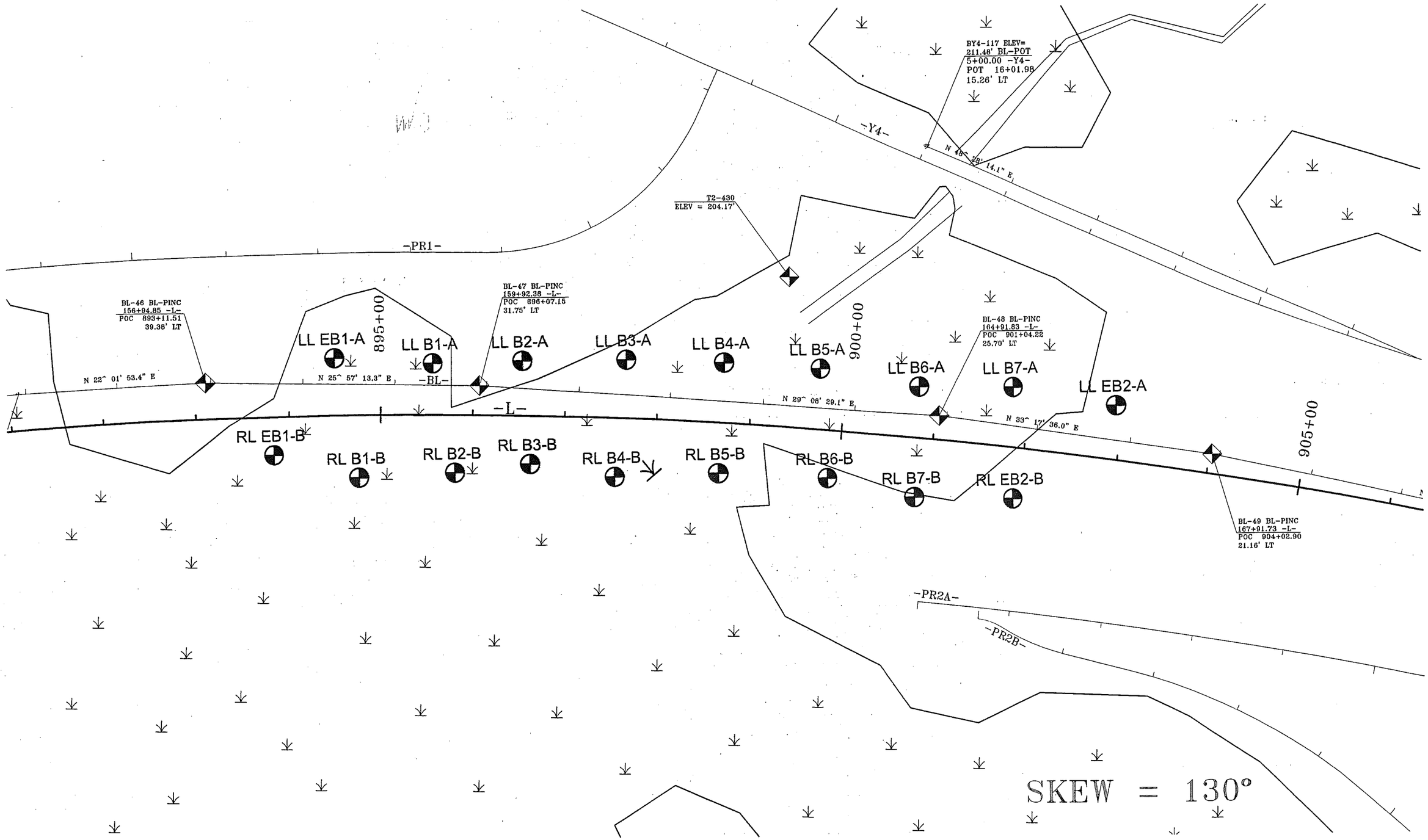
Structures 5 & 6; Dual Bridges on -L- over Stewart's Creek (Left Lane)
NCDOT Proj. No. 34817.1.2 (U-2519CB)

View looking down-station along Left Lane towards LL B7-A (from LL EB2-A).

View looking upstation along Left Lane from LL EB2-A.

View looking along Left Lane Bent 7 toward center line.

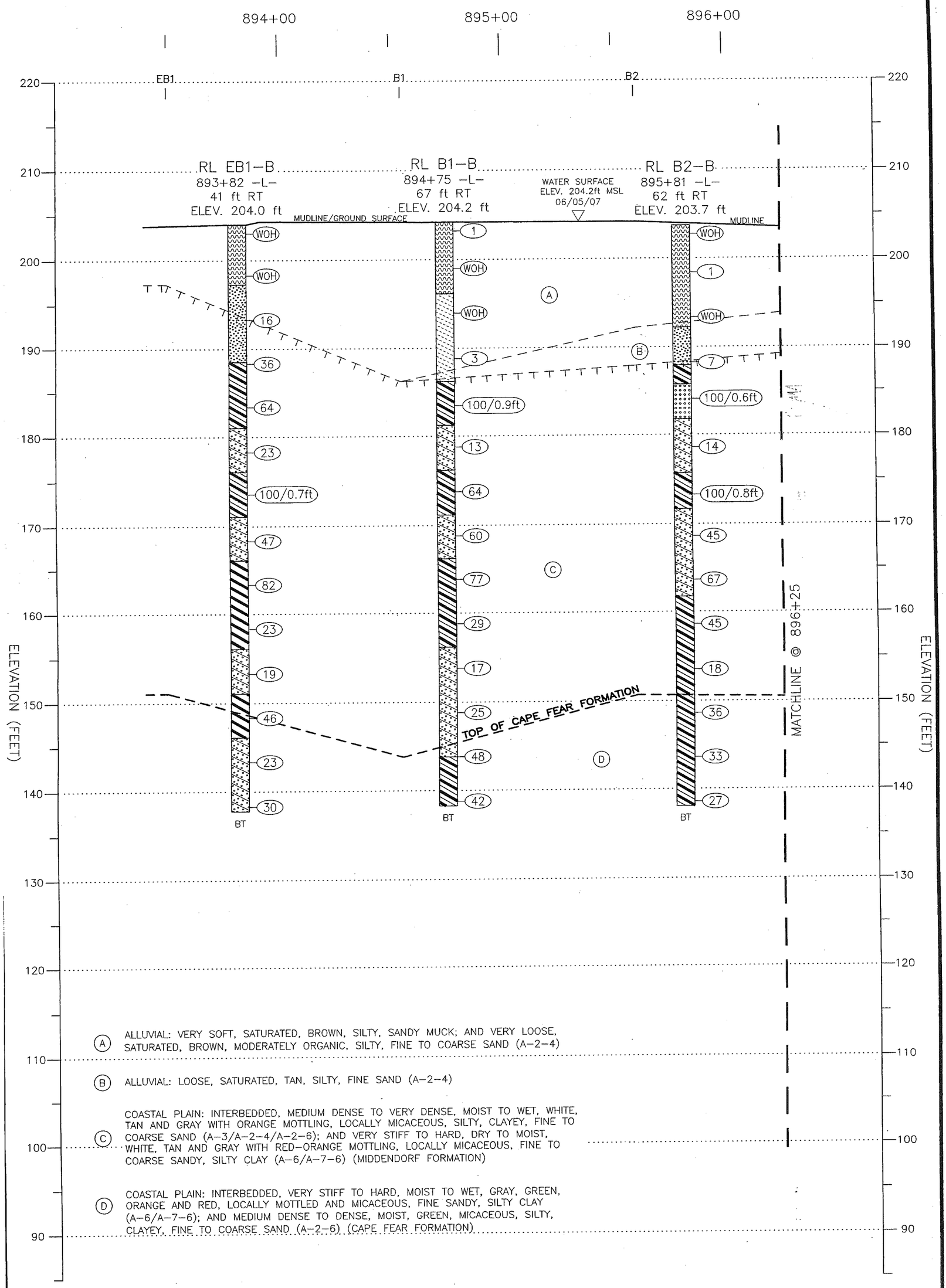
View looking along Left Lane End Bent 2 toward center line.



BORING LOCATION PLAN
STRUCTURES 5 & 6: DUAL BRIDGES ON -L- OVER STEWART'S CREEK
PROJECT NCDOT NO. 34817.1.2 (U-2519CB)
F.A. PROJECT NO. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING & CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 06/22/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1685
	ENG CHECK: S.J.C.	DWG: 16



(A) ALLUVIAL: VERY SOFT, SATURATED, BROWN, SILTY, SANDY MUCK; AND VERY LOOSE, SATURATED, BROWN, MODERATELY ORGANIC, SILTY, FINE TO COARSE SAND (A-2-4)

(B) ALLUVIAL: LOOSE, SATURATED, TAN, SILTY, FINE SAND (A-2-4)

(C) COASTAL PLAIN: INTERBEDDED, MEDIUM DENSE TO VERY DENSE, MOIST TO WET, WHITE, TAN AND GRAY WITH ORANGE MOTTLING, LOCALLY MICACEOUS, SILTY, CLAYEY, FINE TO COARSE SAND (A-3/A-2-4/A-2-6); AND VERY STIFF TO HARD, DRY TO MOIST, WHITE, TAN AND GRAY WITH RED-ORANGE MOTTLING, LOCALLY MICACEOUS, FINE TO COARSE SANDY, SILTY CLAY (A-6/A-7-6) (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED, VERY STIFF TO HARD, MOIST TO WET, GRAY, GREEN, ORANGE AND RED, LOCALLY MOTTLED AND MICACEOUS, FINE SANDY, SILTY CLAY (A-6/A-7-6); AND MEDIUM DENSE TO DENSE, MOIST, GREEN, MICACEOUS, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 20' 40' 80'
HORIZONTAL SCALE IN FEET
1"=40'

PROFILE 59 FT RIGHT OF -L-
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
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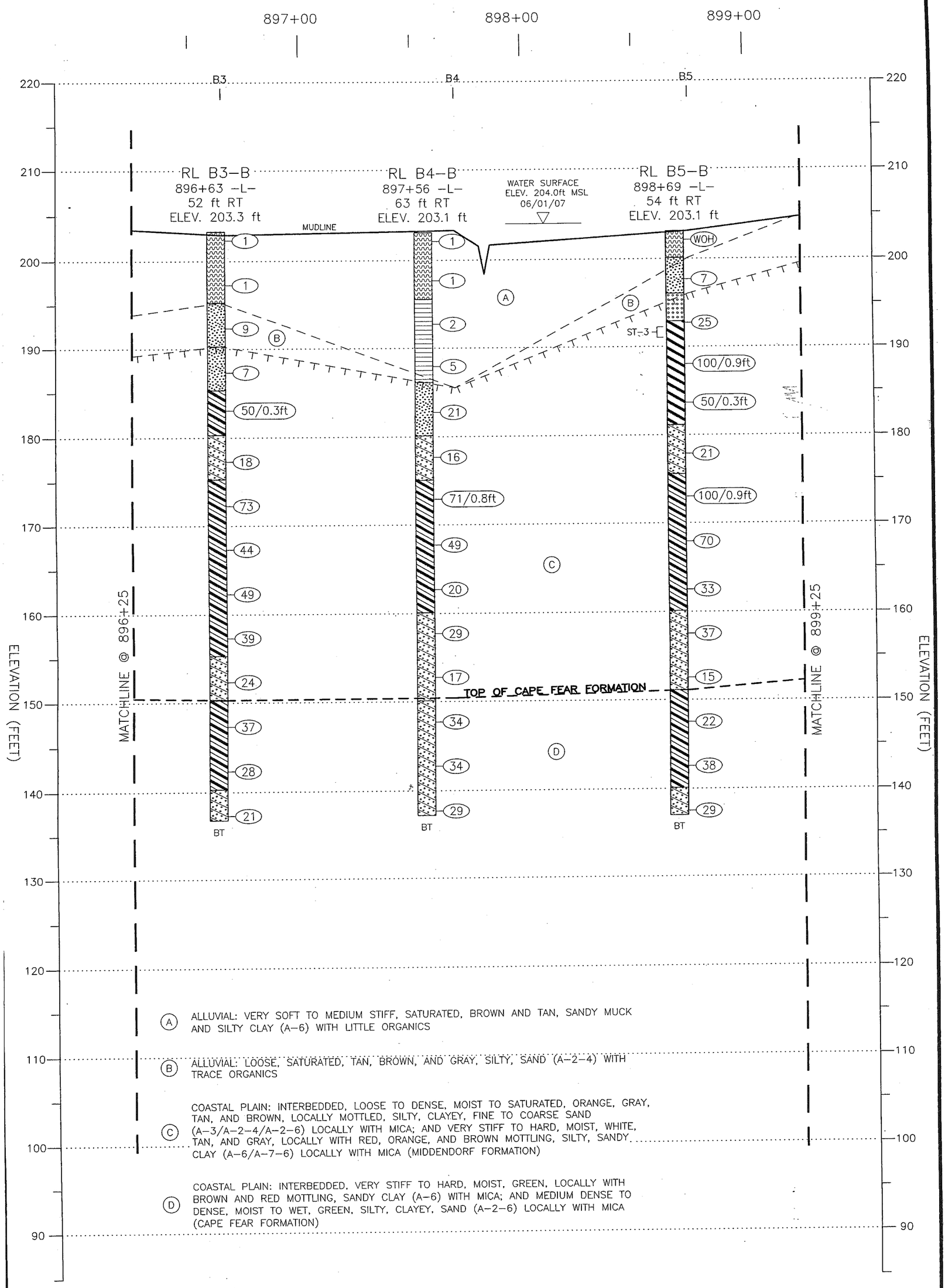
	ENG CHECK: S.J.C.	DWG: 17

SHEET: 37



0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 20' 40' 80'
HORIZONTAL SCALE IN FEET
1"=40'

PROFILE 59 FT RIGHT OF -L-
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
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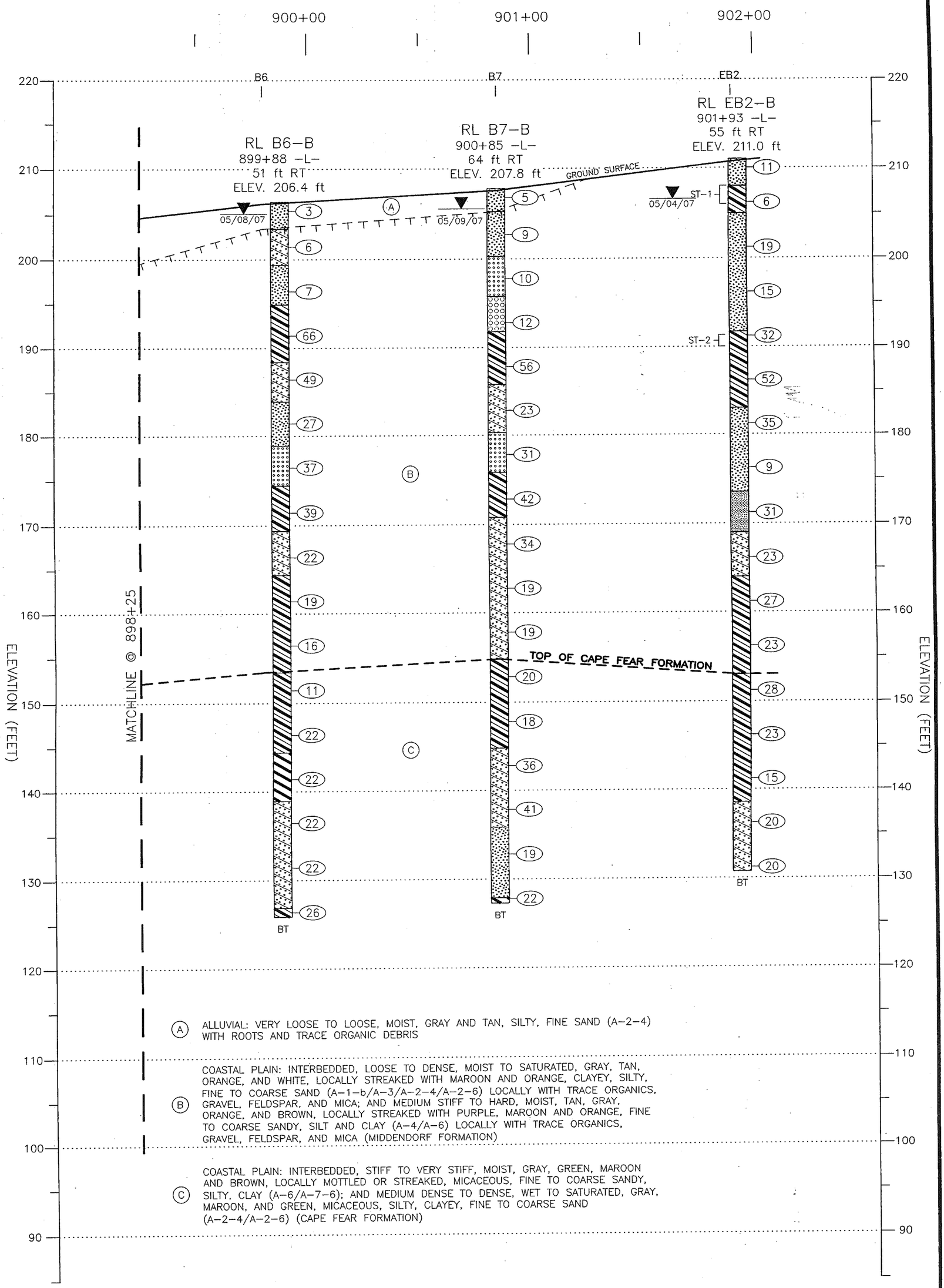
	ENG CHECK: S.J.C.	DWG: 18

SHEET: 38



(A) ALLUVIAL: VERY LOOSE TO LOOSE, MOIST, GRAY AND TAN, SILTY, FINE SAND (A-2-4) WITH ROOTS AND TRACE ORGANIC DEBRIS

(B) COASTAL PLAIN: INTERBEDDED, LOOSE TO DENSE, MOIST TO SATURATED, GRAY, TAN, ORANGE, AND WHITE, LOCALLY STREAKED WITH MAROON AND ORANGE, CLAYEY, SILTY, FINE TO COARSE SAND (A-1-b/A-3/A-2-4/A-2-6) LOCALLY WITH TRACE ORGANICS, GRAVEL, FELDSPAR, AND MICA; AND MEDIUM STIFF TO HARD, MOIST, TAN, GRAY, ORANGE, AND BROWN, LOCALLY STREAKED WITH PURPLE, MAROON AND ORANGE, FINE TO COARSE SANDY, SILT AND CLAY (A-4/A-6) LOCALLY WITH TRACE ORGANICS, GRAVEL, FELDSPAR, AND MICA (MIDDENDORF FORMATION)

(C) COASTAL PLAIN: INTERBEDDED, STIFF TO VERY STIFF, MOIST, GRAY, GREEN, MAROON AND BROWN, LOCALLY MOTTLED OR STREAKED, MICACEOUS, FINE TO COARSE SANDY, SILTY, CLAY (A-6/A-7-6); AND MEDIUM DENSE TO DENSE, WET TO SATURATED, GRAY, MAROON, AND GREEN, MICACEOUS, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-4/A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 20' 40' 80'
HORIZONTAL SCALE IN FEET
1"=40'

PROFILE 59 FT RIGHT OF -L-
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
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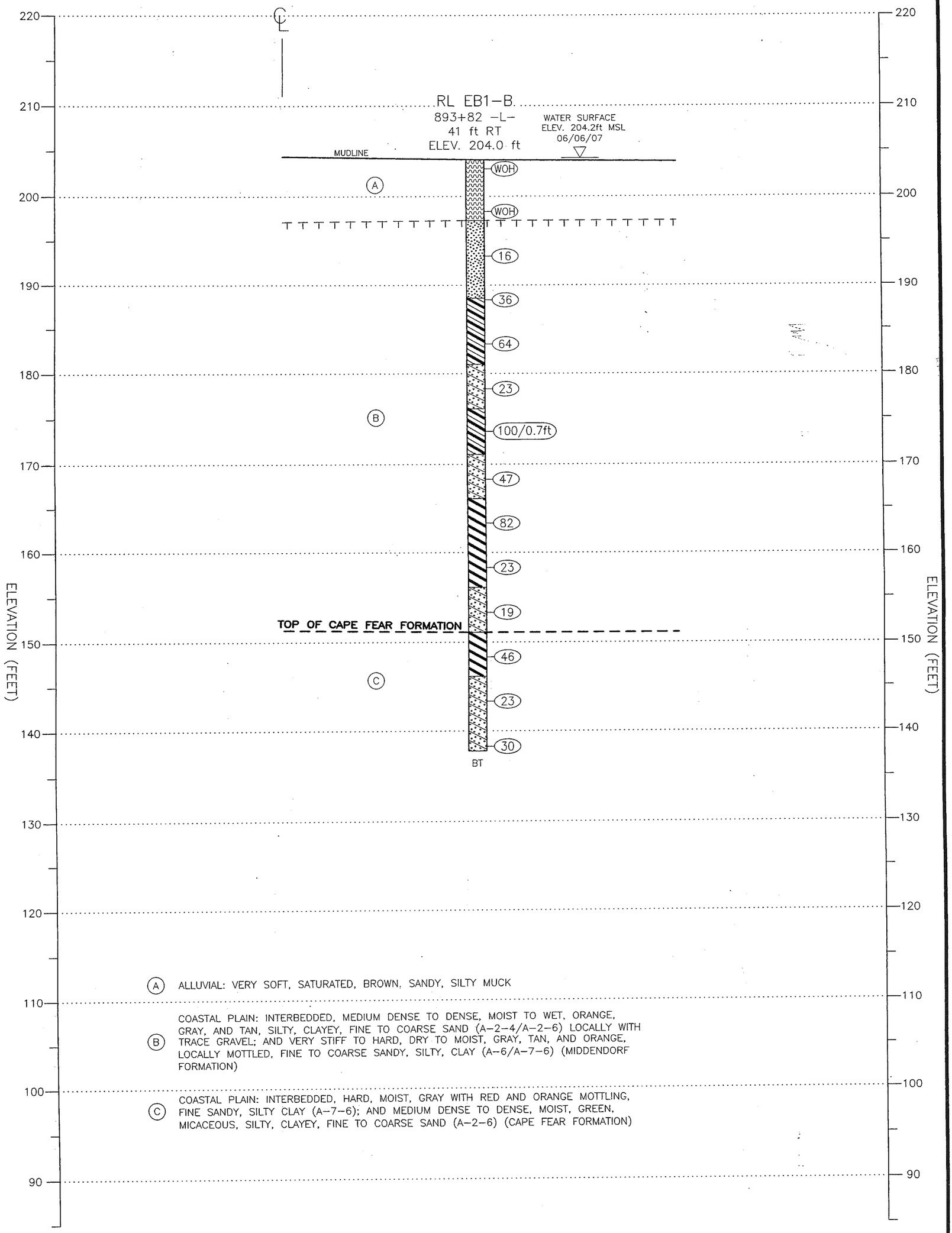
	ENG CHECK: S.J.C.	DWG: 19

SHEET: 39



(A) ALLUVIAL: VERY SOFT, SATURATED, BROWN, SANDY, SILTY MUCK

(B) COASTAL PLAIN: INTERBEDDED, MEDIUM DENSE TO DENSE, MOIST TO WET, ORANGE, GRAY, AND TAN, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-4/A-2-6) LOCALLY WITH TRACE GRAVEL; AND VERY STIFF TO HARD, DRY TO MOIST, GRAY, TAN, AND ORANGE, LOCALLY MOTTLED, FINE TO COARSE SANDY, SILTY, CLAY (A-6/A-7-6) (MIDDENDORF FORMATION)

(C) COASTAL PLAIN: INTERBEDDED, HARD, MOIST, GRAY WITH RED AND ORANGE MOTTLING, FINE SANDY, SILTY CLAY (A-7-6); AND MEDIUM DENSE TO DENSE, MOIST, GREEN, MICACEOUS, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE END BENT 1
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

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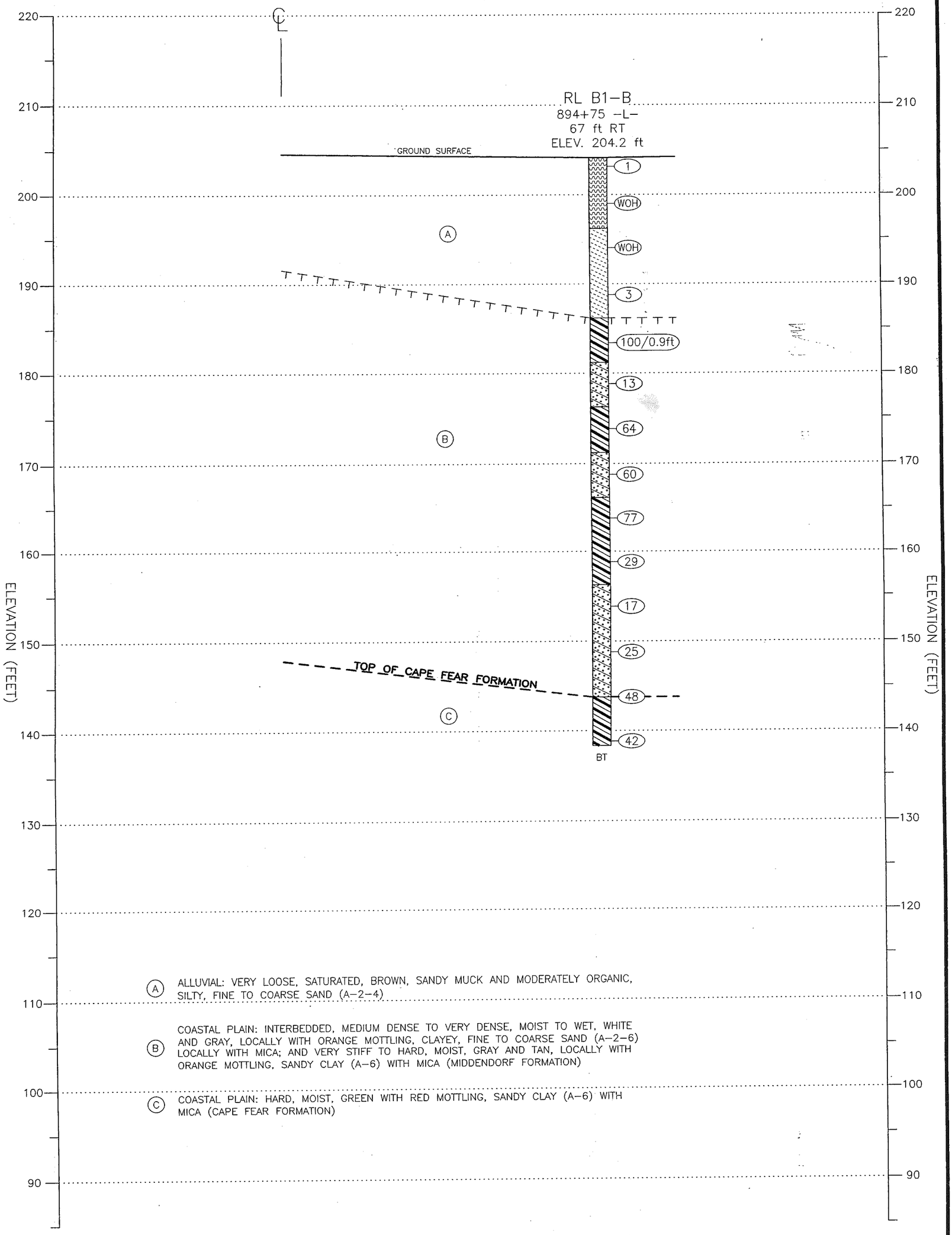
	ENG CHECK: S.J.C.	DWG: 20

SHEET: 40



(A) ALLUVIAL: VERY LOOSE, SATURATED, BROWN, SANDY MUCK AND MODERATELY ORGANIC, SILTY, FINE TO COARSE SAND (A-2-4)

(B) COASTAL PLAIN: INTERBEDDED, MEDIUM DENSE TO VERY DENSE, MOIST TO WET, WHITE AND GRAY, LOCALLY WITH ORANGE MOTTLING, CLAYEY, FINE TO COARSE SAND (A-2-6) LOCALLY WITH MICA; AND VERY STIFF TO HARD, MOIST, GRAY AND TAN, LOCALLY WITH ORANGE MOTTLING, SANDY CLAY (A-6) WITH MICA (MIDDENDORF FORMATION)

(C) COASTAL PLAIN: HARD, MOIST, GREEN WITH RED MOTTLING, SANDY CLAY (A-6) WITH MICA (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 1
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
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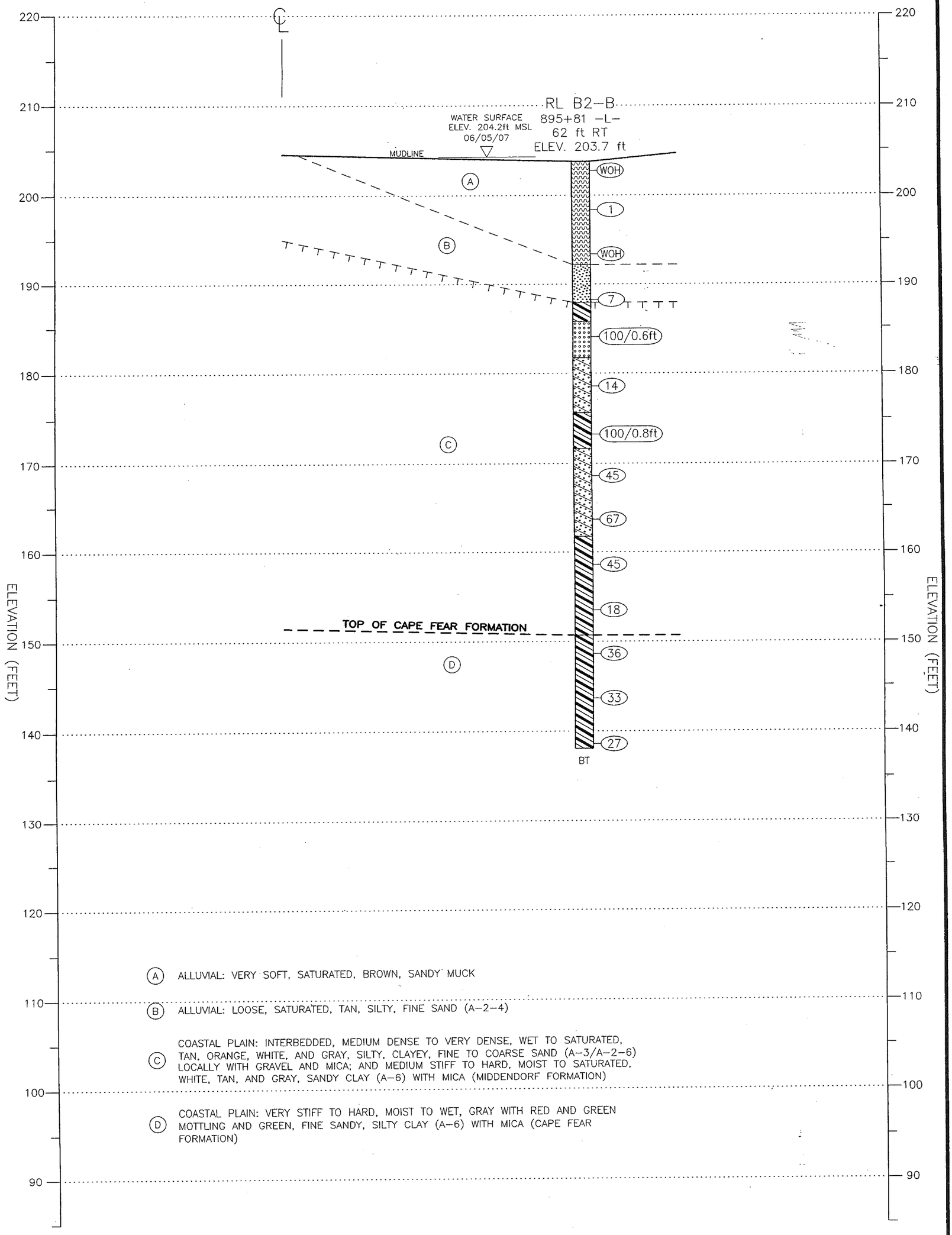
	ENG CHECK: S.J.C.	DWG: 21

SHEET: 41



(A) ALLUVIAL: VERY SOFT, SATURATED, BROWN, SANDY MUCK

(B) ALLUVIAL: LOOSE, SATURATED, TAN, SILTY, FINE SAND (A-2-4)

(C) COASTAL PLAIN: INTERBEDDED, MEDIUM DENSE TO VERY DENSE, WET TO SATURATED, TAN, ORANGE, WHITE, AND GRAY, SILTY, CLAYEY, FINE TO COARSE SAND (A-3/A-2-6) LOCALLY WITH GRAVEL AND MICA; AND MEDIUM STIFF TO HARD, MOIST TO SATURATED, WHITE, TAN, AND GRAY, SANDY CLAY (A-6) WITH MICA (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: VERY STIFF TO HARD, MOIST TO WET, GRAY WITH RED AND GREEN MOTTLING AND GREEN, FINE SANDY, SILTY CLAY (A-6) WITH MICA (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 2
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

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RALEIGH, NORTH CAROLINA

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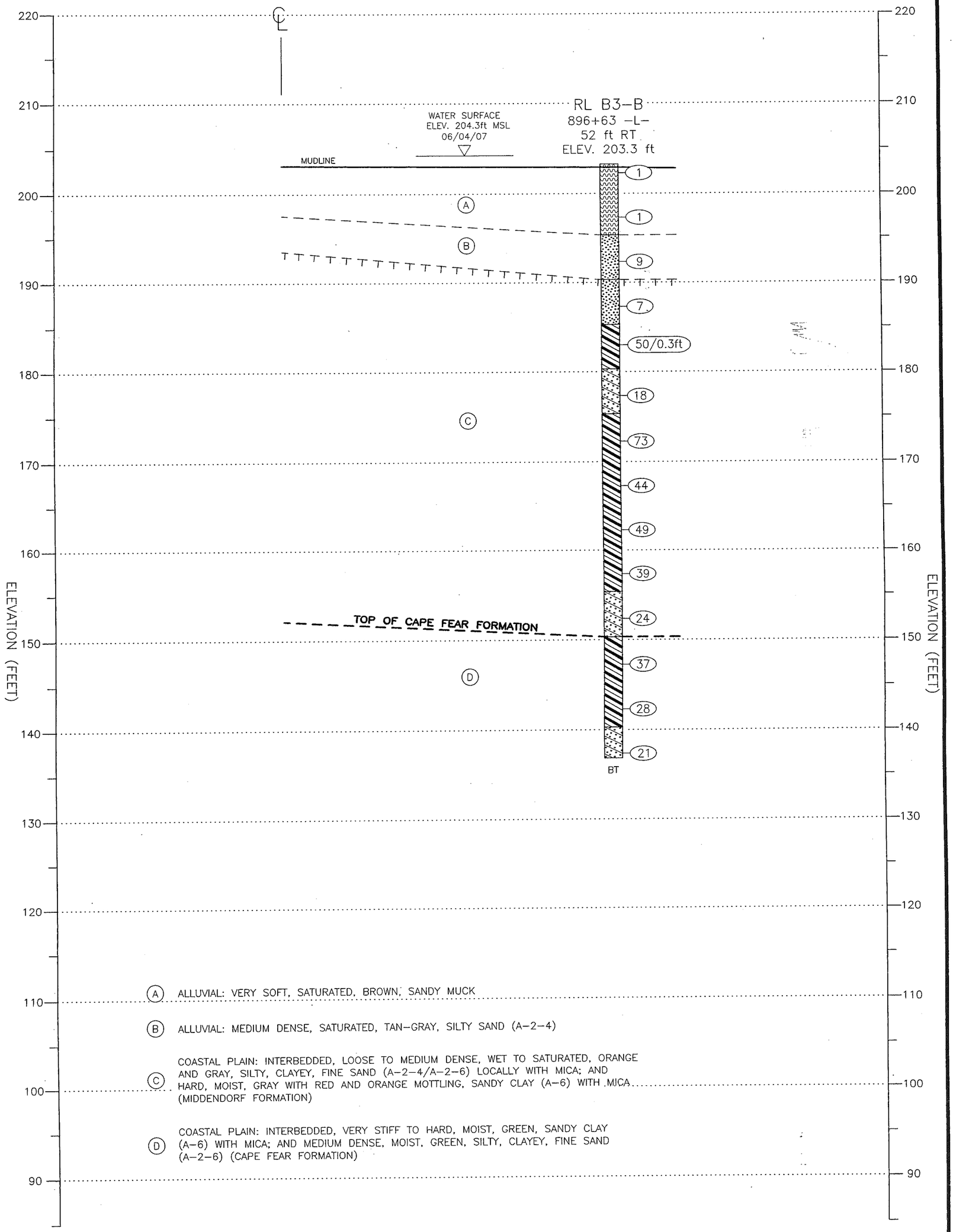
	ENG CHECK: S.J.C.	DWG: 22

SHEET: 42



(A) ALLUVIAL: VERY SOFT, SATURATED, BROWN, SANDY MUCK

(B) ALLUVIAL: MEDIUM DENSE, SATURATED, TAN-GRAY, SILTY SAND (A-2-4)

(C) COASTAL PLAIN: INTERBEDDED, LOOSE TO MEDIUM DENSE, WET TO SATURATED, ORANGE AND GRAY, SILTY, CLAYEY, FINE SAND (A-2-4/A-2-6) LOCALLY WITH MICA; AND HARD, MOIST, GRAY WITH RED AND ORANGE MOTTLING, SANDY CLAY (A-6) WITH MICA (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED, VERY STIFF TO HARD, MOIST, GREEN, SANDY CLAY (A-6) WITH MICA; AND MEDIUM DENSE, MOIST, GREEN, SILTY, CLAYEY, FINE SAND (A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

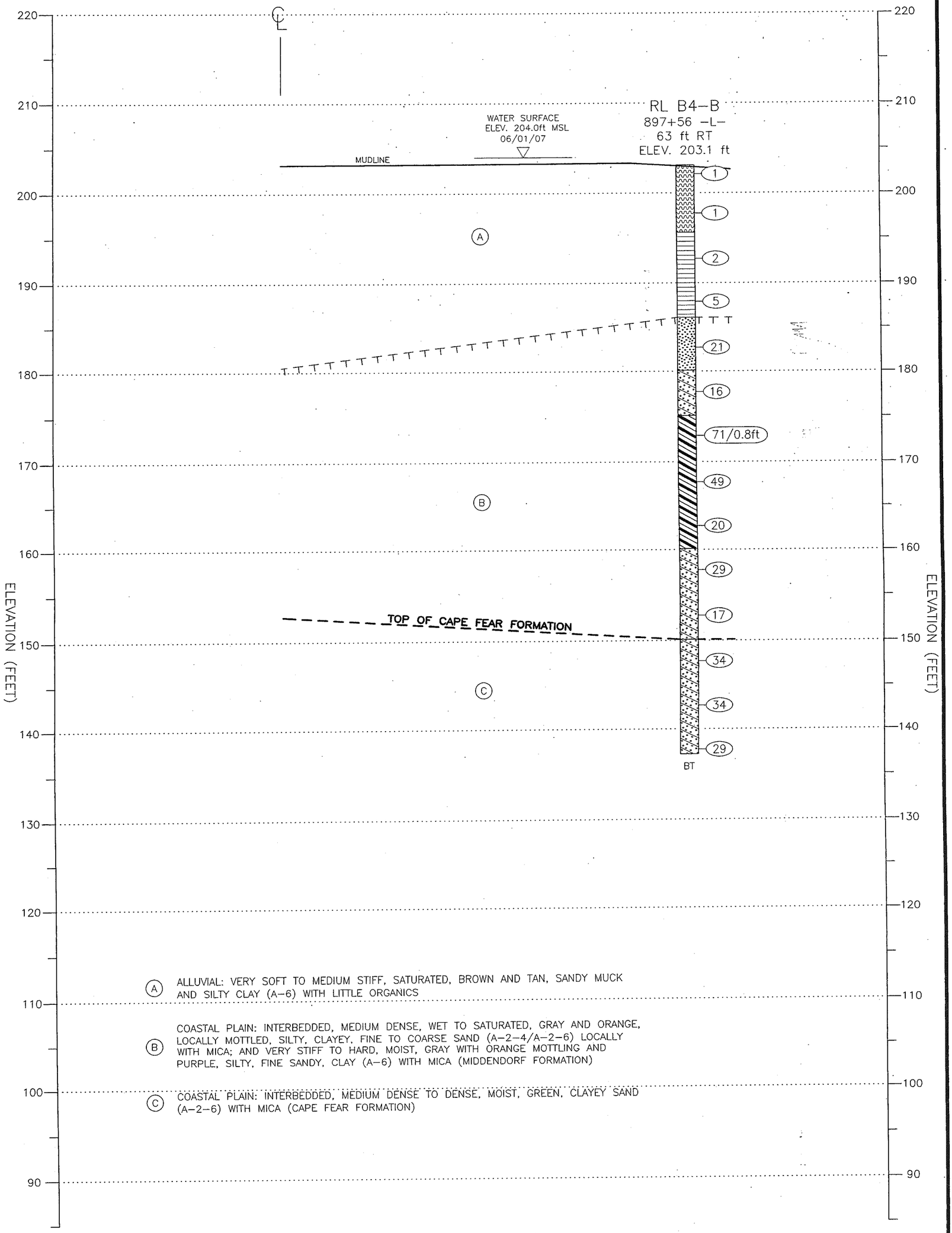
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 3
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 06/22/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1685
	ENG CHECK: S.J.C.	DWG: 23

SHEET: 43



(A) ALLUVIAL: VERY SOFT TO MEDIUM STIFF, SATURATED, BROWN AND TAN, SANDY MUCK AND SILTY CLAY (A-6) WITH LITTLE ORGANICS

(B) COASTAL PLAIN: INTERBEDDED, MEDIUM DENSE, WET TO SATURATED, GRAY AND ORANGE, LOCALLY MOTTLED, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-4/A-2-6) LOCALLY WITH MICA; AND VERY STIFF TO HARD, MOIST, GRAY WITH ORANGE MOTTLING AND PURPLE, SILTY, FINE SANDY, CLAY (A-6) WITH MICA (MIDDENDORF FORMATION)

(C) COASTAL PLAIN: INTERBEDDED, MEDIUM DENSE TO DENSE, MOIST, GREEN, CLAYEY SAND (A-2-6) WITH MICA (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 4
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

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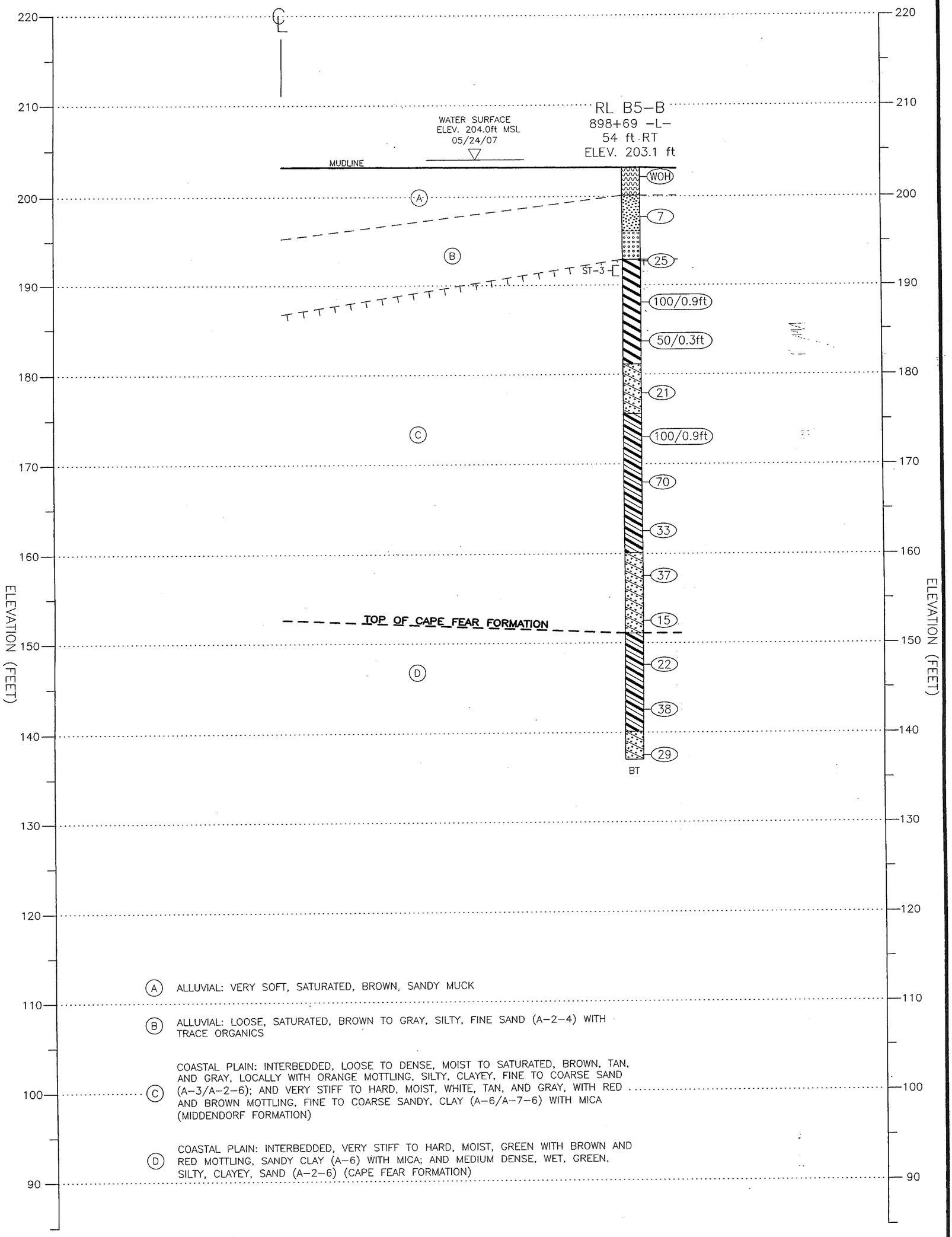
	DFT CHECK: M.B.L.	JOB: 6468-07-1685
	ENG CHECK: S.J.C.	DWG: 24

SHEET: 44



(A) ALLUVIAL: VERY SOFT, SATURATED, BROWN, SANDY MUCK

(B) ALLUVIAL: LOOSE, SATURATED, BROWN TO GRAY, SILTY, FINE SAND (A-2-4) WITH TRACE ORGANICS

(C) COASTAL PLAIN: INTERBEDDED, LOOSE TO DENSE, MOIST TO SATURATED, BROWN, TAN, AND GRAY, LOCALLY WITH ORANGE MOTTLING, SILTY, CLAYEY, FINE TO COARSE SAND (A-3/A-2-6); AND VERY STIFF TO HARD, MOIST, WHITE, TAN, AND GRAY, WITH RED AND BROWN MOTTLING, FINE TO COARSE SANDY, CLAY (A-6/A-7-6) WITH MICA (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED, VERY STIFF TO HARD, MOIST, GREEN WITH BROWN AND RED MOTTLING, SANDY CLAY (A-6) WITH MICA; AND MEDIUM DENSE, WET, GREEN, SILTY, CLAYEY, SAND (A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 5
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
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REVISIONS	DRAWN: R.R.	DATE: 06/22/07
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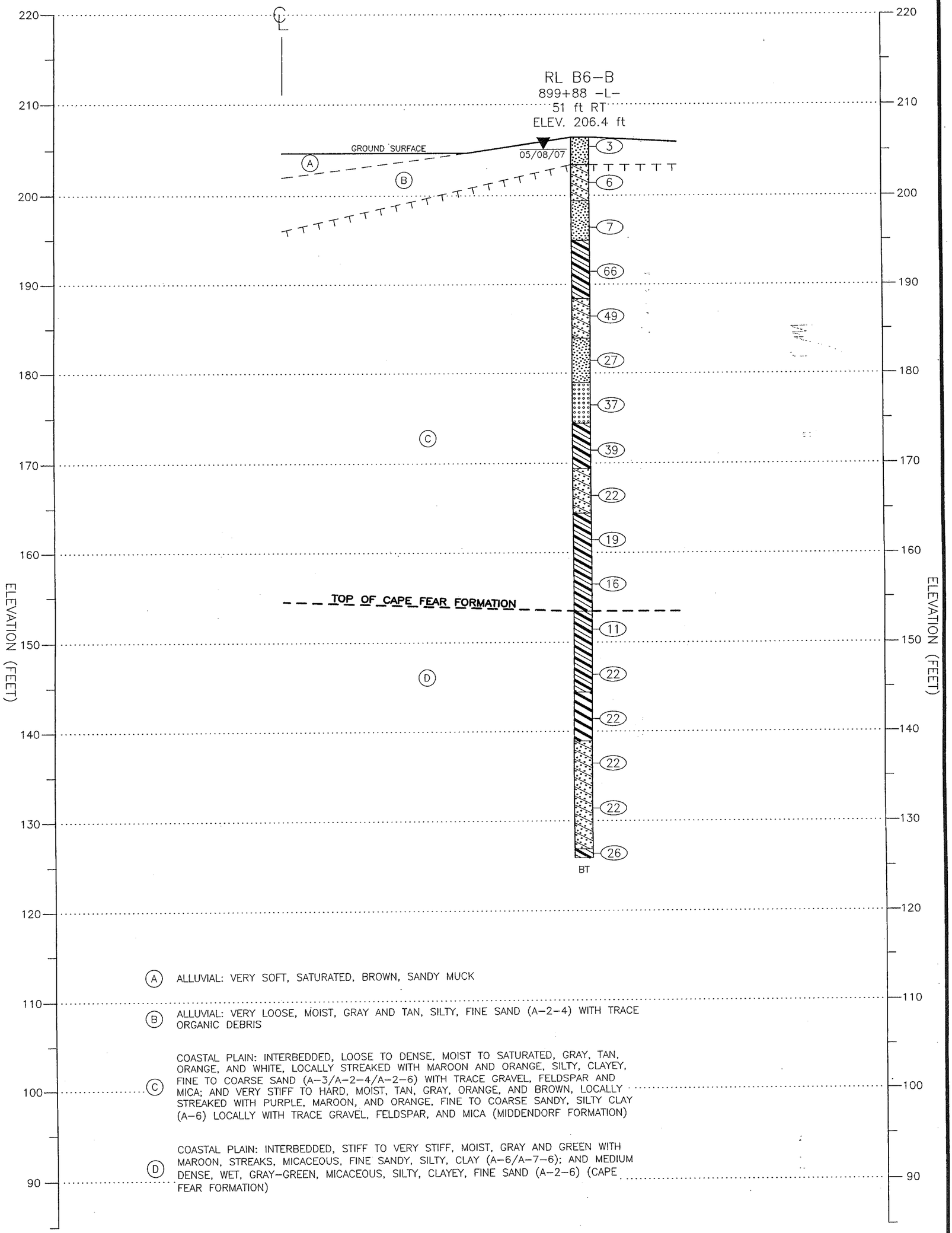
	ENG CHECK: S.J.C.	DWG: 25

SHEET: 45



(A) ALLUVIAL: VERY SOFT, SATURATED, BROWN, SANDY MUCK

(B) ALLUVIAL: VERY LOOSE, MOIST, GRAY AND TAN, SILTY, FINE SAND (A-2-4) WITH TRACE ORGANIC DEBRIS

(C) COASTAL PLAIN: INTERBEDDED, LOOSE TO DENSE, MOIST TO SATURATED, GRAY, TAN, ORANGE, AND WHITE, LOCALLY STREAKED WITH MAROON AND ORANGE, SILTY, CLAYEY, FINE TO COARSE SAND (A-3/A-2-4/A-2-6) WITH TRACE GRAVEL, FELDSPAR AND MICA; AND VERY STIFF TO HARD, MOIST, TAN, GRAY, ORANGE, AND BROWN, LOCALLY STREAKED WITH PURPLE, MAROON, AND ORANGE, FINE TO COARSE SANDY, SILTY CLAY (A-6) LOCALLY WITH TRACE GRAVEL, FELDSPAR, AND MICA (MIDDENDORF FORMATION)

(D) COASTAL PLAIN: INTERBEDDED, STIFF TO VERY STIFF, MOIST, GRAY AND GREEN WITH MAROON, STREAKS, MICACEOUS, FINE SANDY, SILTY, CLAY (A-6/A-7-6); AND MEDIUM DENSE, WET, GRAY-GREEN, MICACEOUS, SILTY, CLAYEY, FINE SAND (A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

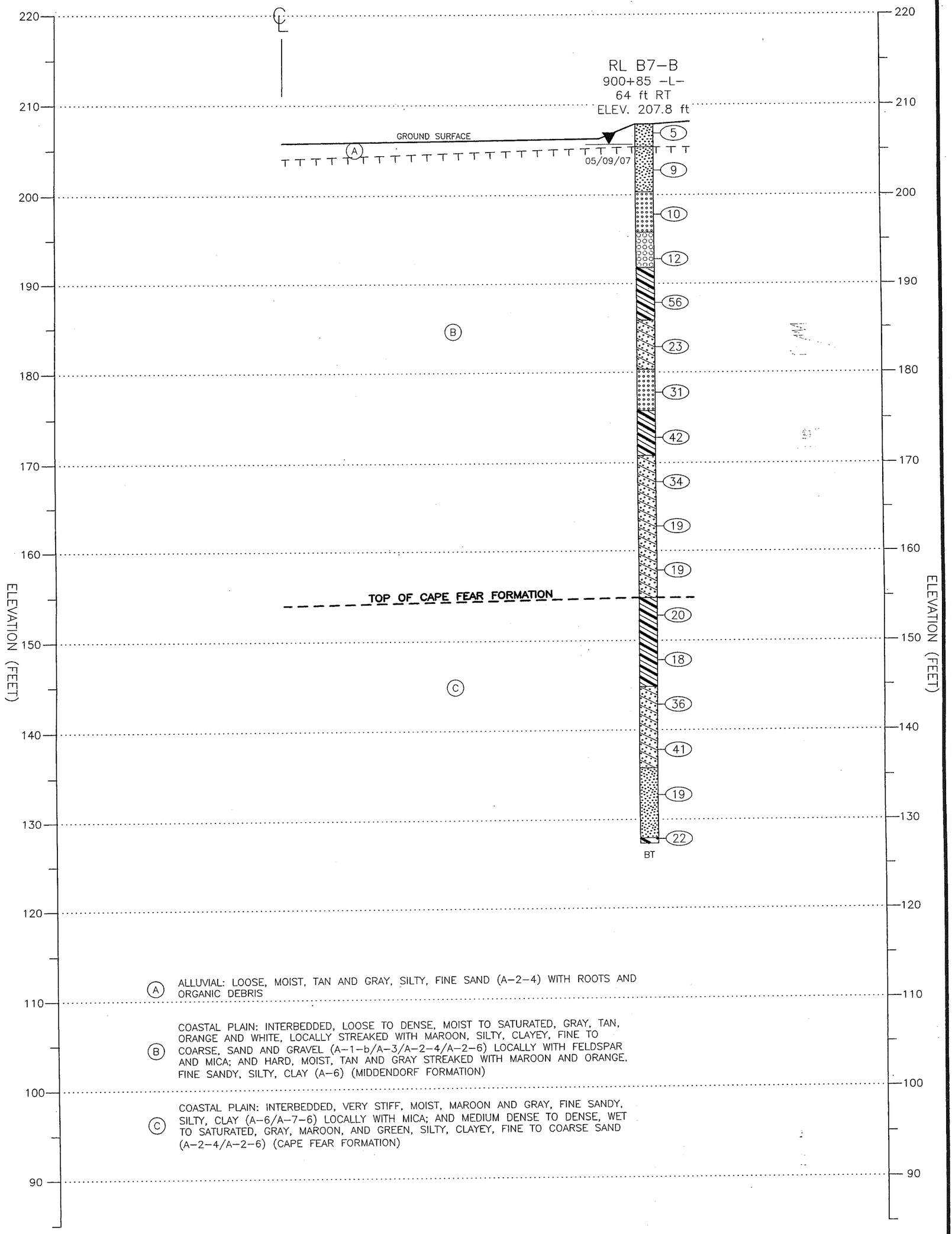
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 6
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 06/22/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1685
	ENG CHECK: S.J.C.	DWG: 26

SHEET: 46



(A) ALLUVIAL: LOOSE, MOIST, TAN AND GRAY, SILTY, FINE SAND (A-2-4) WITH ROOTS AND ORGANIC DEBRIS

(B) COASTAL PLAIN: INTERBEDDED, LOOSE TO DENSE, MOIST TO SATURATED, GRAY, TAN, ORANGE AND WHITE, LOCALLY STREAKED WITH MAROON, SILTY, CLAYEY, FINE TO COARSE, SAND AND GRAVEL (A-1-b/A-3/A-2-4/A-2-6) LOCALLY WITH FELDSPAR AND MICA; AND HARD, MOIST, TAN AND GRAY STREAKED WITH MAROON AND ORANGE, FINE SANDY, SILTY, CLAY (A-6) (MIDDENDORF FORMATION)

(C) COASTAL PLAIN: INTERBEDDED, VERY STIFF, MOIST, MAROON AND GRAY, FINE SANDY, SILTY, CLAY (A-6/A-7-6) LOCALLY WITH MICA; AND MEDIUM DENSE TO DENSE, WET TO SATURATED, GRAY, MAROON, AND GREEN, SILTY, CLAYEY, FINE TO COARSE SAND (A-2-4/A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

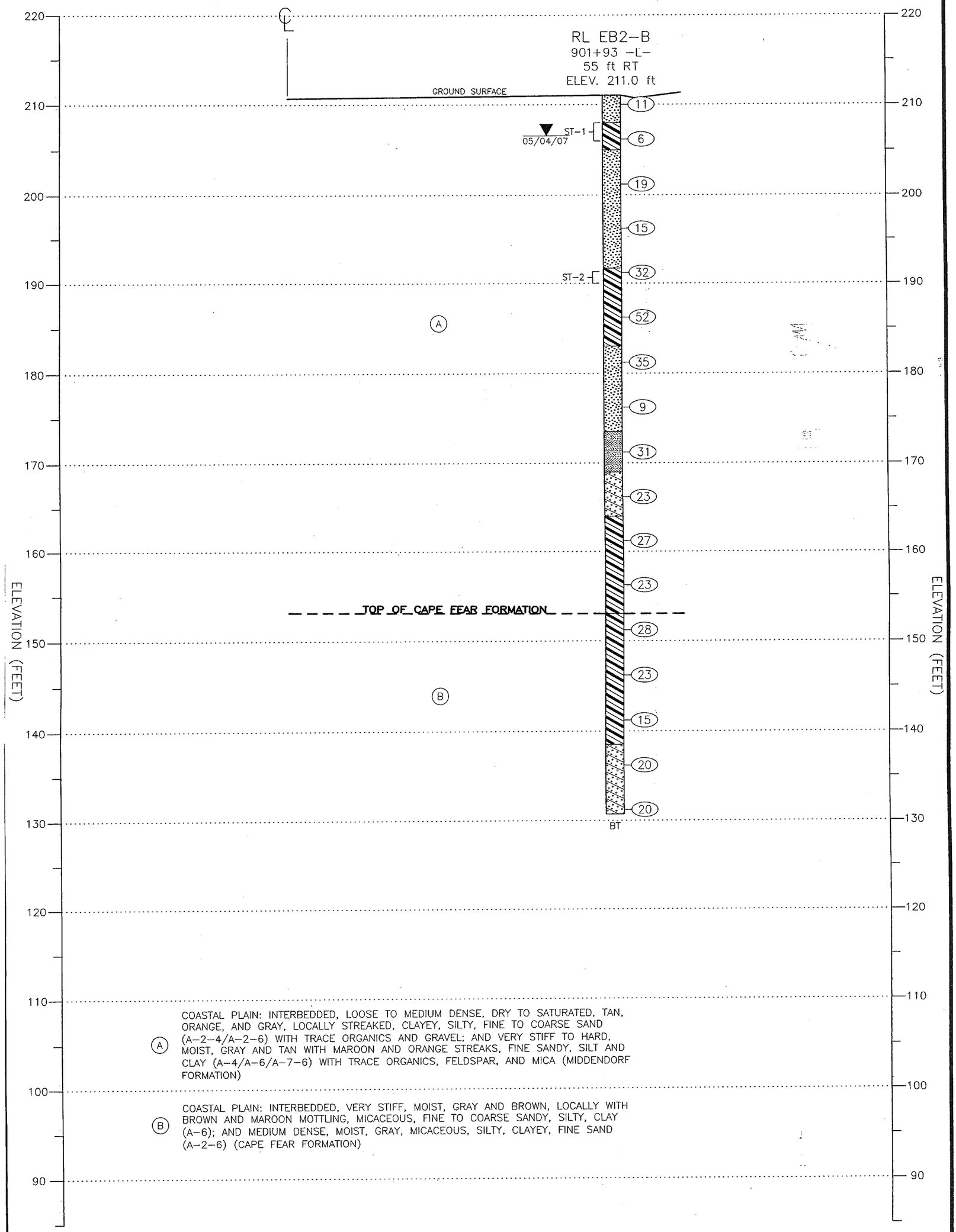
0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE BENT 7
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 06/22/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1685
	ENG CHECK: S.J.C.	DWG: 27

SHEET: 47



(A) COASTAL PLAIN: INTERBEDDED, LOOSE TO MEDIUM DENSE, DRY TO SATURATED, TAN, ORANGE, AND GRAY, LOCALLY STREAKED, CLAYEY, SILTY, FINE TO COARSE SAND (A-2-4/A-2-6) WITH TRACE ORGANICS AND GRAVEL; AND VERY STIFF TO HARD, MOIST, GRAY AND TAN WITH MAROON AND ORANGE STREAKS, FINE SANDY, SILT AND CLAY (A-4/A-6/A-7-6) WITH TRACE ORGANICS, FELDSPAR, AND MICA (MIDDENDORF FORMATION)

(B) COASTAL PLAIN: INTERBEDDED, VERY STIFF, MOIST, GRAY AND BROWN, LOCALLY WITH BROWN AND MAROON MOTTLING, MICACEOUS, FINE TO COARSE SANDY, SILTY, CLAY (A-6); AND MEDIUM DENSE, MOIST, GRAY, MICACEOUS, SILTY, CLAYEY, FINE SAND (A-2-6) (CAPE FEAR FORMATION)

0 5' 10' 20'
VERTICAL SCALE IN FEET
1"=10'

0 10' 20' 40'
HORIZONTAL SCALE IN FEET
1"=20'

CROSS SECTION ALONG RIGHT LANE END BENT 2
STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK
NCDOT PROJECT NO. 34817.1.2 (U-2519CB)
F.A. No. NHF-DPR-0100(001)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 06/22/07
	DFT CHECK: M.B.L.	JOB: 6468-07-1685
	ENG CHECK: S.J.C.	DWG: 28

SHEET: 48

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST S. Lehman
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			GROUND WTR (ft)
BORING NO. RL EB1-B	STATION 893+82	OFFSET 41ft RT	ALIGNMENT -L-
COLLAR ELEV. 204.0 ft	TOTAL DEPTH 66.2 ft	NORTHING 490,567	EASTING 1,992,617
DRILL MACHINE CME-45B	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 06/06/07	COMP. DATE 06/06/07	SURFACE WATER DEPTH 0.2ft	DEPTH TO ROCK N/A

GROUND WTR (ft)	
0 HR.	Water
24 HR.	Boring

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)
205 / 204.0	0.0								204.0 MUDLINE	0.0
		WOH	WOH	WOH	WOH 0		Sat.		**ALLUVIAL** Dark brown, silty MUCK	
199.3	4.7	WOR	WOR	WOH	WOH 0		Sat.		197.3 **COASTAL PLAIN** Orange-tan, silty, clayey, fine to coarse SAND (A-2-4) (Middendorf Formation)	6.7
194.3	9.7	1	7	9	16		W			
189.3	14.7	6	12	24	36		D		188.5 **COASTAL PLAIN** Light gray with tan and orange mottling, fine to coarse sandy, silty CLAY (A-6) (Middendorf Formation)	15.5
184.3	19.7	22	27	37	64		M			
179.3	24.7	21	11	12	23		M		181.0 **COASTAL PLAIN** Light gray, silty, clayey, fine to coarse SAND (A-2-6) with trace gravel (Middendorf Formation)	23.0
174.3	29.7	59	41/0.2		100/0.7		D		176.1 **COASTAL PLAIN** Light gray with orange mottling, fine sandy, silty CLAY (A-6) (Middendorf Formation)	27.9
169.3	34.7	20	22	25	47		M		171.1 **COASTAL PLAIN** Light gray and orange-tan, silty, clayey, fine to coarse SAND (A-2-6) (Middendorf Formation)	32.9
164.3	39.7	25	34	48	82		M		166.1 **COASTAL PLAIN** Dark gray and gray, fine sandy, silty CLAY (A-7-6) (Middendorf Formation)	37.9
159.3	44.7	8	10	13	23		M			
154.3	49.7	8	9	10	19		M		156.1 **COASTAL PLAIN** Light gray and tan, silty, clayey, fine to coarse SAND (A-2-6) (Middendorf Formation)	47.9
149.3	54.7	13	23	23	46		M		151.1 **COASTAL PLAIN** Dark gray with red and orange mottling, fine sandy, silty CLAY (A-7-6) (Cape Fear Formation)	52.9
144.3	59.7	8	11	12	23		M		146.1 **COASTAL PLAIN** Light green to green, micaceous, silty, clayey, fine to coarse SAND (A-2-6) (Cape Fear Formation)	57.9
139.3	64.7	8	12	18	30		M		137.8 Boring Terminated at Elevation 137.8 ft in Coastal Plain: Dense, micaceous, silty, clayey, fine to coarse SAND (A-2-6) (Cape Fear Formation)	66.2

Bits Used: 3" Side Discharge
Drilling Fluid Properties: 9.0 lbs/gal
Casing Depth (4"): 9.1 ft

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			GROUND WTR (ft)
BORING NO. RL B1-B	STATION 894+75	OFFSET 67ft RT	ALIGNMENT -L-
COLLAR ELEV. 204.2 ft	TOTAL DEPTH 65.9 ft	NORTHING 490,640	EASTING 1,992,679
DRILL MACHINE CME-45B	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 06/05/07	COMP. DATE 06/05/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

GROUND WTR (ft)	
0 HR.	0.0
24 HR.	ND

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
205 / 204.2	0.0								204.2 GROUND SURFACE 0.0
		1	WOH	1	1		Sat.		**ALLUVIAL** Brown, sandy MUCK
200.0	4.2	1	WOH	WOH	WOH 0		Sat.		196.2 **ALLUVIAL** Brown, moderately organic, silty, fine to coarse SAND (A-2-4) 8.0
195.0	9.2	WOH	WOH	WOH	WOH 0		Sat.		
189.8	14.4	1	WOH	3	3		Sat.		186.2 **COASTAL PLAIN** Light gray with orange mottling, sandy CLAY (A-6) with mica (Middendorf Formation) 18.0
184.8	19.4	40	43	57/0.4	100/0.9		M		181.2 **COASTAL PLAIN** White, clayey, fine to coarse SAND (A-2-6) (Middendorf Formation) 23.0
179.8	24.4	6	5	8	13		W		176.2 **COASTAL PLAIN** Tan-gray, sandy CLAY (A-6) (Middendorf Formation) 28.0
174.8	29.4	21	26	38	64		M		171.2 **COASTAL PLAIN** Gray with orange mottling, clayey, SAND (A-2-6) (Middendorf Formation) 33.0
169.8	34.4	37	30	30	60		W		166.2 **COASTAL PLAIN** Dark gray with orange mottling and gray, sandy CLAY (A-6) with mica (Middendorf Formation) 38.0
164.8	39.4	23	32	45	77		M		
159.8	44.4	12	13	16	29		M		156.2 **COASTAL PLAIN** Gray, clayey, fine SAND (A-2-6) with mica (Middendorf Formation) 48.0
154.8	49.4	6	7	10	17		M		
149.8	54.4	8	11	14	25		W		
144.8	59.4	12	23	25	48		M		143.8 **COASTAL PLAIN** Green with red mottling, sandy, CLAY (A-6) with mica (Cape Fear Formation) 60.4
139.8	64.4	14	21	21	42		M		138.3 Boring Terminated at Elevation 138.3 ft in Coastal Plain: Hard, sandy, CLAY (A-6) with mica (Cape Fear Formation) 65.9

Bits Used: 3" Side-Discharge Finger Bit
Drilling Fluid Properties: 9.0 lbs/gal
Casing Depth (4"): 14.2 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			GROUND WTR (ft)
BORING NO. RL B2-B	STATION 895+81	OFFSET 62ft RT	ALIGNMENT -L-
COLLAR ELEV. 203.7 ft	TOTAL DEPTH 65.6 ft	NORTHING 490,737	EASTING 1,992,719
DRILL MACHINE CME-45B	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 06/05/07	COMP. DATE 06/05/07	SURFACE WATER DEPTH 0.6ft	DEPTH TO ROCK N/A

GROUND WTR (ft): 0 HR. Water; 24 HR. Boring

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))
205									
203.7	0.0								203.7 / 0.0 MUDLINE
		1	WOH	WOH	WOH 0		Sat.		ALLUVIAL Brown, sandy MUCK
199.4	4.3								
		2	1	WOH	1		Sat.		
194.4	9.3								
		WOH	WOH	WOH	WOH 0		Sat.		192.2 / 11.5 ALLUVIAL Tan, silty, fine SAND (A-2-4)
189.2	14.5								
		8	4	3	7		Sat.		187.9 / 15.8 COASTAL PLAIN White, sandy CLAY (A-6) (Middendorf Formation)
184.6	19.1								185.7 / 18.0 COASTAL PLAIN Tan-orange, coarse SAND (A-3) with gravel (Middendorf Formation)
		35	65/0.1		100/0.6		Sat.		181.7 / 22.0 COASTAL PLAIN White, clayey, fine SAND (A-2-6) (Middendorf Formation)
179.6	24.1								
		4	6	8	14		Sat.		175.7 / 28.0 COASTAL PLAIN Tan gray, sandy, CLAY (A-6) with mica (Middendorf Formation)
174.6	29.1								
		28	50	50/0.3	100/0.6		M		171.7 / 32.0 COASTAL PLAIN Tan and dark gray, silty, clayey, SAND (A-2-6) with mica (Middendorf Formation)
169.6	34.1								
		18	19	26	45		W		
164.6	39.1								
		21	28	39	67		W		161.7 / 42.0 COASTAL PLAIN Gray, sandy, CLAY (A-6) with mica (Middendorf Formation)
159.6	44.1								
		12	18	27	45		M		
154.6	49.1								
		8	9	9	18		W		150.7 / 53.0 COASTAL PLAIN Dark gray with red and green mottling, and green, fine sandy, silty, CLAY (A-6) with mica (Cape Fear Formation)
149.6	54.1								
		11	15	21	36		M		
144.6	59.1								
		8	14	19	33		W		
139.6	64.1								
		8	10	17	27		W		138.1 / 65.6 Boring Terminated at Elevation 138.1 ft in Coastal Plain: Very stiff, fine sandy, silty, CLAY (A-6) with mica (Cape Fear Formation)

Bits Used: 3" Side-Discharge Finger Bit
Drilling Fluid Properties: 9.0 lbs/gal
Casing Depth (4"): 17.1 ft

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			GROUND WTR (ft)
BORING NO. RL B3-B	STATION 896+63	OFFSET 52ft RT	ALIGNMENT -L-
COLLAR ELEV. 203.3 ft	TOTAL DEPTH 66.5 ft	NORTHING 490,815	EASTING 1,992,745
DRILL MACHINE CME-45B	DRILL METHOD Mud Rotary		HAMMER TYPE Manual
START DATE 06/04/07	COMP. DATE 06/04/07	SURFACE WATER DEPTH 1.0ft	DEPTH TO ROCK N/A

GROUND WTR (ft): 0 HR. Water; 24 HR. Boring

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))
205									
203.3	0.0								203.3 / 0.0 MUDLINE
		1	1	WOH	1		Sat.		ALLUVIAL Brown, sandy MUCK
198.3	5.0								
		1	WOH	1	1		Sat.		195.3 / 8.0 ALLUVIAL Tan-gray, silty SAND (A-2-4)
193.3	10.0								
		3	4	5	9		Sat.		190.3 / 13.0 COASTAL PLAIN Orange-gray, silty, fine SAND (A-2-4) (Middendorf Formation)
188.3	15.0								
		2	3	4	7		Sat.		185.3 / 18.0 COASTAL PLAIN Gray, sandy CLAY (A-6) (Middendorf Formation) (No Recovery, description based on drill cuttings)
183.3	20.0								
		50/0.3			50/0.3		M		180.3 / 23.0 COASTAL PLAIN Light gray, clayey, fine SAND (A-2-6) (Middendorf Formation)
178.3	25.0								
		8	8	10	18		Sat.		175.3 / 28.0 COASTAL PLAIN Gray, with red and orange mottling, sandy clay (A-6) with mica (Middendorf Formation)
173.3	30.0								
		15	32	41	73		M		
168.3	35.0								
		17	21	23	44		M		
163.3	40.0								
		14	20	29	49		M		
158.3	45.0								
		13	17	22	39		M		155.3 / 48.0 COASTAL PLAIN Gray, clayey, fine SAND (A-2-6) with mica (Middendorf Formation)
153.3	50.0								
		8	11	13	24		W		150.3 / 53.0 COASTAL PLAIN Green, sandy CLAY (A-6) with mica (Cape Fear Formation)
148.3	55.0								
		11	15	22	37		M		
143.3	60.0								
		13	12	16	28		M		140.3 / 63.0 COASTAL PLAIN Green, silty, clayey, fine SAND (A-2-6) (Cape Fear Formation)
138.3	65.0								
		10	10	11	21		M		136.8 / 66.5 Boring Terminated at Elevation 136.8 ft in Coastal Plain: Medium dense, silty, clayey, fine SAND (A-2-6) (Cape Fear Formation)

Bits Used: 3" Side-Discharge Finger Bit
Drilling Fluid Properties: 9.0 lbs/gal
Casing Depth (4"): 10.0 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			GROUND WTR (ft)
BORING NO. RL B4-B	STATION 897+56	OFFSET 63ft RT	ALIGNMENT -L-	0 HR. Water
COLLAR ELEV. 203.1 ft	TOTAL DEPTH 65.9 ft	NORTHING 490,891	EASTING 1,992,797	24 HR. Boring
DRILL MACHINE CME-45B	DRILL METHOD Mud Rotary		HAMMER TYPE Manual	
START DATE 06/01/07	COMP. DATE 06/01/07	SURFACE WATER DEPTH 0.9ft	DEPTH TO ROCK N/A	

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))
205									
203.1	0.0								MUDLINE (203.1 / 0.0)
		WOH	WOH	1	1		Sat.		ALLUVIAL Brown and tan, sandy MUCK
198.7	4.4								
		1	1	WOH	1		Sat.		
195.6	7.5								ALLUVIAL Brown and tan, silty CLAY (A-6) with little organics Organic Content (SS-29)= 6.7%
193.7	9.4								
		1	1	1	2	SS-29	Sat.		
188.9	14.2								
		1	4	1	5		Sat.		
186.1	17.0								COASTAL PLAIN Gray, with orange mottling, silty, fine to coarse SAND (A-2-4) (Middendorf Formation)
183.7	19.4								
		10	12	9	21	SS-30	Sat.		
180.1	23.0								COASTAL PLAIN Orange and gray, clayey, fine SAND (A-2-6) (Middendorf Formation)
178.7	24.4								
		6	7	9	16	SS-31	Sat.		
175.1	28.0								COASTAL PLAIN Gray with orange mottling and purple, silty, fine sandy, CLAY (A-6) with mica (Middendorf Formation)
173.7	29.4								
		21	50/0.3		71/0.9	SS-32	M		
168.7	34.4								
		21	24	25	49	SS-33	M		
163.7	39.4								
		8	8	12	20	SS-34	17%		
160.1	43.0								COASTAL PLAIN Gray to dark gray, clayey, fine SAND (A-2-6) with mica (Middendorf Formation)
158.7	44.4								
		10	12	17	29	SS-35	17%		
153.7	49.4								
		12	9	8	17	SS-36	W		
150.1	53.0								COASTAL PLAIN Green, clayey SAND (A-2-6) with mica (Cape Fear Formation)
148.7	54.4								
		11	13	21	34	SS-37	22%		
143.7	59.4								
		13	16	18	34		M		
138.7	64.4								
		13	13	16	29	SS-38	29%		
137.2	65.9								Boring Terminated at Elevation 137.2 ft in Coastal Plain: Medium dense, clayey SAND (A-2-6) with mica (Cape Fear Formation) Bits Used: 3" Side-Discharge Finger Bit Drilling Fluid Properties: 9.0 lbs/gal Casing Depth (4"): 12.0 ft

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST J. Howard
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			GROUND WTR (ft)
BORING NO. RL B5-B	STATION 898+69	OFFSET 54ft RT	ALIGNMENT -L-	0 HR. Water
COLLAR ELEV. 203.1 ft	TOTAL DEPTH 66.1 ft	NORTHING 490,994	EASTING 1,992,842	24 HR. Boring
DRILL MACHINE CME-45B	DRILL METHOD Mud Rotary		HAMMER TYPE Manual	
START DATE 05/24/07	COMP. DATE 05/25/07	SURFACE WATER DEPTH 0.9ft	DEPTH TO ROCK N/A	

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
205									
203.1	0.0								MUDLINE (203.1 / 0.0)
		WOH	WOH	WOH	WOH 0		Sat.		ALLUVIAL Brown, sandy MUCK
200.1	3.0								
198.7	4.4								ALLUVIAL Brown to gray, silty, fine SAND (A-2-4) with trace organics Organic Content (SS-39)= 2.6%
		3	4	3	7	SS-39	Sat.		
196.1	7.0								COASTAL PLAIN Reddish brown, silty, fine to coarse SAND (A-3) (Middendorf Formation)
193.7	9.4								
192.9	10.2								
		3	7	18	25		Sat.		COASTAL PLAIN White and tan with red mottling, sandy CLAY (A-7-6) (Middendorf Formation) Pushed Shelby Tube ST-3 from 10.9 to 12.1 feet. Shelby tube not recovered (broke off of head) and left in hole. Attempted to continue boring.
188.9	14.2								
		28	72/0.4		100/0.9	SS-40	15%		
183.9	19.2								
		50/0.3			50/0.3		M		
181.1	22.0								COASTAL PLAIN Tan, with orange mottling, silty, clayey, SAND (A-2-6) (Middendorf Formation)
178.9	24.2								
		9	10	11	21	SS-41	Sat.		
175.6	27.5								COASTAL PLAIN Gray-tan and dark gray, with brown mottling, fine to coarse sandy, CLAY (A-6) with mica (Middendorf Formation) Note: Boring initially drilled to 35.7 ft and abandoned due to shelby tube left in hole-offset 3 ft and continue boring to final termination depth.
173.9	29.2								
		40	60/0.4		100/0.9		M		
168.9	34.2								
		22	30	40	70		M		
163.5	39.6								
		9	12	21	33		M		
160.1	43.0								COASTAL PLAIN Light gray, clayey, fine SAND (A-2-6) (Middendorf Formation)
158.5	44.6								
		13	17	20	37		M		
153.5	49.6								
		8	8	7	15	SS-42	W		
151.1	52.0								COASTAL PLAIN Light green, with brown and red mottling, sandy CLAY (A-6) with mica (Cape Fear Formation)
148.5	54.6								
		6	10	12	22		M		
143.5	59.6								
		11	15	23	38		M		
140.1	63.0								COASTAL PLAIN Dark green, silty, clayey, SAND (A-2-6) (Cape Fear Formation)
138.5	64.6								
		11	12	17	29		W		
137.0	66.1								Boring Terminated at Elevation 137.0 ft in Coastal Plain: Medium dense, silty, clayey SAND (A-2-6) (Cape Fear Formation) Note: Final log is a combination of 2 field logs (RL B5-B and RL B5-Ba); Bits Used: 3" Side-Discharge Finger Bit; Drilling Fluid Properties: 9.1 lbs/gal; Casing Depth (4"): 12.1' Other Samples: ST-3 (10.9 - 12.1)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** M. Lear
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			**GROUND WTR (ft)**
BORING NO. RL B6-B	**STATION** 899+88	**OFFSET** 51ft RT	**ALIGNMENT** -L- — **0 HR.** 2.0
COLLAR ELEV. 206.4 ft	**TOTAL DEPTH** 80.5 ft	**NORTHING** 491,099	**EASTING** 1,992,897 — **24 HR.** 1.3
DRILL MACHINE CME-55LC	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 05/07/07	**COMP. DATE** 05/07/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

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)
210										
206.4	0.0								GROUND SURFACE	0.0
		1	1	2	3		M		**ALLUVIAL** Gray and tan, silty, fine SAND (A-2-4) with trace organic debris	203.4 / 3.0
202.4	4.0	2	3	3	6		W		**COASTAL PLAIN** Gray with tan and orange, silty, clayey, fine SAND (A-2-6) (Middendorf Formation)	199.4 / 7.0
197.4	9.0	2	2	5	7		Sat.		**COASTAL PLAIN** Orange, silty, fine to coarse SAND (A-2-4) with trace gravel (Middendorf Formation)	194.9 / 11.5
192.4	14.0	13	29	37	66		M		**COASTAL PLAIN** Tan-gray with purple and maroon streaks, fine to coarse sandy, silty, CLAY (A-6) with trace gravel (Middendorf Formation)	188.4 / 18.0
187.4	19.0	12	19	30	49		W		**COASTAL PLAIN** Tan-gray with maroon streaks, silty, clayey, fine SAND (A-2-6) (Middendorf Formation)	183.9 / 22.5
182.4	24.0	10	13	14	27		W		**COASTAL PLAIN** Tan-gray with orange streaks, clayey, silty, fine to coarse SAND (A-2-4) (Middendorf Formation)	178.9 / 27.5
177.4	29.0	9	17	20	37		Sat.		**COASTAL PLAIN** Tan-white, silty, fine to coarse SAND (A-3) with trace gravel (Middendorf Formation)	174.4 / 32.0
172.4	34.0	9	17	22	39		M		**COASTAL PLAIN** Gray with orange streaks, silty, fine sandy, CLAY (A-6) (Middendorf Formation)	169.4 / 37.0
167.4	39.0	10	11	11	22		M		**COASTAL PLAIN** Tan-orange, silty, clayey, fine to coarse SAND (A-2-6) with trace gravel, feldspar, mica (Middendorf Formation)	164.4 / 42.0
162.4	44.0	5	8	11	19		M		**COASTAL PLAIN** Gray, orange, and brown, fine to coarse sandy, silty, CLAY (A-6) with trace gravel, feldspar, mica (Middendorf Formation)	
157.4	49.0	4	7	9	16		M			
152.4	54.0	3	5	6	11		M/W		**COASTAL PLAIN** Gray to dark gray, micaceous, fine sandy, silty, CLAY (A-6) (Cape Fear Formation)	153.4 / 53.0
147.4	59.0	6	10	12	22		M			
142.4	64.0	10	10	12	22		M		**COASTAL PLAIN** Gray-green with maroon streaks, micaceous, fine sandy, silty, CLAY (A-7-6) (Cape Fear Formation)	144.4 / 62.0
137.4	69.0	7	10	12	22		W		**COASTAL PLAIN** Gray-green, micaceous, silty, clayey, fine SAND (A-2-6) (Cape Fear Formation)	138.9 / 67.5
132.4	74.0	8	11	11	22		W			

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** Cumberland	**GEOLOGIST** M. Lear
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			**GROUND WTR (ft)**
BORING NO. RL B6-B	**STATION** 899+88	**OFFSET** 51ft RT	**ALIGNMENT** -L- — **0 HR.** 2.0
COLLAR ELEV. 206.4 ft	**TOTAL DEPTH** 80.5 ft	**NORTHING** 491,099	**EASTING** 1,992,897 — **24 HR.** 1.3
DRILL MACHINE CME-55LC	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 05/07/07	**COMP. DATE** 05/07/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

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
130					Match Line				
127.4	79.0	8	11	15	26		M		126.9 / 79.5 **COASTAL PLAIN** Dark gray, fine sandy, silty, CLAY (A-6) (Cape Fear Formation) — 125.9 / 80.5

Boring Terminated at Elevation 125.9 ft in Coastal Plain: Very stiff, fine sandy, silty, CLAY (A-6) (Cape Fear Formation)

Bits Used: 3" Roller Cone
Drilling Fluid Properties: 8.6 lbs/gal
Casing Depth (3"): 3.5 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST M. Lear
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			GROUND WTR (ft)
BORING NO. RL B7-B	STATION 900+85	OFFSET 64ft RT	ALIGNMENT -L-
COLLAR ELEV. 207.8 ft	TOTAL DEPTH 80.5 ft	NORTHING 491,176	EASTING 1,992,956
DRILL MACHINE CME-55LC	DRILL METHOD Mud Rotary		HAMMER TYPE Automatic
START DATE 05/08/07	COMP. DATE 05/08/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

GROUND WTR (ft)	
0 HR.	3.0
24 HR.	2.2

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)
210										
207.8	0.0								207.8 GROUND SURFACE	0.0
		2	2	3	5		M		**ALLUVIAL** Tan and dark gray, silty, fine SAND (A-2-4) with roots and organic debris	205.3 / 2.5
203.7	4.1								**COASTAL PLAIN** Gray and tan, silty, fine to coarse SAND (A-2-4) (Middendorf Formation)	200.3 / 7.5
		4	4	5	9		W		**COASTAL PLAIN** Tan and orange, fine to coarse SAND (A-3) with trace gravel (Middendorf Formation)	195.8 / 12.0
198.8	9.0								**COASTAL PLAIN** Tan, silty, fine to coarse SAND and GRAVEL (A-1-b) (Middendorf Formation)	191.8 / 16.0
		4	4	6	10		Sat.		**COASTAL PLAIN** Tan-gray with maroon streaks, fine sandy, silty, CLAY (A-6) (Middendorf Formation)	185.8 / 22.0
193.8	14.0								**COASTAL PLAIN** Tan-gray with maroon streaks, silty, clayey, fine SAND (A-2-6) (Middendorf Formation)	180.3 / 27.5
		4	6	6	12		Sat.		**COASTAL PLAIN** Tan-white, silty, fine to coarse SAND (A-3) with trace to little gravel (Middendorf Formation)	175.8 / 32.0
188.8	19.0								**COASTAL PLAIN** Gray and tan with orange streaks, silty, fine sandy, CLAY (A-6) (Middendorf Formation)	170.8 / 37.0
		13	23	33	56		M		**COASTAL PLAIN** Orange and gray, silty, clayey, fine to coarse SAND (A-2-6) with trace gravel, feldspar, mica	154.8 / 53.0
183.8	24.0								**COASTAL PLAIN** Maroon, gray, and dark gray, fine sandy, silty, CLAY (A-6) with trace mica (Cape Fear Formation)	144.8 / 63.0
		8	9	14	23		W		**COASTAL PLAIN** Gray-green, maroon, and gray, silty, clayey, fine to coarse SAND (A-2-6) (Cape Fear Formation)	135.8 / 72.0
178.8	29.0								**COASTAL PLAIN** Gray, silty, fine to coarse SAND (A-2-4) (Cape Fear Formation)	
		13	15	16	31		Sat.			
173.8	34.0									
		12	19	23	42		M			
168.8	39.0									
		9	16	18	34		M			
163.8	44.0									
		6	9	10	19		M			
158.8	49.0									
		6	9	10	19		M			
153.8	54.0									
		3	8	12	20		M			
148.8	59.0									
		5	8	10	18		M			
143.8	64.0									
		12	17	19	36		W			
138.8	69.0									
		12	18	23	41		W			
133.8	74.0									
		5	9	10	19		Sat.			

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST M. Lear
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			GROUND WTR (ft)
BORING NO. RL B7-B	STATION 900+85	OFFSET 64ft RT	ALIGNMENT -L-
COLLAR ELEV. 207.8 ft	TOTAL DEPTH 80.5 ft	NORTHING 491,176	EASTING 1,992,956
DRILL MACHINE CME-55LC	DRILL METHOD Mud Rotary		HAMMER TYPE Automatic
START DATE 05/08/07	COMP. DATE 05/08/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

GROUND WTR (ft)	
0 HR.	3.0
24 HR.	2.2

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
130					Match Line				
128.8	79.0								
		7	10	12	22		Sat./M		127.9 / 79.9 **COASTAL PLAIN** Dark gray, fine sandy, silty, CLAY (A-7-6) (Cape Fear Formation) 127.3 / 80.5

Boring Terminated at Elevation 127.3 ft in Coastal Plain: Very stiff, fine sandy, silty, CLAY (A-7-6) (Cape Fear Formation)

Bits Used: 3" Roller Cone
Drilling Fluid Properties: 8.6 lbs/gal
Casing Depth (3"): 18.5 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST M. Lear
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			GROUND WTR (ft)
BORING NO. RL EB2-B	STATION 901+93	OFFSET 55ft RT	ALIGNMENT -L-
COLLAR ELEV. 211.0 ft	TOTAL DEPTH 80.3 ft	NORTHING 491,271	EASTING 1,993,004
DRILL MACHINE CME-55LC	DRILL METHOD Mud Rotary		HAMMER TYPE Automatic
START DATE 05/03/07	COMP. DATE 05/03/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

GROUND WTR (ft)	
0 HR.	5.8
24 HR.	4.4

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))
215									
211.0	0.0								211.0 GROUND SURFACE 0.0
		6	4	7	11		D/M		**COASTAL PLAIN** Tan, silty, fine SAND (A-2-4) with trace organics (Middendorf Formation) 208.0 3.0
207.2	3.8								
		2	3	3	6		25% M		**COASTAL PLAIN** Gray and tan, fine sandy, CLAY (A-7-6) with trace organics (Middendorf Formation) Pushed Shelby Tube (ST-1) at offset location from 3.0 to 5.0 feet, recovery=1.7 ft (85%) 205.0 6.0
202.2	8.8								
		8	8	11	19		W		**COASTAL PLAIN** Tan and orange, clayey, silty, fine to coarse SAND (A-2-4) with trace gravel (Middendorf Formation)
197.2	13.8								
		9	8	7	15		Sat.		
192.2	18.8								191.7 19.3
		8	11	21	32		M		**COASTAL PLAIN** Tan-gray with maroon and orange streaks, silty, fine sandy, CLAY (A-6) (Middendorf Formation) Pushed Shelby Tube (ST-2) at offset location from 19.7 to 21.0 feet, recovery=1.3 ft (100%)-Tube bent
187.2	23.8								
		10	24	28	52		M		
182.2	28.8								183.0 28.0
		9	16	19	35		W		**COASTAL PLAIN** Tan-gray with orange streaks, clayey, silty, fine to coarse SAND (A-2-4) with trace gravel (Middendorf Formation)
177.2	33.8								
		4	4	5	9		Sat.		
172.2	38.8								173.5 37.5
		12	13	18	31		M		**COASTAL PLAIN** Gray with orange streaks, fine sandy, clayey, SILT (A-4) (Middendorf Formation)
167.2	43.8								169.0 42.0
		7	10	13	23		M		**COASTAL PLAIN** Gray-tan with orange, silty, clayey, fine SAND (A-2-6) (Middendorf Formation)
162.2	48.8								164.0 47.0
		9	12	15	27		M		**COASTAL PLAIN** Gray-tan with orange and maroon streaks, silty, fine to coarse sandy, CLAY (A-6) with trace feldspar, mica (Middendorf Formation)
157.2	53.8								
		8	11	12	23		M		
152.2	58.8								153.0 58.0
		7	13	15	26		M		**COASTAL PLAIN** Dark gray, blue gray, gray, and brown, locally with brown and maroon mottling, micaceous, fine to coarse sandy, silty, CLAY (A-6) (Cape Fear Formation)
147.2	63.8								
		7	10	13	23		M		
142.2	68.8								
		6	8	7	15		M		
137.2	73.8								138.5 72.5
		9	10	10	20		M		**COASTAL PLAIN** Gray, micaceous, silty, clayey, fine SAND (A-2-6) (Cape Fear Formation)

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY Cumberland	GEOLOGIST M. Lear
SITE DESCRIPTION Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek (MACTEC Project No. 6468-07-1685)			GROUND WTR (ft)
BORING NO. RL EB2-B	STATION 901+93	OFFSET 55ft RT	ALIGNMENT -L-
COLLAR ELEV. 211.0 ft	TOTAL DEPTH 80.3 ft	NORTHING 491,271	EASTING 1,993,004
DRILL MACHINE CME-55LC	DRILL METHOD Mud Rotary		HAMMER TYPE Automatic
START DATE 05/03/07	COMP. DATE 05/03/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

GROUND WTR (ft)	
0 HR.	5.8
24 HR.	4.4

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
135					Match Line				
132.2	78.8	7	9	11	20		M		**COASTAL PLAIN** Gray, micaceous, silty, clayey, fine SAND (A-2-6) (Cape Fear Formation)*(continued)* 130.7 80.3

Boring Terminated at Elevation 130.7 ft in Coastal Plain: Medium dense, micaceous, silty, clayey, fine SAND (A-2-6) (Cape Fear Formation)

Bits Used: 3" Roller Cone
Drilling Fluid Properties: 8.5 lbs/gal
Casing Depth (3"): 3.4 ft

Other Samples:
ST-1 (3.0 - 5.0)
ST-2 (19.7 - 21.0)

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

N.C.D.O.T./AASHTO CLASSIFICATIONS

REPORT ON SAMPLES OF: SOILS FOR QUALITY

MACTEC PROJECT NAME/ NUMBER: Structures 5 & 6; Dual Bridges on -L- over Stewart's Creek (6468-07-1685)

NCDOT PROJ. NO.: 34817.1.2 (U-2519CB) COUNTY: Cumberland OWNER: N.C.D.O.T.

DATE SAMPLED: May 2007 RECEIVED: 6/5/2007 REPORTED BY: MACTEC

SAMPLED FROM: RL B4-B

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-29	SS-30	SS-31	SS-32	SS-33	SS-34
Retained 4.75 mm Sieve	(%)	0.0	0.7	0.2	0.0	0.0	0.0
Passing 2.00 mm Sieve	(%)	100.0	95.5	98.9	99.8	100.0	99.9
Passing 425 µm Sieve	(%)	97.0	67.2	66.3	90.2	95.5	90.7
Passing 75 µm Sieve	(%)	88.5	23.1	24.1	55.3	44.6	69.2

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	5.1	47.5	51.2	18.3	14.6	15.6
Fine Sand Ret - 53 µm	(%)	8.6	31.5	25.3	32.5	44.5	20.0
Silt 0.05 - 0.005 mm	(%)	14.8	6.2	5.5	18.2	4.4	20.5
Clay < 0.005 mm	(%)	71.5	14.8	18.1	31.0	36.5	43.8

Moisture Content	(%)	ND	ND	ND	ND	ND	16.5
Liquid Limit, L.L.		ND	17	33	29	33	34
Plasticity Index, P.I.		ND	3	16	16	18	20
AASHTO Classification		ND	A-2-4(0)	A-2-6(1)	A-6(5)	A-6(4)	A-6(11)
Organic Content	(%)	6.7	ND	ND	ND	ND	ND

Boring No.		RL B4-B	RL B4-B	RL B4-B	RL B4-B	RL B4-B	RL B4-B
Station		897+56	897+56	897+56	897+56	897+56	897+56
Offset		63 RT	63 RT	63 RT	63 RT	63 RT	63 RT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (FT)	From	9.4	19.4	24.4	29.4	34.4	39.4
	to	10.9	20.9	25.9	30.2	35.9	40.9

REMARKS: ND=Not Determined, NP=Non-Plastic

Submitted by: _____
Laboratory Manager

SHEET 55

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

N.C.D.O.T./AASHTO CLASSIFICATIONS

REPORT ON SAMPLES OF: SOILS FOR QUALITY

MACTEC PROJECT NAME/ NUMBER: Structures 5 & 6; Dual Bridges on -L- over Stewart's Creek (6468-07-1685)

NCDOT PROJ. NO.: 34817.1.2 (U-2519CB) COUNTY: Cumberland OWNER: N.C.D.O.T.

DATE SAMPLED: May 2007 RECEIVED: 6/5/2007 REPORTED BY: MACTEC

SAMPLED FROM: RL B4-B and RL B5-B

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-35	SS-36	SS-37	SS-38	SS-39	SS-40
Retained 4.75 mm Sieve	(%)	0.0	0.0	0.1	0.0	0.9	0.1
Passing 2.00 mm Sieve	(%)	100.0	99.9	99.3	100.0	96.4	94.8
Passing 425 µm Sieve	(%)	64.7	82.4	76.4	95.0	58.7	88.5
Passing 75 µm Sieve	(%)	35.0	27.6	35.4	24.3	12.9	75.6

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	51.6	40.1	44.9	39.5	62.1	10.4
Fine Sand Ret - 53 µm	(%)	14.7	33.6	20.7	36.1	26.8	13.1
Silt 0.05 - 0.005 mm	(%)	4.6	5.5	6.2	3.4	5.3	21.2
Clay < 0.005 mm	(%)	29.1	20.7	28.1	21.0	5.8	55.3

Moisture Content	(%)	17.1	ND	22.0	28.6	ND	15.3
Liquid Limit, L.L.		35	28	39	28	17	47
Plasticity Index, P.I.		21	15	21	13	NP	27
AASHTO Classification		A-2-6(2)	A-2-6(1)	A-2-6(2)	A-2-6(0)	A-2-4(0)	A-7-6(20)
Organic Content	(%)	ND	ND	ND	ND	2.6	ND

Boring No.		RL B4-B	RL B4-B	RL B4-B	RL B4-B	RL B5-B	RL B5-B
Station		897+56	897+56	897+56	897+56	898+69	898+69
Offset		63 RT	63 RT	63 RT	63 RT	54 RT	54 RT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (FT)	From	44.4	49.4	54.4	64.4	4.4	14.2
	to	45.9	50.9	55.9	65.9	5.9	15.7

REMARKS: ND=Not Determined, NP=Non-Plastic

Submitted by: _____
Laboratory Manager

SHEET 56

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

N.C.D.O.T./AASHTO CLASSIFICATIONS

REPORT ON SAMPLES OF: SOILS FOR QUALITY

MACTEC PROJECT NAME/ NUMBER: Structures 5 & 6; Dual Bridges on -L- over Stewart's Creek (6468-07-1685)

NCDOT PROJ. NO.: 34817.1.2 (U-2519CB) COUNTY: Cumberland OWNER: N.C.D.O.T.

DATE SAMPLED: May 2007 RECEIVED: 6/5/2007 REPORTED BY: MACTEC

SAMPLED FROM: RL B5-B and RL EB2-B

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-41	SS-42	ST-1			
Retained 4.75 mm Sieve	(%)	0.0	0.5	0.0			
Passing 2.00 mm Sieve	(%)	98.9	97.9	100.0			
Passing 425 µm Sieve	(%)	56.5	75.2	91.8			
Passing 75 µm Sieve	(%)	24.5	27.3	70.2			

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	61.1	47.6	13.4			
Fine Sand Ret - 53 µm	(%)	14.8	25.8	20.6			
Silt 0.05 - 0.005 mm	(%)	6.1	3.4	16.9			
Clay < 0.005 mm	(%)	18.1	23.2	49.1			

Moisture Content	(%)	ND	ND	24.7			
Liquid Limit, L.L.		33	26	47			
Plasticity Index, P.I.		17	13	25			
AASHTO Classification		A-2-6(1)	A-2-6(0)	A-7-6(16)			
Organic Content	(%)	ND	ND	ND			

Boring No.		RL B5-B	RL B5-B	RL EB2-B			
Station		898+69	898+69	901+93			
Offset		54 RT	54 RT	55 RT			
Alignment		-L-	-L-	-L-			
Depth (FT)	From	24.2	49.6	3.0			
	to	25.7	51.1	5.0			

REMARKS: ND=Not Determined, NP=Non-Plastic

Submitted by: _____
Laboratory Manager

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 34817.1.2 TIP: U-2519CB COUNTY: CUMBERLAND

DESCRIPTION(1): STRUCTURES 5 & 6; DUAL BRIDGES ON -L- OVER STEWART'S CREEK

EXISTING BRIDGE

Information from: Field Inspection X Microfilm ____ (reel ____ pos: ____)
Other (explain) Not Applicable: No Existing Bridge

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

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: ____

Interior Bents: ____

Channel Bed: ____

Channel Bank: ____

EXISTING SCOUR PROTECTION

Type(3): ____

Extent(4): ____

Effectiveness(5): ____

Obstructions(6): ____

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.

DESIGN INFORMATION

Channel Bed Material(7): Alluvial: Muck, SAND (A-2-4/A-3), and CLAY (A-6)

Channel Bank Material(8): Alluvial: SAND (A-2-4)

Channel Bank Cover(9): Pine and hardwood trees; brush

Floodplain Width(10): Approximately 850 feet

Floodplain Cover(11): Moderately to densely wooded; hardwood, pine, and cypress trees; brush

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

Channel Migration Tendency(13): None

Observations and Other Comments: Surface water flows into the site along a channel that crosses the alignment between bents 3 and 4 and spreads laterally, flooding the majority of the site.

Reported by: [signature] **Date:** 6/19/2007
MACTEC Engineering and Consulting, Inc.

DESIGN SCOUR ELEVATIONS(14) Feet X Meters ____

BENTS	B1	B2	B3	B4	B5	B6	B7				
100-year DSE	204.2	202.6	200.8	200.7	200.8	202.5	205.3				
500-year DSE	203	202.1	200.5	200.5	200.6	202.3	203.3				

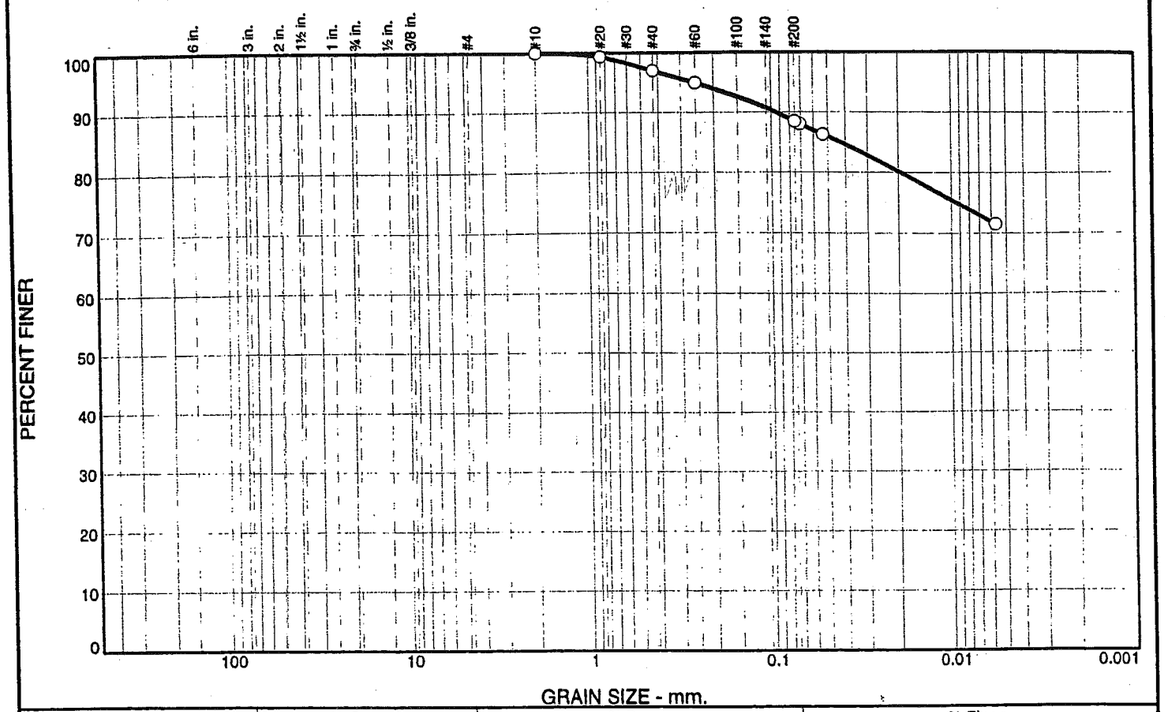
Comparison of DSE to Hydraulics Unit theoretical scour:
We agree with the scour calculations presented in the Bridge Survey & Hydraulic Report, dated 10/3/05.

DSE determined by: [signature] B. D. Worley **Date:** 7/3/2007

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank	BED	BED/BANK					
Sample No.	SS-29	SS-39					
Retained #4	0	0.9					
Passed #10	100	96.4					
Passed #40	97	58.7					
Passed #200	88.5	12.9					
Coarse Sand	5.1	62.1					
Fine Sand	8.6	26.8					
Silt	14.8	5.3					
Clay	71.5	5.8					
LL	ND	17					
PI	ND	NP					
AASHTO	ND	A-2-4(0)					
Station	897+56	898+69					
Offset	63ft RT	54ft RT					
Depth	9.4-10.9 ft	4.4-5.9 ft					

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	3.0	8.5	88.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.3		
#40	97.0		
#60	94.9		
#200	88.5		
0.0706 mm.	88.0		
#270	86.3		
0.0057 mm.	71.5		

* (no specification provided)

Soil Description

Dark Silty CLAY with organic and roots

Atterberg Limits

PL= n/d LL= n/d PI=

Coefficients

D_{85}= 0.0427 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= n/d AASHTO=

Remarks

Insufficent material for limits testing.

Sample No.: SS-29 **Source of Sample:** RL B4-B **Date:** 6-1-07
Location: **Elev./Depth:** 9.4-10.9'

MACTEC, Inc.

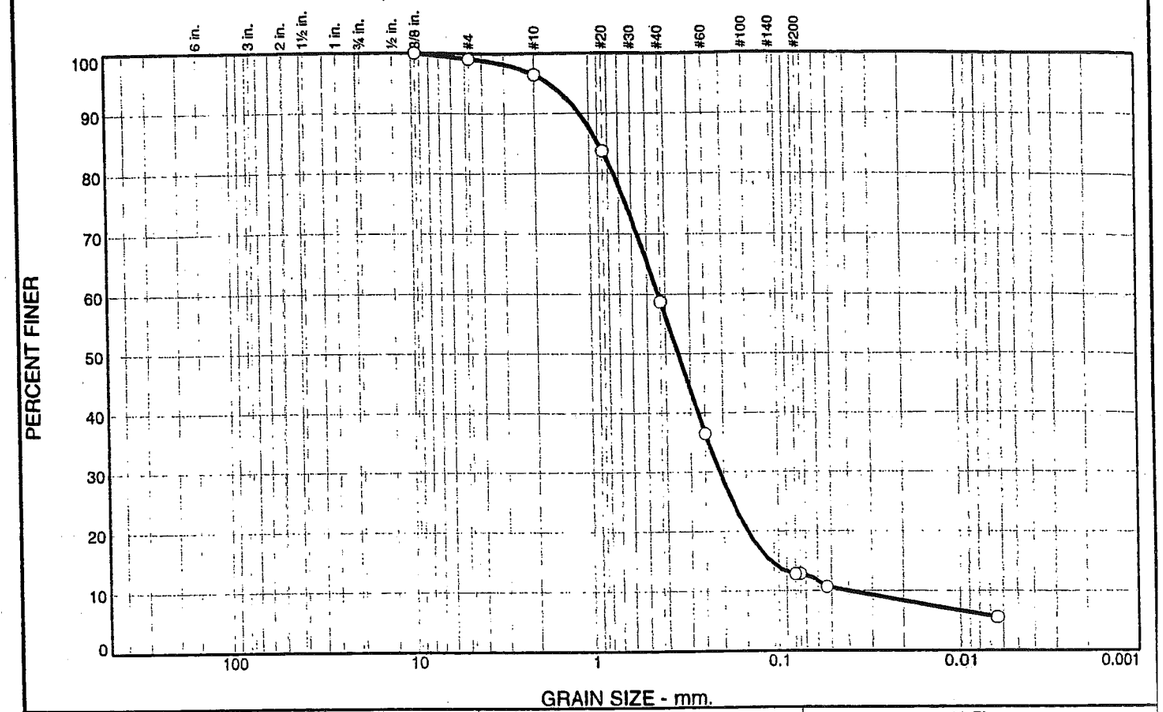
Raleigh, North Carolina

Client: NCDOT
Project: Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek
Project No: 6468071685 Task 05 **Figure**

Tested By: CS **Checked By:** LBJ

SHEET 58

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.9	2.7	37.7	45.8	12.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.1		
#10	96.4		
#20	83.7		
#40	58.7		
#60	36.5		
0.0798 mm.	12.8		
#200	12.9		
#270	10.7		
0.0064 mm.	5.6		

* (no specification provided)

Soil Description

Dark Gray Silty SAND With Organics

Atterberg Limits

PL= NP LL= 17 PI= NP

Coefficients

D_{85}= 0.8925 D_{60}= 0.4384 D_{50}= 0.3471
D_{30}= 0.2105 D_{15}= 0.1113 D_{10}= 0.0400
C_u= 10.95 C_c= 2.53

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Sample No.: SS-39 **Source of Sample:** RL B5-B **Date:** 5-24-07
Location: **Elev./Depth:** 4.4-5.9'

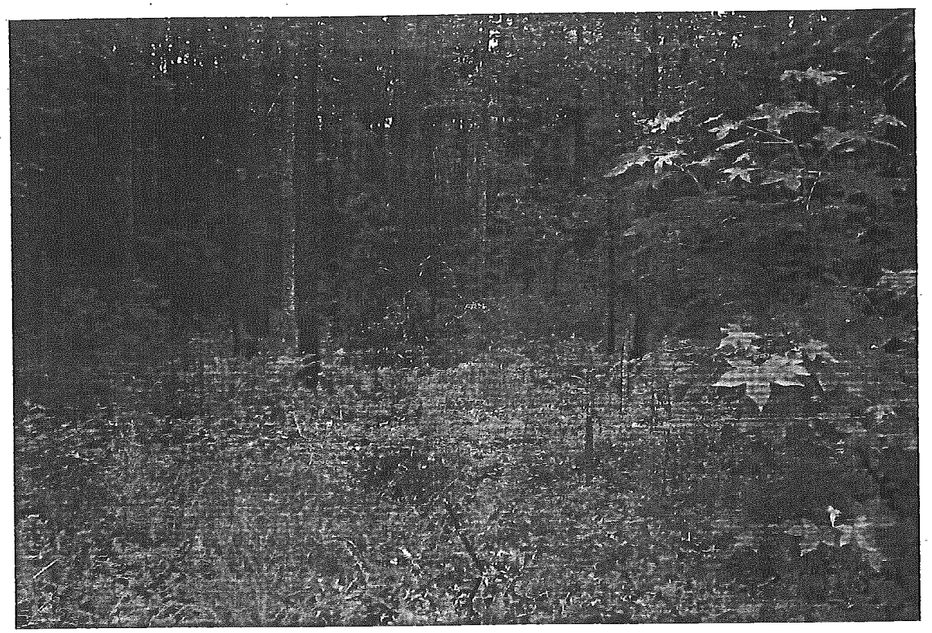
MACTEC, Inc.

Raleigh, North Carolina

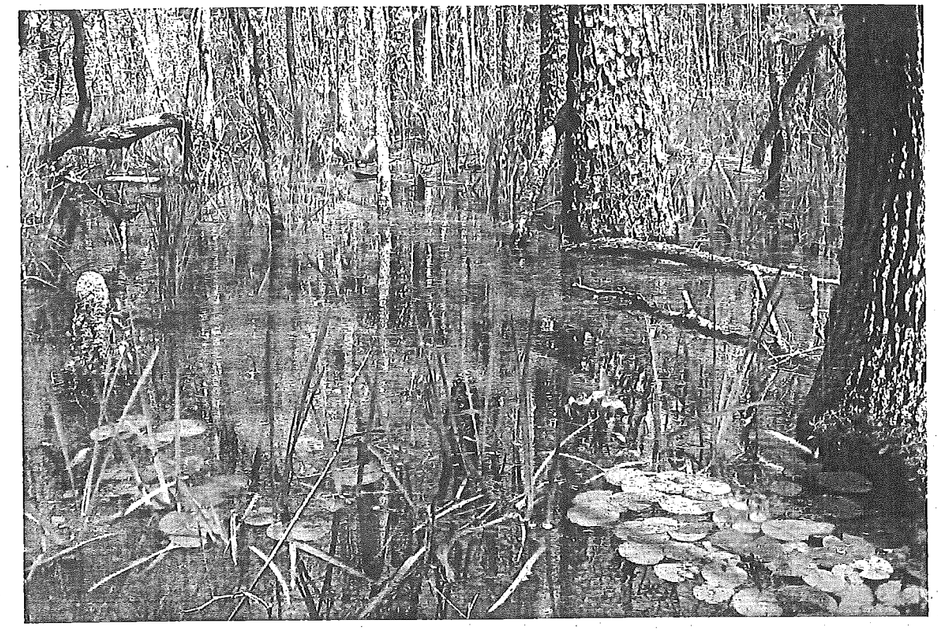
Client: NCDOT
Project: Structures 5 & 6; Dual Bridges on -L- Over Stewart's Creek
Project No: 6468071685 Task 05 **Figure**

Tested By: CS **Checked By:** LBJ

Site Photos
MACTEC Proj. No. 6468-07-1685



View looking upstation towards RL EB1-B.

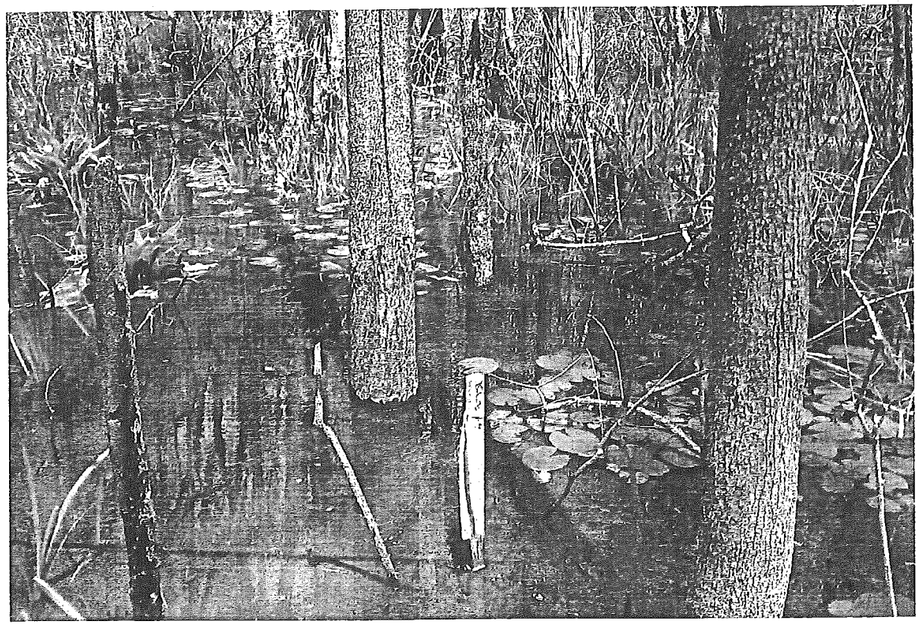


View looking along Right Lane Bent 3 towards center line.

View looking upstation along Right Lane toward RL B4-B (from RL B3-B).

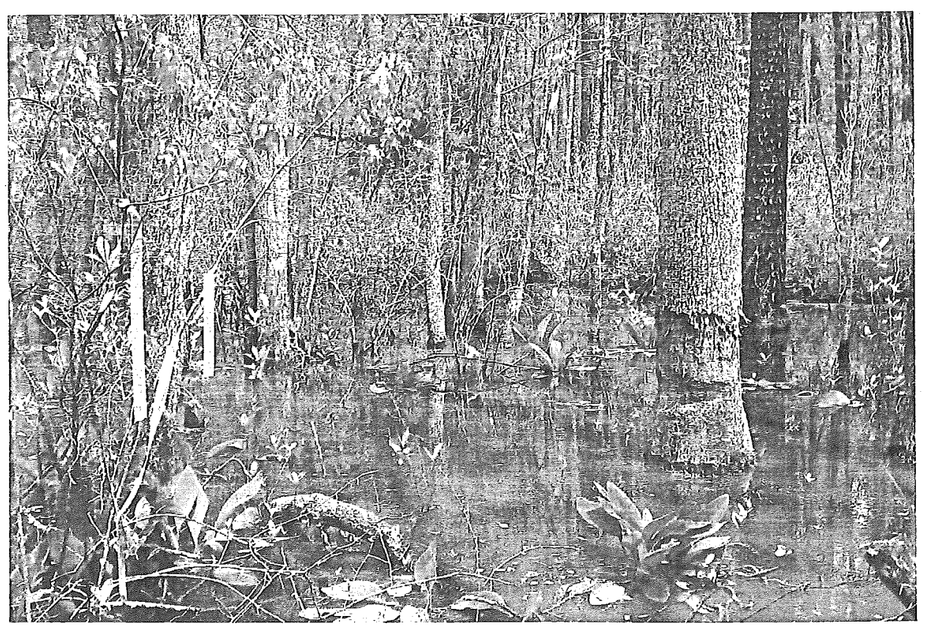
View looking upstation along Right Lane toward RL B5-B.

Site Photos
MACTEC Proj. No. 6468-07-1685

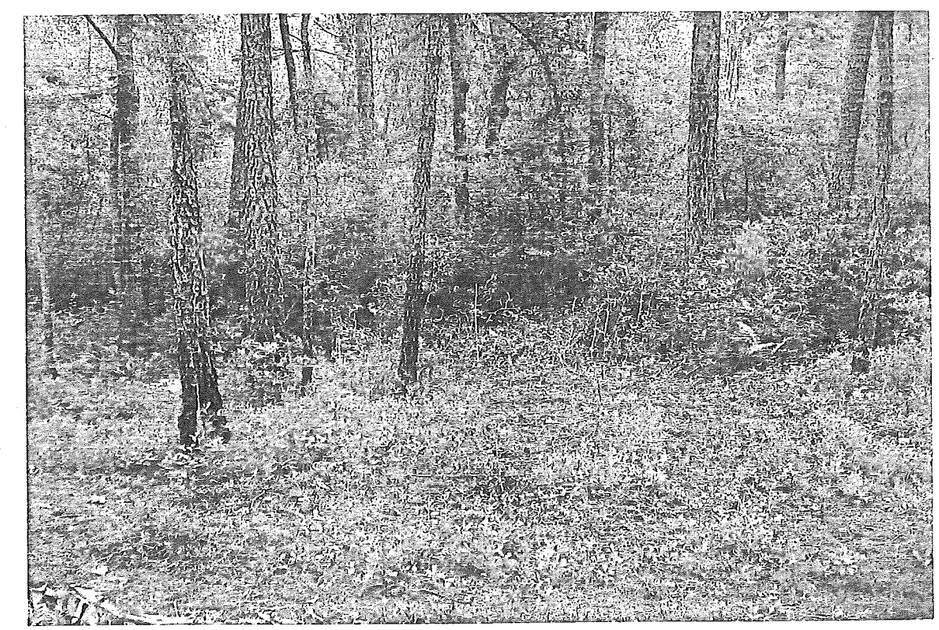


View looking along Right Lane Bent 4 towards center line.

View looking along Right Lane Bent 5 towards center line.



View looking upstation along Right Lane toward RL B6-B.



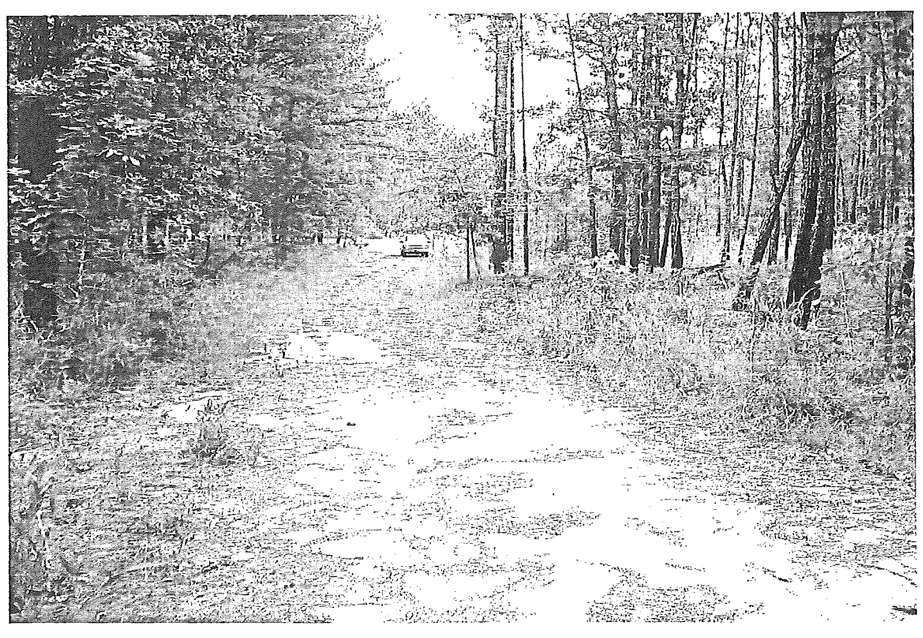
View looking along Right Lane Bent 7 towards center line.

Site Photos
MACTEC Proj. No. 6468-07-1685

Structures 5 & 6; Dual Bridges on -L- over Stewart's Creek (Right Lane)
NCDOT Proj. No. 34817.1.2 (U-2519CB)

View looking upstation along Right Lane toward RL EB2-B.

View looking down-station along Right Lane toward RL B7-B.



View looking along Right Lane End Bent 2 towards center line.

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34817.1.2 (U-2519CB)	1	8

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34817.1.2 (U-2519CB) F.A. PROJ. NHF-DPR-0100(001)

COUNTY CUMBERLAND

PROJECT DESCRIPTION FAYETTEVILLE OUTER LOOP FROM SOUTH OF SR 1400 (CLIFFDALE RD.) TO EAST OF SR 1415 (YADKIN RD.)

SITE DESCRIPTION STRUCTURES NO. 7 AND NO. 8 ON -L- (FAYETTEVILLE OUTER LOOP) OVER -Y2- (SR 1403)

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4-5	PROFILES
6-7	BORE LOGS
8	SOILS 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. M. WRIKE

F & R PERSONNEL

INVESTIGATED BY F.M. WESCOTT III

CHECKED BY D.N. ARGENBRIGHT

SUBMITTED BY D.N. ARGENBRIGHT

DATE FEBRUARY, 2008

NORTH CAROLINA LICENSED SEAL 1050 GEOLOGIST D. N. ARGENBRIGHT

2-1-08

PROJECT: 34817.1.2

ID: U-2519CB

DRAWN BY: C.P. TURNER

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 REFERENCE NO.	SHEET NO.
34817.1.2 (U-2519CB)	2 OF 8

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	6 MX		NP	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				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	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	>10%	>20%	HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- 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
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 2 15/16 " 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-60 -L- STA. 969+85.85 76.07' RT

ELEVATION: 300.21 FT.

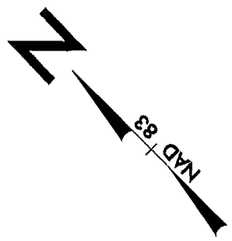
NOTES:

REVISED 02/23/06

PROJECT REFERENCE NO.	SHEET NO.
U-2519CB	3 OF 8
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

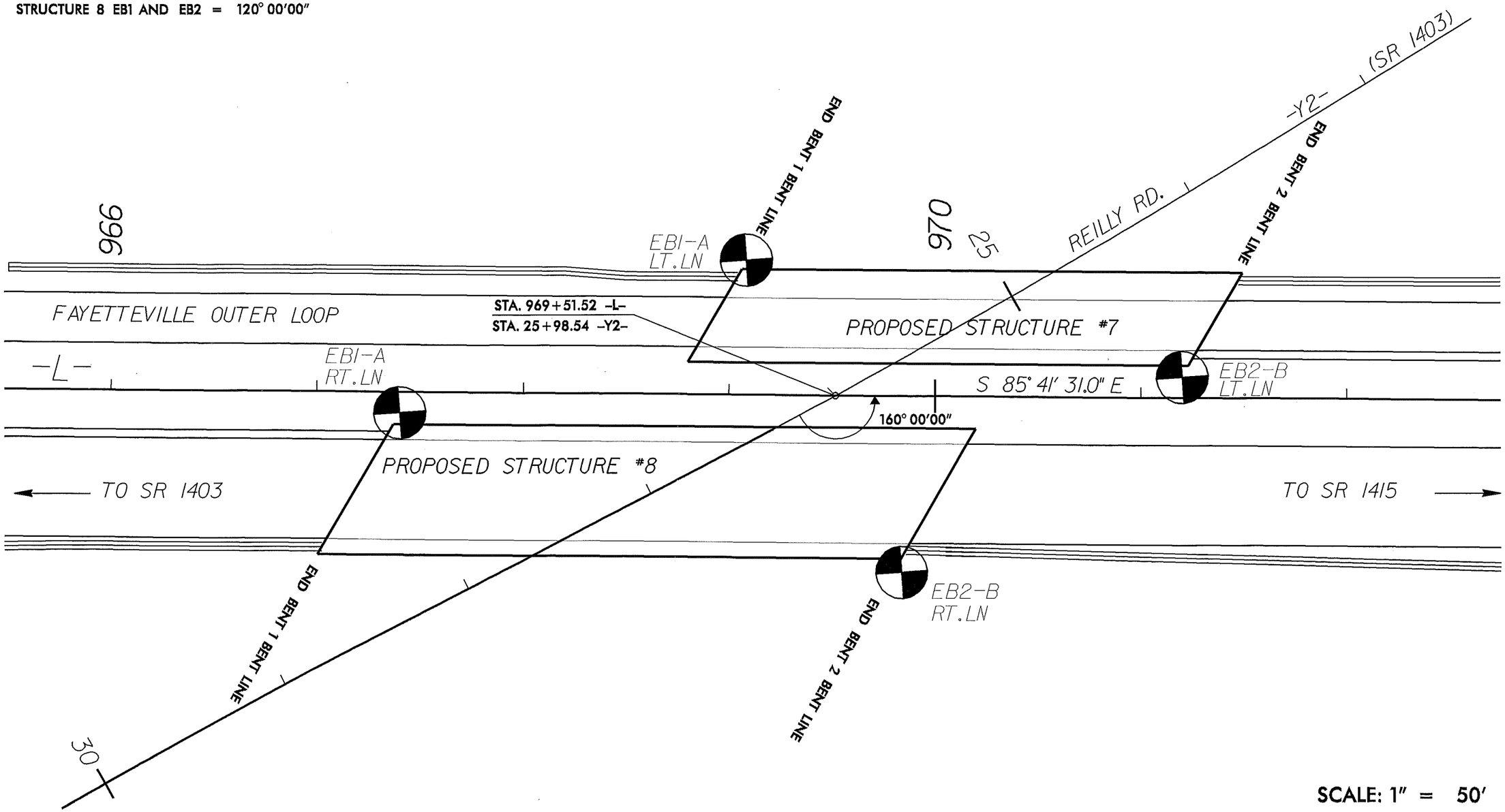
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

STRUCTURES NO. 7 AND NO. 8
SITE PLAN



SKEW

STRUCTURE 7 EB1 AND EB2 = 120° 00′00″
STRUCTURE 8 EB1 AND EB2 = 120° 00′00″



SCALE: 1″ = 50′

31-JAN-2008 11:54
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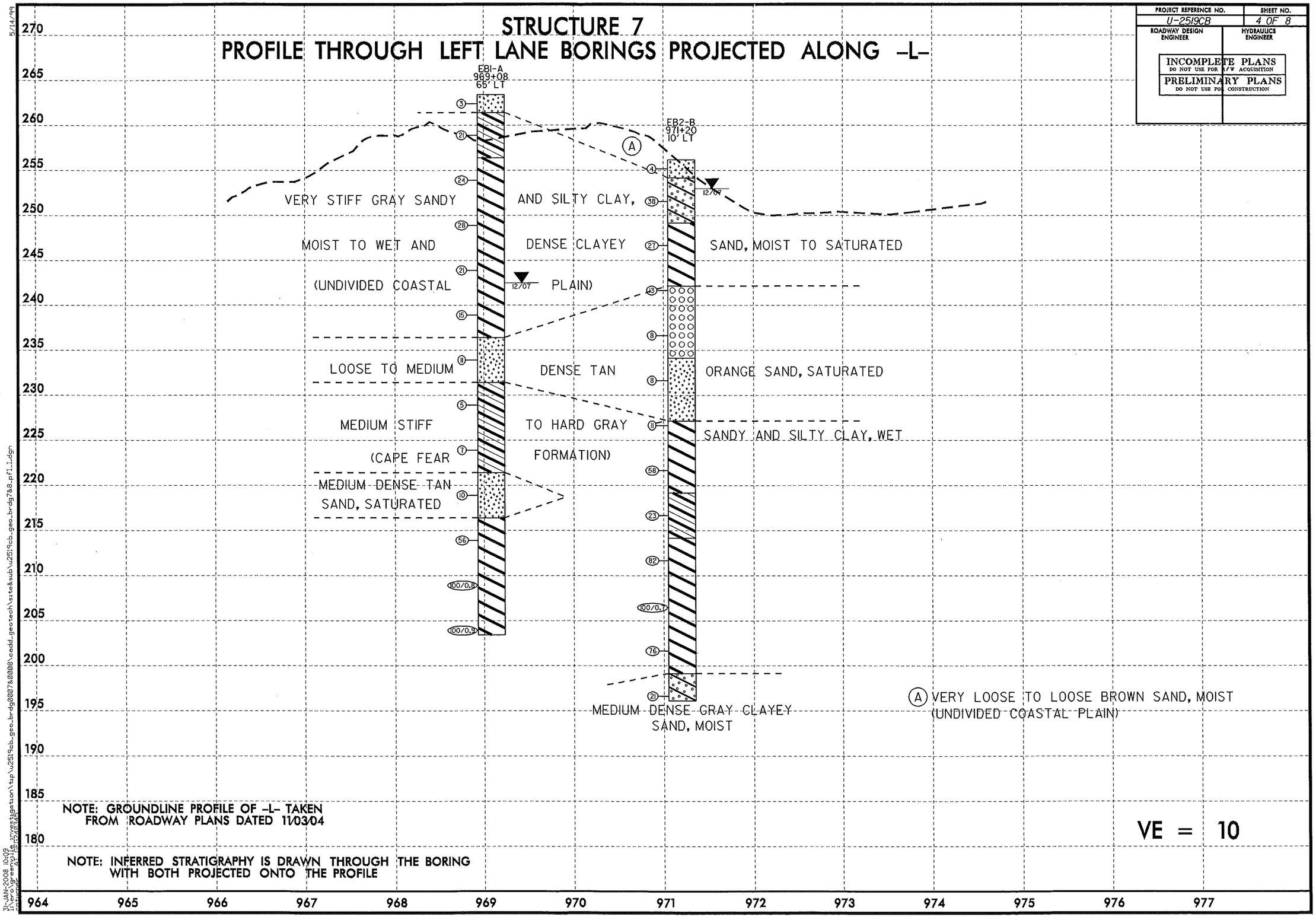
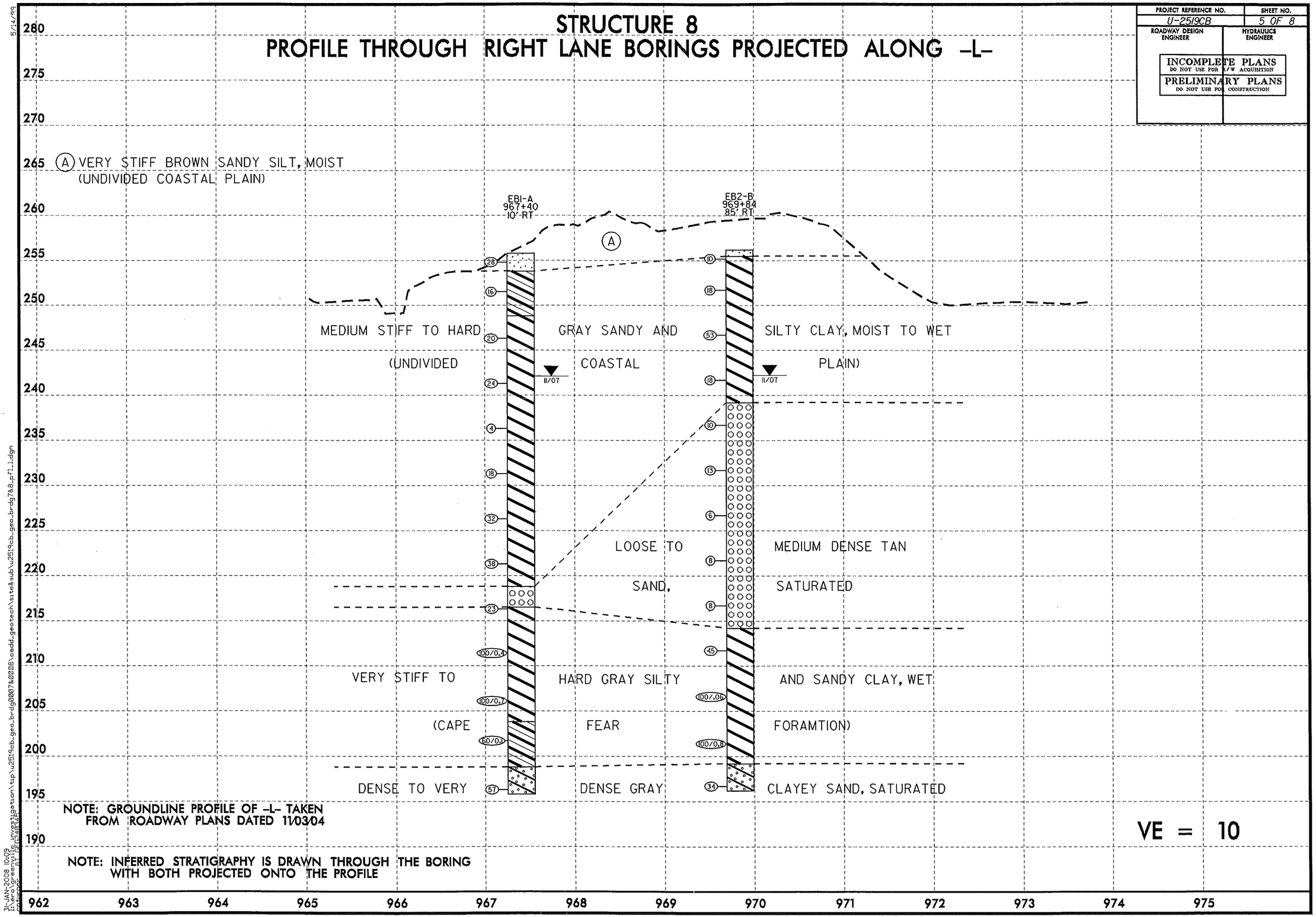


STRUCTURE 7
PROFILE THROUGH LEFT LANE BORINGS PROJECTED ALONG -L-
PROJECT REFERENCE NO.
U-2519CB
SHEET NO.
4 OF 8
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION
EB1-A
969+08
65' LT
EB2-B
971+20
10' LT
VERY STIFF GRAY SANDY
AND SILTY CLAY,
MOIST TO WET AND
DENSE CLAYEY
SAND, MOIST TO SATURATED
(UNDIVIDED COASTAL
PLAIN)
LOOSE TO MEDIUM
DENSE TAN
ORANGE SAND, SATURATED
MEDIUM STIFF
TO HARD GRAY
SANDY AND SILTY CLAY, WET
(CAPE FEAR
FORMATION)
MEDIUM DENSE TAN
SAND, SATURATED
MEDIUM DENSE GRAY CLAYEY
SAND, MOIST
A VERY LOOSE TO LOOSE BROWN SAND, MOIST
(UNDIVIDED COASTAL PLAIN)
NOTE: GROUNDLINE PROFILE OF -L- TAKEN
FROM ROADWAY PLANS DATED 11/03/04
NOTE: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORING
WITH BOTH PROJECTED ONTO THE PROFILE
VE = 10

PROJECT REFERENCE NO.	SHEET NO.
U-2519CB	5 OF 8
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

STRUCTURE 8
PROFILE THROUGH RIGHT LANE BORINGS PROJECTED ALONG -L-



NOTE: GROUNDLINE PROFILE OF -L- TAKEN FROM ROADWAY PLANS DATED 11/03/04

NOTE: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORING WITH BOTH PROJECTED ONTO THE PROFILE

VE = 10

5/14/99

31-JAN-2008 10:09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** CUMBERLAND		**GEOLOGIST** Wrike, C. M.
SITE DESCRIPTION STRUCTURE NO. 7 ON -L- (FAYETTEVILLE OUTER LOOP) OVER -Y2- (SR 1403)				**GROUND WTR (ft)**
BORING NO. EB1-A LT. LN	**STATION** 969+08	**OFFSET** 65ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 263.4 ft	**TOTAL DEPTH** 60.0 ft	**NORTHING** 494,022	**EASTING** 1,998,725	**24 HR.** 20.9
DRILL MACHINE CME-550	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/29/07	**COMP. DATE** 11/30/07	**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	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
	265										
	263.4	0.0								263.4 GROUND SURFACE	0.0
			WOH	1	2	3	SS-11			261.4 BROWN SAND, MOIST (UNDIVIDED COASTAL PLAIN)	2.0
260	259.9	3.5								GRAY SANDY AND SILTY CLAY, MOIST TO WET	
			6	9	12	21	SS-12			256.4	7.0
255	254.9	8.5									
			8	10	14	24	SS-13	27%			
250	249.9	13.5									
			9	12	16	28					
245	244.9	18.5									
			7	10	11	21	SS-14				
240	239.9	23.5									
			6	9	6	15	SS-15			236.4	27.0
235	234.9	28.5								TAN SAND, SATURATED	
			5	5	6	11	SS-16			231.4	32.0
230	229.9	33.5								GRAY SANDY CLAY, WET (CAPE FEAR FORMATION)	
			1	2	3	5	SS-17				
225	224.9	38.5									
			3	3	4	7				221.4	42.0
220	219.9	43.5								TAN SAND, SATURATED	
			2	4	6	10	SS-18			216.4	47.0
215	214.9	48.5								GRAY SILTY CLAY, WET	
			12	24	32	56	SS-19				
210	209.9	53.5									
			25	45	55/0.3	100/0.8					
205	204.9	58.5									
			26	45	55/0.4	100/0.9	SS-20			203.4	60.0
										Boring Terminated at Elevation 203.4 ft in hard silty clay	
200											
195											
190											
185											

PROJECT NO. 34817.1.2	**ID.** U-2519CB	**COUNTY** CUMBERLAND		**GEOLOGIST** Wrike, C. M.
SITE DESCRIPTION STRUCTURE NO. 7 ON -L- (FAYETTEVILLE OUTER LOOP) OVER -Y2- (SR 1403)				**GROUND WTR (ft)**
BORING NO. EB2-B LT. LN.	**STATION** 971+20	**OFFSET** 10ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 256.2 ft	**TOTAL DEPTH** 60.0 ft	**NORTHING** 493,951	**EASTING** 1,998,933	**24 HR.** 3.2
DRILL MACHINE CME-550	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 12/03/07	**COMP. DATE** 12/03/07	**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	SOIL AND ROCK DESCRIPTION
	260									
	256.2	0.0								256.2 GROUND SURFACE 0.0
255			1	1	3	4	SS-30			254.2 BROWN ORANGE SAND, MOIST (UNDIVIDED COASTAL PLAIN) 2.0
	252.6	3.6								BROWN ORANGE CLAYEY SAND, MOIST TO SATURATED
250			15	17	21	38	SS-31	8%		249.2 7.0
	247.7	8.5								GRAY SILTY CLAY, WET
245			8	11	16	27	SS-32	24%		
	242.7	13.5								242.2 14.0
240			6	6	7	13	SS-33			ORANGE SAND, SATURATED
	237.7	18.5								
235			4	5	3	8	SS-34			234.2 22.0
	232.7	23.5								
230			3	3	5	8	SS-35			
	227.7	28.5								227.2 29.0
225			4	4	7	11	SS-36			GRAY SILTY AND SANDY CLAY, WET (CAPE FEAR FORMATION)
	222.7	33.5								
220			18	25	33	58	SS-37			219.2 37.0
	217.7	38.5								
215			2	6	17	23	SS-38			214.2 42.0
	212.7	43.5								
210			21	33	49	82	SS-39			
	207.7	48.5								
205			33	62	38/0.2	100/0.7				
	202.7	53.5								
200			16	25	51	76	SS-40			199.2 57.0
	197.7	58.5								GRAY CLAYEY SAND, SATURATED
			9	9	12	21	SS-41			196.2 60.0
195										Boring Terminated at Elevation 196.2 ft in medium dense clayey sand
190										
185										
180										

NCDOT BORE DOUBLE U2519CB_GEO_BRDG7.GPJ NC_DOT.GDT 01/31/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY CUMBERLAND	GEOLOGIST Wrike, C. M.	
SITE DESCRIPTION STRUCTURE NO. 8 ON -L- (FAYETTEVILLE OUTER LOOP) OVER -Y2- (SR 1403)				GROUND WTR (ft)
BORING NO. EB1-A RT. LN.	STATION 967+40	OFFSET 10ft RT	ALIGNMENT -L-	0 HR. N/A
COLLAR ELEV. 255.8 ft	TOTAL DEPTH 60.0 ft	NORTHING 493,960	EASTING 1,998,552	24 HR. 13.7
DRILL MACHINE CME-550	DRILL METHOD Mud Rotary		HAMMER TYPE Automatic	
START DATE 11/28/07	COMP. DATE 11/28/07	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	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
	260										
	255.8	0.0								255.8 GROUND SURFACE	0.0
255			6	14	14	28	SS-1			253.8 BROWN SANDY SILT, MOIST (UNDIVIDED COASTAL PLAIN)	2.0
	252.5	3.3								GRAY SANDY AND SILTY CLAY, MOIST TO WET	
250			7	8	8	16	SS-2			248.8	7.0
	247.3	8.5									
245			5	9	11	20	SS-3	30%			
	242.3	13.5									
240			7	10	14	24					
	237.3	18.5									
235			1	2	2	4	SS-4				
	232.3	23.5									
230					10	18	SS-5				
	227.3	28.5									
225			9	14	18	32					
	222.3	33.5									
220			10	16	22	38	SS-6				
	217.3	38.5								218.8 TAN SAND, SATURATED	37.0
215			1	9	14	23	SS-7			216.5 GRAY SILTY AND SANDY CLAY, WET (CAPE FEAR FORMATION)	39.3
	212.3	43.5									
210			36	100/0.4		100/0.4	SS-8				
	207.3	48.5									
205			22	45	55/0.2	100/0.7				203.8	52.0
	202.3	53.5									
200			100	60/0.1		60/0.1	SS-9			198.8 GRAY CLAYEY SAND, SATURATED	57.0
	197.3	58.5									
195			20	25	32	57	SS-10			195.8 Boring Terminated at Elevation 195.8 ft in very dense clayey sand	60.0
190											
185											
180											

PROJECT NO. 34817.1.2	ID. U-2519CB	COUNTY CUMBERLAND	GEOLOGIST Wrike, C. M.	
SITE DESCRIPTION STRUCTURE NO. 8 ON -L- (FAYETTEVILLE OUTER LOOP) OVER -Y2- (SR 1403)				GROUND WTR (ft)
BORING NO. EB2-B RT. LN	STATION 969+84	OFFSET 85ft RT	ALIGNMENT -L-	0 HR. N/A
COLLAR ELEV. 256.2 ft	TOTAL DEPTH 60.0 ft	NORTHING 493,867	EASTING 1,998,790	24 HR. 14.0
DRILL MACHINE CME-550	DRILL METHOD Mud Rotary		HAMMER TYPE Automatic	
START DATE 11/30/07	COMP. DATE 11/30/07	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	SOIL AND ROCK DESCRIPTION
	260									
	256.2	0.0								256.2 GROUND SURFACE 0.0
255			2	5	5	10	SS-21			255.5 BROWN SANDY SILT, MOIST (UNDIVIDED COASTAL PLAIN) 0.7
	252.7	3.5								GRAY SILTY CLAY, MOIST TO WET
250			6	7	11	18	SS-22	23%		
	247.7	8.5								
245			11	21	32	53				
	242.7	13.5								
240			7	8	10	18	SS-23			
	237.7	18.5								239.2 TAN SAND, SATURATED 17.0
235			6	6	4	10	SS-24			
	232.7	23.5								
230			4	7	6	13				
	227.7	28.5								
225			2	3	3	6	SS-25			
	222.7	33.5								
220			3	3	5	8				
	217.7	38.5								
215			3	4	4	8	SS-26			214.2 GRAY SILTY CLAY, WET (CAPE FEAR FORMATION) 42.0
	212.7	43.5								
210			9	15	30	45	SS-27			
	207.7	48.5								
205			35	78	22/.1	100/.06				
	202.7	53.5								
200			30	50	50/0.3	100/0.8	SS-28			199.2 GRAY CLAYEY SAND, SATURATED 57.0
	197.7	58.5								
195			15	16	18	34	SS-29			196.2 Boring Terminated at Elevation 196.2 ft in dense clayey sand 60.0
190										
185										
180										

U-2519CB
STRUCTURES NO. 7 AND 8 ON -L- OVER -Y2-

STRUCTURE 7

HOLE #	SAMPLE #	PASS 10	PASS 40	PASS 200	CSESAND	FINESAND	SI	CL	LL	PI	CLASS	DEPTH	MOIST.	ORG.
EB1-A	SS-11	99	71	23	47.9	34.5	11.5	6.1	19	NP	A-2-4(0)	1.0-1.5		
LT. LN.	SS-12	100	99	56	4.0	47.4	14.2	34.3	35	16	A-6(6)	3.5-5.0		
	SS-13	100	99	96	1.2	5.9	16.2	76.7	67	38	A-7-6(43)	8.5-10.0	26.7	
	SS-14	100	100	99	0.2	1.2	15.8	82.7	81	50	A-7-5(60)	18.5-20.0		
	SS-15	99	60	40	50.1	11.3	6.4	32.3	45	23	A-7-6(4)	23.5-25.0		
	SS-16	98	22	10	83.6	7.0	2.4	7.1	25	7	A-2-4(0)	28.5-30.0		
	SS-17	99	74	48	35.9	18.6	13.2	32.3	38	15	A-6(4)	33.5-35.0		
	SS-18	100	54	14	74.5	12.4	5.0	8.1	21	NP	A-2-4(0)	43.5-45.0		
	SS-19	100	99	96	2.2	2.8	8.2	86.8	71	43	A-7-6(48)	48.5-50.0		
	SS-20	100	98	89	3.0	11.5	16.9	68.6	70	46	A-7-6(46)	58.5-60.0		
EB2-B	SS-30	97	74	29	39.8	36.7	15.5	8.0	16	NP	A-2-4(0)	1.0-1.5		
LT. LN.	SS-31	96	70	27	41.6	33.9	6.4	18.1	26	11	A-2-6(0)	3.6-5.1	8.3	
	SS-32	100	97	92	3.8	7.6	26.3	62.2	53	30	A-7-6(31)	8.5-10.0	24.2	
	SS-33	100	64	10	70.9	20.5	4.6	4.0	15	NP	A-3(0)	14.0-15.0		
	SS-34	96	50	19	56.2	25.1	4.6	14.1	26	6	A-1-b(0)	18.5-20.0		
	SS-35	100	92	16	29.1	56.2	4.6	10.0	21	NP	A-2-4(0)	23.5-25.0		
	SS-36	100	94	90	7.0	3.6	7.0	82.3	79	44	A-7-5(47)	29.0-30.0		
	SS-37	100	99	97	1.0	7.8	26.9	64.3	54	31	A-7-6(34)	33.5-35.0		
	SS-38	100	73	39	54.0	8.4	9.4	28.1	32	17	A-6(2)	38.5-40.0		
	SS-39	100	98	92	3.0	6.8	11.8	78.3	64	37	A-7-6(39)	43.5-45.0		
	SS-40	100	98	58	4.8	40.4	8.6	46.2	49	30	A-7-6(14)	53.5-55.0		
	SS-41	100	81	26	50.7	23.4	1.8	24.1	29	14	A-2-6(0)	58.5-60.0		

STRUCTURE 8

HOLE #	SAMPLE #	PASS 10	PASS 40	PASS 200	CSESAND	FINESAND	SI	CL	LL	PI	CLASS	DEPTH	MOIST.	ORG.
EB1-A	SS-1	95	71	36	41.2	26.0	12.6	20.2	22	6	A-4(0)	1.0-1.5		
RT. LN.	SS-2	99	89	59	18.4	29.3	18.1	34.3	37	18	A-6(8)	3.3-4.8		
	SS-3	100	100	98	1.0	2.2	14.0	82.7	71	40	A-7-5(47)	8.5-10.0	30.4	
	SS-4	100	94	88	8.5	6.5	34.6	50.5	54	31	A-7-6(30)	18.5-20.0		
	SS-5	100	100	99	0.6	0.4	16.2	82.7	67	36	A-7-5(43)	23.5-25.0		
	SS-6	100	100	98	0.2	5.9	23.3	70.6	64	36	A-7-6(42)	33.5-35.0		
	SS-7	100	86	63	31.7	5.2	8.6	54.5	51	27	A-7-6(15)	39.3-40.0		
	SS-8	100	98	87	3.8	18.4	33.4	44.4	46	24	A-7-6(22)	43.5-44.4		
	SS-9	100	99	86	2.2	20.4	35.0	42.4	32	16	A-6(12)	53.5-54.1		
	SS-10	100	82	35	31.1	35.7	4.9	28.3	35	18	A-2-6(2)	58.5-60.0		
EB2-B	SS-21	100	91	70	16.8	17.6	15.2	50.5	53	28	A-7-6(19)	1.0-1.5		
RT. LN.	SS-22	100	100	95	0.6	8.7	20.1	70.6	61	29	A-7-5(34)	3.5-5.0	23.4	
	SS-23	100	100	95	1.6	5.0	14.6	78.7	74	46	A-7-6(51)	13.5-15.0		
	SS-24	97	26	8	82.8	9.8	2.3	5.0	19	NP	A-1-b(0)	18.5-20.0		
	SS-25	100	50	13	78.4	10.0	3.5	8.1	21	NP	A-1-b(0)	28.5-30.0		
	SS-26	99	31	9	83.5	7.7	3.7	5.0	20	NP	A-1-b(0)	38.5-40.0		
	SS-27	100	99	97	1.0	5.0	33.7	60.2	49	22	A-7-6(25)	43.5-45.0		
	SS-28	100	98	92	3.0	8.4	28.3	60.2	49	28	A-7-6(28)	53.5-54.8		
	SS-29	100	99	32	17.1	51.6	5.2	26.1	30	13	A-2-6(1)	58.5-60.0		

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34817.1.2 (U-2519CB)	1	19

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34817.1.2 (U-2519CB) F.A. PROJ. DPR-0100(001)

COUNTY CUMBERLAND

PROJECT DESCRIPTION FAYETTEVILLE OUTER LOOP FROM EAST OF SR 1415 TO WEST OF NC 24 (BRAGG BOULEVARD)

SITE DESCRIPTION STRUCTURE NOS. 9 & 10 ON -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4, 5	PROFILES
6-17	BORE LOGS
18, 19	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) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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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

MACTEC

TRIGON

INVESTIGATED BY N.D. MOHS

CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE SEPTEMBER 2013

NORTH CAROLINA LICENSED SEAL 2124 GEOLOGIST NATHAN DANIEL MOHS

9/17/13

PROJECT: 34817.1.2

ID: U-2519CB

DRAWN BY: N.D. MOHS

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 REFERENCE NO.	SHEET NO.
34817.1.2 (U-2519CB)	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	6 MX		NP	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				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)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
SL — SHRINKAGE LIMIT		
	- 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	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	>10%	>20%	HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- 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
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

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
- [X] CME-45B
- [ ] _____

ADVANCING TOOLS:
- [X] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [X] HARD FACED FINGER BITS
- [ ] 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.

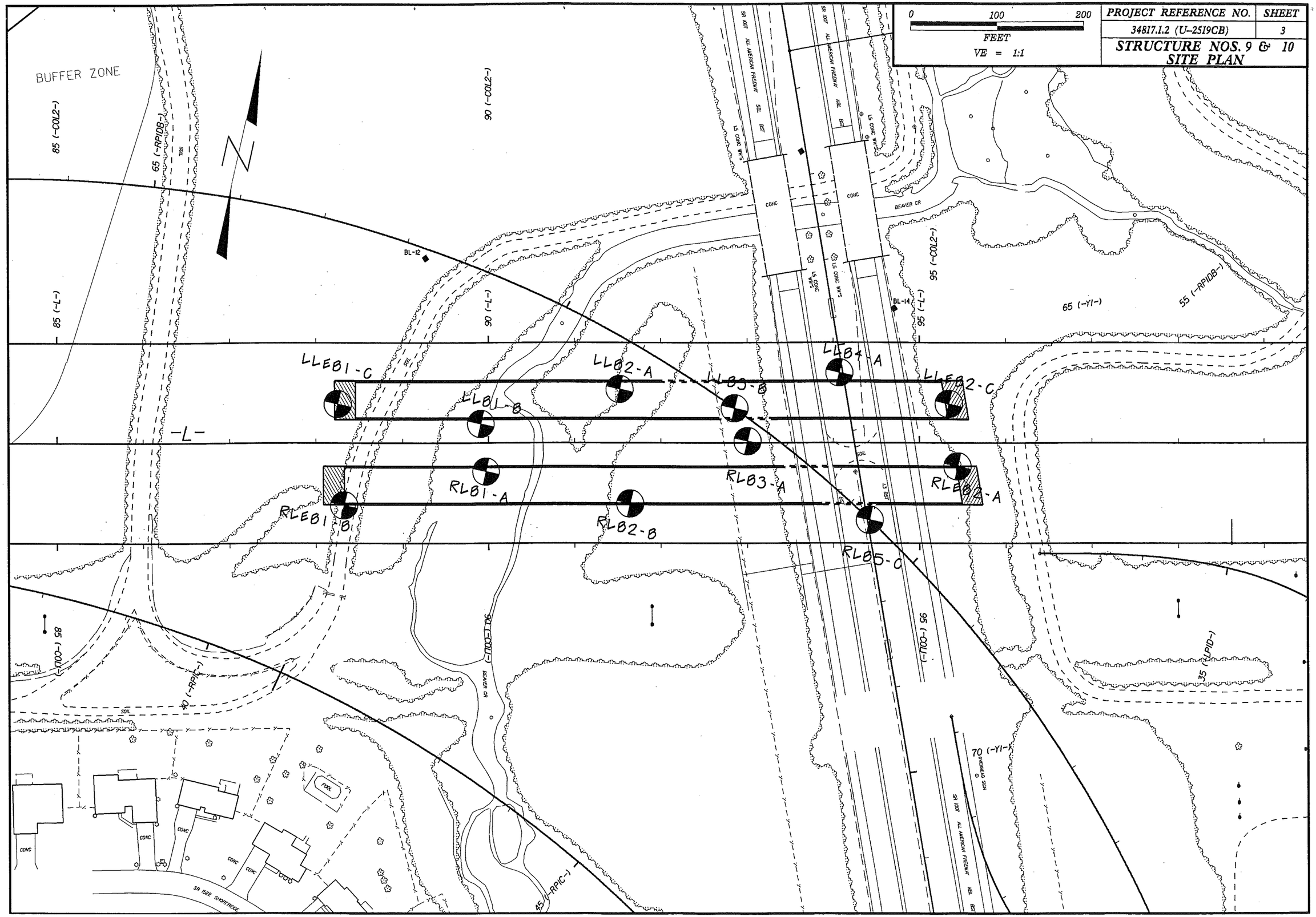
BENCH MARK: BL-12, N: 495550.2, E: 2006994.7, ELEV=195.23 FT.
BL-14, N: 495615.4, E: 2007537.8, ELEV=212.54 FT.

ELEVATION: FT.

NOTES:

REVISED 09/23/09

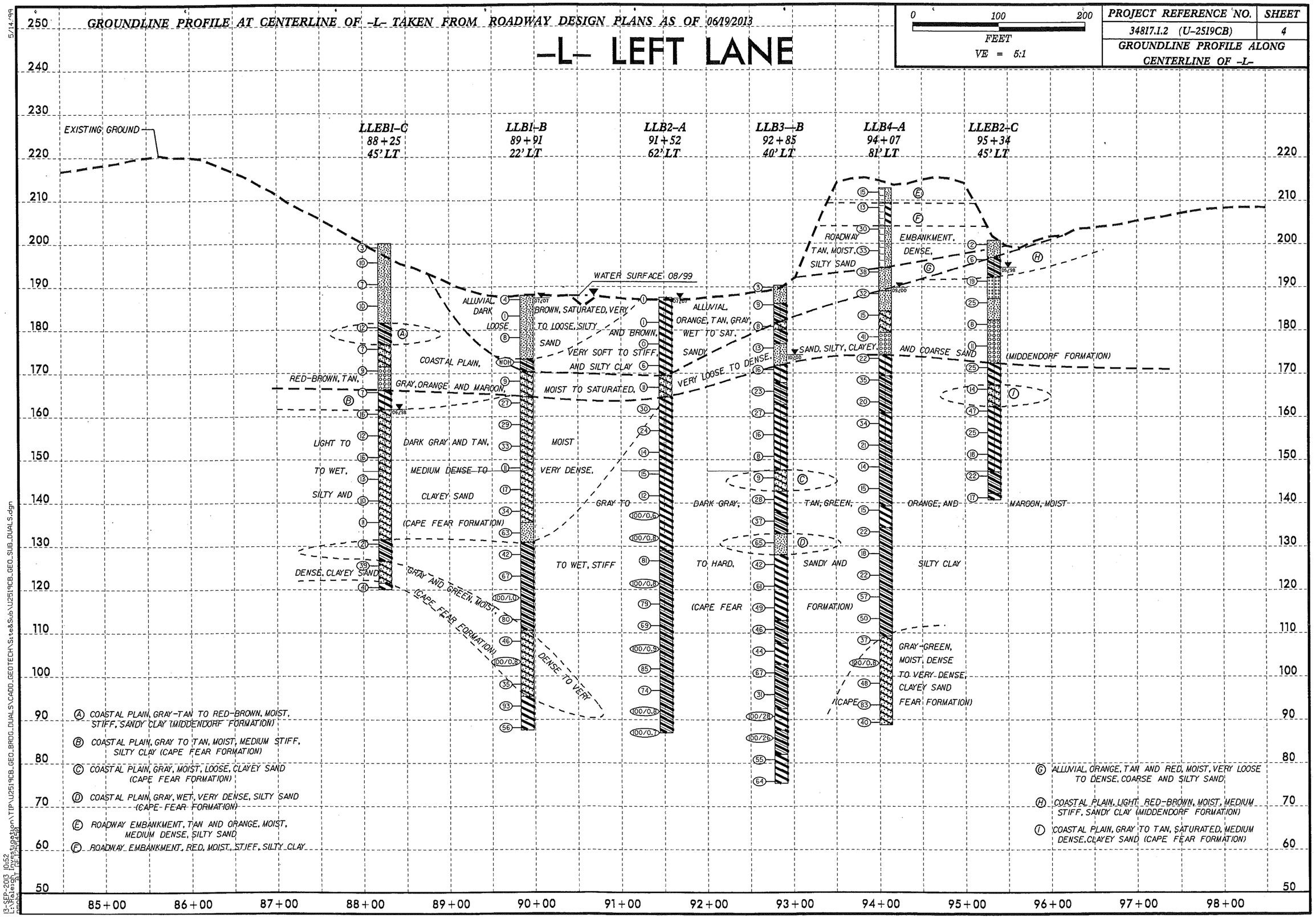
PROJECT REFERENCE NO.	SHEET
34817.1.2 (U-2519CB)	3
STRUCTURE NOS. 9 & 10 SITE PLAN	



PROJECT REFERENCE NO.	SHEET
34817.1.2 (U-2519CB)	4
GROUNDLINE PROFILE ALONG CENTERLINE OF -L-	

0 100 200
FEET
VE = 5:1

-L- LEFT LANE



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bmacke
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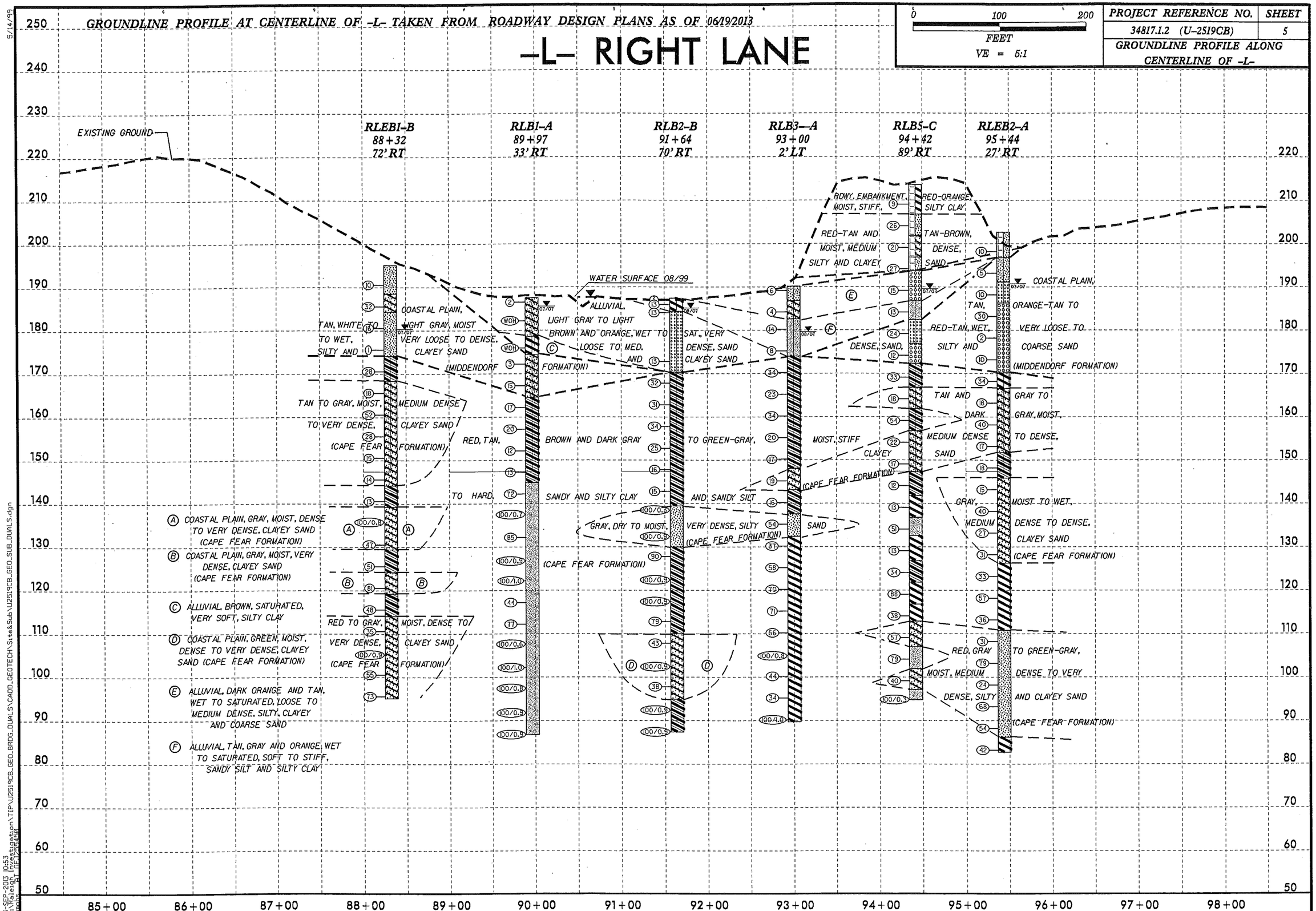
PROJECT REFERENCE NO.	SHEET
34817.1.2 (U-2519CB)	5
GROUNDLINE PROFILE ALONG CENTERLINE OF -L-	

0 100 200
FEET
VE = 5:1

GROUNDLINE PROFILE AT CENTERLINE OF -L- TAKEN FROM ROADWAY DESIGN PLANS AS OF 06/19/2013

-L- RIGHT LANE



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NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34817.1.2	**TIP** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** J. HOWARD
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			**GROUND WTR (ft)**
BORING NO. LLEB1-C	**STATION** 88+25	**OFFSET** 45 ft LT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 201.4 ft	**TOTAL DEPTH** 80.0 ft	**NORTHING** 495,363	**EASTING** 2,006,933 — **24 HR.** 38.4
DRILL RIG/HAMMER EFF./DATE CME-550		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 06/10/98	**COMP. DATE** 06/10/98	**SURFACE WATER DEPTH** 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)
205											
	201.4	0.0	1	1	2	3		M		201.4 GROUND SURFACE	0.0
200										**COASTAL PLAIN** RED-BROWN, TAN, AND GRAY, SILTY SAND (MIDDENDORF FORMATION)	
	197.9	3.5	3	5	5	10	SS-2	8% M			
195											
	192.9	8.5	3	3	4	7	SS-3	7% M			
190											
	187.9	13.5	4	4	6	10	SS-4	17% M			
185											
	182.9	18.5	2	3	9	12		13% M		182.9 GRAY-TAN TO RED-BROWN, SANDY CLAY	18.5
180											
	177.9	23.5	2	4	3	7	SS-5	21% M		177.9 GRAY-TAN TO RED-BROWN, CLAYEY SAND	23.5
175											
	172.9	28.5	3	4	5	9	SS-7	M		172.9 TAN, RED-BROWN TO GRAY, COARSE SAND	28.5
170											
	167.9	33.5	2	2	5	7	SS-8	13% M		167.4 GRAY TO TAN, SILTY CLAY (CAPE FEAR FORMATION)	34.0
165											
	162.9	38.5	5	6	10	16	SS-9	14% M		162.9 GRAY TO TAN, CLAYEY SAND	38.5
160											
	157.9	43.5	5	6	6	12	SS-10	16% M			
155											
	152.9	48.5	4	7	9	16	SS-11	13% M			
150											
	147.9	53.5	4	5	8	13	SS-12	15% M			
145											
	142.9	58.5	4	5	5	10	SS-13	14% M			
140											
	137.9	63.5	6	6	5	11	SS-14	17% M			
135											
	132.9	68.5	7	10	11	21	SS-15	14% M		132.9 GRAY TO TAN, SANDY CLAY	68.5
130											
	127.9	73.5	13	18	21	39	SS-16	17% M		127.9 GRAY, CLAYEY SAND	73.5
125											

WBS 34817.1.2	**TIP** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** J. HOWARD
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			**GROUND WTR (ft)**
BORING NO. LLEB1-C	**STATION** 88+25	**OFFSET** 45 ft LT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 201.4 ft	**TOTAL DEPTH** 80.0 ft	**NORTHING** 495,363	**EASTING** 2,006,933 — **24 HR.** 38.4
DRILL RIG/HAMMER EFF./DATE CME-550		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 06/10/98	**COMP. DATE** 06/10/98	**SURFACE WATER DEPTH** 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	
125						Match Line					
	122.9	78.5	12	16	25	41	SS-17	15% M		122.9 GRAY, CLAYEY SAND *(continued)*	78.5
										121.4 GRAY TO RED-BROWN, SILTY CLAY	80.0
										Boring Terminated at Elevation 121.4 ft in COASTAL PLAIN SILTY CLAY	

NCDOT BORE DOUBLE U2519CB_GEO_BH_DUALS.GPJ NC_DOT.GDT 9/16/13

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34817.1.2	TIP U-2519CB	COUNTY CUMBERLAND	GEOLOGIST J. HOWARD
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			GROUND WTR (ft)
BORING NO. LLB1-B	STATION 89+91	OFFSET 22 ft LT	ALIGNMENT -L-
COLLAR ELEV. 188.0 ft	TOTAL DEPTH 100.4 ft	NORTHING 495,378	EASTING 2,007,100
DRILL RIG/HAMMER EFF./DATE CME-45B		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 07/17/07	COMP. DATE 07/17/07	SURFACE WATER DEPTH N/A

GROUND WTR (ft): 0 HR. 2.3; 24 HR. 0.7

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))
190										
	188.0	0.0								188.0 / 0.0 GROUND SURFACE
			1	2	2	4		Sat.		ALLUVIAL DARK BROWN, SILTY SAND
185										
	184.2	3.8	1	1	0	1		Sat.		
180										
	179.2	8.8	WOH	1	7	8	SS-20	Sat.		
175										
	173.5	14.5	WOH	WOH	WOH	0		W		173.2 / 14.8 TAN, SANDY CLAY
170										170.3 / 17.7 COASTAL PLAIN LIGHT GRAY, CLAYEY SAND (MIDDENDORF FORMATION)
	169.1	18.9	4	4	5	9		W		
165										
	164.1	23.9	6	8	19	27		M		164.5 / 23.5 LIGHT TO DARK GRAY, CLAYEY SAND (CAPE FEAR FORMATION)
160										
	159.1	28.9	10	13	16	29		M		
155										
	154.1	33.9	10	14	19	33	SS-23	W		
150										
	149.1	38.9	5	5	6	11		W		
145										
	144.1	43.9	6	8	9	17		M		
140										
	139.1	48.9	8	14	20	34		M		
135										
	134.1	53.9	21	26	37	63	SS-24	Sat.		135.5 / 52.5 LIGHT GRAY, SILTY SAND
130										130.9 / 57.1 DARK GRAY, SANDY CLAY
	129.1	58.9	12	19	23	42	SS-25	M		
125										
	124.1	63.9	17	26	41	67		M		
120										
	119.1	68.9	43	57/0.5		100/1.0		M		
115										
	114.1	73.9	27	39	41	80		M		
110										110.6 / 77.4

WBS 34817.1.2	TIP U-2519CB	COUNTY CUMBERLAND	GEOLOGIST J. HOWARD
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			GROUND WTR (ft)
BORING NO. LLB1-B	STATION 89+91	OFFSET 22 ft LT	ALIGNMENT -L-
COLLAR ELEV. 188.0 ft	TOTAL DEPTH 100.4 ft	NORTHING 495,378	EASTING 2,007,100
DRILL RIG/HAMMER EFF./DATE CME-45B		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 07/17/07	COMP. DATE 07/17/07	SURFACE WATER DEPTH N/A

GROUND WTR (ft): 0 HR. 2.3; 24 HR. 0.7

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
110						Match Line				
	109.1	78.9	13	23	23	46	SS-26	M		GREEN AND GRAY, CLAYEY SAND *(continued)*
105										
	104.1	83.9	60	40/0.3		100/0.8		M		
100										
	99.1	88.9	15	18	17	35		M		95.3 / 92.7 DARK GRAY TO GREEN, SILTY CLAY
95										
	94.1	93.9	46	36	57	93	SS-27	M		
90										
	89.1	98.9	22	26	30	56		M		87.6 / 100.4 Boring Terminated at Elevation 87.6 ft in COASTAL PLAIN SILTY CLAY

NCDOT BORE DOUBLE U2519CB_GEO_BH_DUALS.GPJ NC_DOT.GDT 9/16/13

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34817.1.2	**TIP** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** J. HOWARD
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			**GROUND WTR (ft)**
BORING NO. LLB2-A	**STATION** 91+52	**OFFSET** 62 ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 187.5 ft	**TOTAL DEPTH** 100.5 ft	**NORTHING** 495,453	**EASTING** 2,007,248
DRILL RIG/HAMMER EFF./DATE CME-45B		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 07/26/07	**COMP. DATE** 07/26/07	**SURFACE WATER DEPTH** N/A

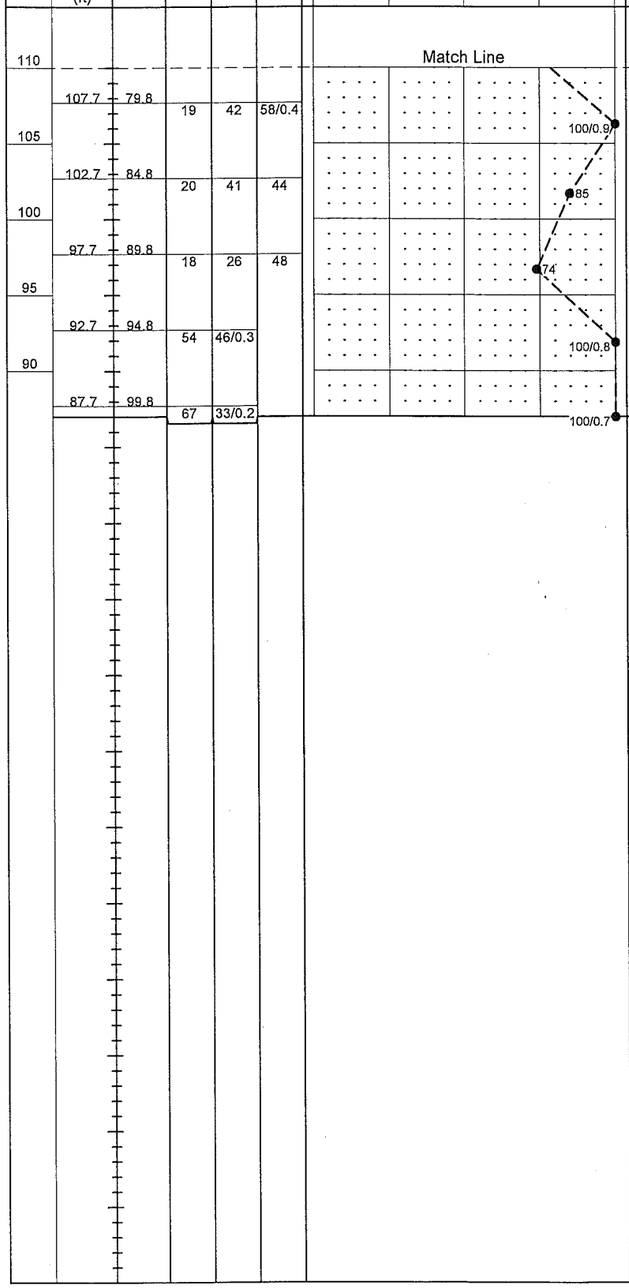
GROUND WTR (ft)	
0 HR.	0.0
24 HR.	0.2

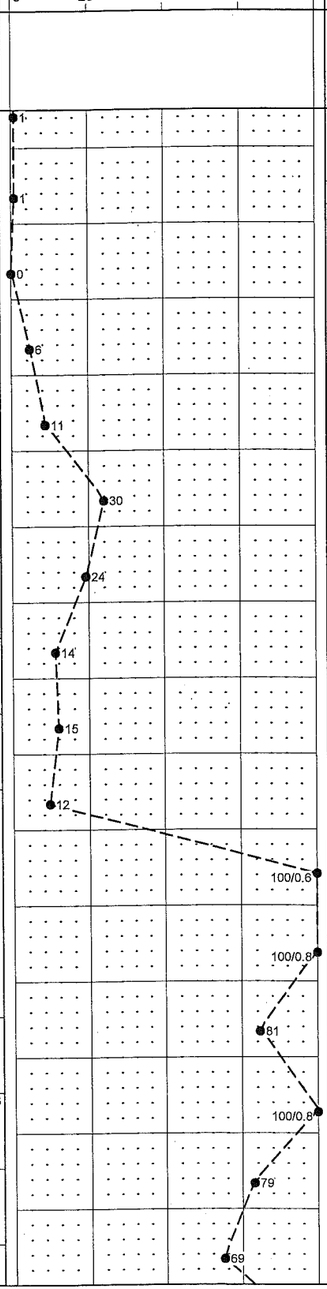
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
187.5		0.0							GROUND SURFACE (0.0)
	187.5	0.0	WOH	1	0		Sat.		**ALLUVIAL** GRAY AND BROWN, SILTY CLAY
	182.7	4.8	WOH	1	0	SS-28	Sat.		
	177.7	9.8	1	0	0		Sat.		
	172.7	14.8	2	3	3		Sat.		
169.5		18.0							**COASTAL PLAIN** GRAY, CLAYEY SAND (MIDDENDORF FORMATION)
	167.7	19.8	6	5	6	SS-29	M		
164.5		23.0							GRAY TO DARK GRAY, SILTY CLAY (CAPE FEAR FORMATION)
	162.7	24.8	9	13	17	SS-30	M		
	157.7	29.8	8	10	14		M		
	152.7	34.8	5	7	7		M		
	147.7	39.8	7	7	8		M		
	142.7	44.8	4	5	7		M		
	137.7	49.8	62	38/0.1			M		
	132.7	54.8	55	45/0.3			M		
	127.7	59.8	27	39	42	SS-31	M		
	122.7	64.8	33	53	47/0.3		M		
	117.7	69.8	28	32	47		M		
	112.7	74.8	22	33	36		M		
129.1		58.4							DARK GRAY AND GREEN, SANDY CLAY

WBS 34817.1.2	**TIP** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** J. HOWARD
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			**GROUND WTR (ft)**
BORING NO. LLB2-A	**STATION** 91+52	**OFFSET** 62 ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 187.5 ft	**TOTAL DEPTH** 100.5 ft	**NORTHING** 495,453	**EASTING** 2,007,248
DRILL RIG/HAMMER EFF./DATE CME-45B		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 07/26/07	**COMP. DATE** 07/26/07	**SURFACE WATER DEPTH** N/A

GROUND WTR (ft)	
0 HR.	0.0
24 HR.	0.2

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
	107.7	79.8	19	42	58/0.4		M		DARK GRAY AND GREEN, SANDY CLAY *(continued)*
	102.7	84.8	20	41	44		M		
	97.7	89.8	18	26	48		M		
	92.7	94.8	54	46/0.3			M		
	87.7	99.8	67	33/0.2			M		
87.0		100.5							Boring Terminated at Elevation 87.0 ft in COASTAL PLAIN SANDY CLAY





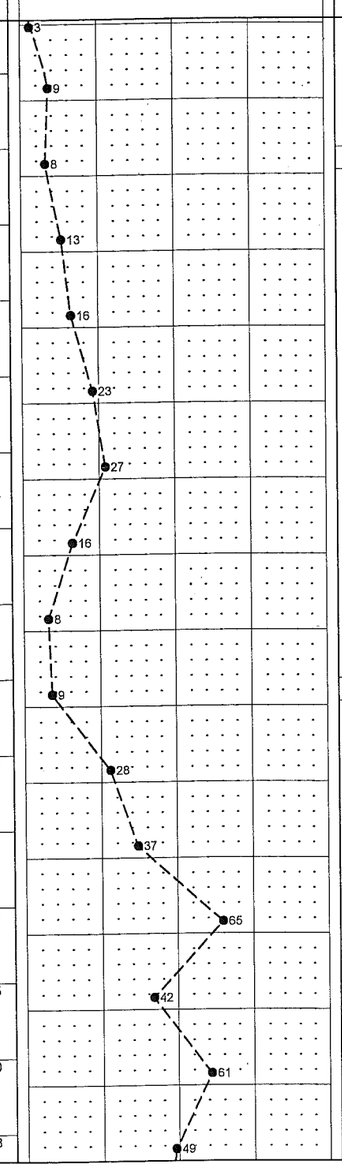
NCDOT BORE DOUBLE U2519CB_GEO_BH_DUALS.GPJ NC_DOT.GDT 9/16/13

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34817.1.2	TIP U-2519CB	COUNTY CUMBERLAND	GEOLOGIST D. CARR
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			GROUND WTR (ft)
BORING NO. LLB3-B	STATION 92+85	OFFSET 40 ft LT	ALIGNMENT -L-
COLLAR ELEV. 190.3 ft	TOTAL DEPTH 115.0 ft	NORTHING 495,461	EASTING 2,007,382
DRILL RIG/HAMMER EFF./DATE CME-550		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 10/18/00	COMP. DATE 10/20/00	SURFACE WATER DEPTH N/A

GROUND WTR (ft): 0 HR. 17.4; 24 HR. 16.1

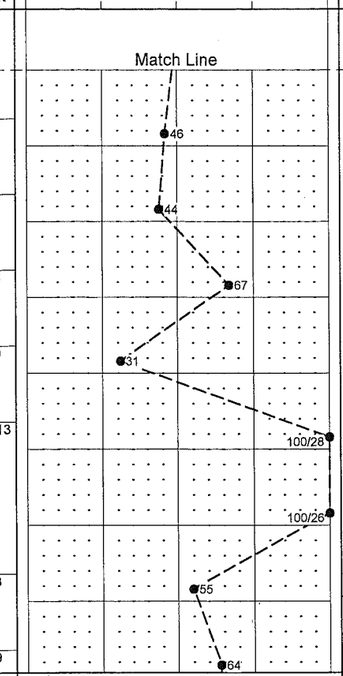
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
190.3		0.0	1	1	2		M		GROUND SURFACE	0.0
									ALLUVIAL ORANGE, SILTY SAND	
186.8		3.5	2	3	6		M		LIGHT GRAY, TAN AND ORANGE, SANDY CLAY	4.2
181.8		8.5	4	4	4	SS-3	20%		**COASTAL PLAIN** ORANGE AND LIGHT GRAY, CLAYEY SAND (MIDDENDORF FORMATION)	8.5
176.8		13.5	16	6	7		W		GRAY-GREEN, SANDY CLAY; TAN AND MAROON, SILTY SAND	10.2
171.8		18.5	4	5	11		M		TAN, SILTY CLAY (CAPE FEAR FORMATION)	13.5
166.8		23.5	5	11	12		M		LIGHT AND TAN-ORANGE, SANDY CLAY	18.5
161.8		28.5	5	11	16		M		GRAY, SILTY CLAY	22.5
156.8		33.5	3	7	9		M			27.6
151.8		38.5	2	3	5		M			
146.8		43.5	2	3	6	SS-10	18%		GRAY, CLAYEY SAND	42.7
141.8		48.5	3	5	23		M		GRAY AND MAROON, SILTY CLAY	47.6
136.8		53.5	15	18	19		M		GRAY, SANDY CLAY	52.5
131.8		58.5	28	31	34		W		GRAY, SILTY SAND	57.4
126.8		63.5	11	17	25	SS-14	19%		GRAY AND TAN, SILTY CLAY	62.3
121.8		68.5	15	21	40		M			
116.8		73.5	22	21	28		M			



WBS 34817.1.2	TIP U-2519CB	COUNTY CUMBERLAND	GEOLOGIST D. CARR
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			GROUND WTR (ft)
BORING NO. LLB3-B	STATION 92+85	OFFSET 40 ft LT	ALIGNMENT -L-
COLLAR ELEV. 190.3 ft	TOTAL DEPTH 115.0 ft	NORTHING 495,461	EASTING 2,007,382
DRILL RIG/HAMMER EFF./DATE CME-550		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 10/18/00	COMP. DATE 10/20/00	SURFACE WATER DEPTH N/A

GROUND WTR (ft): 0 HR. 17.4; 24 HR. 16.1

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
									Match Line	
									GRAY AND TAN, SILTY CLAY *(continued)*	112.9 / 77.4
	111.8	78.5	25	16	30		M		LIGHT GRAY TO GRAY-GREEN, SAND CLAY	107.6 / 82.7
	106.8	83.5	13	17	27		M		GRAY-GREEN AND GRAY, SILTY CLAY	102.7 / 87.6
	101.8	88.5	25	31	36		M		GRAY-GREEN AND GRAY, SANDY CLAY	92.5 / 97.8
	96.8	93.5	8	11	20		M		GRAY TO GRAY-GREEN, SILTY CLAY	87.6 / 102.7
	91.8	98.5	29	35	65/13		M		GRAY-GREEN, SANDY CLAY	82.0 / 108.3
	86.8	103.5	54	46/11			M		GRAY-GREEN AND MAROON, SILTY CLAY	75.3 / 115.0
	81.8	108.5	20	22	33	SS-23	21%			
	76.8	113.5	20	25	39		M		Boring Terminated at Elevation 75.3 ft in COASTAL PLAIN SILTY CLAY	



NCDOT BORE DOUBLE U2519CB_GEO_BH_DUALS.GPJ NC_DOT.GDT 9/16/13

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34817.1.2	TIP U-2519CB	COUNTY CUMBERLAND	GEOLOGIST D. CARR
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			GROUND WTR (ft)
BORING NO. LLB4-A	STATION 94+07	OFFSET 81 ft LT	ALIGNMENT -L-
COLLAR ELEV. 212.8 ft	TOTAL DEPTH 124.0 ft	NORTHING 495,529	EASTING 2,007,492
DRILL RIG/HAMMER EFF./DATE CME-550		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 08/30/00	COMP. DATE 09/01/00	SURFACE WATER DEPTH N/A

GROUND WTR (ft)	
0 HR.	23.1
24 HR.	23.1

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)
215	212.8	0.0	5	8	7	15		M		212.8 GROUND SURFACE	0.0
210	209.3	3.5	4	7	6	13		M		ROADWAY EMBANKMENT TAN AND ORANGE, SILTY SAND 209.3	3.5
205	204.3	8.5	6	12	18	30		M		RED, SILTY CLAY 204.0	8.8
200	199.3	13.5	8	16	17	33		M		TAN, SILTY SAND	
195	194.3	18.5	8	17	21	38	SS-5	9% M		194.3	18.5
190	189.3	23.5	12	16	16	32		M		ALLUVIAL TAN AND RED, SILTY SAND, WITH BASAL, COARSE SAND 189.0	23.8
185	184.3	28.5	4	8	7	15		M		COASTAL PLAIN TAN, SILTY SAND (MIDDENDORF FORMATION) 184.3	28.5
180	179.3	33.5	12	19	22	41		W		LIGHT GRAY, CLAYEY SAND 179.3	33.5
175	174.3	38.5	5	8	14	22	SS-9	20% M		ORANGE, MAROON, AND TAN, COARSE SAND 174.1	38.7
170	169.3	43.5	9	14	21	35		M		GRAY AND TAN, SILTY CLAY (CAPE FEAR FORMATION) 169.3	43.5
165	164.3	48.5	8	9	11	20		M		TAN AND ORANGE, SANDY CLAY 160.8	52.0
160	159.3	53.5	9	12	22	34		M		GRAY, SILTY CLAY 154.3	58.5
155	154.3	58.5	6	8	13	21		M		GRAY, SANDY CLAY 139.3	73.5
150	149.3	63.5	4	6	8	14		M			
145	144.3	68.5	13	7	8	15		M			
140	139.3	73.5	4	6	9	15	SS-16	26% M		MAROON, GRAY, AND ORANGE, SILTY CLAY	
135											

WBS 34817.1.2	TIP U-2519CB	COUNTY CUMBERLAND	GEOLOGIST D. CARR
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			GROUND WTR (ft)
BORING NO. LLB4-A	STATION 94+07	OFFSET 81 ft LT	ALIGNMENT -L-
COLLAR ELEV. 212.8 ft	TOTAL DEPTH 124.0 ft	NORTHING 495,529	EASTING 2,007,492
DRILL RIG/HAMMER EFF./DATE CME-550		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 08/30/00	COMP. DATE 09/01/00	SURFACE WATER DEPTH N/A

GROUND WTR (ft)	
0 HR.	23.1
24 HR.	23.1

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
135						Match Line				
130	134.3	78.5	7	10	12	22		M		134.3 GRAY, SANDY CLAY 78.5
125	129.3	83.5	6	7	11	18		M		
120	124.3	88.5	5	10	12	22		M		
115	119.3	93.5	13	23	34	57		M		
110	114.3	98.5	12	20	30	50	SS-21	24% M		109.3 GRAY-GREEN, CLAYEY SAND 103.5
105	109.3	103.5	12	15	22	37		M		
100	104.3	108.5	17	56	44/0.3	100/0.8		M		
95	99.3	113.5	16	21	27	48				
90	94.3	118.5	30	33	50	83	SS-25	12% M		88.8 Boring Terminated at Elevation 88.8 ft in COASTAL PLAIN CLAYEY SAND 124.0
	90.3	122.5	15	17	23	40		M		

NCDOT BORE DOUBLE U2519CB_GEO_BH_DUALS.GPJ NC_DOT.GDT 9/16/13

WBS 34817.1.2	**TIP** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** J. HOWARD
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			**GROUND WTR (ft)**
BORING NO. LLEB2-C	**STATION** 95+34	**OFFSET** 45 ft LT	**ALIGNMENT** -L- — **0 HR.** 3.3
COLLAR ELEV. 200.8 ft	**TOTAL DEPTH** 60.0 ft	**NORTHING** 495,522	**EASTING** 2,007,624 — **24 HR.** 6.3
DRILL RIG/HAMMER EFF./DATE CME-550		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 05/12/98	**COMP. DATE** 05/01/98	**SURFACE WATER DEPTH** 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
205										
200	200.8	0.0								200.8 GROUND SURFACE 0.0
			1	1	1	2		M		**ALLUVIAL** TAN, SILTY SAND
	197.3	3.5								196.8 4.0
			3	3	3	6	SS-2	M		**COASTAL PLAIN** LIGHT RED-BROWN, SANDY CLAY (MIDDENDORF FORMATION)
195										
	192.3	8.5								192.3 8.5
			5	9	10	19	SS-3	Sat.		LIGHT RED-BROWN TO TAN, SAND
190										
	187.3	13.5								187.3 13.5
			8	11	14	25	SS-4	Sat.		GRAY, TAN AND DARK RED, SILTY SAND
185										
	182.3	18.5								182.3 18.5
			4	4	4	8	SS-5	Sat.		RED-BROWN TO TAN, COARSE SAND
180										
	177.3	23.5								
			4	4	7	11	SS-6	Sat.		
175										
	172.3	28.5								172.3 28.5
			7	10	15	25	SS-7	W		GRAY TO TAN, SILTY CLAY (CAPE FEAR FORMATION)
170										
	167.3	33.5								167.3 33.5
			4	6	8	14	SS-8	Sat.		GRAY TO TAN, CLAYEY SAND
165										
	162.3	38.5								162.3 38.5
			9	19	28	47	SS-9	W		GRAY, BROWN, AND RED, SILTY CLAY
160										
	157.3	43.5								
			6	10	15	25	SS-10	M		
155										
	152.3	48.5								
			5	7	11	18	SS-11	M		
150										
	147.3	53.5								147.3 53.5
			7	10	12	22	SS-12	W		GRAY, SANDY CLAY
145										
	142.3	58.5								142.3 58.5
			3	6	11	17	SS-13	M		140.8 GRAY, BROWN, AND RED, SILTY CLAY 60.0
										Boring Terminated at Elevation 140.8 ft in COASTAL PLAIN SILTY CLAY

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34817.1.2	TIP U-2519CB	COUNTY CUMBERLAND	GEOLOGIST J. GERNER
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			GROUND WTR (ft)
BORING NO. RLEB1-B	STATION 88+32	OFFSET 72 ft RT	ALIGNMENT -L- — 0 HR. 16.4
COLLAR ELEV. 195.1 ft	TOTAL DEPTH 100.0 ft	NORTHING 495,250	EASTING 2,006,966 — 24 HR. 14.8
DRILL RIG/HAMMER EFF./DATE CME-850		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 07/25/07	COMP. DATE 07/25/07	SURFACE WATER DEPTH 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)
200											
195										195.1 GROUND SURFACE	0.0
										COASTAL PLAIN TAN, SILTY SAND (MIDDENDORF FORMATION)	
190	191.6	3.5	3	5	5	10	SS-120	M			
										188.5 TAN, CLAYEY SAND	6.6
185	186.6	8.5	6	15	17	32	SS-121	M			
										184.3 WHITE, RED, AND TAN, SILTY SAND	10.8
180	181.6	13.5	6	9	7	16	SS-122	M			
175	176.6	18.5	1	1	0	1		W			
										174.1 GRAY, SANDY CLAY (CAPE FEAR FORMATION)	21.0
170	171.6	23.5	7	12	16	28	SS-124	M			
										168.4 TAN TO GRAY, CLAYEY SAND	26.7
165	166.6	28.5	4	8	10	18	SS-125	M			
160	161.6	33.5	14	24	28	52		M			
155	156.6	38.5	7	11	17	28	SS-127	M			
150	151.6	43.5	6	8	7	15		M			
145	146.6	48.5	4	6	8	14	SS-129	M			
										144.2 RED TO GRAY, SANDY CLAY	50.9
140	141.6	53.5	4	6	7	13	SS-130	M			
										139.3 GRAY, CLAYEY SAND	55.8
135	136.6	58.5	52	48/0.3		100/0.8		M			
130	131.6	63.5	26	25	22	47	SS-132	M			
										129.5 GRAY, SANDY CLAY	65.6
125	126.6	68.5	13	22	29	51		M			
										124.2 GRAY, CLAYEY SAND	70.9
120	121.6	73.5	20	35	46	81		M			

WBS 34817.1.2	TIP U-2519CB	COUNTY CUMBERLAND	GEOLOGIST J. GERNER
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			GROUND WTR (ft)
BORING NO. RLEB1-B	STATION 88+32	OFFSET 72 ft RT	ALIGNMENT -L- — 0 HR. 16.4
COLLAR ELEV. 195.1 ft	TOTAL DEPTH 100.0 ft	NORTHING 495,250	EASTING 2,006,966 — 24 HR. 14.8
DRILL RIG/HAMMER EFF./DATE CME-850		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 07/25/07	COMP. DATE 07/25/07	SURFACE WATER DEPTH 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
120						Match Line				
115	116.6	78.5	15	21	27	48		M		119.3 RED TO GRAY, SANDY CLAY — 75.8
110	111.6	83.5	11	15	20	35		M		114.1 RED TO GRAY, CLAYEY SAND — 81.0
105	106.6	88.5	14	37	63/0.4	100/0.9		M		
100	101.6	93.5	17	26	29	55		M		
	96.6	98.5	22	33	40	73		M		95.1 Boring Terminated at Elevation 95.1 ft in COASTAL PLAIN CLAYEY SAND — 100.0

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34817.1.2	**TIP** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** J. HOWARD
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			**GROUND WTR (ft)**
BORING NO. RLB1-A	**STATION** 89+97	**OFFSET** 33 ft RT	**ALIGNMENT** -L- — **0 HR.** 0.7
COLLAR ELEV. 187.5 ft	**TOTAL DEPTH** 100.7 ft	**NORTHING** 495,325	**EASTING** 2,007,118 — **24 HR.** 2.0
DRILL RIG/HAMMER EFF./DATE CME-45B		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 07/19/07	**COMP. DATE** 07/23/07	**SURFACE WATER DEPTH** 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)
190											
	187.5	0.0	WOH	1	1	2	SS-32	Wr		187.5 GROUND SURFACE	0.0
185										**ALLUVIAL** LIGHT BROWN, CLAYEY SAND	
	183.2	4.3	WOH	WOH	WOH	0		W			
180										178.6 BROWN, SILTY CLAY	8.9
	176.9	10.6	WOH	WOH	WOH	0	SS-33	Sat.			
175										174.4 **COASTAL PLAIN** WHITE AND LIGHT GRAY, CLAYEY SAND (MIDDENDORF FORMATION)	13.1
	173.2	14.3	1	1	2	3	SS-34	W			
170											
	168.2	19.3	8	6	9	15	SS-35	W			
165										164.5 GRAY TO DARK GRAY, SANDY CLAY (CAPE FEAR FORMATION)	23.0
	163.2	24.3	9	8	9	17	SS-36	M			
160											
	158.2	29.3	9	9	11	20		M			
155											
	153.2	34.3	4	5	7	12		M			
150											
	148.2	39.3	6	6	7	13		M			
145										144.8 GREEN, GRAY TO DARK GRAY, SANDY SILT	42.7
	143.2	44.3	18	34	38	72	SS-37	W			
140											
	138.2	49.3	51	49/0.2		100/0.7		Sat.			
135											
	133.2	54.3	26	39	46	85	SS-38	M			
130											
	128.2	59.3	30	48	52/0.4	100/0.9		M			
125											
	123.2	64.3	33	67/0.5		100/1.0		M			
120											
	118.2	69.3	14	17	27	44		M			
115											
	113.2	74.3	32	37	40	77		M			
110											

WBS 34817.1.2	**TIP** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** J. HOWARD
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			**GROUND WTR (ft)**
BORING NO. RLB1-A	**STATION** 89+97	**OFFSET** 33 ft RT	**ALIGNMENT** -L- — **0 HR.** 0.7
COLLAR ELEV. 187.5 ft	**TOTAL DEPTH** 100.7 ft	**NORTHING** 495,325	**EASTING** 2,007,118 — **24 HR.** 2.0
DRILL RIG/HAMMER EFF./DATE CME-45B		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 07/19/07	**COMP. DATE** 07/23/07	**SURFACE WATER DEPTH** 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
110						Match Line				
	108.2	79.3	80	20/0.1		100/0.6		M		GREEN, GRAY TO DARK GRAY, SANDY SILT *(continued)*
105										
	103.2	84.3	13	33	67/0.5	100/1.0		M		
100										
	98.2	89.3	55	45/0.3		100/0.8		M		
95										
	93.2	94.3	37	43	57/0.4	100/0.9		M		
90										
	88.2	99.3	42	47	53/0.4	100/0.9		M		86.8 Boring Terminated at Elevation 86.8 ft in COASTAL PLAIN SANDY SILT 100.7

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34817.1.2	TIP U-2519CB	COUNTY CUMBERLAND	GEOLOGIST J. HOWARD
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			GROUND WTR (ft)
BORING NO. RLB2-B	STATION 91+64	OFFSET 70 ft RT	ALIGNMENT -L-
COLLAR ELEV. 187.4 ft	TOTAL DEPTH 100.0 ft	NORTHING 495,327	EASTING 2,007,289
DRILL RIG/HAMMER EFF./DATE CME-45B		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 07/31/07	COMP. DATE 08/01/07	SURFACE WATER DEPTH N/A

GROUND WTR (ft): 0 HR. 0.0; 24 HR. 2.3

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	SAMP. NO.	MOI	SOIL AND ROCK DESCRIPTION (ELEV. ft / DEPTH ft)
								187.4 / 0.0 GROUND SURFACE
	187.4	0.0						
	186.4	1.0	1	1	1	SS-39	W	ALLUVIAL TAN, SILTY CLAY
			3	6	7	SS-40	Sat.	
	184.5	2.9						184.4 / 3.0
			7	6	7		Sat.	LIGHT GRAY TO ORANGE, SAND
	173.8	13.6	3	6	7		Sat.	
	168.8	18.6	8	14	18	SS-41	M	170.3 / 17.1 COASTAL PLAIN GRAY AND DARK GRAY, SANDY CLAY (CAPE FEAR FORMATION)
	163.8	23.6	10	15	16		M	
	158.8	28.6	8	16	18		M	
	153.8	33.6	7	12	13		M	
	148.8	38.6	5	8	8		M	
	143.8	43.6	6	7	8		M	
	138.8	48.6	100/0.3				D	139.5 / 47.9 GRAY, SILTY SAND
	133.8	53.6	31	69/0.4		SS-42	M	
	128.8	58.6	15	46	44	SS-43	M	130.0 / 57.4 DARK GRAY AND GREEN, SANDY CLAY
	123.8	63.6	20	57	43/0.4		M	
	118.8	68.6	26	58	42/0.4		M	
	113.8	73.6	31	41	38		M	110.0 / 77.4

BLOWS PER FOOT: 0 25 50 75 100

WBS 34817.1.2	TIP U-2519CB	COUNTY CUMBERLAND	GEOLOGIST J. HOWARD
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			GROUND WTR (ft)
BORING NO. RLB2-B	STATION 91+64	OFFSET 70 ft RT	ALIGNMENT -L-
COLLAR ELEV. 187.4 ft	TOTAL DEPTH 100.0 ft	NORTHING 495,327	EASTING 2,007,289
DRILL RIG/HAMMER EFF./DATE CME-45B		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 07/31/07	COMP. DATE 08/01/07	SURFACE WATER DEPTH N/A

GROUND WTR (ft): 0 HR. 0.0; 24 HR. 2.3

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	SAMP. NO.	MOI	SOIL AND ROCK DESCRIPTION
	108.8	78.6	13	23	20	SS-44	M	GREEN, CLAYEY SAND
	103.8	83.6	32	42	58/0.4		M	
	98.8	88.6	15	17	21		M	94.9 / 92.5
	93.8	93.6	13	22	78/0.4	SS-45	M	GREEN, SANDY CLAY
	88.8	98.6	36	40	60/0.4		M	87.4 / 100.0 Boring Terminated at Elevation 87.4 ft in COASTAL PLAIN SANDY CLAY

BLOWS PER FOOT: 0 25 50 75 100

Match Line

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34817.1.2	TIP U-2519CB	COUNTY CUMBERLAND	GEOLOGIST J. HOWARD
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			GROUND WTR (ft)
BORING NO. RLB3-A	STATION 93+00	OFFSET 2 ft LT	ALIGNMENT -L- — 0 HR. 0.3
COLLAR ELEV. 190.1 ft	TOTAL DEPTH 100.4 ft	NORTHING 495,428	EASTING 2,007,405 — 24 HR. 10.5
DRILL RIG/HAMMER EFF./DATE CME-45B		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 08/14/07	COMP. DATE 08/14/07	SURFACE WATER DEPTH 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)
195											
190	190.1	0.0								190.1 GROUND SURFACE	0.0
			WOH	3	3	6	SS-46	Sat.		**ALLUVIAL** DARK ORANGE, SILTY SAND	
										186.8	3.3
185	185.2	4.9	2	2	2	4	SS-47	Sat.		TAN, CLAYEY SAND	
										182.6	7.5
180	181.2	8.9	2	5	9	14	SS-48	Sat.		GRAY TO ORANGE, SANDY SILT	
175	176.2	13.9	3	5	3	8		Sat.		174.0	16.1
170	171.2	18.9	8	16	18	34	SS-49	M		**COASTAL PLAIN** GRAY TO DARK GRAY, SANDY CLAY (CAPE FEAR FORMATION)	
165	166.2	23.9	7	9	14	23		M			
160	161.2	28.9	13	17	17	34		M			
155	156.2	33.9	7	8	12	20		M			
150	151.2	38.9	5	7	10	17		M			
145	146.2	43.9	6	8	11	19	SS-50	M		148.1 DARK GRAY, CLAYEY SAND	42.0
140	141.2	48.9	4	7	9	16		M		143.2 GRAY, SANDY CLAY	46.9
135	136.2	53.9	15	23	31	54	SS-51	M		137.6 GRAY, SILTY SAND	52.5
130	131.2	58.9	23	16	21	37	SS-52	M		132.4 GREEN TO GRAY, SILTY CLAY	57.7
125	126.2	63.9	16	34	24	58		M			
120	121.2	68.9	22	32	38	70		M			
115	116.2	73.9	23	26	45	71		M			

WBS 34817.1.2	TIP U-2519CB	COUNTY CUMBERLAND	GEOLOGIST J. HOWARD
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			GROUND WTR (ft)
BORING NO. RLB3-A	STATION 93+00	OFFSET 2 ft LT	ALIGNMENT -L- — 0 HR. 0.3
COLLAR ELEV. 190.1 ft	TOTAL DEPTH 100.4 ft	NORTHING 495,428	EASTING 2,007,405 — 24 HR. 10.5
DRILL RIG/HAMMER EFF./DATE CME-45B		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 08/14/07	COMP. DATE 08/14/07	SURFACE WATER DEPTH 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
115						Match Line				
110	111.2	78.9	20	28	28	56		M		GREEN TO GRAY, SILTY CLAY *(continued)*
105	106.2	83.9	21	56	44/0.3	100/0.8		M		
100	101.2	88.9	22	24	20	44		M		
95	96.2	93.9	15	15	19	34		M		
90	91.2	98.9	30	37	63/0.5	100/1.0		M		89.7 100.4 Boring Terminated at Elevation 89.7 ft in COASTAL PLAIN SILTY CLAY

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34817.1.2	**TIP** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** D.G./J.G.
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			**GROUND WTR (ft)**
BORING NO. RLB5-C	**STATION** 94+42	**OFFSET** 89 ft RT	**ALIGNMENT** -L- — **0 HR.** 26.0
COLLAR ELEV. 213.6 ft	**TOTAL DEPTH** 118.8 ft	**NORTHING** 495,371	**EASTING** 2,007,564 — **24 HR.** 24.0
DRILL RIG/HAMMER EFF./DATE CME-850		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 07/18/07	**COMP. DATE** 07/19/07	**SURFACE WATER DEPTH** 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)
215										213.6 GROUND SURFACE	0.0
										ROADWAY EMBANKMENT RED-ORANGE, SILTY CLAY	
210	210.1	3.5	3	4	5	9	SS-45	M		206.8	6.8
										RED-TAN, SILTY SAND	
205	205.1	8.5	2	10	16	26	SS-46	M		201.9	11.7
										TAN, CLAYEY SAND	
200	200.1	13.5	5	10	11	21	SS-47	M		196.9	16.7
										TAN, SILTY SAND	
195	195.1	18.5	9	13	14	27	SS-48	M		193.7	19.9
										ALLUVIAL TAN, COARSE SAND WITH TRACE GRAVEL	
190	190.1	23.5	13	10	5	15	SS-49	W		186.7	26.9
										LIGHT GRAY, SANDY SILT WITH LAYERS OF SILTY CLAY, AND TRACE ORGANICS	
185	185.1	28.5	1	2	11	13	SS-50	W		182.4	31.2
										COASTAL PLAIN TAN, SAND (MIDDENDORF FORMATION)	
180	180.1	33.5	9	12	12	24	SS-51	W		176.9	36.7
										TAN, COARSE SAND	
175	175.1	38.5	3	4	8	12	SS-52	M		172.3	41.3
										LIGHT GRAY, SANDY CLAY (CAPE FEAR FORMATION)	
170	170.1	43.5	6	12	21	33	SS-53	M		166.8	46.8
										TAN-GRAY, CLAYEY SAND	
165	165.1	48.5	4	8	10	18	SS-54	M		161.9	51.7
										TAN AND GRAY, SANDY CLAY	
160	160.1	53.5	14	25	29	54	SS-55	M		156.8	56.8
										TAN AND GRAY, CLAYEY SAND	
155	155.1	58.5	7	9	13	22	SS-56	M		147.3	66.3
										GRAY, SANDY CLAY WITH TRACE MICA	
150	150.1	63.5	5	8	9	17	SS-57	M		141.8	71.8
										RED AND GRAY, SILTY CLAY	
145	145.1	68.5	4	5	7	12	SS-58	M		136.8	76.8
										GRAY, SANDY SILT	
140	140.1	73.5	4	5	8	13	SS-59	M			
135	135.1	78.5									

WBS 34817.1.2	**TIP** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** D.G./J.G.
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			**GROUND WTR (ft)**
BORING NO. RLB5-C	**STATION** 94+42	**OFFSET** 89 ft RT	**ALIGNMENT** -L- — **0 HR.** 26.0
COLLAR ELEV. 213.6 ft	**TOTAL DEPTH** 118.8 ft	**NORTHING** 495,371	**EASTING** 2,007,564 — **24 HR.** 24.0
DRILL RIG/HAMMER EFF./DATE CME-850		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 07/18/07	**COMP. DATE** 07/19/07	**SURFACE WATER DEPTH** 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
135						Match Line				
			37	29	22	51	SS-60	M		GRAY, SANDY SILT *(continued)* 132.6 — 81.0
										GRAY, SILTY CLAY, HIGHLY PLASTIC
130	130.1	83.5	11	6	7	13	SS-61	M		126.9 — 86.7
										BROWN, SANDY CLAY
125	125.1	88.5	6	14	20	34	SS-62	M		121.9 — 91.7
										BROWN TO GRAY, SILTY CLAY
120	120.1	93.5	21	36	52	88	SS-63	M		116.8 — 96.8
										GRAY TO BROWN, SILTY CLAY, HIGHLY PLASTIC
115	115.1	98.5	13	16	22	38	SS-64	M		112.9 — 100.7
										GRAY, CLAYEY SAND
110	110.1	103.5	21	26	31	57	SS-65	M		107.0 — 106.6
										GRAY, SANDY SILT
105	105.1	108.5	21	32	47	79	SS-66	M		101.9 — 111.7
										GREEN-GRAY, CLAYEY SAND
100	100.1	113.5	12	19	21	40	SS-67	M		97.1 — 116.5
										GRAY, SANDY SILT
95	95.1	118.5	100/0.3			100/0.3	SS-68	M		94.8 — 118.8
										Boring Terminated at Elevation 94.8 ft in COASTAL PLAIN SANDY SILT

NCDOT BORE DOUBLE U2519CB_GEO_BH_DUALS.GPJ NC_DOT.GDT 9/16/13

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34817.1.2	**TIP** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** D. GOODNIGHT
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			**GROUND WTR (ft)**
BORING NO. RLEB2-A	**STATION** 95+44	**OFFSET** 27 ft RT	**ALIGNMENT** -L- — **0 HR.** 12.4
COLLAR ELEV. 202.7 ft	**TOTAL DEPTH** 120.0 ft	**NORTHING** 495,454	**EASTING** 2,007,650 — **24 HR.** 12.0
DRILL RIG/HAMMER EFF./DATE CME-850		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 07/11/07	**COMP. DATE** 07/12/07	**SURFACE WATER DEPTH** 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)
205										202.7 GROUND SURFACE	0.0
200	199.2	3.5	7	6	4	10	SS-1	M		**ROADWAY EMBANKMENT** TAN AND BROWN, SILTY SAND — 196.8	5.9
195	194.2	8.5	2	2	3	5	SS-2	M		**COASTAL PLAIN** ORANGE-TAN, SILTY SAND (MIDDENDORF FORMATION) — 191.2	11.5
190	189.2	13.5	3	5	5	10	SS-3	W		TAN, SAND — 186.3	16.4
185	184.2	18.5	10	14	16	30	SS-4	W		RED-TAN, COARSE SAND	
180	179.2	23.5	WOH	WOH	2	2		W			
175	174.2	28.5	2	4	6	10		W			
170	169.2	33.5	8	14	20	34	SS-7	M		TAN, SILTY CLAY (CAPE FEAR FORMATION) — 170.2	32.5
165	164.2	38.5	5	8	10	18	SS-8	M		TAN AND GRAY, CLAYEY SAND — 166.6	36.1
160	159.2	43.5	11	18	22	40		M			
155	154.2	48.5	6	8	9	17		M		GRAY, SANDY CLAY — 151.8	50.9
150	149.2	53.5	4	8	10	18	SS-11	M		GRAY, CLAYEY SAND — 145.9	56.8
145	144.2	58.5	6	6	9	15	SS-12	M			
140	139.2	63.5	4	18	22	40		M			
135	134.2	68.5	19	13	14	27		W			
130	129.2	73.5	5	15	16	31		M		TAN AND GRAY, SILTY CLAY — 126.3	76.4
125											

WBS 34817.1.2	**TIP** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** D. GOODNIGHT
SITE DESCRIPTION STRUCTURE NOS. 9 & 10 -L- OVER BEAVER CREEK AND -Y1- (ALL AMERICAN FREEWAY)			**GROUND WTR (ft)**
BORING NO. RLEB2-A	**STATION** 95+44	**OFFSET** 27 ft RT	**ALIGNMENT** -L- — **0 HR.** 12.4
COLLAR ELEV. 202.7 ft	**TOTAL DEPTH** 120.0 ft	**NORTHING** 495,454	**EASTING** 2,007,650 — **24 HR.** 12.0
DRILL RIG/HAMMER EFF./DATE CME-850		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 07/11/07	**COMP. DATE** 07/12/07	**SURFACE WATER DEPTH** 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
125						Match Line				
	124.2	78.5	9	13	20	33	SS-16	M		TAN AND GRAY, SILTY CLAY *(continued)*
120	119.2	83.5	13	22	35	57		M		
115	114.2	88.5	11	15	21	36		M		110.8 — 91.9
110	109.2	93.5	13	16	15	31	SS-19	M		GREEN-GRAY, GRAY AND RED, SILTY SAND
105	104.2	98.5	18	33	46	79		M		
100	99.2	103.5	10	12	12	24		M		
95	94.2	108.5	19	29	39	68		M		
90	89.2	113.5	16	27	27	54		M		86.2 — 116.5 GRAY, SILTY CLAY
85	84.2	118.5	13	19	23	42		M		82.7 — 120.0 Boring Terminated at Elevation 82.7 ft in COASTAL PLAIN SILTY CLAY

NCDOT BORE DOUBLE U2519CB_GEO_BH_DUALS.GPJ NC_DOT.GDT 9/16/13

LLEB1-C

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-2	45' LT	88+25	3.5-5.0	A-2-4(0)	31	8	67.6	16.3	3.7	12.4	97.8	47.2	17.0	7.9	-
SS-3	45' LT	88+25	8.5-10.0	A-2-4(0)	29	10	72.7	8.7	5.9	12.7	97.0	41.3	18.8	7.0	-
SS-4	45' LT	88+25	13.5-15.0	A-2-4(0)	23	NP	30.0	58.6	0.5	10.9	93.2	70.0	13.5	17.4	-
SS-5	45' LT	88+25	23.5-25.0	A-6(7)	36	19	27.2	19.2	17.4	36.2	97.2	77.4	55.4	13.2	-
SS-7	45' LT	88+25	28.5-30.0	A-1-b(0)	22	2	88.0	5.8	1.9	4.3	94.7	21.2	6.3	-	-
SS-8	45' LT	88+25	33.5-35.0	A-7-6(13)	41	23	11.6	26.1	43.5	11.6	100.0	93.8	66.7	13.4	-
SS-9	45' LT	88+25	38.5-40.0	A-2-7(1)	42	25	54.3	17.2	4.6	23.9	98.9	66.2	29.1	14.3	-
SS-10	45' LT	88+25	43.5-45.0	A-2-6(0)	39	22	64.0	10.0	4.1	21.9	96.8	48.6	26.0	15.9	-
SS-11	45' LT	88+25	48.5-50.0	A-2-6(3)	38	23	40.1	25.3	4.1	30.5	99.1	74.7	35.4	13.3	-
SS-12	45' LT	88+25	53.5-55.0	A-2-6(0)	34	20	64.4	12.7	3.2	19.7	97.7	51.9	23.1	15.0	-
SS-13	45' LT	88+25	58.5-60.0	A-2-6(1)	33	19	49.4	19.1	4.4	27.1	99.5	69.1	32.7	14.3	-
SS-14	45' LT	88+25	63.5-65.0	A-2-7(0)	53	38	71.8	7.9	4.2	16.1	96.6	38.3	20.4	17.4	-
SS-15	45' LT	88+25	68.5-70.0	A-6(6)	29	15	15.3	30.7	43.1	10.9	100.0	91.1	61.9	14.2	-
SS-16	45' LT	88+25	73.5-75.0	A-2-6(0)	36	15	70.7	16.9	1.1	11.3	99.3	51.9	14.0	17.2	-
SS-17	45' LT	88+25	78.5-80.5	A-7-6(24)	51	33	7.3	17.4	28.7	46.6	93.5	90.0	74.8	15.0	-

RLEB1-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-120	72' RT	88+32	3.5-5.0	A-2-4(0)	20	3	70.3	4.2	13.3	12.1	97	63	26	-	-
SS-121	72' RT	88+32	8.5-10.0	A-2-6(0)	29	14	62.1	16.3	2.4	19.2	100	50	23	-	-
SS-122	72' RT	88+32	13.5-15.0	A-2-4(0)	18	NP	72.6	17.4	2.9	7.1	98	53	11	-	-
SS-124	72' RT	88+32	23.5-25.0	A-6(12)	38	22	12.7	26.1	14.7	46.5	100	93	66	-	-
SS-125	72' RT	88+32	28.5-30.0	A-2-6(1)	37	21	54.3	17.6	4.9	23.3	90	55	26	-	-
SS-127	72' RT	88+32	38.5-40.0	A-2-6(2)	35	22	52.1	15.9	1.7	30.3	98	69	32	-	-
SS-129	72' RT	88+32	48.5-50.0	A-2-6(1)	34	18	64.5	13.5	3.7	18.2	99	58	23	-	-
SS-130	72' RT	88+32	53.5-55.0	A-6(17)	40	23	8.3	17.8	23.4	50.6	100	96	78	-	-
SS-132	72' RT	88+32	63.5-65.0	A-2-6(1)	36	19	51.9	22.3	9.6	16.2	93	64	26	-	-

LLB1-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-20	22' LT	89+91	8.8-10.3	A-2-4(0)	27	NP	64.6	21.9	7.4	6.0	97	54	15	-	-
SS-23	22' LT	89+91	33.9-35.4	A-2-6(0)	34	18	72.6	6.5	1.7	19.1	94	40	20	-	-
SS-24	22' LT	89+91	53.9-55.4	A-2-4(0)	18	NP	64.1	22.0	5.8	8.0	99	61	16	-	-
SS-25	22' LT	89+91	58.9-60.4	A-6(12)	36	21	13.5	24.5	29.8	32.2	100	92	70	-	-
SS-26	22' LT	89+91	78.9-80.4	A-2-6(0)	37	16	68.3	13.5	12.2	6.0	95	47	20	-	-
SS-27	22' LT	89+91	93.9-95.4	A-7-6(10)	44	19	23.5	20.7	39.6	16.1	99	84	61	-	-

RLB1-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-32	33' RT	89+97	0.0-1.5	A-2-6(1)	35	13	45.3	22.5	20.1	12.1	98	75	34	-	-
SS-33	33' RT	89+97	10.6-12.1	A-7-5(13)	67	23	32.4	7.0	28.4	32.2	94	70	58	-	-
SS-34	33' RT	89+97	14.3-15.8	A-2-6(0)	30	12	59.2	17.9	2.8	20.1	97	60	23	-	-
SS-35	33' RT	89+97	19.3-20.8	A-2-6(0)	27	11	67.9	12.6	2.4	17.1	84	41	17	-	-
SS-36	33' RT	89+97	24.3-25.8	A-6(9)	39	22	34.0	12.1	9.7	44.3	100	78	56	-	-
SS-37	33' RT	89+97	44.3-45.8	A-4(0)	19	3	16.7	52.1	21.1	10.1	100	90	42	-	-
SS-38	33' RT	89+97	54.3-55.8	A-4(0)	24	7	28.8	40.6	12.5	18.1	100	85	37	-	-

LLB2-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-28	62' LT	91+52	4.8-6.3	A-7-6(12)	54	26	38.2	7.4	26.2	28.2	98	65	55	-	-
SS-29	62' LT	91+52	19.8-21.3	A-2-6(1)	37	20	57.0	17.0	2.8	23.1	97	61	26	-	-
SS-30	62' LT	91+52	24.8-26.3	A-7-6(24)	52	28	10.3	11.7	13.7	64.4	100	94	81	-	-
SS-31	62' LT	91+52	59.8-61.3	A-6(9)	40	18	18.1	24.9	32.8	24.1	100	89	63	-	-

RLB2-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-39	70' RT	91+64	0.0-1.0	A-7-6(20)	49	27	12.9	17.1	21.7	48.3	100	92	74	-	-
SS-40	70' RT	91+64	1.0-2.5	A-3(0)	19	NP	69.0	24.3	0.6	6.0	100	60	8	-	-
SS-41	70' RT	91+64	18.6-20.1	A-6(5)	35	15	24.9	26.4	10.5	38.2	100	83	52	-	-
SS-42	70' RT	91+64	53.6-55.1	A-2-4(0)	24	9	46.7	29.2	12.1	12.1	99	72	29	-	-
SS-43	70' RT	91+64	58.6-60.1	A-6(14)	38	25	14.1	25.6	36.2	24.1	100	92	67	-	-
SS-44	70' RT	91+64	78.6-80.1	A-2-6(0)	37	11	56.9	23.3	13.7	6.0	95	57	22	-	-
SS-45	70' RT	91+64	93.6-95.1	A-6(3)	31	17	46.6	11.8	28.6	13.1	96	67	41	-	-

LLB3-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-3	40' LT	92+85	8.5-10.0	A-2-6(0)	37	16	69.1	8.3	5.2	17.4	99.8	46.6	22.7	19.9	-
SS-10	40' LT	92+85	43.5-45.0	A-2-6(0)	39	14	68.9	6.8	6.7	17.6	99.4	46.2	24.3	17.5	-
SS-14	40' LT	92+85	63.5-65.0	A-7-6(23)	48	16	9.4	15.9	36.1	38.6	100.0	94.6	76.2	18.9	-
SS-23	40' LT	92+85	108.5-110.0	A-7-6(3)	42	20	24.4	41.6	24.4	9.6	100.0	87.4	36.7	20.7	-

RLB3-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-46	2' LT	93+00	0.0-1.5	A-2-4(0)	19	2	54.2	30.0	3.7	12.1	96	65	19	-	-
SS-47	2' LT	93+00	4.9-6.4	A-2-6(0)	28	11	71.3	13.6	2.0	13.1	94	42	15	-	-
SS-48	2' LT	93+00	8.9-10.4	A-4(0)	21	4	15.7	49.1	21.1	14.1	100	94	47	-	-
SS-49	2' LT	93+00	18.9-20.4	A-6(10)	35	17	8.9	25.8	19.1	46.3	100	95	72	-	-
SS-50	2' LT	93+00	43.9-45.4	A-2-7(2)	41	27	62.3	11.3	8.4	18.1	94	51	26	-	-
SS-51	2' LT	93+00	53.9-55.4	A-2-4(0)	20	6	32.2	37.4	16.3	14.1	96	76	31	-	-
SS-52	2' LT	93+00	58.9-60.4	A-7-6(11)	41	24	4.0	42.3	17.5	36.2	100	99	59	-	-

LLB4-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-5	81' LT	94+07	18.5-20.0	A-2-4(0)	28	20	70.6	9.6	5.5	14.3	96.8	44.2	19.4	9.1	-
SS-9	81' LT	94+07	38.5-40.0	A-7-6(31)	57	22	4.2	12.4	20.4	63.0	100.0	97.9	83.8	20.2	-
SS-16	81' LT	94+07	73.5-75.0	A-7-6(20)	65	25	9.0	7.9	13.4	69.7	100.0	94.3	83.6	25.9	-
SS-21	81' LT	94+07	98.5-100.0	A-7-6(15)	57	27	20.1	25.9	32.6	21.4	100.0	88.4	56.7	24.2	-
SS-25	81' LT	94+07	118.5-120.0	A-2-6(0)	30	15	45.0	30.0	21.2	3.8	99.6	72.4	26.6	11.6	-

RLB5-C

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-45	89' RT	94+42	3.5-5.0	A-7-6(3)	43	21	35.1	31.0	5.6	28.4	98	78	38	-	-
SS-46	89' RT	94+42	8.5-10.0	A-2-4(0)	25	9	52.1	24.7	2.9	20.3	97	66	25	-	-
SS-47	89' RT	94+42	13.5-15.0	A-2-6(0)	32	14	56.7	21.7	1.3	20.3	94	63	22	-	-
SS-48	89' RT	94+42	18.5-20.0	A-2-4(0)	21	3	63.6	21.9	1.3	13.2	97	60	16	-	-
SS-49	89' RT	94+42	23.5-25.0	A-1-b(0)	17	NP	63.8	24.5	3.5	8.1	91	49	13	-	-
SS-50	89' RT	94+42	28.5-30.0	A-4(0)	21	4	8.3	53.1	14.3	24.3	100	98	51	-	-
SS-51	89' RT	94+42	33.5-35.0	A-3(0)	22	NP	70.1	21.7	1.1	7.1	97	55	9	-	-
SS-52	89' RT	94+42	38.5-40.0	A-1-b(0)	23	NP	90.6	3.3	0.0	6.1	100	23	6	-	-
SS-53	89' RT	94+42	43.5-45.0	A-6(6)	31	16	10.1	40.9	14.5	34.4	100	95	55	-	-
SS-54	89' RT	94+42	48.5-50.0	A-2-691)	30	15	45.4	23.5	1.7	29.4	99	86	32	-	-
SS-55	89' RT	94+42	53.5-55.0	A-6(4)	30	17	37.1	19.0	11.4	32.4	100	77	48	-	-
SS-56	89' RT	94+42	58.5-60.0	A-2-6(2)	35	22	50.4	18.8	0.4	30.4	97	68	31	-	-
SS-57	89' RT	94+42	63.5-65.0	A-2-6(1)	31	15	61.4	11.6	4.8	22.3	99	60	28	-	-
SS-58	89' RT	94+42	68.5-70.0	A-6(1)	28	14	24.0	42.2	8.4	25.3	99	91	36	-	-
SS-59	89' RT	94+42	73.5-75.0	A-7-6(26)	53	36	12.8	15.8	20.8	50.7	100	93	74	-	-
SS-60	89' RT	94+42	78.5-80.0	A-4(0)	20	7	22.9	48.6	48.3	10.1	100	90	36	-	-
SS-61	89' RT	94+42	83.5-85.0	A-7-6(26)	54	36	4.3	30.6	30.7	34.4	100	97	74	-	-
SS-62	89' RT	94+42	88.5-90.0	A-6(11)	35	21	16.8	22.5	26.2	34.4	100	91	67	-	-
SS-63	89' RT	94+42	93.5-95.0	-7-6(4)	42	19	43.0	16.4	18.3	22.3	98	70	42	-	-
SS-64	89' RT	94+42	98.5-100.0	A-7-6(16)	46	26	13.8	25.7	34.1	26.3	100	92	68	-	-
SS-65	89' RT	94+42	103.5-105.0	A-2-7(1)	48	22	62.2	10.7	13.9	13.2	95	49	27	-	-
SS-66	89' RT	94+42	108.5-110.0	A-4(0)	32	10	45.6	20.6	19.7	14.2	98	68	37	-	-
SS-67	89' RT	94+42	113.5-115.0	A-2-6(0)	39	17	62.1	27.1	6.7	4.1	96	59	14	-	-
SS-68	89' RT	94+42	118.5-118.8	A-4(0)	23	8	39.9	27.4	22.4	10.2	100	76	37	-	-

RLEB2-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-1	27' RT	95+44	3.5-5.0	A-2-4(0)	27	NP	40.6	38.8	16.5	4.0	100	76	26	-	-
SS-2	27' RT	95+44	8.5-10.0	A-2-4(0)	21	6	53.8	26.5	7.6	12.1	90	53	21	-	-
SS-3	27' RT	95+44	13.5-15.0	A-3(0)	17	NP	69.4	23.7	0.9	6.1	100	61	8	-	-
SS-4	27' RT	95+44	18.5-20.0	A-1-b(0)	16	NP	84.1	8.7	3.1	4.0	98	29	8	-	-
SS-7	27' RT	95+44	33.5-35.0	A-7-6(15)	43	26	17.4	17.4	34.9	30.3	100	94	66	-	-
SS-8	27' RT	95+44	38.5-40.0	A-2-6(1)	34	17	64.1	11.5	2.1	22.2	94	47	24	-	-
SS-11	27' RT	95+44	53.5-55.0	A-6(2)	27	12	11.1	45.3	11.2	32.4	100	97	47	-	-
SS-12	27' RT	95+44	58.5-60.0	A-2-6(1)	36	19	59.3	16.4	4.1	20.2	100	62	26	-	-
SS-16	27' RT	95+44	78.5-80.0	A-7-6(36)	60	35	2.0	8.9	46.6	42.5	100	99	92	-	-
SS-19	27' RT	95+44	93.5-95.0	A-2-4(0)	35	NP	44.1	41.5	10.4	4.0	100	81	19	-	-

LLEB2-C

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-2	45' LT	95+34	3.5-5.0	A-6(3)	39	19	41.5	23.3	6.6	28.6	100	75.7	38.1	-	-
SS-3	45' LT	95+34	8.5-10.0	A-3(0)	26	NP	58.9	35.2	4.3	1.6	100	79.3	6.4	-	-
SS-4	45' LT	95+34	13.5-15.0	A-2-4(0)	27	8	46.6	30.3	6.2	16.9	99.4	72.2	24.4	-	-
SS-5	45' LT	95+34	18.5-20.0	A-1-b(0)	25	NP	76.7	16.6	1.2	5.5	97.1	49.9	6.7	-	-
SS-6	45' LT	95+34	23.5-25.0	A-1-b(0)	25	NP	79.7	13.3	3.6	3.4	100.0	40.5	7.4	-	-
SS-7	45' LT	95+34	28.5-30.0	A-7-6(13)	46	25	8.3	34.2	10.9	46.6	100.0	97.4	62.6	-	-
SS-8	45' LT	95+34	33.5-35.0	A-2-7(1)	44	23	56.7	14.0	1.6	27.7	99.4	61.7	30.1	-	-
SS-9	45' LT	95+34	38.5-40.0	A-7-6(11)	41	25	26.7	18.3	8.7	46.3	100.0	83.5	58.0	-	-
SS-10	45' LT	95+34	43.5-45.0	A-7-6(4)	47	29	52.0	11.6	1.6	34.8	98.2	65.8	36.5	-	-
SS-11	45' LT	95+34	48.5-50.0	A-7-6(24)	49	29	6.6	16.3	14.9	62.2	100.0	96.1	80.5	-	-
SS-12	45' LT	95+34	53.5-55.0	A-6(2)	32	18	40.9	24.8	11.7	22.6	99.4	76.6	36.8	-	-
SS-13	45' LT	95+34	58.5-60.0	A-7-6(30)	56	41	10.4	18.7	10.7	60.2	99.8	94.6	74.7	-	-

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34817.1.2 (U-2519CB)	1	7

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34817.1.2 (U-2519CB) F.A. PROJ. NHF-DPR-0100(001)

COUNTY CUMBERLAND

PROJECT DESCRIPTION FAYETTEVILLE OUTER LOOP FROM SOUTH OF SR 1400 (CLIFFDALE RD.) TO EAST OF SR 1415 (YADKIN RD.)

SITE DESCRIPTION STRUCTURE NO. 11 ON CANOPY LANE OVER OVER -L- (FAYETTEVILLE OUTER LOOP)

CONTENTS

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1	TITLE SHEET
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PERSONNEL

C. M. WRIKE

J. R. SWARTLEY

W. N. CHERRY

R. E. SMITH

INVESTIGATED BY F.M. WESCOTT III

CHECKED BY D.N. ARGENBRIGHT

SUBMITTED BY D.N. ARGENBRIGHT

DATE JUNE 2013

NORTH CAROLINA LICENSED SEAL 1050 GEOLOGIST D. N. ARGENBRIGHT

6-19-13

PROJECT: 34817.1.2

ID: U-2519CB

DRAWN BY: C.P. TURNER

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 REFERENCE NO.	SHEET NO.
34817.1.2 (U-2519CB)	2 OF 7

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

GRAIN SIZE						
MM	305	75	2.0	0.25	0.05	0.005
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	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	>10%	>20%	HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- 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
- GPT 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
- [ ] CME-550
- [ ] PORTABLE HOIST
- [X] CME-45B
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 2 15/16 " 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 IN 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-55 -L- STA. 942+61.36 45.72' RT

ELEVATION: 300.21 FT.

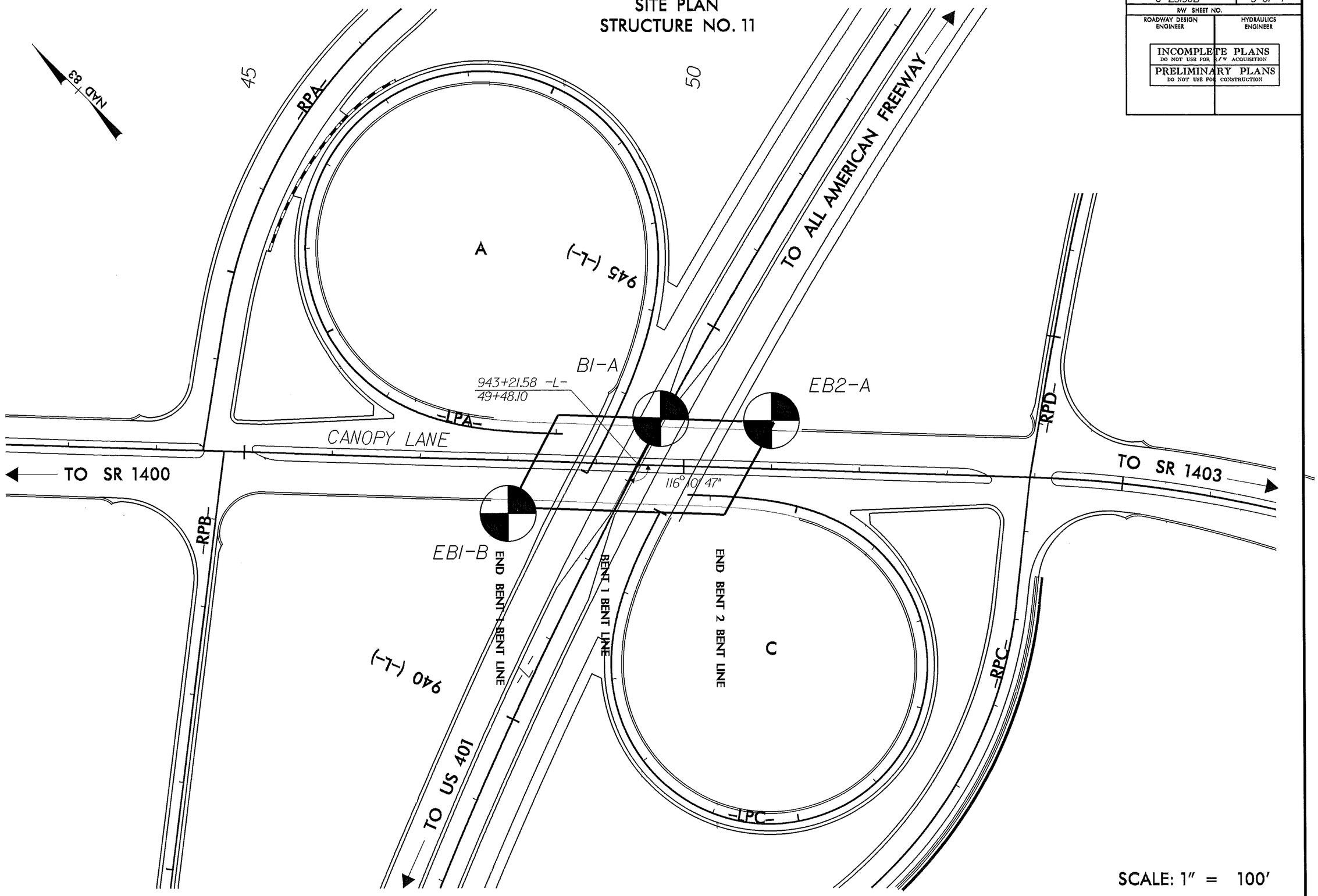
NOTES:

PROJECT REFERENCE NO.	SHEET NO.
U-2519CB	3 OF 7
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

SITE PLAN
STRUCTURE NO. 11



SCALE: 1" = 100'

REVISIONS

8/17/99

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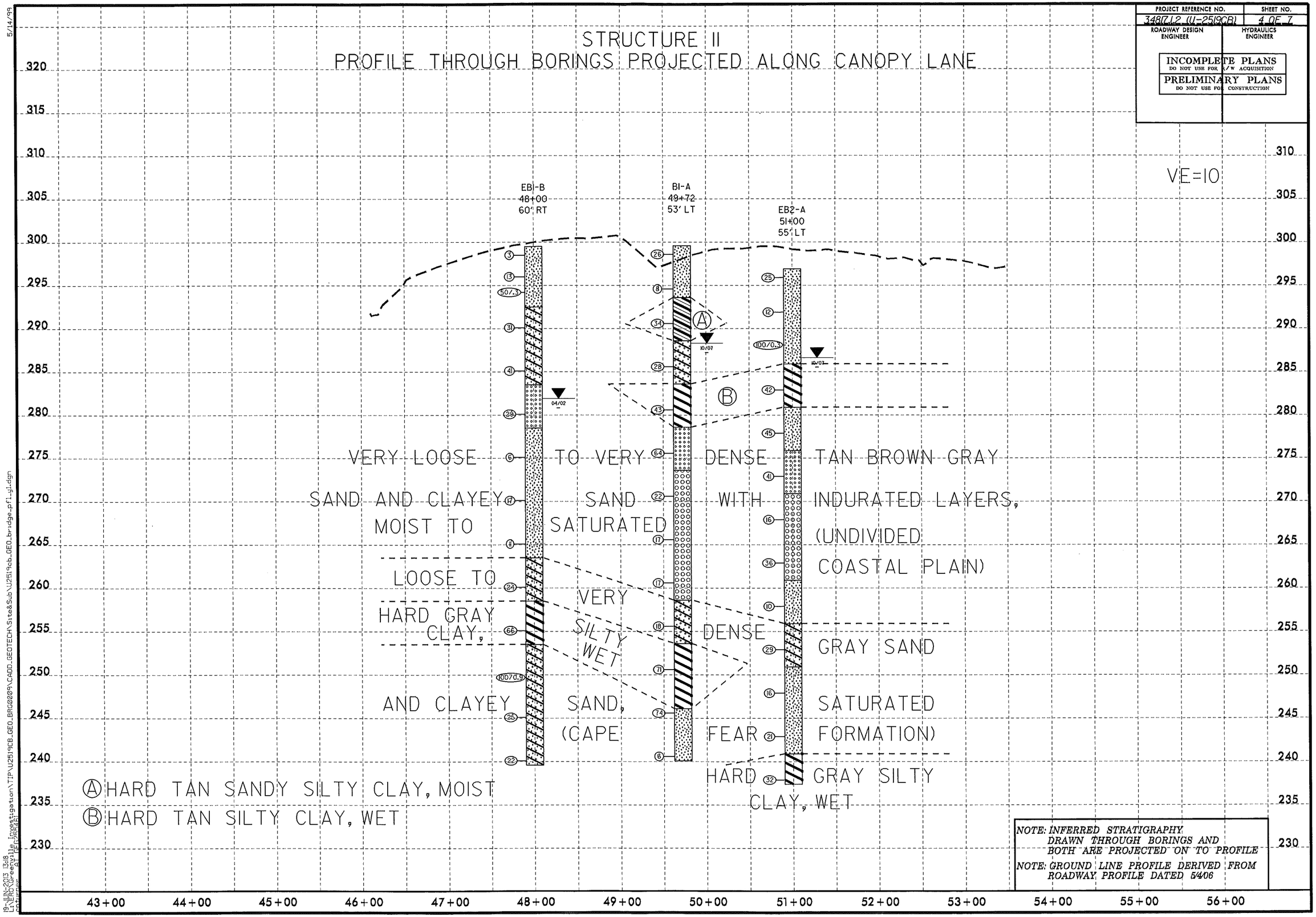
PROJECT REFERENCE NO.	SHEET NO.
34817.2 (U-2519CB)	4 OF 7
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

STRUCTURE II
PROFILE THROUGH BORINGS PROJECTED ALONG CANOPY LANE



NOTE: INFERRED STRATIGRAPHY DRAWN THROUGH BORINGS AND BOTH ARE PROJECTED ON TO PROFILE

NOTE: GROUND LINE PROFILE DERIVED FROM ROADWAY PROFILE DATED 5/4/06

5/14/99

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BORELOG REPORT

WBS 34817.1.2	**TIP** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** Edwards, R.L.
SITE DESCRIPTION STRUCTURE 11 ON CANOPY LANE OVER -L- (FAYETTEVILLE OUTER LOOP)			**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 48+00	**OFFSET** 60 ft RT	**ALIGNMENT** -Y1-	**0 HR.** N/A
COLLAR ELEV. 299.5 ft	**TOTAL DEPTH** 59.9 ft	**NORTHING** 493,827	**EASTING** 1,996,016	**24 HR.** 17.6
DRILL RIG/HAMMER EFF./DATE CME-45B		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Cherry, W. N.	**START DATE** 04/10/02	**COMP. DATE** 04/10/02	**SURFACE WATER DEPTH** 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)
300										299.5 GROUND SURFACE	0.0
	299.5	0.0	1	1	2	3				TAN BROWN GRAY SAND AND CLAYEY SAND WITH INDURATED LAYERS, MOIST TO SATURATED (UNDIVIDED COASTAL PLAIN)	
	297.0	2.5	4	5	8	13	SS-212				
295	294.5	5.0	50/.3			50/0.3				292.5	7.0
	291.1	8.4	13	16	15	31	SS-213				
290											
	286.1	13.4	12	18	23	41	SS-214			283.5	16.0
285											
	281.1	18.4	11	13	16	29	SS-215			278.5	21.0
280											
	276.1	23.4	3	3	3	6	SS-216				
275											
	271.1	28.4	6	8	9	17	SS-217				
270											
	266.1	33.4	7	5	6	11					
265											
	261.1	38.4	8	12	12	24	SS-218			263.5	36.0
260										GRAY CLAYEY SAND, SATURATED (CAPE FEAR FORMATION)	
	256.1	43.4	15	29	37	66	SS-219			258.5	41.0
255										GRAY SILTY CLAY, WET	
	251.1	48.4	30	56	44/.4	100/0.9	SS-220			253.5	46.0
250										GRAY CLAYEY SAND, SATURATED	
	246.1	53.4	18	13	12	25	SS-221				
245											
	241.1	58.4	13	10	12	22				239.6	59.9
240										Boring Terminated at Elevation 239.6 ft in medium dense clayey sand	

WBS 34817.1.2	**TIP** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** Swartley, J. R.
SITE DESCRIPTION STRUCTURE 11 ON CANOPY LANE OVER -L- (FAYETTEVILLE OUTER LOOP)			**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 49+72	**OFFSET** 53 ft LT	**ALIGNMENT** -Y1-	**0 HR.** N/A
COLLAR ELEV. 299.6 ft	**TOTAL DEPTH** 59.5 ft	**NORTHING** 493,780	**EASTING** 1,996,215	**24 HR.** 11.3
DRILL RIG/HAMMER EFF./DATE CME-45B		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Cherry, W. N.	**START DATE** 10/16/07	**COMP. DATE** 10/16/07	**SURFACE WATER DEPTH** 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
300										299.6 GROUND SURFACE 0.0
	299.6	0.0	7	13	13	26	SS-10			BROWN TAN SAND, MOIST (UNDIVIDED COASTAL PLAIN)
	295.6	4.0	5	4	4	8				293.6 6.0
295										TAN SANDY SILTY CLAY, MOIST
	291.6	8.0	9	13	21	34	SS-11	13%		
290										288.6 11.0
	286.6	13.0	10	13	15	28	SS-12			TAN CLAYEY SAND, MOIST TO SATURATED
285										283.6 16.0
	281.6	18.0	11	18	25	43	SS-13			TAN SILTY CLAY, WET
280										278.6 21.0
	276.6	23.0	20	27	37	64	SS-14			TAN SAND AND CLAYEY SAND, SATURATED
275										273.6 26.0
	271.6	28.0	13	12	10	22	SS-15			
270										
	266.6	33.0	8	8	9	17				
265										
	261.6	38.0	7	9	8	17				
260										258.6 41.0
	256.6	43.0	5	7	11	18	SS-16			GRAY CLAYEY SAND, SATURATED (CAPE FEAR FORMATION)
255										253.6 46.0
	251.6	48.0	16	29	42	71	SS-17			TAN SILTY CLAY, WET
250										
	246.6	53.0	30	36	38	74	SS-18			246.1 53.5
245										GRAY SAND, SATURATED
	241.6	58.0	2	3	3	6				240.1 59.5
										Boring Terminated at Elevation 240.1 ft in loose sand

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34817.1.2	**TIP** U-2519CB	**COUNTY** CUMBERLAND	**GEOLOGIST** Swartley, J. R.
SITE DESCRIPTION STRUCTURE 11 ON CANOPY LANE OVER -L- (FAYETTEVILLE OUTER LOOP)			**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 51+00	**OFFSET** 55 ft LT	**ALIGNMENT** -Y1-	**0 HR.** N/A
COLLAR ELEV. 296.9 ft	**TOTAL DEPTH** 59.5 ft	**NORTHING** 493,689	**EASTING** 1,996,303	**24 HR.** 10.3
DRILL RIG/HAMMER EFF./DATE CME-45B		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Cherry, W. N.	**START DATE** 10/15/07	**COMP. DATE** 10/16/07	**SURFACE WATER DEPTH** 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)
300											
	296.9	0.0								296.9 GROUND SURFACE	0.0
295			3	13	12	25	SS-1			BROWN SAND WITH INDURATED LAYERS, MOIST TO SATURATED (UNDIVIDED COASTAL PLAIN)	
	292.9	4.0	5	6	6	12	SS-2				
290											
	288.9	8.0	35	100/0.3		100/0.3					
285										285.9	11.0
	283.9	13.0	8	17	25	42	SS-3	19%		TAN SILTY CLAY, WET	
280										280.9	16.0
	278.9	18.0	13	23	22	45	SS-4			TAN SAND, SATURATED	
275										275.9	21.0
	273.9	23.0	14	21	20	41					
270										270.9	26.0
	268.9	28.0	7	8	8	16	SS-5				
265											
	263.9	33.0	15	17	19	36					
260										260.9	36.0
	258.9	38.0	2	4	6	10	SS-6			255.9	41.0
255										GRAY CLAYEY SAND AND SAND, SATURATED (CAPE FEAR FORMATION)	
	253.9	43.0	5	7	22	29	SS-7			250.9	46.0
250											
	248.9	48.0	6	5	11	16	SS-8				
245											
	243.9	53.0	4	9	12	21				240.9	56.0
240										GRAY SILTY CLAY, WET	
	238.9	58.0	7	14	18	32	SS-9	34%		237.4	59.5
										Boring Terminated at Elevation 237.4 ft in hard silty clay	

NCDOT BORE DOUBLE BORELOGS.GPJ NC_DOT.GDT 6/19/13

U-2519CB
STRUCTURE NO. 11 ON CANOPY LANE OVER -L-(FAYETTEVILE OUTER LOOP)

HOLE #	SAMPLE #	PASS 10	PASS 40	PASS 200	CSESAND	FINESAND	SI	CL	LL	PI	CLASS	DEPTH	MOIST.	ORG.
EB2-A	SS-1	100	87	28	30.4	45.5	5.9	18.2	22	3	A-2-4(0)	1.0-1.5		
	SS-2	100	93	32	23.3	46.2	2.2	28.3	32	9	A-2-4(0)	4.0-5.5		
	SS-3	100	96	81	8.1	15.8	21.5	54.7	43	20	A-7-6(16)	13.0-14.5	19.2	
	SS-4	100	77	19	56.4	26.3	4.1	13.2	19	NP	A-2-4(0)	18.0-19.5		
	SS-5	85	45	19	59.2	19.8	4.8	16.2	18	2	A-1-b(0)	28.0-29.5		
	SS-6	100	85	18	49.8	33.7	6.4	10.1	20	NP	A-2-4(0)	38.0-39.5		
	SS-7	97	60	31	52.2	17.5	2.9	27.4	37	18	A-2-6(1)	43.0-44.5		
	SS-8	100	66	19	68.5	13.0	2.3	16.2	24	3	A-2-4(0)	48.0-49.5		
	SS-9	100	97	94	4.5	2.0	4.5	89.1	88	55	A-7-6(62)	58.0-59.5	34.3	
B1-A	SS-10	98	80	22	39.5	42.6	5.8	12.1	18	NP	A-2-4(0)	1.0-1.5		
	SS-11	97	86	63	19.2	20.0	20.2	40.5	38	22	A-6(11)	8.0-9.5	12.5	
	SS-12	99	57	28	58.8	13.8	0.1	27.3	51	30	A-2-7(3)	13.0-14.5		
	SS-13	100	95	79	8.7	17.4	21.3	52.6	46	25	A-7-6(20)	18.0-19.5		
	SS-14	99	66	10	84.7	6.8	3.4	5.1	23	NP	A-3(0)	23.0-24.5		
	SS-15	88	38	14	71.8	13.3	3.8	11.1	22	5	A-1-b(0)	28.0-29.5		
	SS-16	97	55	26	61.7	12.7	1.3	24.3	45	25	A-2-7(2)	43.0-44.5		
	SS-17	100	98	90	3.0	10.5	21.7	64.8	59	36	A-7-6(36)	48.0-49.5		
	SS-18	100	85	13	42.2	45.4	1.2	11.1	21	NP	A-2-4(0)	53.5-54.5		
EB1-B	SS-212	100	84	23	37.6	40.8	1.4	20.2	25	4	A-2-4(0)	2.5-3.5		
	SS-213	100	66	34	52.7	14.3	0.6	32.2	45	34	A-2-7(3)	8.4-9.9		
	SS-214	100	75	31	48.5	22.0	3.2	26.3	3	14	A-2-6(1)	13.4-14.9		
	SS-215	99	69	9	62.6	28.7	1.6	7.1	19	NP	A-3(0)	18.4-19.9		
	SS-216	100	54	13	70.8	17.6	2.5	9.1	17	NP	A-2-4(0)	23.4-24.9		
	SS-217	100	75	14	61.9	24.7	2.2	11.1	16	NP	A-2-4(0)	28.4-29.9		
	SS-218	98	60	30	55.9	14.5	2.3	27.3	45	24	A-2-7(2)	38.4-39.9		
	SS-219	100	98	94	2.6	5.3	21.4	70.7	59	33	A-7-6(36)	43.4-44.9		
	SS-220	100	77	28	44.2	29.7	3.8	22.2	26	12	A-2-6(0)	48.4-49.8		
	SS-221	90	29	16	76.0	7.0	1.9	15.2	38	20	A-2-6(0)	53.4-54.9		