STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	35196.3.18 (X-0002BC)	1	8

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 35196.3.18 (X-0002BC)

COUNTY ***CUMBERLAND***

PROJECT DESCRIPTION ***FAYETTEVILLE OUTER LOOP FROM EAST OF NC 24 (BRAGG BLVD.) TO 1.7 km EAST OF NC 87 /NC 210 (MURCHINSON RD.)***

SITE DESCRIPTION ***RWALL 6 – MSE WALL –CDR– STA. 55+90***
RWALL 7 – MSE WALL –CDR– STA. 56+21
RWALL 8 – MSE WALL RIGHT OF –CDR– STA. 62+60
RWALL 9 – MSE WALL RIGHT OF –Y1– STA. 30+50

WALL INVENTORY

ID: X-0002BC

PROJECT: 35196.3.18

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	RWALL 6 SITE PLAN
4	RWALL 6 PROFILE
5	RWALL 7
6	RWALL 8
7	RWALL 9 SITE PLAN
8	RWALL 9 PROFILE

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.

THIS SUBSURFACE INFORMATION WAS ORIGINALLY ASSEMBLED AS STATE PROJECT 35196.1.3 (X-0002B), BUT IS BEING LET AS 35196.3.18 (X-0002BC)

RETAINING WALLS 6, 7, & 8 ARE NOT PART OF PROJECTS X-0002CA/BC OR X-0002CB AND WILL BE CONSTRUCTED BY OTHERS

PERSONNEL
J.I. MILKOVITS JR.
J. L. PEDRO
M. L. REEDER

INVESTIGATED BY ***J.I. MILKOVITS JR.***
CHECKED BY ***N. T. ROBERSON***
SUBMITTED BY ***N. T. ROBERSON***
DATE ***AUGUST 2008***

NORTH CAROLINA LICENSED SEAL 1912 GEOLOGIST NEIL T. ROBERSON
8-21-08

DRAWN BY: ***J. R. MATULA***

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.

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

PROJECT REFERENCE NO.	SHEET NO.
35196.1.3 (X-0002B)	2

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 30 CM 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 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
LIQUID LIMIT PLASTIC INDEX	6 MX		NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
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 (kN/m^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<25
	SOFT	2 TO 4	25 TO 50
	MEDIUM STIFF	4 TO 8	50 TO 100
	STIFF	8 TO 15	100 TO 200
	VERY STIFF	15 TO 30	200 TO 400
	HARD	>30	>400

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
	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
- SOUNDING ROD
- SPT CPT DPT PMT 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 - 9PLIT SPOON SAMPLE
ST - 9HELBY 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
- ☐ _____
- ☐ _____

ADVANCING TOOLS:
- ☐ CLAY BITS
- ■ 152mm CONTINUOUS FLIGHT AUGER
- ■ 203mm HOLLOW AUGERS
- ☐ HARD FACED FINGER BITS
- ☐ TUNG.-CARBIDE INSERTS
- ☐ CASING ☐ W/ ADVANCER
- ☐ TRICONE _____mm STEEL TEETH
- ☐ TRICONE _____mm TUNG.-CARB.
- ☐ CORE BIT
- ☐ _____

HAMMER TYPE:
- ■ 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 3 CM 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 30 CM 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 BLOWS PER 30 CM*
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 BLOWS PER 30 CM*
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 6 MM 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 13 MM DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 25 MM 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 25 MM OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 3 M
WIDE	1 TO 3 M
MODERATELY CLOSE	30 TO 100 CM
CLOSE	5 TO 30 CM
VERY CLOSE	LESS THAN 5 CM

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 1 M
THICKLY BEDDED	0.5 - 1 M
THINLY BEDDED	0.05 - 0.5 M
VERY THINLY BEDDED	10 - 50 MM
THICKLY LAMINATED	2.5 - 10 MM
THINLY LAMINATED	< 2.5 MM

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 10 CM 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) OF A 63.5 KG HAMMER FALLING 0.76 M REQUIRED TO PRODUCE A PENETRATION OF 30 CM INTO SOIL WITH A 5 CM OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 3 CM 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 10 CM DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK:

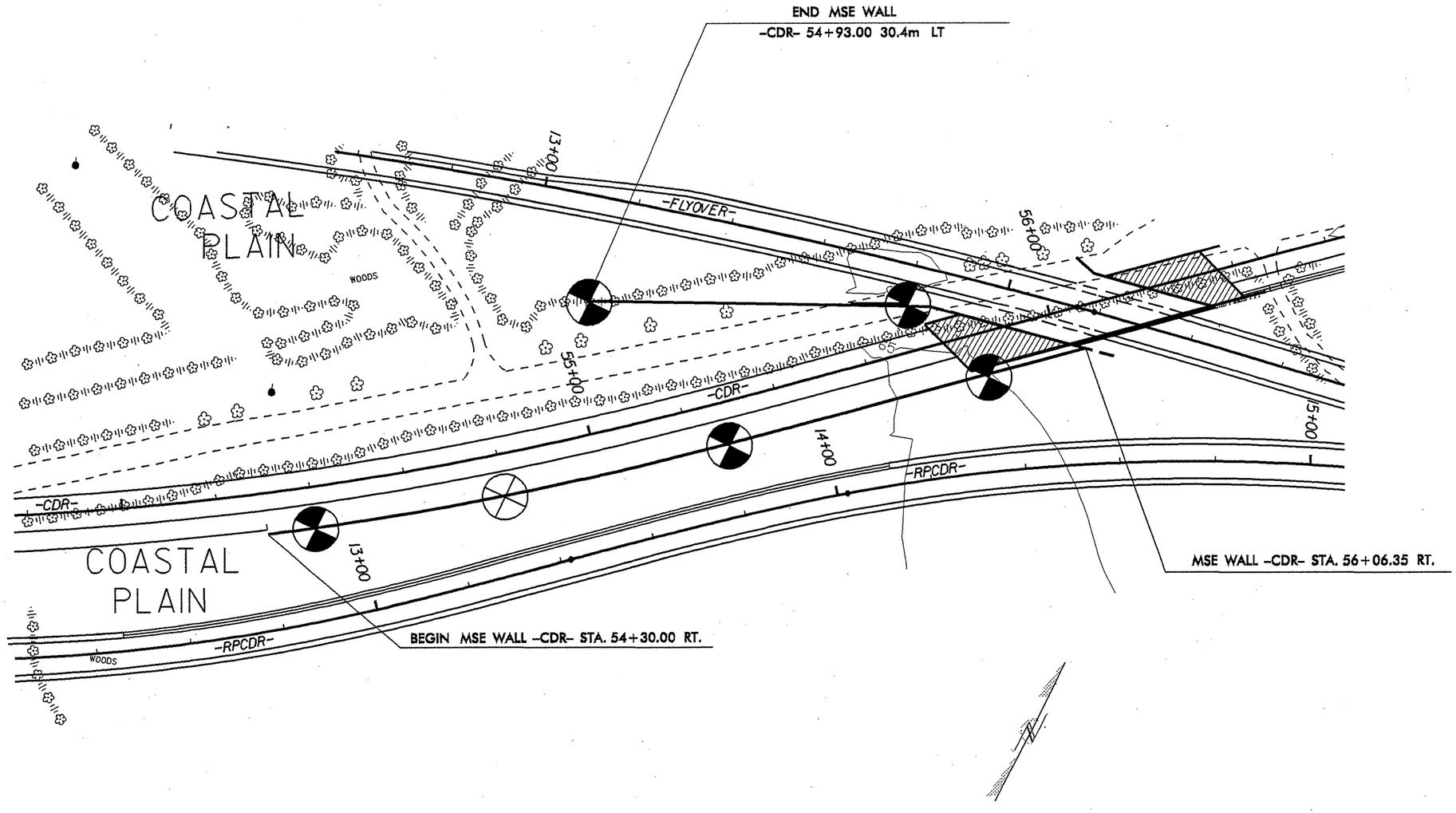
ELEVATION: M

NOTES:

REVISED 02/23/06

PROJECT REFERENCE NO.	SHEET NO.
X-00028	3

WALL 6

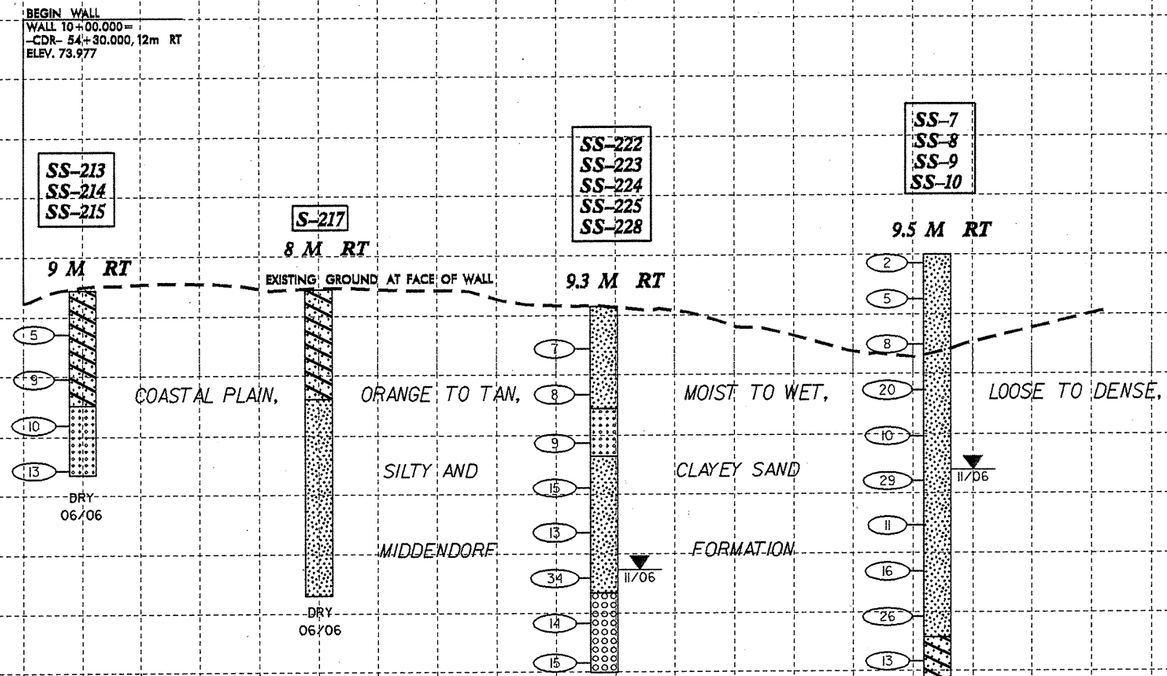


PROJECT REFERENCE NO.	SHEET NO.
X-0002B	4

RETAINING WALL 12m RT OF –CDR–

WALL 6

BEGIN WALL
WALL 10+00.000=
–CDR– 54+30.000, 12m RT
ELEV. 73.977



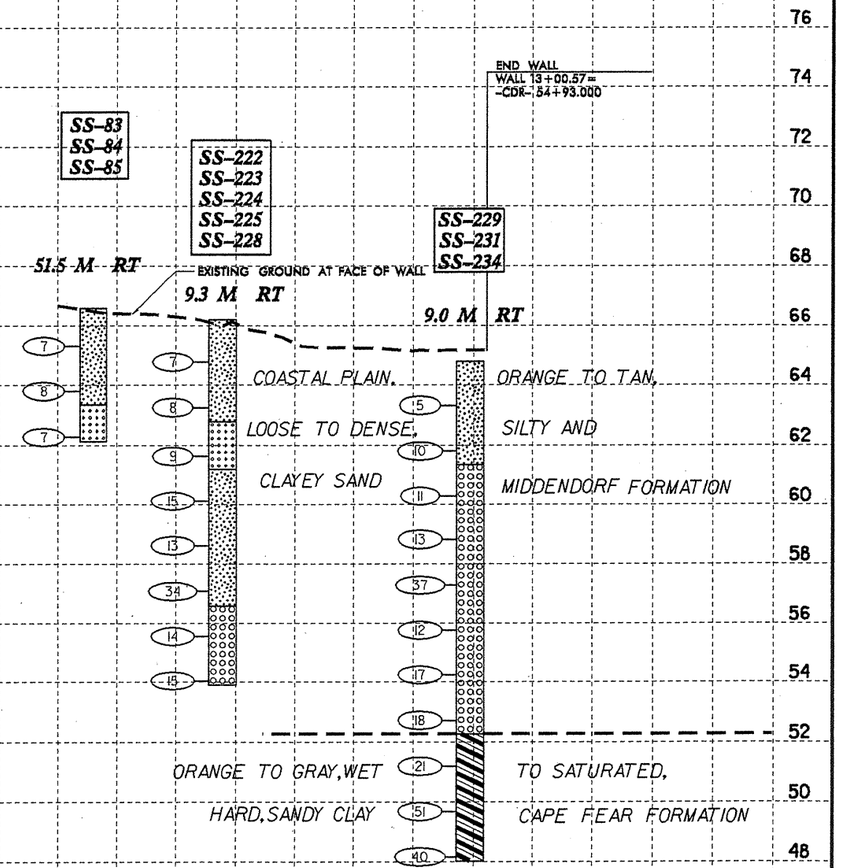
SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C. SAND	F. SAND	SILT	CLAY	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
SS-7	9.4 RT	55+84	2.7-3.1	A-2-4(0)	24	NP	27.6	55.3	0.9	16.1	96	82	20	-	-
SS-8	8.4 RT	55+84	8.8-9.2	A-2-4(0)	22	NP	27.6	54.9	5.3	12.1	96	82	21	-	-
SS-9	9.4 RT	55+84	13.3-13.8	A-2-6(0)	29	11	60.9	13.9	0.9	24.2	99	77	26	-	-
SS-10	9.4 RT	55+84	14.9-15.3	A-6(17)	39	23	3.6	24.0	21.9	50.5	100	99	79	-	-
SS-83	51.5 LT	14+60	1.0-1.4	A-2-4(0)	18	NP	23.5	52.1	4.1	20.3	98	85	27	-	-
SS-85	51.5 LT	14+60	4.0-4.5	A-3(0)	25	NP	57.4	36.3	0.2	6.1	96	66	8	-	-
S-217	9.0 RT	54+80	3.7-4.6	A-2-4(0)	21	NP	15.2	67.6	4.1	13.1	99	90	23	-	-
SS-213	9.0 RT	54+00	1.2-1.6	A-2-6(0)	31	12	22.3	55.7	4.8	17.1	99	87	27	-	-
SS-214	9.0 RT	54+40	4.2-4.7	A-2(0)	20	NP	54.1	37.7	1.1	7.0	87	62	9	-	-
SS-215	9.0 RT	54+40	5.7-6.2	A-3(0)	19	NP	60.9	32.6	0.9	6.0	100	74	8	-	-
SS-222	9.3 RT	55+28	1.1-1.6	A-2-4(0)	22	NP	26.1	56.4	2.4	15.1	100	83	20	-	-
SS-223	9.3 RT	55+28	2.6-3.1	A-2-4(0)	23	NP	3.3	78.3	3.3	15.1	100	98	24	-	-
SS-224	9.3 RT	55+28	4.3-4.7	A-3(0)	22	NP	44.2	45.8	2.0	8.0	81	59	10	-	-
SS-225	9.3 RT	55+28	5.8-6.2	A-2-4(0)	20	NP	63.6	26.6	1.8	8.0	100	78	11	-	-
SS-228	9.3 RT	55+28	10.3-10.8	A-1-b(0)	19	NP	74.4	19.1	2.4	4.0	92	40	7	-	-
SS-229	8.8 RT	55+69	1.2-1.6	A-2-4(0)	21	NP	25.2	61.0	1.8	12.1	95	81	16	-	-
SS-231	8.8 RT	55+69	4.2-4.7	A-1-b(0)	20	NP	79.7	13.7	0.6	6.0	98	46	7	-	-
SS-234	8.8 RT	55+69	8.7-9.2	A-1-b(0)	22	NP	73.3	18.6	2.0	6.0	91	46	8	-	-

WALL 6

RETAINING WALL LT OF –CDR–

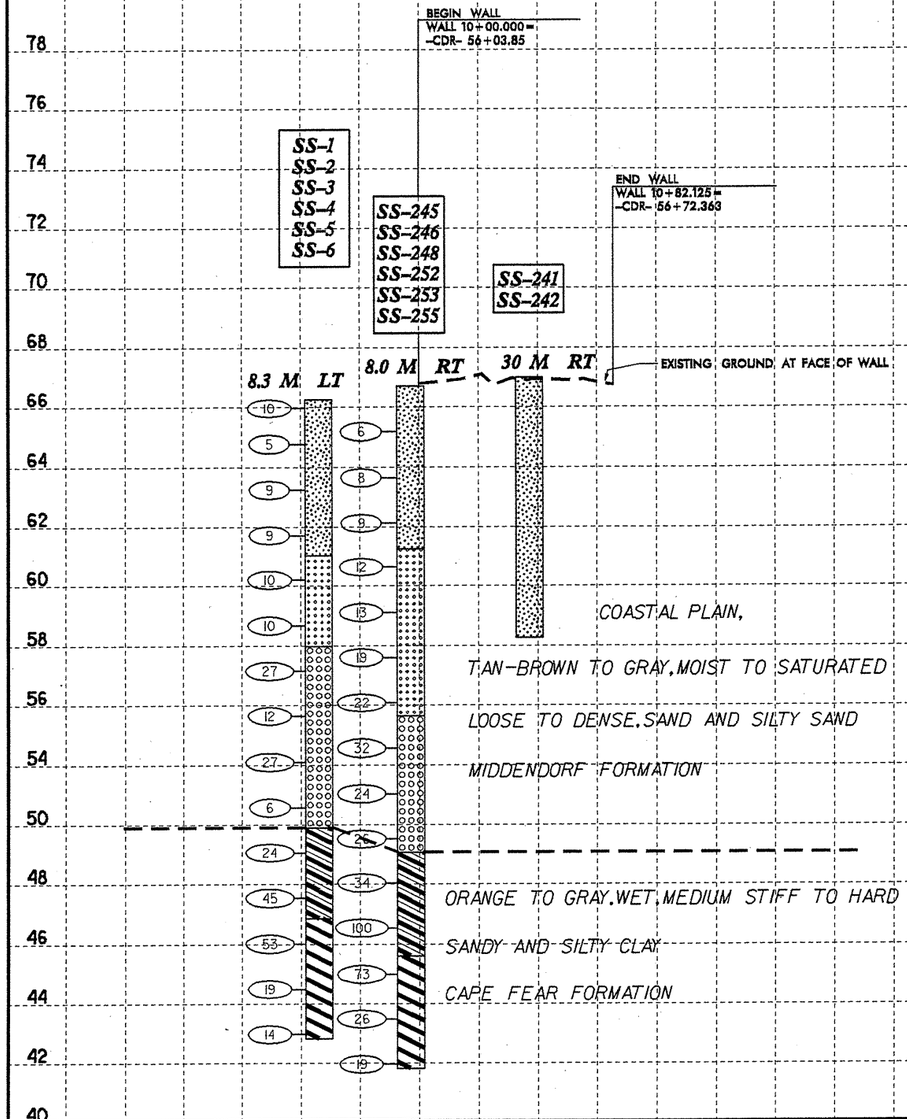
END WALL
WALL 13+00.57=
–CDR–, 54+93.000

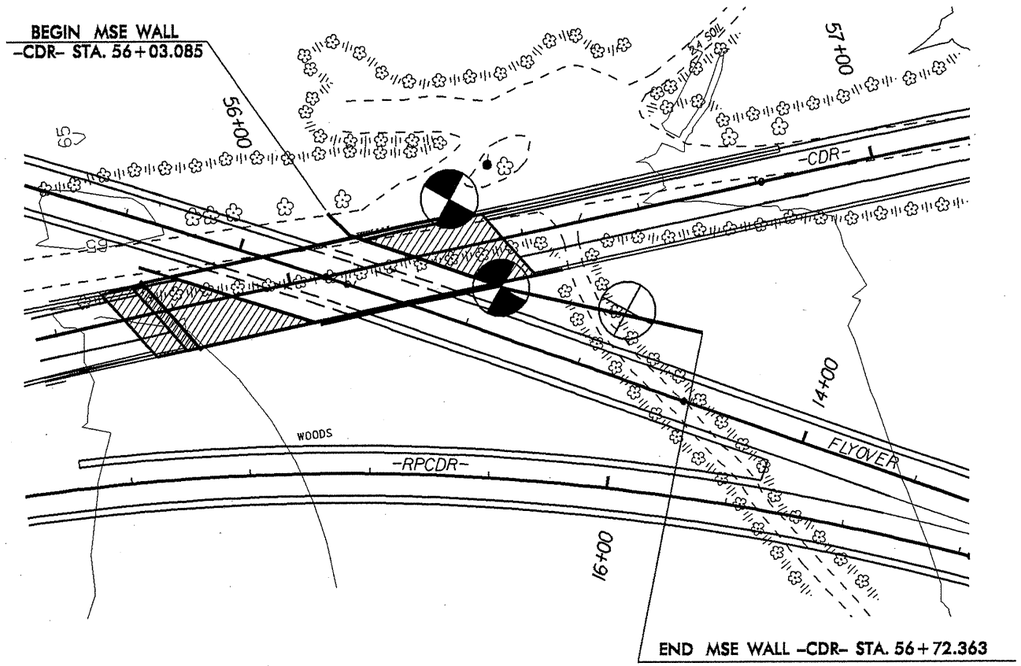


PROJECT REFERENCE NO.	SHEET NO.
X-0002B	5

WALL 7

RETAINING WALL –CDR– STA. 56+21





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	8.3 RT	56+29	1.2-1.6	A-2-4(0)	21	NP	24.2	57.9	3.7	14.1	99	84	19	-	-
SS-2	8.3 RT	56+29	5.7-6.2	A-3(0)	22	NP	57.9	33.5	0.5	8.1	99	74	9	-	-
SS-3	8.3 RT	56+29	8.8-9.2	A-1-b(0)	22	NP	78.7	13.3	1.9	6.1	92	38	8	-	-
SS-4	8.3 RT	56+29	14.9-15.3	A-6(9)	34	18	8.7	34.7	12.2	44.4	100	96	63	-	-
SS-5	8.3 RT	56+29	17.9-18.3	A-7-6(25)	50	26	4.8	10.3	18.3	66.6	100	97	88	-	-
SS-6	8.3 RT	56+29	21.0-21.4	A-7-6(19)	47	31	17.2	17.8	14.6	50.5	100	90	69	-	-
S-241	30.0 LT	16+00	0.0-1.5	A-2-4(0)	20	NP	30.8	52.4	3.7	13.1	99	78	19	-	-
S-242	30.0 LT	16+00	5.2-6.0	A-2-4(0)	18	NP	36.4	46.0	4.5	13.1	86	67	18	-	-
SS-245	8.0 RT	56+35	1.2-1.7	A-2-4(0)	19	NP	25.3	57.4	3.3	14.0	100	82	20	-	-
SS-246	8.0 RT	56+35	2.8-3.2	A-2-4(0)	23	NP	11.2	77.8	1.9	9.0	100	93	13	-	-
SS-248	8.0 RT	56+35	5.8-6.2	A-3(0)	22	NP	58.7	32.3	2.0	7.0	90	63	9	-	-
SS-252	8.0 RT	56+35	11.9-12.3	A-1-b(0)	21	NP	78.6	15.8	3.5	2.0	89	33	6	-	-
SS-253	8.0 RT	56+35	13.4-13.8	A-1-b(0)	20	NP	89.0	7.7	1.3	2.0	91	27	3	-	-
SS-255	8.0 RT	56+35	16.4-16.8	A-6-(7)	32	17	17.7	27.7	12.5	42.1	97	87	59	-	-

PROJECT REFERENCE NO.	SHEET NO.
X-0002B	6

WALL 8

RETAINING WALL RT OF -CDR- AND LT AND RT OF FLYOVER

BEGIN WALL
WALL 10+00.000=
-CDR- 62+80, 15.600m RT

END WALL
WALL 10+48.967=
-CDR- 63+07.115, 15.600 RT

SS-307
30 M RT

SS-1
SS-3
SS-4
28 M RT

SS-336
SS-338
SS-342
SS-343
SS-345
SS-346
SS-348
SS-349
42 M RT

SS-358
SS-359
SS-362
SS-363
SS-365
23 M RT

EXISTING GROUND AT FACE OF WALL

06/06
05/06
06/06

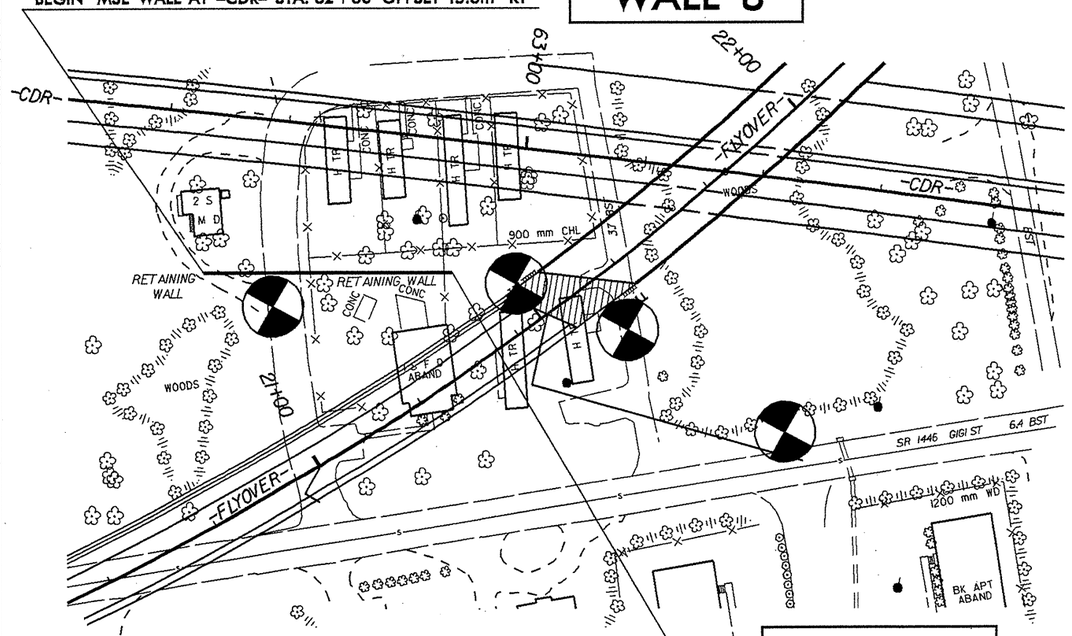
COASTAL PLAIN, ORANGE TO GRAY, MOIST TO WET, VERY LOOSE TO DENSE, CLAYEY SAND, COARSE SAND AND SILTY SAND MIDDENDORF FORMATION

GRAY, WET, VERY STIFF, SILTY CLAY

TAN TO GRAY, WET, STIFF TO HARD, SILTY CLAY AND VERY DENSE, CLAYEY SAND CAPE FEAR FORMATION

+60 +80 63 +40 +60

BEGIN MSE WALL AT -CDR- STA. 62+60 OFFSET 15.6m RT



END MSE WALL AT -CDR- STA. 63+07 OFFSET 15.6m RT

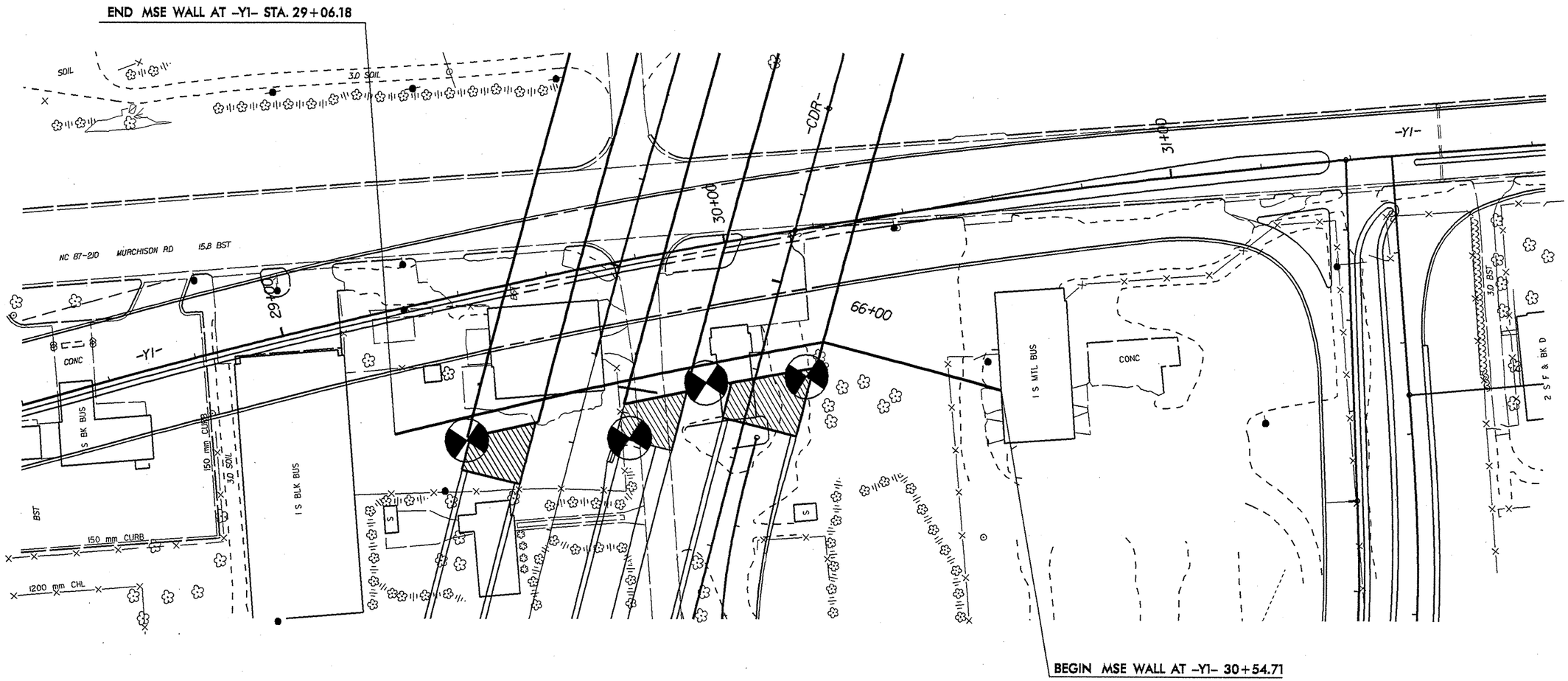
WALL 8

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C. SAND	F. SAND	SILT	CLAY	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
SS-1	7.0 LT	21+44	0.3-0.8	A-2-4(0)	18	NP	31.0	58.6	0.2	10.1	100	80	12	-	-
SS-3	7.0 LT	21+44	2.6-3.0	A-2-4(0)	24	NP	3.6	78.0	2.2	16.2	100	98	20	-	-
SS-4	7.0 LT	21+44	4.1-4.5	A-1-b(0)	14	NP	58.2	33.5	2.2	6.1	73	46	7	-	-
SS-307	30.0 RT	62+60	1.1-1.6	A-2-4(0)	18	NP	52.4	38.7	0.9	8.1	100	72	11	-	-
SS-336	10.0 RT	21+55	1.2-1.6	A-3(0)	21	NP	59.2	32.2	0.5	8.1	100	60	10	-	-
SS-338	10.0 RT	21+55	4.2-4.7	A-2-4(0)	23	NP	14.9	72.6	1.4	11.1	100	90	15	-	-
SS-342	10.0 RT	21+55	10.3-10.8	A-2-6(1)	36	17	62.8	9.1	3.9	24.2	93	49	27	-	-
SS-343	10.0 RT	21+55	11.8-12.3	A-1-b(0)	20	NP	80.0	11.7	2.3	6.0	92	48	8	-	-
SS-345	10.0 RT	21+55	14.9-15.3	A-1-b(0)	21	NP	76.1	13.9	1.9	8.1	100	49	11	-	-
SS-346	10.0 RT	21+55	16.4-16.8	A-1-b(0)	20	NP	88.0	6.0	1.9	4.0	95	30	6	-	-
SS-348	10.0 RT	21+55	19.4-19.9	A-2-6(1)	31	15	43.7	24.4	3.7	28.2	100	81	33	-	-
SS-349	10.0 RT	21+55	21.0-21.4	A-7-6(28)	57	32	9.5	9.1	13.0	68.5	98	93	82	-	-
SS-358	40.0 RT	21+65	1.3-1.7	A-2-4(0)	19	NP	51.6	39.4	2.0	7.0	100	65	11	-	-
SS-359	40.0 RT	21+65	2.8-3.2	A-3(0)	21	NP	47.0	48.2	1.7	3.0	100	69	6	-	-
SS-362	40.0 RT	21+65	7.4-7.8	A-2-4(0)	20	NP	62.9	26.3	1.7	9.1	97	74	11	-	-
SS-363	40.0 RT	21+65	8.9-9.3	A-1-b(0)	19	NP	84.6	9.3	2.1	4.0	87	31	6	-	-
SS-365	40.0 RT	21+65	10.4-10.8	A-2-6(0)	29	13	30.2	39.4	1.2	29.2	100	84	31	-	-

PROJECT REFERENCE NO.	SHEET NO.
X-0002B	7

WALL 9



PROJECT REFERENCE NO.	SHEET NO.
X-0002B	8

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C. SAND	F. SAND	SILT	CLAY	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
SS-1	32.3 RT	30+13	1.2-1.6	A-2-4(0)	21	NP	24.2	57.9	3.7	14.1	99	84	19	-	-
SS-2	32.3 RT	30+13	5.7-6.2	A-3(0)	22	NP	57.9	33.5	0.5	8.1	99	74	9	-	-
SS-3	32.3 RT	30+13	8.8-9.2	A-1-b(0)	22	NP	78.7	13.3	1.9	6.1	92	38	8	-	-
SS-4	32.3 RT	30+13	14.9-15.3	A-6(9)	34	18	8.7	34.7	12.2	44.4	100	96	63	-	-
SS-5	32.3 RT	30+13	17.9-18.3	A-7-6(25)	50	26	4.8	10.3	18.3	66.6	100	97	88	-	-
SS-6	32.3 RT	30+13	21.0-21.4	A-7-6(19)	47	31	17.2	17.8	14.6	50.5	100	90	69	-	-
SS-7	32.3 RT	30+13	2.7-3.1	A-2-4(0)	24	NP	27.6	55.3	0.9	16.1	96	82	20	-	-
SS-8	32.3 RT	30+13	8.8-9.2	A-2-4(0)	22	NP	27.6	54.9	5.3	12.1	96	82	21	-	-
SS-12	31.5 RT	29+35	1.2-1.7	A-2-4(0)	19	NP	36.8	46.1	1.0	16.2	98	79	21	-	-
SS-411	10.3 LT	65+74	1.2-1.7	A-2-4(0)	19	NP	53.1	36.0	2.8	8.1	97	62	13	-	-
SS-413	10.3 LT	65+74	4.3-4.7	A-2-4(0)	21	NP	11.0	74.5	1.3	13.1	100	92	17	-	-
SS-416	10.3 LT	65+74	8.8-9.3	A-3(0)	22	NP	58.5	33.1	1.3	7.1	98	81	9	-	-
SS-419	10.3 LT	65+74	13.4-13.8	A-6(6)	33	18	8.7	44.6	10.3	36.4	100	95	54	-	-
SS-420	10.3 LT	65+74	14.9-15.4	A-2-4(0)	19	NP	65.1	24.5	0.3	10.1	100	71	11	-	-
SS-421	10.3 LT	65+74	16.4-16.9	A-1-b(0)	17	NP	86.1	8.9	1.0	4.0	96	36	5	-	-
SS-423	10.3 LT	65+74	19.5-19.9	A-7-6(15)	44	26	9.5	29.7	14.3	46.5	100	95	67	-	-
SS-425	38.5 RT	29+71	1.3-1.7	A-3(0)	18	NP	61.2	31.7	1.0	6.1	100	55	8	-	-
SS-429	38.5 RT	29+71	7.4-7.8	A-6(9)	38	18	2.4	56.2	9.1	32.3	100	99	64	-	-
SS-430	38.5 RT	29+71	8.9-9.3	A-2-4(0)	19	NP	58.2	29.8	0.9	11.1	97	71	14	-	-
SS-432	38.5 RT	29+71	11.9-12.4	A-1-b(0)	20	NP	88.6	7.8	0.6	3.0	84	21	4	-	-
SS-433	38.5 RT	29+71	13.5-13.9	A-6(9)	37	21	2.8	43.8	10.9	42.4	100	99	59	-	-
SS-434	38.5 RT	29+71	15.0-15.5	A-3(0)	19	NP	69.6	20.6	1.7	8.1	99	65	10	-	-
SS-437	38.5 RT	29+71	19.5-20.0	A-6(9)	37	18	9.1	32.9	3.5	44.4	100	95	64	-	-

WALL 9

END MSE WALL AT -Y1- 29+06.18

BEGIN MSE WALL AT -Y1- 30+54.71

SS-12 31.5 M RT

SS-425, SS-429, SS-430, SS-432, SS-433, SS-434, SS-437 38.5 M RT

SS-411, SS-413, SS-416, SS-419, SS-420, SS-421, SS-423 10.3 M LT

SS-1, SS-2, SS-3, SS-4, SS-4, SS-5, SS-6, SS-7, SS-8 32.3 M RT

COASTAL PLAIN, TAN TO GRAY, VERY LOOSE TO DENSE.

MOIST TO SATURATED, 07/06

11/06

Ⓐ

GRAY, MOIST, VERY STIFF, SANDY CLAY

TAN TO GRAY, SATURATED, VERY LOOSE TO DENSE, SAND AND MEDIUM TO DENSE, CLAYEY SAND

TAN TO DARK GRAY, MOIST AND MEDIUM DENSE, TO WET, STIFF TO HARD CLAYEY SAND

SAND AND SILTY SAND

DENSE, CLAYEY SAND

SAND AND SILTY SAND

SANDY AND SILTY CLAY

CAPE FEAR FORMATION

Ⓐ GRAY, MOIST, STIFF, SANDY CLAY

100 95 90 85 80 75 70 65 60 55 50 45 40

80 29+00 20 40 60 80 30+00 20 40 60

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	35196.3.18 (X-0002BC)	1	18

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

EASTERN
REGIONAL DESIGN
ENGINEER

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 35196.3.18 (X-0002BC)

COUNTY *CUMBERLAND*

PROJECT DESCRIPTION *NC 24 EXTENSION (FAYETTEVILLE OUTER LOOP) FROM NC 24 TO 1.3 MILES EAST OF NC 87-210*

SITE DESCRIPTION *BRIDGE NO. 354 AND NO. 355 ON -L- OVER -Y1- (NC 87, MURCHISON ROAD)*
BRIDGE NO. 360 ON -CDR- OVER -Y1- (NC 87, MURCHISON ROAD)

INVENTORY

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	GEOTECHNICAL REPORT
4	SITE PLAN
5	PROFILE FOR BRIDGE NO. 354
6-8	BORE LOGS FOR BRIDGE NO. 354
9	PROFILE FOR BRIDGE NO. 355
10-12	BORE LOGS FOR BRIDGE NO. 355
13	PROFILE FOR BRIDGE NO. 360
14-16	BORE LOGS FOR BRIDGE NO. 360
17	SOIL TEST RESULTS
18	SITE PHOTOGRAPH(S)

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.

THIS SUBSURFACE INFORMATION WAS ORIGINALLY ASSEMBLED AS STATE PROJECT 35196.1.3 (X-0002B), BUT IS BEING LET AS 35196.3.18 (X-0002BC)

PERSONNEL
C.D. CZAJKA
W.N. CHERRY
R.E. SMITH

INVESTIGATED BY *C.A.YOUNGBLOOD*
CHECKED BY *N.T. ROBERSON*
SUBMITTED BY *N.T. ROBERSON*
DATE *JANUARY 2007*

NORTH CAROLINA LICENSED SEAL 1959 GEOLOGIST CHERYL A. YOUNGBLOOD 1/26/07

DRAWN BY: *T.T. WALKER*

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: 35196.3.18

ID: X-0002BC

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

PROJECT REFERENCE NO.	SHEET NO.
35196.1.3(X-0002B)	2

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 30 CM 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, SATY 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 (kN/m^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	N/A
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<25
	SOFT	2 TO 4	25 TO 50
	MEDIUM STIFF	4 TO 8	50 TO 100
	STIFF	8 TO 15	100 TO 200
	VERY STIFF	15 TO 30	200 TO 400
	HARD	>30	>400

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
	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
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%
MODERATELY ORGANIC	5 - 10%	12 - 20%
HIGHLY ORGANIC	>10%	>20%

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

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

ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- ☐ MOBILE B-___
- ☐ BK-51
- ☐ CME-45C
- ☐ CME-550
- ☐ PORTABLE HOIST
- ■ CME-45B
- ☐ _____

ADVANCING TOOLS:
- ■ CLAY BITS
- ☐ 152mm CONTINUOUS FLIGHT AUGER
- ☐ 203mm HOLLOW AUGERS
- ☐ HARD FACED FINGER BITS
- ☐ TUNG.-CARBIDE INSERTS
- ☐ CASING ☐ W/ ADVANCER
- ☐ TRICONE _____mm STEEL TEETH
- ☐ TRICONE _____mm TUNG.-CARB.
- ☐ CORE BIT
- ☐ _____

HAMMER TYPE:
- ■ 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 3 CM 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 30 CM 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 BLOWS PER 30 CM*
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 BLOWS PER 30 CM*
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 6 MM 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 13 MM DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 25 MM 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 25 MM OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 3 M
WIDE	3 TO 10 M
MODERATELY CLOSE	30 TO 100 CM
CLOSE	5 TO 30 CM
VERY CLOSE	LESS THAN 5 CM

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 1 M
THICKLY BEDDED	0.5 - 1 M
THINLY BEDDED	0.05 - 0.5 M
VERY THINLY BEDDED	10 - 50 MM
THICKLY LAMINATED	2.5 - 10 MM
THINLY LAMINATED	< 2.5 MM

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 10 CM 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 OF A 63.5 KG HAMMER FALLING 0.76 M REQUIRED TO PRODUCE A PENETRATION OF 30 CM INTO SOIL WITH A 5 CM OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 3 CM 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 10 CM DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK: X2-3: AN ALUMINUM CAP AT -BY4A- 12+43.29 OFFSET 0.00 M

ELEVATION: 69.080 M

NOTES:

REVISED 02/23/06

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

January 26, 2007

STATE PROJECT: 35196.1.3 (X-0002B)
F.A. PROJECT: NHF-DPR-0100 (002)
COUNTY: Cumberland

DESCRIPTION: Bridge No. 354 and No. 355 on -L- over –Y1– (NC 87, Murchison Road) and Bridge No. 360 on –CDR– over –BY4– (NC 87, Murchison Road)

SUBJECT: Geotechnical Report – Structure Inventory

Project Description

This report contains subsurface inventories for three parallel structures on -L- and -CDR- over NC 87 and CSX railroad for the X-0002B project. Each bridge consists of two spans with proposed span lengths ranging from 53.55 meters to 54.875 meters and 31.390 meters to 36.175 meters. Skew angles are unique to each bent and range between 63° 53' 40" and 70° 13" 46". The project is located in northwestern Cumberland County between the City of Fayetteville and Fort Bragg Military Reservation.

The subsurface investigation was conducted during July and November of 2006 using an ATV-mounted CME-45B drill machine. Standard Penetration Test borings were performed at each of the proposed bent locations. All borings were terminated between elevations 43.93 meters and 47.45 meters. Representative soil samples were obtained for visual classification in the field and selected samples were sent to the Materials and Tests Unit for laboratory analysis.

Physiography and Geology

The project is located in the flat to gently rolling terrain of the Coastal Plain Physiographic province. The land use in the area consists of commercial businesses, residential homes and woods. Geologically, the site is underlain by Coastal Plain soils of the Middendorf and Cape Fear Formations. The Coastal Plain soils were derived from the multiple transgression and regression of sea level during the Cretaceous age.

Soil Properties

Soils encountered at the project site include roadway embankment, artificial fill and Coastal Plain materials that include the Middendorf and Cape Fear Formations.

Soil Properties for Bridge No. 354 (-L- WBL)

Roadway embankment was encountered in boring B1-A. These soils consist of approximately 0.70 meters of brown, medium dense to dense, silty sand (A-2-4). Middendorf Formation soils underlie the roadway embankment.

Artificial Fill is located in the area of the railroad tracks and consists of sand. Middendorf Formation underlies artificial fill.

Middendorf Formation soils occur at or near the ground surface and consists of orange-brown, white, pink and gray, moist, very loose to medium dense, fine, silty and clayey sand (A-3, A-2-4, A-2-6) with lesser amounts of orange-brown to gray, moist, medium stiff to very stiff, sandy clay (A-2-6).

Cape Fear Formation soils underlie the Middendorf Formation and consist of gray and orange, moist, very stiff to hard, sandy clay (A-6) and medium dense, clayey sand (A-2-6).

Soil Properties for Bridge No. 355 (-L- EBL)

Roadway embankment was encountered in boring B1-B. These soils consist of approximately 0.70 meters of brown, dense, silty sand (A-2-4). Middendorf Formation soils underlie the roadway embankment.

Artificial Fill is located in the area of the railroad tracks and consists of sand. Middendorf Formation underlies artificial fill.

Middendorf Formation soils occur at or near the ground surface and consists of orange-brown, white, and gray, moist to saturated, loose to dense, fine to coarse, silty and clayey sand (A-3, A-1-b, A-2-4, A-2-6) with lesser amounts of orange to gray, saturated, stiff to hard, sandy clay (A-2-6).

Cape Fear Formation soils underlie the Middendorf Formation and consist of gray and orange, moist to wet, very stiff to hard, sandy and silty clay (A-6, A-7-6) and medium dense, clayey sand (A-2-6).

Soil Properties for Bridge No. 360 (-CDR-)

Roadway embankment was encountered in boring B1-B. These soils consist of approximately 0.70 meters of brown, dense, silty sand (A-2-4). Middendorf Formation soils underlie the roadway embankment.

Artificial Fill is located in the area of the railroad tracks and consists of sand. Middendorf Formation underlies artificial fill.

Middendorf Formation soils occur at or near the ground surface and consists of orange-brown, white, pink and gray, moist to wet, very loose to dense, fine to coarse, silty and clayey sand (A-3, A-1-b, A-2-4, A-2-6) with lesser amounts of tan, pink and gray, moist, stiff to hard, sandy silt (A-4) and sandy clay (A-6).

Cape Fear Formation soils underlie the Middendorf Formation and consist of gray and orange, moist, very stiff to hard, sandy clay (A-6) and medium dense to dense, clayey sand (A-2-6).

Groundwater

Groundwater was evident at all bent locations. The groundwater elevation ranges from 60.11 meters to 66.59 meters.

Notice

This Geotechnical foundation report is based on the Preliminary General Drawing dated April and May, 2006 and Roadway Design files dated December, 2006 and January, 2007. If significant changes are made in the design or location of the proposed structure, the subsurface information should be reviewed and modified as necessary.

Prepared by,

Cheryl A. Youngblood, L.G.
Project Geological Engineer

PROJECT REFERENCE NO.	SHEET
35196.1.3(X-0002B	4

SITE PLAN

0 20 40

METERS

NAD 83 NC GRID

METRIC

SMITH LAKE RD.

WOODS

SOIL

CSX RAILROAD

CSX R/R

MURCHISON ROAD NC 87

NC 87-210 MURCHISON RD

SOIL & GR

-L- (BRIDGE NO. 354)

-L- (BRIDGE NO. 355)

-L- (BRIDGE NO. 360)

-L- WBL

-L- EBL

-CDR-

-Y1-

-L- 65+00

30+00

EB2-A

EB2-B

EB1-A

EB1-B

BL-A

BL-B

SR 1446 GIBLST

EIP

-FLYOVER-

-RPC-

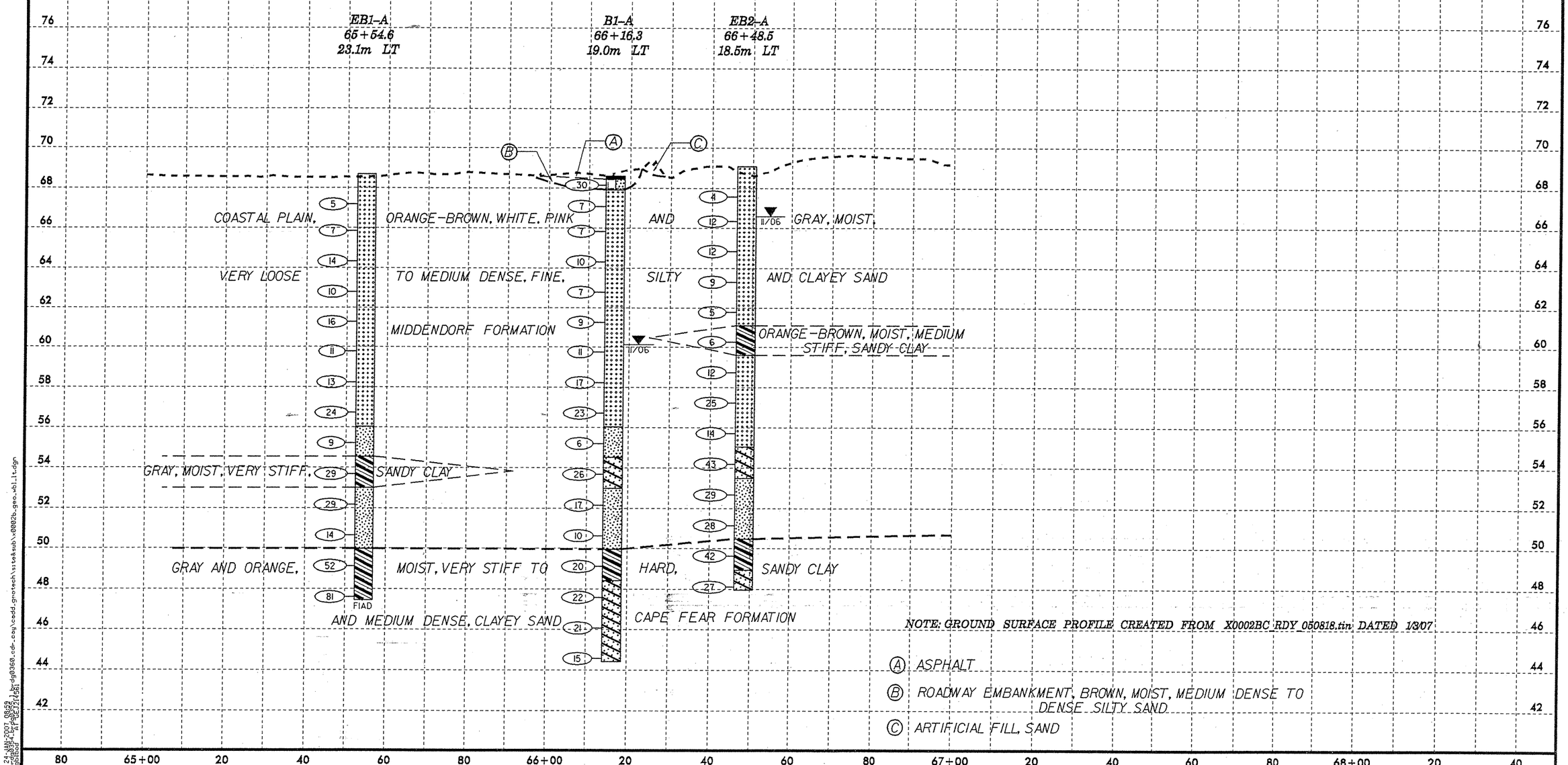
PROJECT REFERENCE NO.	SHEET NO.
35196.1.3(X-0002B)	5

METRIC

5 0 10

BRIDGE NO. 354

FENCE DIAGRAM OF BORINGS PROJECTED TO 23m LT OF -L-



NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND	**GEOLOGIST** Czajka, C. D.
SITE DESCRIPTION BRIDGE NO. 354 ON -L- OVER -Y1- (NC 87, MURCHISON RD.)			**GROUND WTR (m)**
BORING NO. EB1-A	**STATION** 65+54.6	**OFFSET** 23.1 m LT	**ALIGNMENT** -L-
COLLAR ELEV. 68.70 m	**TOTAL DEPTH** 21.25 m	**NORTHING** 152,186.9	**EASTING** 615,287.8
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 11/27/06	**COMP. DATE** 11/27/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

0 HR. N/A
24 HR. FIAD

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
									ELEV. (m) DEPTH (m)
69									68.70 GROUND SURFACE 0.00
									COASTAL PLAIN, ORANGE-BROWN TO TAN AND WHITE, FINE SAND (MIDDENDORF FORMATION)
68	67.48 1.22	2	2	3	5		M		
67	66.14 2.56	3	3	4	7		M		
66	64.62 4.08	4	5	9	14		M		
65	63.10 5.60	3	4	6	10		M		
64	61.58 7.12	5	7	9	16		M		
63	60.06 8.64	4	4	7	11		M		
62	58.54 10.16	3	4	9	13		M		
61	57.02 11.68	7	9	15	24		M		
60	55.50 13.20	4	4	5	9		M		
59	53.98 14.72	7	12	17	29	SS-12	M		
58	52.46 16.24	8	13	16	29		M		
57	50.94 17.76	2	8	6	14		M		
56	49.42 19.28	11	18	34	52		M		56.04 12.66 TAN, SILTY SAND
55									54.52 14.18 GRAY, SANDY CLAY
54									53.00 15.70 WHITE AND PINK, SILTY SAND
53									49.96 18.74 GRAY AND ORANGE, SANDY CLAY (CAPE FEAR FORMATION)
52									
51									
50									
49									

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND	**GEOLOGIST** Czajka, C. D.
SITE DESCRIPTION BRIDGE NO. 354 ON -L- OVER -Y1- (NC 87, MURCHISON RD.)			**GROUND WTR (m)**
BORING NO. EB1-A	**STATION** 65+54.6	**OFFSET** 23.1 m LT	**ALIGNMENT** -L-
COLLAR ELEV. 68.70 m	**TOTAL DEPTH** 21.25 m	**NORTHING** 152,186.9	**EASTING** 615,287.8
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 11/27/06	**COMP. DATE** 11/27/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

0 HR. N/A
24 HR. FIAD

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
49					Match Line				GRAY AND ORANGE, SANDY CLAY (CAPE FEAR FORMATION) *(continued)*
48	47.90								
	20.80	18	29	52	81		M		47.45 21.25 Boring Terminated at Elevation 47.45 m IN SANDY CLAY (CAPE FEAR FORMATION)
47									
46									
45									
44									
43									
42									
41									
40									
39									
38									
37									
36									
35									
34									
33									
32									
31									
30									
29									

NCDOT BORE DOUBLE X0002B_GEO_BH_BRDG0354.GPJ NC_DOT.GDT 01/24/07

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND	**GEOLOGIST** Czajka, C. D.	
SITE DESCRIPTION BRIDGE NO. 354 ON -L- OVER -Y1- (NC 87, MURCHISON RD.)				**GROUND WTR (m)**
BORING NO. B1-A	**STATION** 66+16.3	**OFFSET** 19.1 m LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 68.61 m	**TOTAL DEPTH** 24.21 m	**NORTHING** 152,203.4	**EASTING** 615,347.6	**24 HR.** 8.50
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/28/06	**COMP. DATE** 11/28/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (m) / DEPTH (m)
69									
	66.46								68.61 GROUND SURFACE 0.00
	0.15	7	12	18	30				68.46 ASPHALT 0.15
68	67.39					SS-13			67.91 ROADWAY EMBANKMENT 0.70
	1.22	3	3	4	7		M		BROWN, SILTY SAND
67	66.13								COASTAL PLAIN, ORANGE-BROWN TO WHITE AND RED FINE SAND (MIDDENDORF FORMATION)
	2.48	2	3	4	7		M		
66	64.61								
	4.00	3	4	6	10		M		
65	63.09								
	5.52	3	4	3	7		M		
64	61.57								
	7.04	4	4	5	9		M		
63	60.05								
	8.56	5	6	5	11		M		
62	58.53								
	10.08	4	5	12	17		M		
61	57.01								
	11.60	6	10	13	23		M		
60	55.49								
	13.12	3	2	4	6		M		
59	53.97								
	14.64	9	10	16	26		M		
58	52.45								
	16.16	8	7	10	17		M		
57	50.93								
	17.68	5	5	5	10		M		
56	49.41								
	19.20	5	8	12	20	SS-14	M		56.03 TAN, SILTY SAND 12.58
55									54.51 WHITE AND PINK, CLAYEY COARSE SAND 14.10
54									52.99 TAN, SILTY SAND 15.62
53									
52									
51									
50									49.95 ORANGE AND GRAY, SANDY CLAY (CAPE FEAR FORMATION) 18.66
49									

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND	**GEOLOGIST** Czajka, C. D.	
SITE DESCRIPTION BRIDGE NO. 354 ON -L- OVER -Y1- (NC 87, MURCHISON RD.)				**GROUND WTR (m)**
BORING NO. B1-A	**STATION** 66+16.3	**OFFSET** 19.1 m LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 68.61 m	**TOTAL DEPTH** 24.21 m	**NORTHING** 152,203.4	**EASTING** 615,347.6	**24 HR.** 8.50
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/28/06	**COMP. DATE** 11/28/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
49					Match Line				
	47.89								48.43 TAN, CLAYEY SAND 20.18
48	20.72	8	10	12	22		M		
47	46.37								
	22.24	10	10	11	21		M		
46	44.85								
45	23.76	5	7	8	15		M		44.40 Boring Terminated at Elevation 44.40 m IN CLAYEY SAND (CAPE FEAR FORMATION) 24.21
44									
43									
42									
41									
40									
39									
38									
37									
36									
35									
34									
33									
32									
31									
30									
29									

NCDOT BORE DOUBLE X0002B_GEO_BH_BRDG0354.GPJ NC_DOT.GDT 01/24/07

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND	**GEOLOGIST** Czajka, C. D.
SITE DESCRIPTION BRIDGE NO. 354 ON -L- OVER -Y1- (NC 87, MURCHISON RD.)			**GROUND WTR (m)**
BORING NO. EB2-A	**STATION** 66+48.5	**OFFSET** 18.5 m LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 69.10 m	**TOTAL DEPTH** 21.14 m	**NORTHING** 152,213.2	**EASTING** 615,378.4	**24 HR.** 2.51
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/09/06	**COMP. DATE** 11/14/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (m)	DEPTH (m)
									69.10 GROUND SURFACE	0.00
									COASTAL PLAIN, ORANGE-BROWN AND WHITE, FINE SAND (MIDDENDORF FORMATION)	
	67.88 1.22	2	2	2	4					
	66.65 2.45	4	5	7	12					
	65.13 3.97	3	5	7	12					
	63.61 5.49	5	4	5	9					
	62.09 7.01	2	3	2	5					
	60.57 8.53	2	2	4	6	SS-9				
	59.05 10.05	5	5	7	12					
	57.53 11.57	9	10	15	25					
	56.01 13.09	9	6	8	14					
	54.49 14.61	12	19	24	43					
	52.97 16.13	11	13	16	29					
	51.45 17.65	10	12	16	28					
	49.93 19.17	7	15	27						
									61.11 ORANGE-BROWN, SANDY CLAY	7.99
									59.59 ORANGE AND WHITE, FINE SAND	9.51
									55.03 GRAY, CLAYEY SAND	14.07
									53.49 GRAY, SILTY SAND	15.61
									50.47 GRAY, SANDY CLAY (CAPE FEAR FORMATION)	18.63

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND	**GEOLOGIST** Czajka, C. D.
SITE DESCRIPTION BRIDGE NO. 354 ON -L- OVER -Y1- (NC 87, MURCHISON RD.)			**GROUND WTR (m)**
BORING NO. EB2-A	**STATION** 66+48.5	**OFFSET** 18.5 m LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 69.10 m	**TOTAL DEPTH** 21.14 m	**NORTHING** 152,213.2	**EASTING** 615,378.4	**24 HR.** 2.51
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/09/06	**COMP. DATE** 11/14/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
					Match Line				GRAY, SANDY CLAY (CAPE FEAR FORMATION) *(continued)*
	48.41 20.69	9	11	16	27				48.95 GRAY AND ORANGE, CLAYEY SAND 20.15
									47.96 Boring Terminated at Elevation 47.96 m IN CLAYEY SAND (CAPE FEAR FORMATION) 21.14

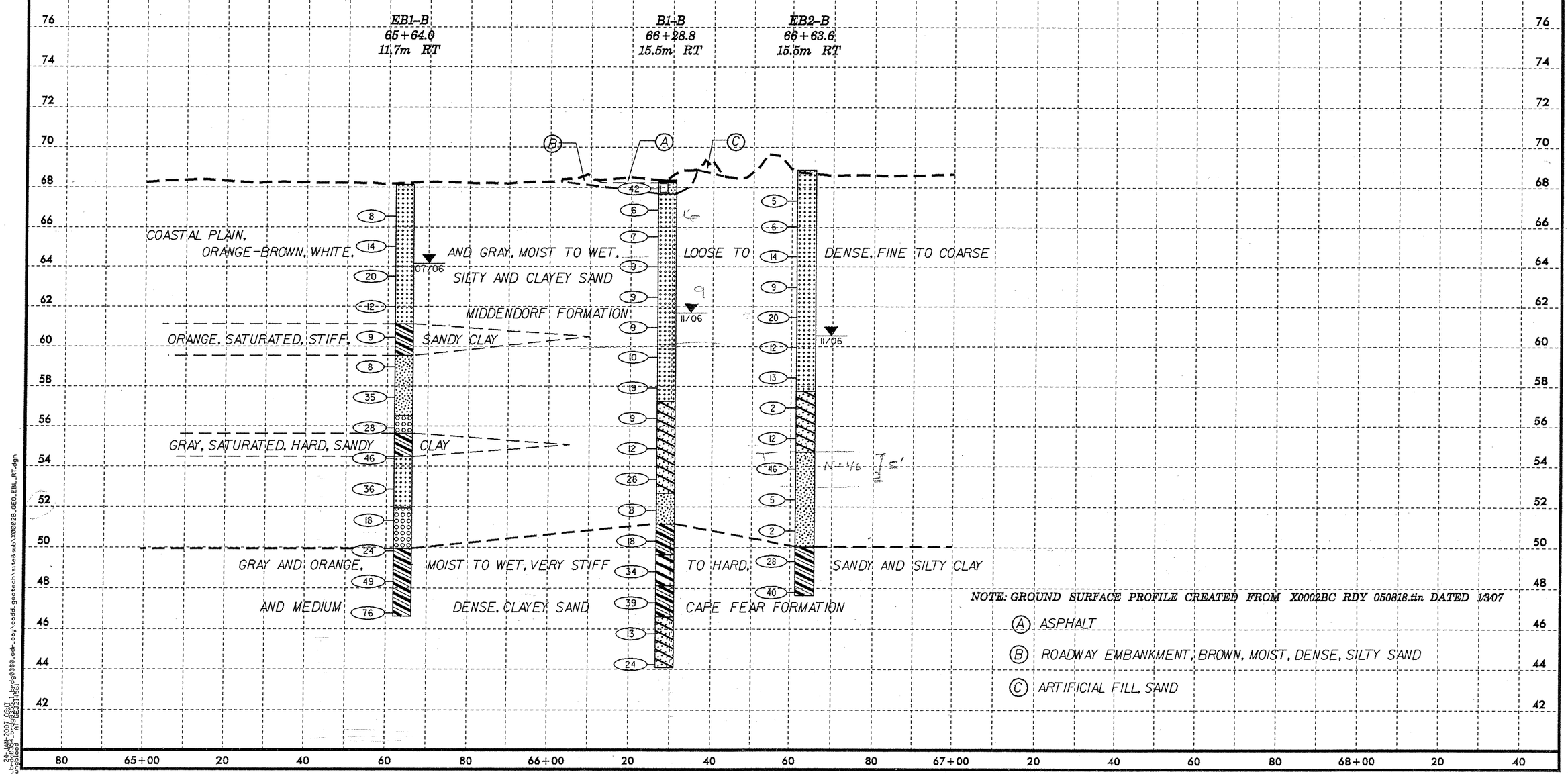
NCDOT BORE DOUBLE X0002B_GEO_BH_BRDG0354.GPJ NC_DOT.GDT 01/24/07

PROJECT REFERENCE NO.	SHEET NO.
35196.1.3(X-0002B)	9

METRIC

BRIDGE NO. 355

FENCE DIAGRAM OF BORINGS PROJECTED TO 15m RT OF -L-



NOTE: GROUND SURFACE PROFILE CREATED FROM X0002BC RDY 050818.tin DATED 1/3/07

(A) ASPHALT

(B) ROADWAY EMBANKMENT, BROWN, MOIST, DENSE, SILTY SAND

(C) ARTIFICIAL FILL, SAND

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND	**GEOLOGIST** Bradley N.	
SITE DESCRIPTION BRIDGE NO. 355 ON -L- OVER -Y1- (NC 87, MURCHISON RD.)			**GROUND WTR (m)**	
BORING NO. EB1-B	**STATION** 65+64.0	**OFFSET** 11.7 m RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 68.13 m	**TOTAL DEPTH** 21.50 m	**NORTHING** 152,157.2	**EASTING** 615,308.2	**24 HR.** 3.96
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 07/07/06	**COMP. DATE** 07/07/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (m)	DEPTH (m)
									GROUND SURFACE	68.13	0.00
									COASTAL PLAIN, ORANGE, SAND (MIDDENDORF FORMATION)		
	66.84 1.29	12	4	4	8	SS-425	M				
	65.32 2.81	6	7	7	14		M				
	63.80 4.33	7	10	10	20		M				
	62.28 5.85	17	6	6	12		M				
	60.76 7.37	10	6	3	9	SS-429	Sat.			61.13	7.00
	59.24 8.89	5	3	5	8	SS-430	Sat.		ORANGE, SANDY CLAY	59.53	8.60
	57.72 10.41	8	15	20	35 N=31		Sat.		ORANGE, SILTY SAND	56.53	11.60
	56.20 11.93	6	11	17	28	SS-432	Sat.		ORANGE, COARSE SAND	55.63	12.50
	54.68 13.45	6	19	27	46 N=45	SS-433	Sat.		GRAY, SANDY CLAY	54.48	13.65
	53.16 14.97	16	17	19	36	SS-434	Sat.		ORANGE, SAND	54.18	13.95
	51.64 16.49	12	10	8	18		Sat.		ORANGE, COARSE SAND	51.93	16.20
	50.12 18.01	10	12	12	24		Sat.		GRAY, SANDY CLAY (CAPE FEAR FORMATION)	49.93 49.83 49.63	18.20 18.30 18.50

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND	**GEOLOGIST** Bradley N.	
SITE DESCRIPTION BRIDGE NO. 355 ON -L- OVER -Y1- (NC 87, MURCHISON RD.)			**GROUND WTR (m)**	
BORING NO. EB1-B	**STATION** 65+64.0	**OFFSET** 11.7 m RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 68.13 m	**TOTAL DEPTH** 21.50 m	**NORTHING** 152,157.2	**EASTING** 615,308.2	**24 HR.** 3.96
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 07/07/06	**COMP. DATE** 07/07/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
	48.60 19.53	17	20	29	Match Line 49	SS-437	W		GRAY, SANDY CLAY (CAPE FEAR FORMATION) *(continued)*
	47.08 21.05	23	39	37	76		W		46.63 21.50 Boring Terminated at Elevation 46.63 m IN SANDY CLAY (CAPE FEAR FORMATION)

NCDOT BORE DOUBLE X0002B_GEO_BH_BRDG0354.GPJ NC_DOT.GDT 01/26/07

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND		**GEOLOGIST** Czajka, C. D.
SITE DESCRIPTION BRIDGE NO. 355 ON -L- OVER -Y1- (NC 87, MURCHISON RD.)				**GROUND WTR (m)**
BORING NO. B1-B	**STATION** 66+28.8	**OFFSET** 15.5 m RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 68.38 m	**TOTAL DEPTH** 24.29 m	**NORTHING** 152,174.7	**EASTING** 615,370.6	**24 HR.** 6.71
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/28/06	**COMP. DATE** 11/29/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (m)	DEPTH (m)
69										
	68.23								68.38	0.00
68	0.15	11	18	24	42		M		GROUND SURFACE	
	67.16								68.23	0.15
67	1.22	3	3	3	6		M		ASPHALT	
	65.82								67.68	0.70
66	2.56	3	3	4	7		M		**ROADWAY EMBANKMENT** BROWN, SILTY SAND	
	64.30								**COASTAL PLAIN,** ORANGE-BROWN AND WHITE, FINE SAND (MIDDENDORF FORMATION)	
65	4.08	5	4	5	9		M			
	62.78									
64	5.60	3	4	5	9		M			
	61.26									
63	7.12	3	4	5	9		M			
	59.74									
62	8.64	3	4	6	10		M			
	58.22									
61	10.16	4	7	12	19		M			
	56.70									
60	11.68	3	4	5	9		M			
	55.18									
59	13.20	2	4	8	12		M			
	53.66									
58	14.72	9	13	15	28		M			
	52.14									
57	16.24	2	3	5	8		M			
	50.62									
56	17.76	7	9	9	18		M			
	49.10									
55	19.28	7	13	21	34	SS-15	M		57.24	11.14
									ORANGE TO GRAY, CLAYEY COARSE SAND	
									52.68	15.70
									WHITE AND TAN, SILTY SAND	
									51.16	17.22
									GRAY AND PINK, SANDY CLAY (CAPE FEAR FORMATION)	
									49.64	18.74
									GRAY, SILTY CLAY	

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND		**GEOLOGIST** Czajka, C. D.
SITE DESCRIPTION BRIDGE NO. 355 ON -L- OVER -Y1- (NC 87, MURCHISON RD.)				**GROUND WTR (m)**
BORING NO. B1-B	**STATION** 66+28.8	**OFFSET** 15.5 m RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 68.38 m	**TOTAL DEPTH** 24.29 m	**NORTHING** 152,174.7	**EASTING** 615,370.6	**24 HR.** 6.71
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/28/06	**COMP. DATE** 11/29/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
49					Match Line				GRAY, SILTY CLAY *(continued)*
									48.12 20.26
48	47.58								GRAY AND ORANGE, SANDY CLAY
	20.80	9	15	24	39		M		
47	46.06								46.60 21.78
	22.32	5	5	8	13		M		GRAY, CLAYEY SAND
46	44.54								
	23.84	13	10	14	24		M		44.09 24.29
45									Boring Terminated at Elevation 44.09 m IN CLAYEY SAND (CAPE FEAR FORMATION)
44									
43									
42									
41									
40									
39									
38									
37									
36									
35									
34									
33									
32									
31									
30									
29									

NCDOT BORE DOUBLE X0002B_GEO_BH_BRDG0354.GPJ NC_DOT.GDT 01/26/07

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND		**GEOLOGIST** Czajka, C. D.
SITE DESCRIPTION BRIDGE NO. 355 ON -L-.OVER -Y1- (NC 87, MURCHISON RD.)				**GROUND WTR (m)**
BORING NO. EB2-B	**STATION** 66+63.6	**OFFSET** 15.5 m RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 68.84 m	**TOTAL DEPTH** 21.20 m	**NORTHING** 152,185.6	**EASTING** 615,403.5	**24 HR.** 8.30
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/15/06	**COMP. DATE** 11/15/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (m)	DEPTH (m)
									68.84	0.00
									GROUND SURFACE	
									COASTAL PLAIN,ORANGE-BROWN AND WHITE, FINE SAND (MIDDENDORF FORMATION)	
	67.62 1.22	3	3	2	5		M			
	66.33 2.51	3	3	3	6		M			
	64.81 4.03	3	6	8	14		M			
	63.29 5.55	3	4	5	9		M			
	61.77 7.07	6	8	12	20		M			
	60.25 8.59	5	5	7	12		M			
	58.73 10.11	4	5	8	13		M			
	57.21 11.63	2	1	1	2	SS-10	M		57.75	11.09
	55.69 13.15	4	8	4	12		M		ORANGE, RED, AND WHITE, CLAYEY COARSE SAND	
	54.17 14.67	11	16	30	46		M		54.71	14.13
	52.65 16.19	4	2	3	5		M		GRAY TO ORANGE AND WHITE, SILTY SAND	
	51.13 17.71	1	1	1	2		M		50.04	18.80
	49.61 19.23	7	12	16	28		M		GRAY AND ORANGE, SANDY CLAY (CAPE FEAR FORMATION)	

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND		**GEOLOGIST** Czajka, C. D.
SITE DESCRIPTION BRIDGE NO. 355 ON -L- OVER -Y1- (NC 87, MURCHISON RD.)				**GROUND WTR (m)**
BORING NO. EB2-B	**STATION** 66+63.6	**OFFSET** 15.5 m RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 68.84 m	**TOTAL DEPTH** 21.20 m	**NORTHING** 152,185.6	**EASTING** 615,403.5	**24 HR.** 8.30
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/15/06	**COMP. DATE** 11/15/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
					Match Line				
	48.09 20.75	9	17	23	40		M		GRAY AND ORANGE, SANDY CLAY (CAPE FEAR FORMATION) *(continued)*
									47.64 21.20
									Boring Terminated at Elevation 47.64 m IN CLAYEY SAND (CAPE FEAR FORMATION)

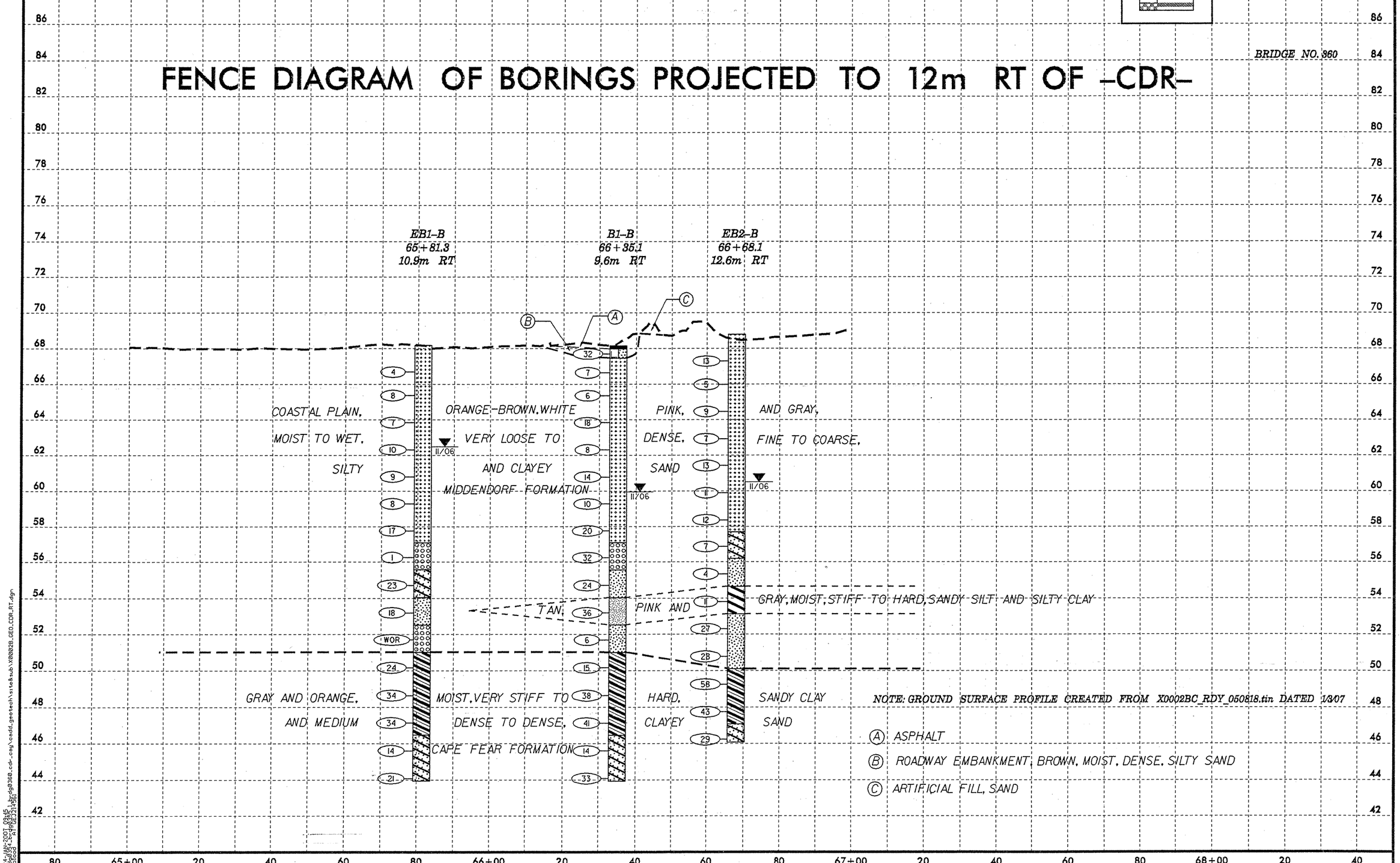
PROJECT REFERENCE NO.	SHEET NO.
35196.1.3(X-0002B)	13

METRIC

5 0 10

BRIDGE NO. 360

FENCE DIAGRAM OF BORINGS PROJECTED TO 12m RT OF -CDR-



NOTE: GROUND SURFACE PROFILE CREATED FROM X0002BC_RDY_050818.tin DATED 1/3/07

(A) ASPHALT

(B) ROADWAY EMBANKMENT, BROWN, MOIST, DENSE, SILTY SAND

(C) ARTIFICIAL FILL, SAND

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND		**GEOLOGIST** Czajka, C. D.
SITE DESCRIPTION BRIDGE NO. 360 ON -CDR- OVER -Y1- (NC 87, MURCHISON RD.)				**GROUND WTR (m)**
BORING NO. EB1-B	**STATION** 65+81.3	**OFFSET** 10.9 m RT	**ALIGNMENT** -CDR-	**0 HR.** N/A
COLLAR ELEV. 68.19 m	**TOTAL DEPTH** 24.25 m	**NORTHING** 152,132.2	**EASTING** 615,341.1	**24 HR.** 5.73
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/08/06	**COMP. DATE** 11/08/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
									ELEV. (m) DEPTH (m)
68.19									GROUND SURFACE 0.00
									COASTAL PLAIN, ORANGE-BROWN AND WHITE, FINE SAND (MIDDENDORF FORMATION)
	66.97 1.22	2	2	2	4	SS-1	M		
	65.67 2.52	2	4	4	8		M		
	64.15 4.04	3	3	4	7		M		
	62.63 5.56	4	5	5	10				
	61.11 7.08	4	4	5	9	SS-2	M		
	59.59 8.60	3	3	5	8		M		
	58.07 10.12	3	6	11	17		M		
	56.55 11.64	2	1	0	1	SS-3	W		
	55.03 13.16	2	8	15	23	SS-4	M		
	53.51 14.68	5	7	11	18	SS-5	M		
	51.99 16.20	WOR	WOR	WOR	0		W		
	50.47 17.72	4	7	17	24	SS-6	M		
	48.95 19.24	8	14	20					
57.09									11.10 ORANGE AND GRAY, COARSE SAND
55.57									12.62 GRAY, CLAYEY SAND
54.05									14.14 ORANGE-WHITE AND PINK, SILTY SAND
52.53									15.66 GRAY, COARSE SAND
51.01									17.18 ORANGE AND GRAY, SANDY CLAY (CAPE FEAR FORMATION)

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND		**GEOLOGIST** Czajka, C. D.
SITE DESCRIPTION BRIDGE NO. 360 ON -CDR- OVER -Y1- (NC 87, MURCHISON RD.)				**GROUND WTR (m)**
BORING NO. EB1-B	**STATION** 65+81.3	**OFFSET** 10.9 m RT	**ALIGNMENT** -CDR-	**0 HR.** N/A
COLLAR ELEV. 68.19 m	**TOTAL DEPTH** 24.25 m	**NORTHING** 152,132.2	**EASTING** 615,341.1	**24 HR.** 5.73
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/08/06	**COMP. DATE** 11/08/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
					Match Line				
	47.43 20.76	8	14	20	34		M		ORANGE AND GRAY, SANDY CLAY (CAPE FEAR FORMATION) *(continued)*
	45.91 22.28	4	6	8	14	SS-7	M		
	44.39 23.80	7	10	11	21	SS-8	M		
46.45									21.74 GRAY AND ORANGE, CLAYEY SAND
43.94									24.25 Boring Terminated at Elevation 43.94 m IN CLAYEY SAND (CAPE FEAR FORMATION)

NCDOT BORE DOUBLE X0002B_GEO_BH_BRDG0360.GPJ NC_DOT.GDT 01/09/07

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND		**GEOLOGIST** Czajka, C. D.
SITE DESCRIPTION BRIDGE NO. 360 ON -CDR- OVER -Y1- (NC 87, MURCHISON RD.)				**GROUND WTR (m)**
BORING NO. B1-B	**STATION** 66+33.9	**OFFSET** 9.6 m RT	**ALIGNMENT** -CDR-	**0 HR.** N/A
COLLAR ELEV. 68.15 m	**TOTAL DEPTH** 24.22 m	**NORTHING** 152,150.3	**EASTING** 615,390.4	**24 HR.** 8.21
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/29/06	**COMP. DATE** 11/30/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (m)	DEPTH (m)
68	68.00								68.15 GROUND SURFACE	0.00
	0.15	8	13	19	32		M		67.99 **ROADWAY EMBANKMENT**	0.16
67	66.93								67.45 BROWN, SILTY SAND	0.70
	1.22	4	3	4	7		M		**COASTAL PLAIN,** ORANGE-BROWN AND WHITE, FINE SAND (MIDDENDORF FORMATION	
66	65.66									
	2.49	2	3	3	6		M			
65	64.14									
	4.01	5	8	10	18		M			
64	62.62									
	5.53	4	4	4	8		M			
63	61.10									
	7.05	6	6	8	14		M			
62	59.58									
	8.57	3	4	6	10		M			
61	58.06									
	10.09	6	9	11	20		M			
60	56.54									
	11.61	8	14	18	32		M			
59	55.02									
	13.13	4	8	16	24		M			
58	53.50									
	14.65	2	14	22	36	SS-16	M			
57	51.98									
	16.17	4	4	2	6		M		57.08 TAN, COARSE SAND	11.07
56	50.46								55.56 TAN AND PINK, SILTY SAND	12.59
	17.69	6	3	12	15		M		54.04 TAN AND PINK, SANDY SILT	14.11
55	48.94								52.52 ORANGE AND WHITE, SILTY SAND	15.63
	19.21	8	14	24					51.00 GRAY AND ORANGE, SANDY CLAY (CAPE FEAR FORMATION)	17.15

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND		**GEOLOGIST** Czajka, C. D.
SITE DESCRIPTION BRIDGE NO. 360 ON -CDR- OVER -Y1- (NC 87, MURCHISON RD.)				**GROUND WTR (m)**
BORING NO. B1-B	**STATION** 66+33.9	**OFFSET** 9.6 m RT	**ALIGNMENT** -CDR-	**0 HR.** N/A
COLLAR ELEV. 68.15 m	**TOTAL DEPTH** 24.22 m	**NORTHING** 152,150.3	**EASTING** 615,390.4	**24 HR.** 8.21
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/29/06	**COMP. DATE** 11/30/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
49					Match Line				
48	47.42								
	20.73	10	18	23	41		M		GRAY AND ORANGE, SANDY CLAY (CAPE FEAR FORMATION) *(continued)*
47	45.90								46.44 21.71
	22.25	6	6	8	14		M		GRAY, CLAYEY SAND
46	44.38								
	23.77	16	15	18	33		M		43.93 24.22
45									Boring Terminated at Elevation 43.93 m IN CLAYEY SAND (CAPE FEAR FORMATION)
44									
43									
42									
41									
40									
39									
38									
37									
36									
35									
34									
33									
32									
31									
30									
29									

NCDOT BORE DOUBLE X0002B_GEO_BH_BRDG0360.GPJ NC_DOT.GDT 01/24/07

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND		**GEOLOGIST** Czajka, C. D.
SITE DESCRIPTION BRIDGE NO. 360 ON -CDR- OVER -Y1- (NC 87, MURCHISON RD.)				**GROUND WTR (m)**
BORING NO. EB2-B	**STATION** 66+68.1	**OFFSET** 12.6 m RT	**ALIGNMENT** -CDR-	**0 HR.** N/A
COLLAR ELEV. 68.80 m	**TOTAL DEPTH** 22.73 m	**NORTHING** 152,158.2	**EASTING** 615,423.8	**24 HR.** 8.30
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/15/06	**COMP. DATE** 11/15/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (m)	DEPTH (m)
69									68.80	0.00
									COASTAL PLAIN, ORANGE-BROWN AND WHITE, FINE SAND (MIDDENDORF FORMATION)	
68	67.58 1.22	5	6	7	13		M			
67	66.28 2.52	1	2	3	5		M			
66	64.76 4.04	3	3	6	9		M			
65	63.24 5.56	2	3	4	7		M			
64	61.72 7.08	4	5	8	13		M			
63	60.20 8.60	5	5	6	11		M			
62	58.68 10.12	4	5	7	12		M			
61	57.16 11.64	3	3	4	7		M		57.70	11.10
									WHITE AND RED, CLAYEY SAND	
60	55.64 13.16	2	2	2	4		M		56.18	12.62
									ORANGE, SILTY SAND	
59	54.12 14.68	3	4	7	11		M		54.66	14.14
									GRAY, SILTY CLAY, HIGHLY PLASTIC	
58	52.60 16.20	16	14	13	27	SS-11	M		53.14	15.66
									ORANGE AND WHITE, SILTY SAND	
57	51.08 17.72	10	13	15	28		M		50.10	18.70
									GRAY, SANDY CLAY (CAPE FEAR FORMATION)	
56	49.56 19.24	6	16	42	58		M			

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** CUMBERLAND		**GEOLOGIST** Czajka, C. D.
SITE DESCRIPTION BRIDGE NO. 360 ON -CDR- OVER -Y1- (NC 87, MURCHISON RD.)				**GROUND WTR (m)**
BORING NO. EB2-B	**STATION** 66+68.1	**OFFSET** 12.6 m RT	**ALIGNMENT** -CDR-	**0 HR.** N/A
COLLAR ELEV. 68.80 m	**TOTAL DEPTH** 22.73 m	**NORTHING** 152,158.2	**EASTING** 615,423.8	**24 HR.** 8.30
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 11/15/06	**COMP. DATE** 11/15/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV. (m)	ELEV. DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
49					Match Line				
48	48.04 20.76	10	19	24	43		M		GRAY, SANDY CLAY (CAPE FEAR FORMATION) *(continued)*
47	46.52 22.28	8	12	17	29		M		47.06 21.74 GRAY AND ORANGE, CLAYEY SAND
46									46.07 22.73 Boring Terminated at Elevation 46.07 m IN CLAYEY SAND (CAPE FEAR FORMATION)
45									
44									
43									
42									
41									
40									
39									
38									
37									
36									
35									
34									
33									
32									
31									
30									
29									

NCDOT BORE DOUBLE X0002B_GEO_BH_BRDG0360.GPJ NC_DOT.GDT 01/24/07

PROJ. NO. - 35196.1.3
ID NO. - X-0002B
COUNTY - CUMBERLAND

EB1-A Bridge No. 354

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-12	23.1M LT	65+54.6	14.70-15.70	A-6(10)	39	20	23.9	17.5	16.4	42.2	100	85	63	-	-

B1-A Bridge No. 354

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-13	19.1M LT	66+16.3	0.15-0.60	A-2-4(0)	19	NP	56.8	28.5	3.6	11.1	99	61	16	-	-
SS-14	19.1 M LT	66+16.3	19.20-19.65	A-6(3)	34	19	26.8	34.9	5.1	33.2	100	90	39	-	-

EB2-A Bridge No. 354

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-9	8.3M LT	66+48.5	8.53-8.98	A-6(5)	40	20	17.2	50.6	8.0	24.3	100	88	45	-	-

EB1-B Bridge No. 355

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-425	11.70 RT	65+64	1.29-1.74	A-3(0)	18	NP	61.2	31.7	1.0	6.1	100	55	8	-	-
SS-429	11.70 RT	65+64	7.37-7.82	A-6(9)	38	18	2.4	56.2	9.1	32.3	100	99	64	-	-
SS-430	11.70 RT	65+64	8.89-9.34	A-2-4(0)	19	NP	58.2	29.8	0.9	11.1	97	71	14	-	-
SS-432	11.70 RT	65+64	11.93-12.38	A-1-b(0)	20	NP	88.6	7.8	0.6	3.0	84	21	4	-	-
SS-433	11.70 RT	65+64	13.45-13.65	A-6(9)	37	21	2.8	43.8	10.9	42.4	100	99	59	-	-
SS-434	11.70 RT	65+64	14.97-15.42	A-3(0)	19	NP	69.6	20.6	1.7	8.1	99	65	10	-	-
SS-437	11.70 RT	65+64	19.53-19.98	A-6(9)	37	18	9.1	32.9	13.5	44.4	100	95	64	-	-

B1-B Bridge No. 355

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-15	15.5M RT	66+28.8	19.20-19.65	A-7-6(35)	51	33	3.0	10.1	22.6	64.3	100	98	97	-	-

EB1-B Bridge No. 355

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-10	15.5M RT	66+63.6	11.63-12.08	A-2-6(0)	28	12	63.1	13.5	9.2	14.2	87	43	22	-	-

EB1-B Bridge No. 360

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	10.9M RT	65+81.3	1.22-1.67	A-3(0)	19	NP	65.8	25.5	0.6	8.1	100	52	10	-	-
SS-2	10.9M RT	65+81.3	7.08-7.53	A-3(0)	23	NP	33.4	56.1	1.3	9.1	81	63	10	-	-
SS-3	10.9M RT	65+81.3	11.64-12.09	A-1-b(0)	21	NP	82.1	13.2	0.7	4.1	72	25	4	-	-
SS-4	10.9M RT	65+81.3	13.16-13.61	A-2-6(3)	29	24	40.7	28.6	4.4	26.3	99	76	33	-	-
SS-5	10.9M RT	65+81.3	14.68-15.13	A-2-4(0)	20	NP	67.1	22.2	0.6	10.1	100	59	11	-	-
SS-6	10.9M RT	65+81.3	17.72-18.16	A-6(12)	38	19	2.6	39.1	11.7	46.6	100	99	71	-	-
SS-7	10.9M RT	65+81.3	22.28-22.73	A-2-6(1)	32	19	46.2	25.5	1.9	26.3	100	77	29	-	-
SS-8	10.9M RT	65+81.3	23.80-24.25	A-2-6(2)	38	22	57.3	13.8	0.5	28.4	97	63	29	-	-

B1-B Bridge No. 360

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-16	9.6M RT	66+35.1	14.65-15.10	A-4(1)	24	10	19.1	39.6	13.2	28.1	98	88	46	-	-

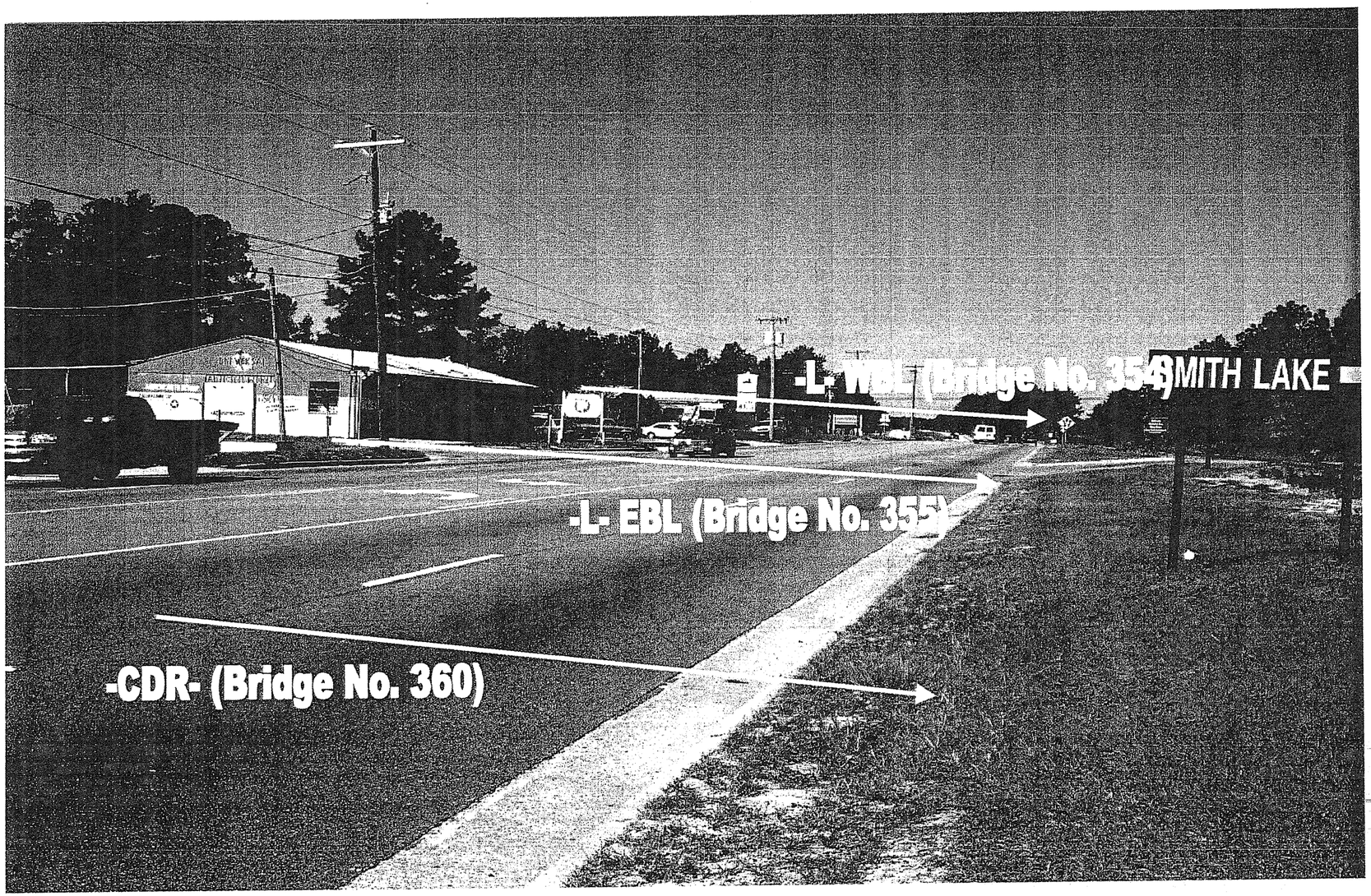
EB2-B Bridge No. 360

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-11	12.6M RT	66+68.1	14.68-15.13	A-7-6(23)	50	28	2.0	21.8	11.4	64.7	100	99	79	-	-

SITE PHOTOGRAPH

Bridge No. 354 and No. 355 on –L– Over –BY4– (NC 87, Murchison Road)
and
Bridge No. 360 on –CDR– Over –BY4– (NC 87, Murchison Road)



STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	35196.1.3	1	59

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
(X-0002BC)		P.E.
		CONST.

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

SUBSURFACE INVESTIGATION

THIS SUBSURFACE INFORMATION WAS ORIGINALLY ASSEMBLED AS STATE PROJECT 35196.1.3 (X-0002B), BUT IS BEING LET AS 35196.3.18 (X-0002BC)

STATE PROJECT 35196.3.18 I.D. NO. (X-0002BC)

COUNTY CUMBERLAND

PROJECT DESCRIPTION FAYETTEVILLE OUTER LOOP FROM EAST OF NC 24 (BRAGG BLVD) TO EAST OF NC 87/NC 210 (MURCHISON RD)

SITE DESCRIPTION DUAL BRIDGES OVER CROSS CREEK ON -L-

CONTENTS:

	SHEET
STRUCTURE TITLE SHEET	1
NC DEPARTMENT OF TRANSPORTATION, DIVISION OF HIGHWAYS, GEOTECHNICAL ENGINEERING UNIT, SOIL AND ROCK LEGEND, TERMS, SYMBOLS AND ABBREVIATIONS	2
GEOTECHNICAL REPORT	3-4
SITE LOCATION MAP AND TOPOGRAPHIC SITE MAP (DRAWING NOS. 1-2)	5
BORING LOCATION PLAN (DRAWING NO. 3)	6
PROFILE 18m LEFT OF -L- (DRAWING NOS. 4-6)	7-9
CROSS SECTION ALONG LEFT LANE END BENT 1 (DRAWING NO. 7)	10
CROSS SECTION ALONG LEFT LANE BENT 1 (DRAWING NO. 8)	11
CROSS SECTION ALONG LEFT LANE BENT 2 (DRAWING NO. 9)	12
CROSS SECTION ALONG LEFT LANE BENT 3 (DRAWING NO. 10)	13
CROSS SECTION ALONG LEFT LANE BENT 4 (DRAWING NO. 11)	14
CROSS SECTION ALONG LEFT LANE BENT 5 (DRAWING NO. 12)	15
CROSS SECTION ALONG LEFT LANE END BENT 2 (DRAWING NO. 13)	16
LEFT LANE BORING LOGS	17-23
LEFT LANE AASHTO/ASTM LABORATORY TEST RESULTS	24
LEFT LANE SCOUR REPORT	25
LEFT LANE GRAIN SIZE CURVES	26
LEFT LANE SITE PHOTOGRAPHS	27-29
BORING LOCATION PLAN (DRAWING NO. 14)	30
PROFILE 22m RIGHT OF -L- (DRAWING NOS. 15-17)	31-33
CROSS SECTION ALONG RIGHT LANE END BENT 1 (DRAWING NO. 18)	34
CROSS SECTION ALONG RIGHT LANE BENT 1 (DRAWING NO. 19)	35
CROSS SECTION ALONG RIGHT LANE BENT 2 (DRAWING NO. 20)	36
CROSS SECTION ALONG RIGHT LANE BENT 3 (DRAWING NO. 21)	37
CROSS SECTION ALONG RIGHT LANE BENT 4 (DRAWING NO. 22)	38
CROSS SECTION ALONG RIGHT LANE BENT 5 (DRAWING NO. 23)	39
CROSS SECTION ALONG RIGHT LANE END BENT 2 (DRAWING NO. 24)	40
RIGHT LANE BORING LOGS	41-50
RIGHT LANE AASHTO/ASTM LABORATORY TEST RESULTS	51-52
RIGHT LANE SCOUR REPORT	53
RIGHT LANE GRAIN SIZE CURVES	54-56
RIGHT LANE SITE PHOTOGRAPHS	57-59

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WAS 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 UNIT @ (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA IS 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.

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.

DRAWN BY: R. RAHIE

INVESTIGATED BY	MACTEC ENGINEERING & CONSULTING, INC.	PERSONNEL	S. LEHMAN
CHECKED BY	S. CRISCENZO		C. FRIDETTE
SUBMITTED BY	W. DEOBALD		B. DEOBALD
DATE	01/12/07		F. COX
REVISED	01/26/07		

Structure Design

NORTH CAROLINA LICENSED SEAL 1927 GEOLOGIST MICHAEL B. LEAR SEAL

MACTEC

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

SIGNATURE

PROJECT: 35196.3.18 ID: X-0002BC

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

ID	PROJECT NO.	SHEET NO.	TOTAL SHEETS
X-0002B	35196.1.3	2	59

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 30 cm 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	6 MX		N.P.	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

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 (kN/m^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<25
	SOFT	2 TO 4	25 TO 50
	MEDIUM STIFF	4 TO 8	50 TO 100
	STIFF	8 TO 15	100 TO 200
	VERY STIFF	15 TO 30	200 TO 400
	HARD	>30	>400

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)	- 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, 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
- CORE BORING
- BM — BENCH MARK
- 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 - CBR SAMPLE
- MARSH
- TREE LINE

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
LS. - LIMESTONE
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:
- [X] DIEDRICH D-50
- [ ] CME-550
- [X] CME-45 ON MARSH BUGGY
- [ ] CME-55 ON BARGE
- [ ] PORTABLE HOIST
- [ ] OTHER CME-55 TRAILOR
- [ ] OTHER

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [X] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [ ] TRICONE 7-9cm STEEL TEETH
- [ ] TRICONE ____ TUNG.-CARB.
- [ ] CORE BIT
- [X] OTHER SIDE-DISCHARGE WING BIT

HAMMER TYPE:
- [ ] AUTOMATIC [X] MANUAL

CORE SIZE:
- [ ] -B ____
- [ ] -N ____
- [ ] -H ____

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 2.5 cm PER 50 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 30 cm.
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 2.5 cm. 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 BLOWS PER 30 cm.*
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 BLOWS PER 30 cm.*
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 6 mm 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 1 mm DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 25 mm 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 CENTIMETERS 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 25 mm OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 3 m
WIDE	1 TO 3 m
MODERATELY CLOSE	30 TO 100 cm
CLOSE	5 TO 30 cm
VERY CLOSE	LESS THAN 5 cm

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 1 m
THICKLY BEDDED	0.5 - 1 m
THINLY BEDDED	0.05 - 0.5 m
VERY THINLY BEDDED	10 - 50 mm
THICKLY LAMINATED	2.5 - 10 mm
THINLY LAMINATED	< 2.5 mm

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 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 10 CENTIMETERS 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) OF A 63.5 kg HAMMER FALLING 0.76 METERS REQUIRED TO PRODUCE A PENETRATION OF 30 cm INTO SOIL WITH A 5 cm OUTSIDE DIAMETER SPLIT-SPOON SAMPLER. SPT REFUSAL IS LESS THAN 2.5 cm PENETRATION WITH 50 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 10 CENTIMETERS DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: T-3-5014 (STABLISHED BY NCDOT)
ELEV: 53.538m

NOTES:
Geotechnical Exploration
Performed By:

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

Subject: **Geotechnical Report**

Description: **Dual Bridges over Cross Creek on -L-**

Project Number:	**35196.1.3**
Tip Number:	**X-0002B**
F.A. Number:	**NHF-DPR-0100 (002)**
MACTEC Project Number:	**6468-06-1600**

Project Information

The purpose of this investigation was to obtain geotechnical information for design and construction of proposed dual bridges over Cross Creek located east of NC 210 (Murchison Road) and adjacent to Gigi Street, Cumberland County, North Carolina (Drawings 1 and 2). The bridges are part of a proposed segment of the Fayetteville Outer Loop from east of NC 24 (Bragg Blvd) to east of NC 87/210 (Murchison 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 November 21, 2006, 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 approximately 210 meters long. The left-lane structure is approximately 14 meters wide. The right-lane structure is approximately 18 meters wide. Each bridge is to be constructed on seven bents with six 35-meter long spans.

We were requested to drill up to three SPT-borings along each bent-line, for a maximum of 21 borings for the project. The initial plan was to drill 14 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 borings to the depth of 20 meters. Selected borings could be advanced to greater depth at NCDOT's direction.

Field Testing

During November and December, 2006, MACTEC advanced 17 borings (the 14 initial borings and 3 additional borings) at locations shown on the Boring Location Plans (Drawings 3 and 14). The borings were drilled with a CME-45 marsh buggy-mounted drill rig and a D-50 ATV-mounted drill rig. The borings were advanced using rotary-wash drilling techniques.

Five borings, selected by NCDOT, were advanced to a depth of approximately 24 meters. All other borings were terminated approximately at a depth of 20 meters. 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.

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. Traverse point T3-5014 (Elev. 53.538 meters), established at the project site by NCDOT, was used as a benchmark.

Laboratory Testing

Laboratory testing consisting of AASHTO classification and grain-size distribution tests were performed on split-barrel samples SS-1 through SS-10 and SS-12 through SS-30. Sample SS-11 did not contain sufficient quantity to complete 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 and ST-3, were taken in borings LL B1-A and LL B5-A. These samples were submitted to the NCDOT Geotechnical Engineering Unit on January 9, 2007 for testing at their discretion. Test results of undisturbed samples were not available at the time of this report.

Physiography

The ground surface along the approaches to the proposed bridges slopes downward gradually toward End Bents 1 and 2. There is approximately 6 to 8 meters of relief between the End Bents and the Cross Creek flood plain. Most of the elevation change occurs between the End Bents and the adjacent interior bents. End Bents 1 are at elevation 55± meters mean sea level (msl), End Bents 2 are at elevation 53± meters msl, and the flood plain is at elevation 47± meters msl.

Left-lane structure Bent 1 and Bents 5 for both right and left-lane structures are located on the slopes just above the flood plain. Left-lane structure Bents 2, 3 and 4, and right-lane structure Bents 1, 2, 3 and 4 were under up to 1 meter of water during our field investigation.

The site is mostly undeveloped and wooded. There is a small soil-berm built along the top of the slope between End Bents 1 and Bents 1. Cross Creek does not appear to have a well-defined main channel. The water surface elevation of Cross Creek was measured at 47.98 meters msl on December 21, 2006. 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 Cape Fear Formation. Without additional evidence to accurately identify the origin of all soils encountered at the project site, we grouped some of the upland surficial-soils together and assigned their origin as Coastal Plain Undivided. We encountered the following stratigraphic units at the project site:

- Alluvium
- Coastal Plain Undivided
- 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 15, 16, 17, depict subsurface conditions along the length of both structures. Generalized cross-sections, Drawings 7 to 13 and 18 to 24 depict subsurface conditions along each bent of both structures.

Soil

Alluvium was encountered in borings located in the Cross Creek flood plain from approximately Bents 1 to Bents 5. The soils consist of interlayered very soft to soft muck, silt, and sandy clay (A-4/A-6) and very loose to medium dense, silty, fine to coarse sand (A-1-b/A-3/A-2-4). Alluvial soils overlie the Cape Fear Formation at approximate elevations ranging from 41 to 48± meters msl.

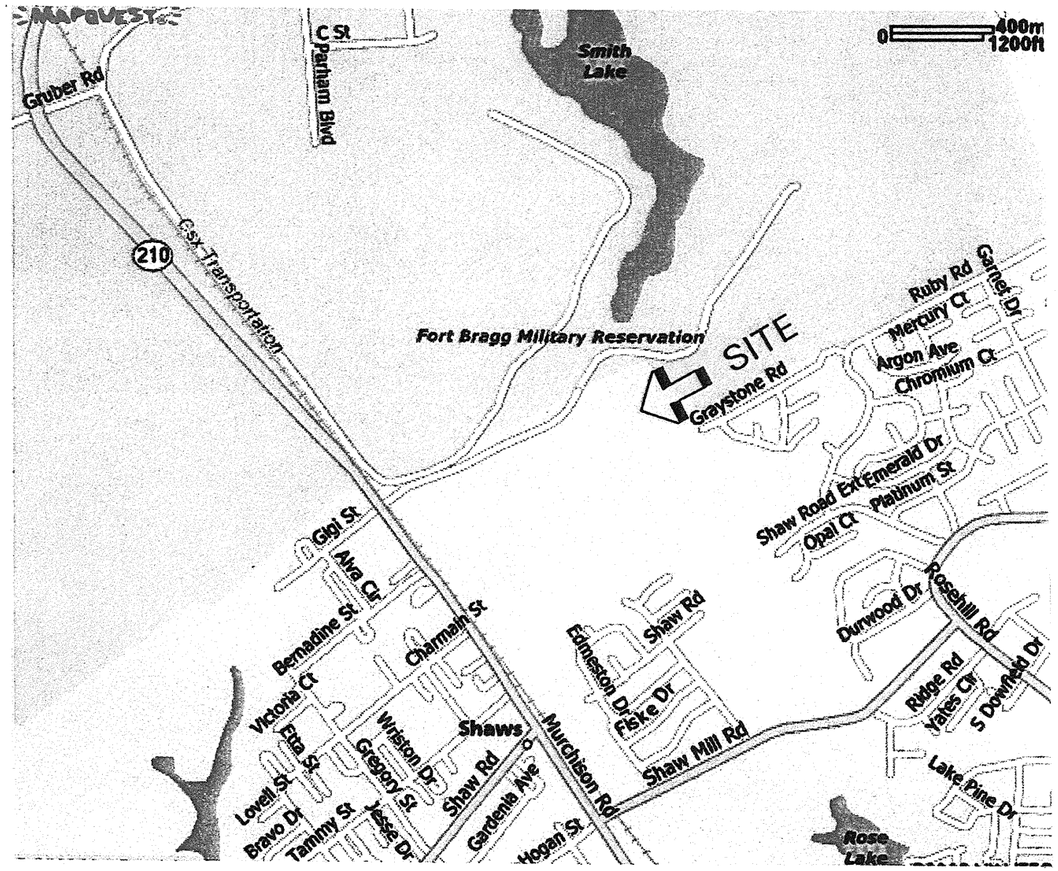
Coastal Plain Undivided soils were encountered at elevations above the Cross Creek flood plain at the End Bents. The soils consist of loose to medium dense, silty, clayey, fine to coarse sand (A-1-b/A-2-4/A-2-6) and stiff, sandy clay (A-7-6). The soils extend from the surface to elevation 49± meters msl and overlie the Cape Fear Formation.

The Cape Fear Formation generally consists of interbedded clays and sands. The clay is typically gray in color with thin red zones, may contain mica, and beds are generally discontinuous and range in thickness from a few centimeters to 2± meters. The sand is typically gray-green in color, fine to coarse-grained, with gravel common along with coarse sand, and beds vary greatly in thickness. Overall, the sands are very clayey.

The soils we encountered across the entire site and identified as the Cape Fear Formation generally match this description. The top of the formation is at approximately elevation 49± meters msl at the End Bents, and at approximately 41± meters msl near the middle of the Cross Creek drainage. The soils mostly consist of medium to very dense, silty, clayey sand (A-2-4/A-2-5/A-2-6/A-2-7), with laterally discontinuous silt and clay interbeds. The interbeds generally consist of medium stiff to hard, sandy silt or sandy, silty clay (A-4/A-6/A-7-5/A-7-6). A clay interbed ranging in thickness from 1 to 5± meters extends along the length of the left-lane structure at elevation 43± meters msl, and a 1.5± meter-thick clay interbed extends along the length of the right-lane structure at elevation 36± meters msl. However, neither interbed is laterally continuous across both structures. Other less prominent silt and clay interbeds occur within the clayey sands of the formation.

Groundwater

24-hour groundwater level measurements were obtained in borings at End Bents 1, End Bents 2 and Bents 5. Groundwater level elevations ranged from 52 to 53± meters msl at both End Bents, and 48± meters at Bents 5.



REFERENCE: 2007 MAPQUEST

GRAPHIC SCALE FEET

2000 1000 0 2000 4000

QUADRANGLE LOCATION

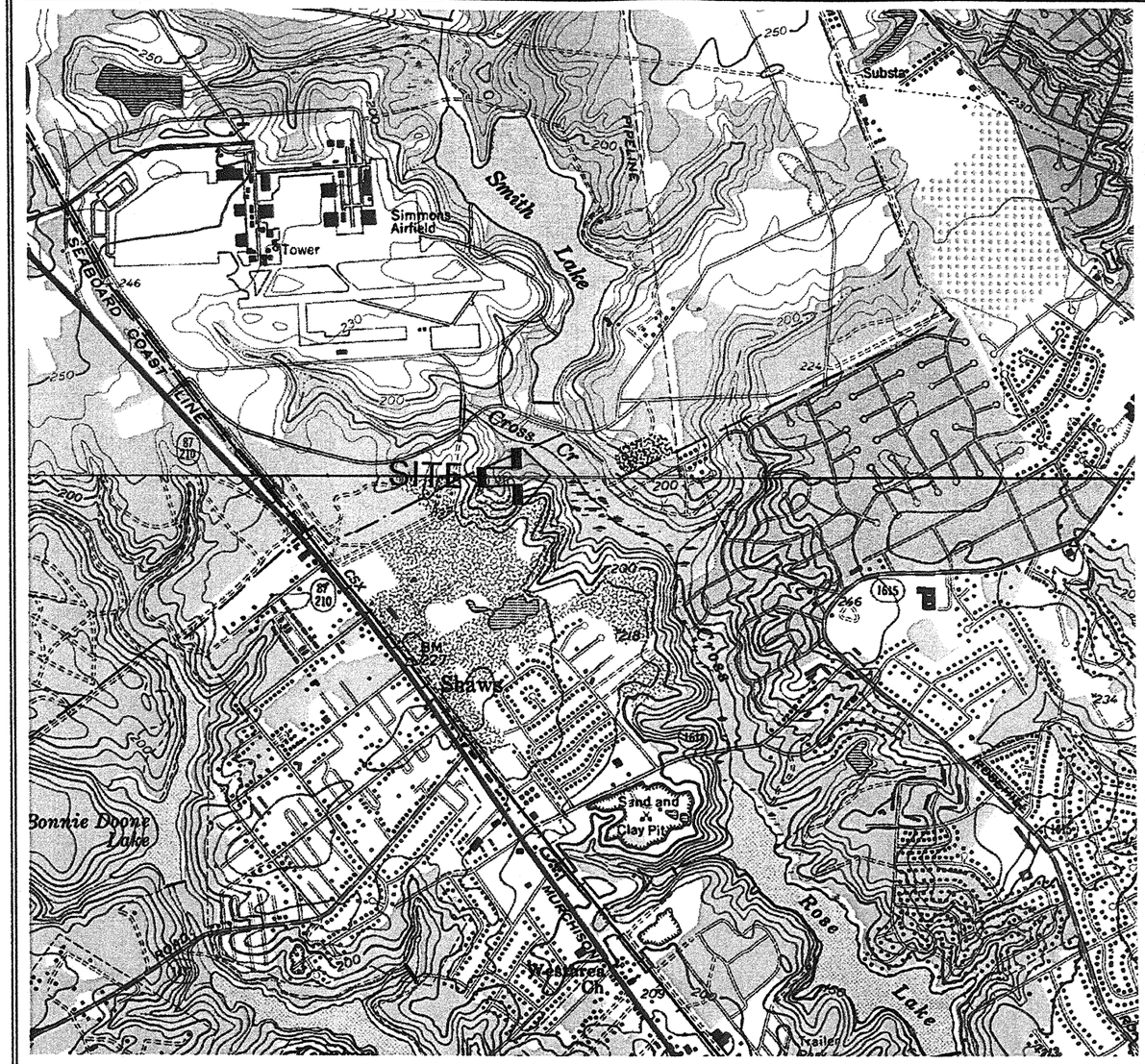
NOTE: SITE LOCATION IS APPROXIMATE

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

SITE LOCATION MAP
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJ. NO. 35196.1.3 (X-0002B)
CUMBERLAND COUNTY, NORTH CAROLINA

DRAWN: R. R.	DATE: JANUARY 2007	DRAWING
ENG CHECK: WBO	SCALE: 1 : 24000	1
APPROVAL: NBR	JOB: 6468-06-1600	



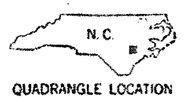
FAYETTEVILLE, N.C.
SW/4 FAYETTEVILLE 15' QUADRANGLE
35078-A8-TF-024
1957
PHOTOREVISED 1987
DMA 5254 III SW – SERIES V842

MANCHESTER, N.C.
NW/4 FAYETTEVILLE 15' QUADRANGLE
35078-B8-TF-024
1957
PHOTOREVISED 1987
DMA 5254 III NW – SERIES V842

CONTOUR INTERVALS 10 FEET

GRAPHIC SCALE FEET

2000 1000 0 2000 4000



QUADRANGLE LOCATION

NOTE: SITE LOCATION IS APPROXIMATE

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

TOPOGRAPHIC SITE MAP
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJ. NO. 35196.1.3 (X-0002B)
CUMBERLAND COUNTY, NORTH CAROLINA

DRAWN: R. R.	DATE: JANUARY 2007	DRAWING
ENG CHECK: WBO	SCALE: 1 : 24000	2
APPROVAL: NBR	JOB: 6468-06-1600	

SHEET: 6 OF 59

WOODS

WOODS

WOODS

WOODS

WOODS

EXCAVATED AREA

T3-5014
ELEV=53.538

N 64° 56' 54.8" E

-L-

76+00

77+00

78+00

79+00

LL EB1-A

LL B1-A

LL B2-A

LL B3-A

LL B4-A

LL B5-A

LL EB2-A

RL EB1-B

RL B1-B

RL B2-A

RL B2-B

RL B3-A

RL B3-B

RL B4-A

RL B4-B

RL B5-B

RL EB2-B

3.0 SOIL

1200

SKEW=90°

0 10 20 40

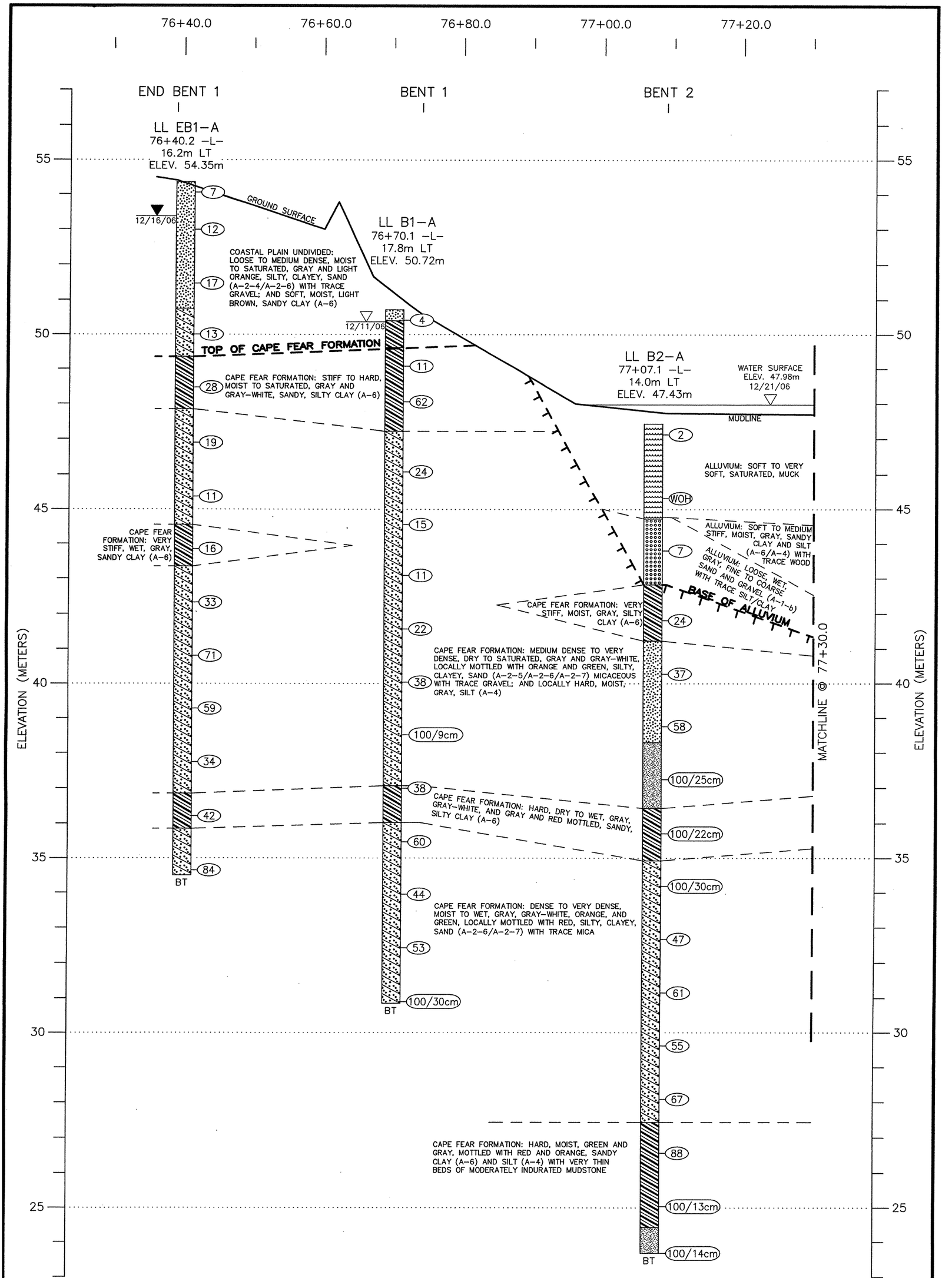
HORIZONTAL SCALE (METER)
1:1000

NAD 83

BORING LOCATION PLAN
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING & CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB : 6468-06-1600
	ENG CHECK: S.J.C.	DWG: 3

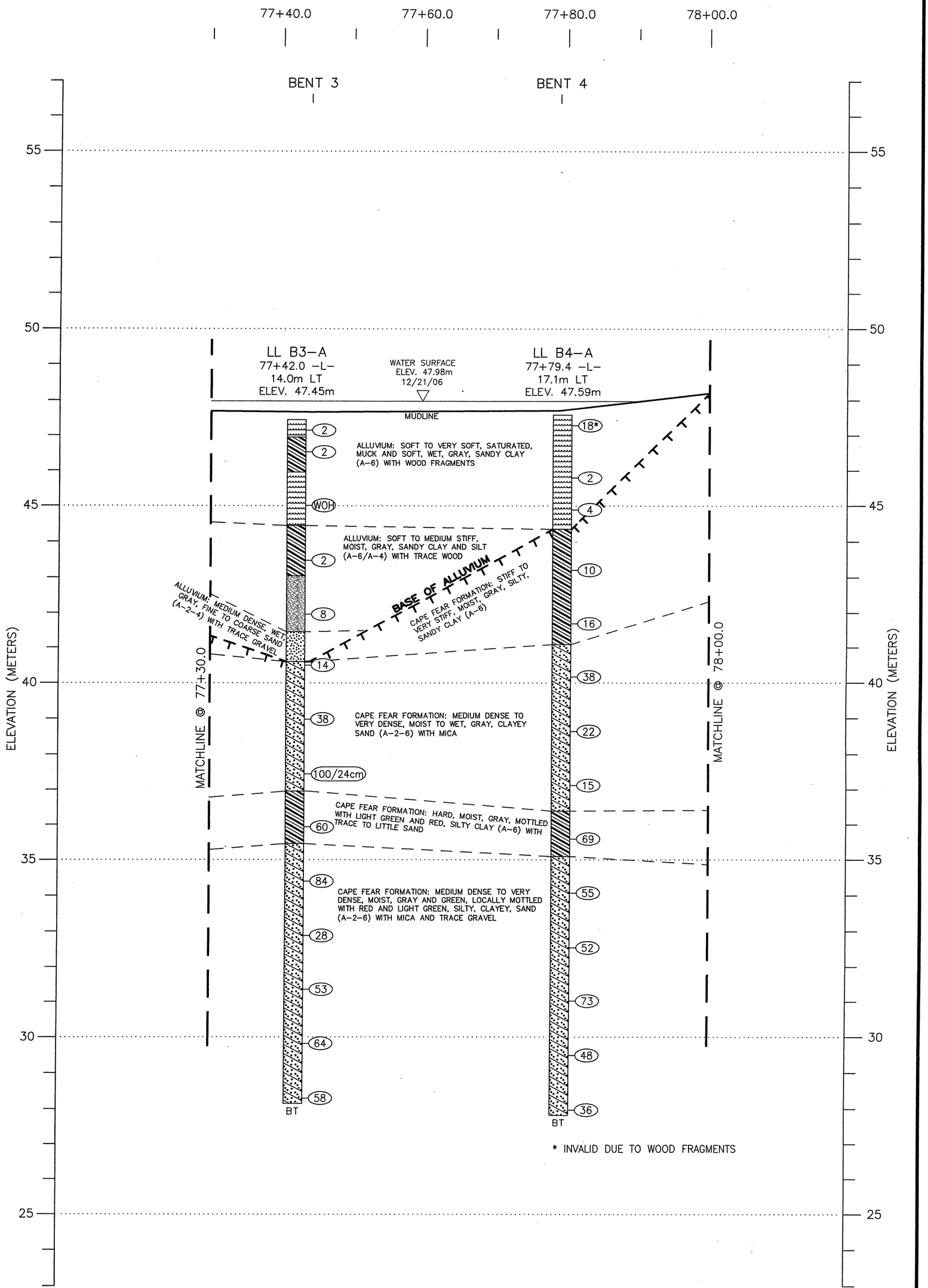


PROFILE 18m LEFT OF -L-
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 4

SHEET: 7 OF 59



0 1 2 4
VERTICAL SCALE (METERS)
1:100

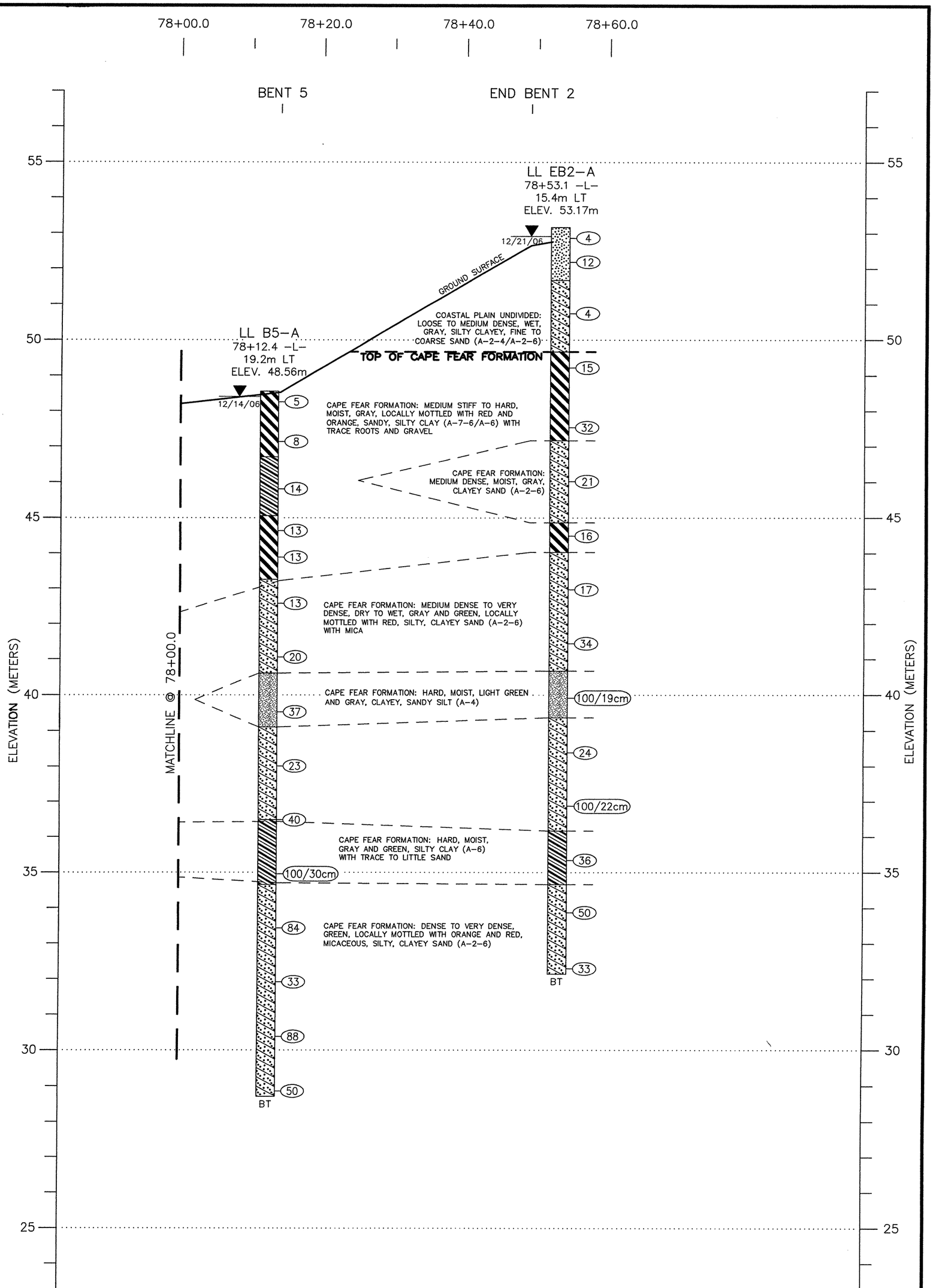
0 5 10 20
HORIZONTAL SCALE (METERS)
1:500

PROFILE 18m LEFT OF –L–
DUAL BRIDGES OVER CROSS CREEK ON –L–
NCDOT PROJECT NO. 35196.1.3 (X–0002B)
F.A. No. NHF–DPR–0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468–06–1600
	ENG CHECK: W.B.D.	DWG: 5

SHEET: 8 OF 59



0 1 2 4
VERTICAL SCALE (METERS)
1:100

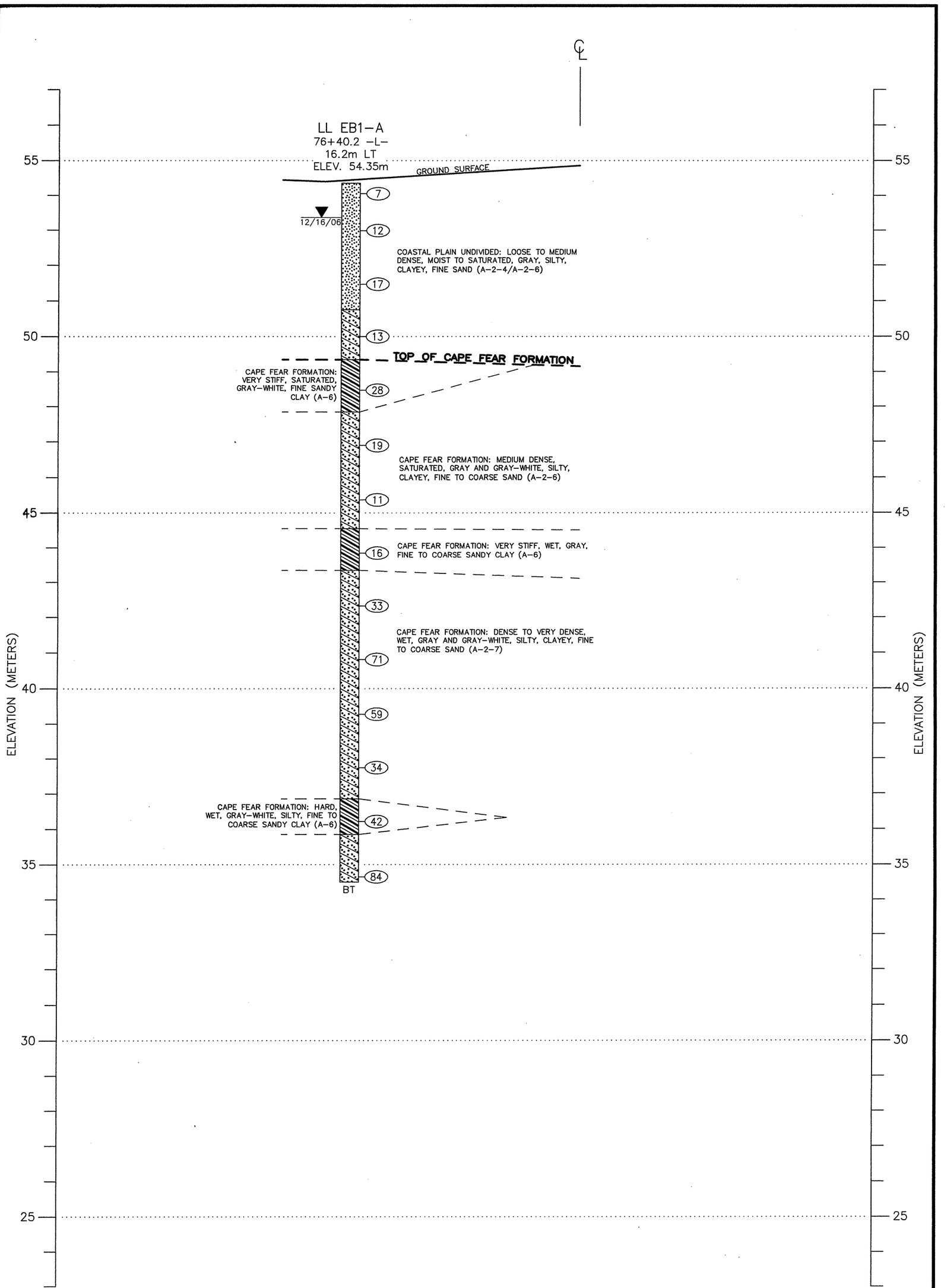
0 5 10 20
HORIZONTAL SCALE (METERS)
1:500

PROFILE 18m LEFT OF -L-
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 6

SHEET: 9 OF 59



0 1 2 4
VERTICAL SCALE (METERS)
1:100

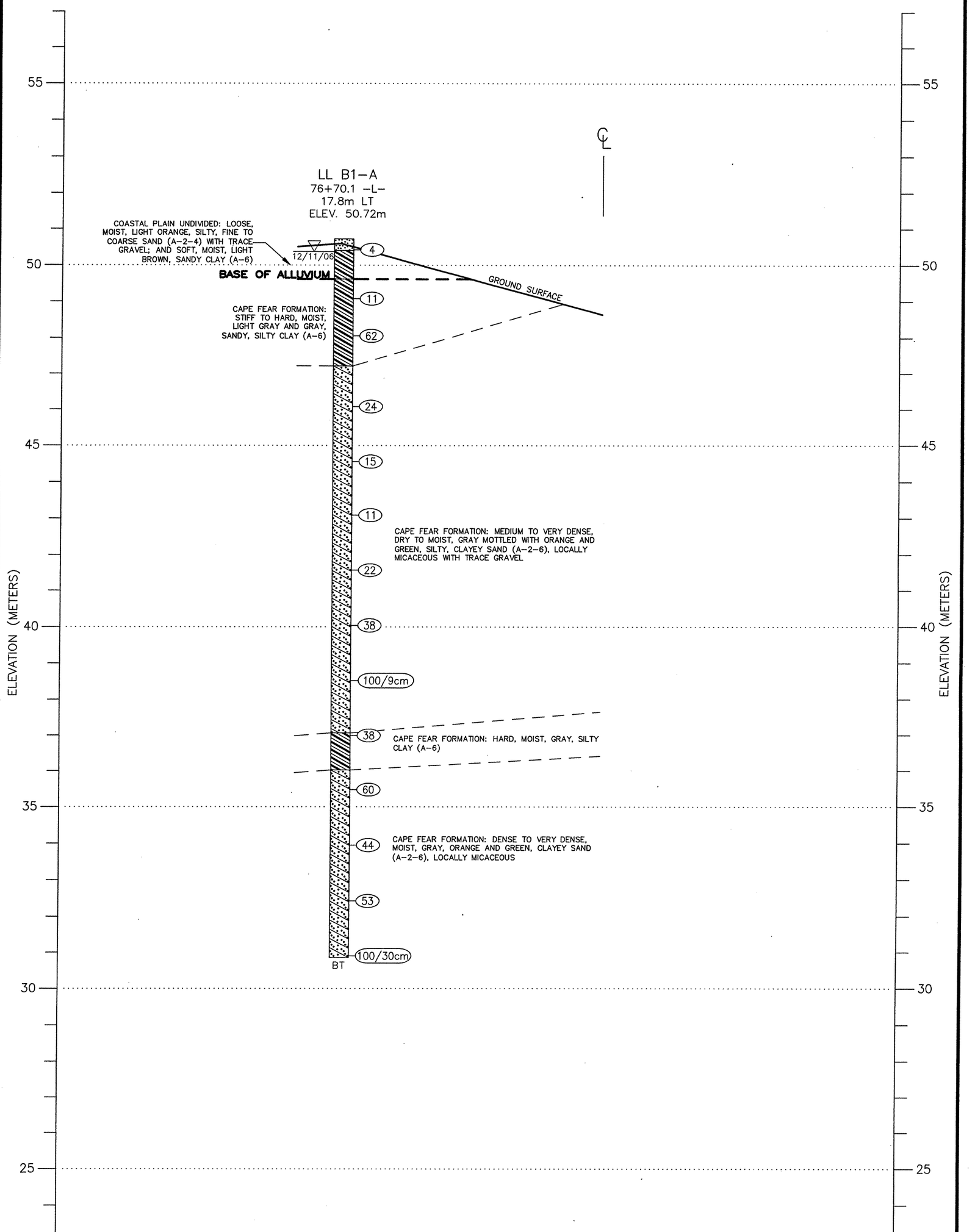
0 2.5 5 10
HORIZONTAL SCALE (METERS)
1:250

CROSS SECTION ALONG LEFT LANE END BENT 1
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 7

SHEET: 10 OF 56



0 1 2 4
VERTICAL SCALE (METERS)
1:100

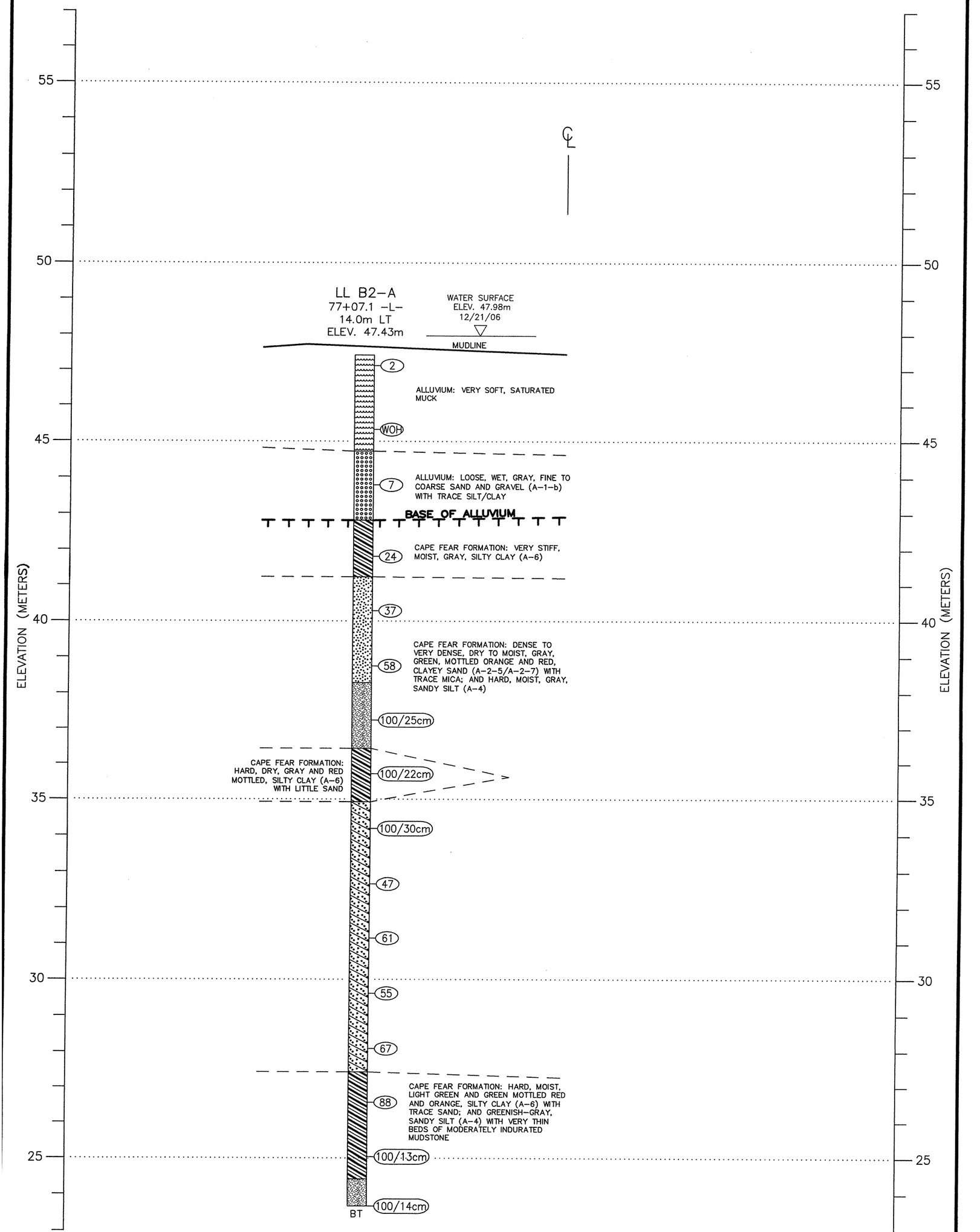
0 2.5 5 10
HORIZONTAL SCALE (METERS)
1:250

CROSS SECTION ALONG LEFT LANE BENT 1
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 8

SHEET: 11 OF 59



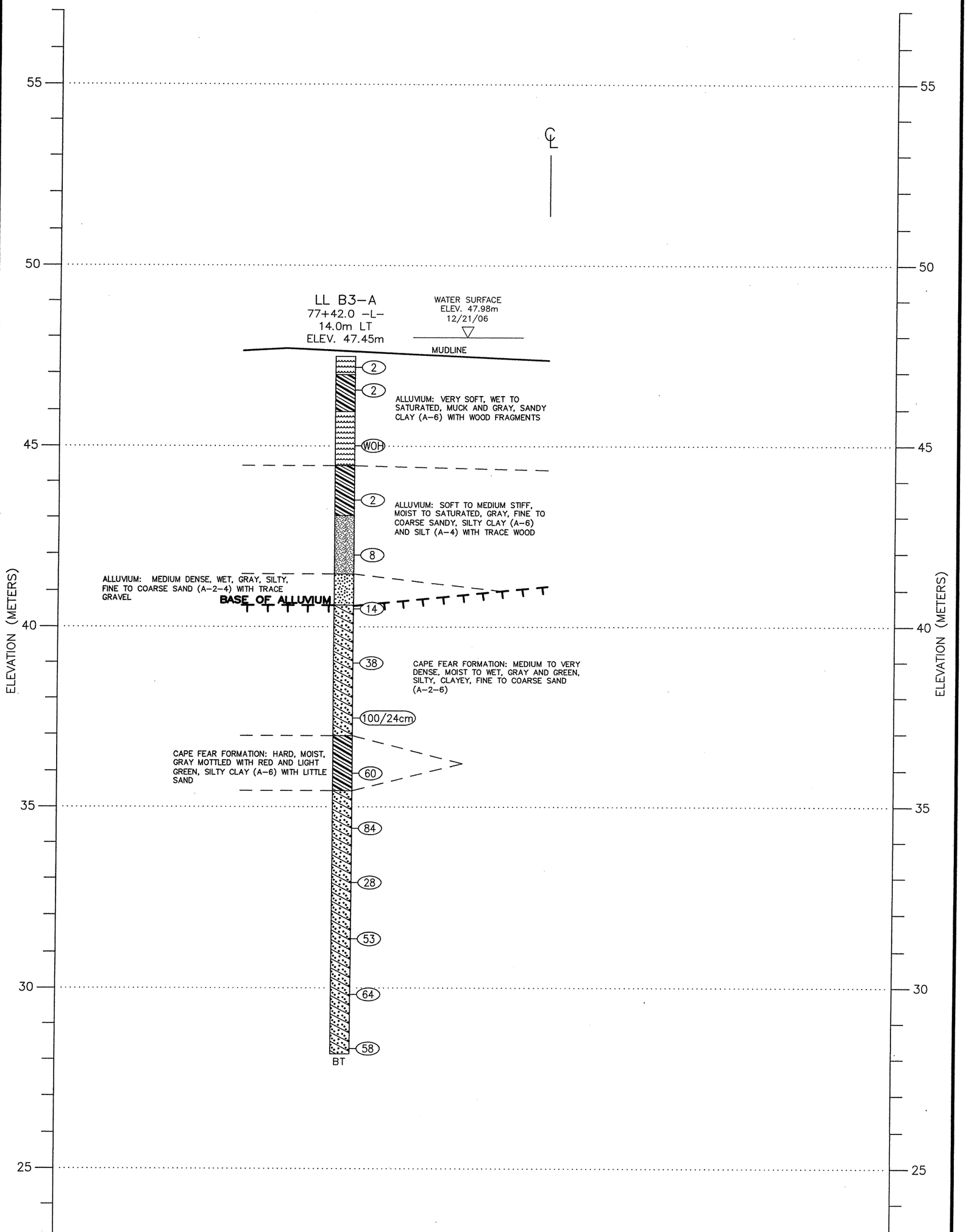
0 1 2 4
VERTICAL SCALE (METERS)
1:100

0 2.5 5 10
HORIZONTAL SCALE (METERS)
1:250

CROSS SECTION ALONG LEFT LANE BENT 2
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 9



0 1 2 4
VERTICAL SCALE (METERS)
1:100

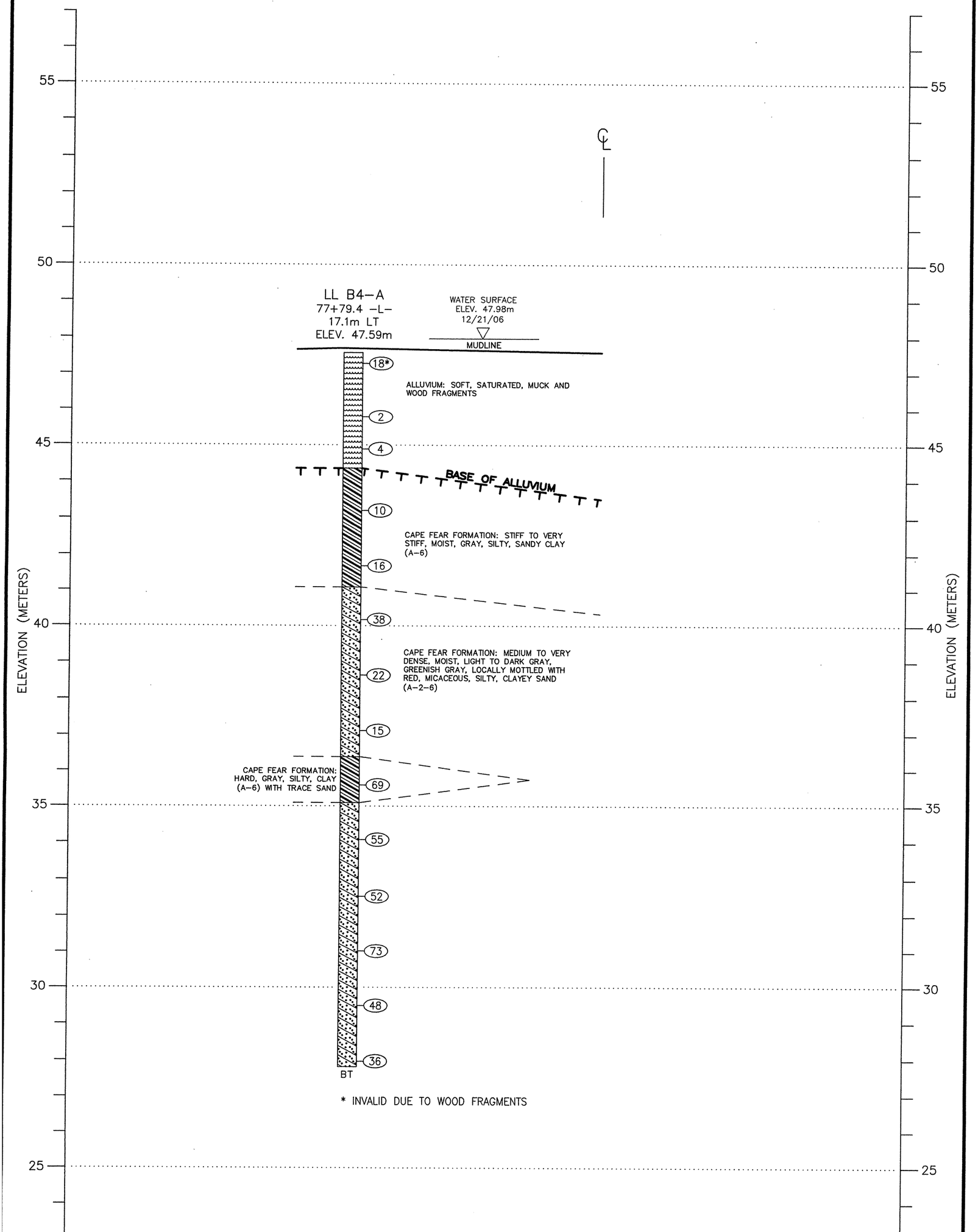
0 2.5 5 10
HORIZONTAL SCALE (METERS)
1:250

CROSS SECTION ALONG LEFT LANE BENT 3
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 10

SHEET: 13 OF 59



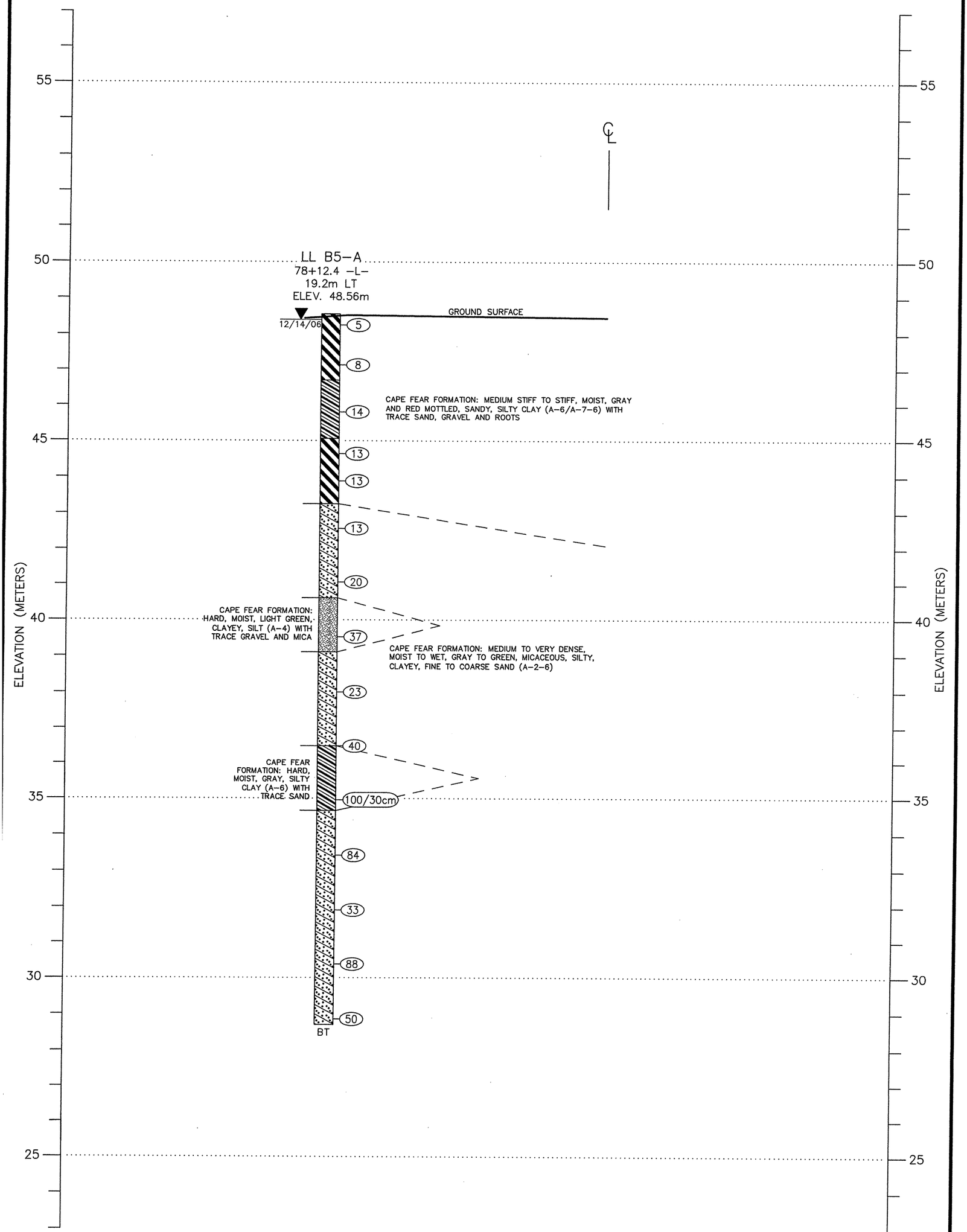
0 1 2 4
VERTICAL SCALE (METERS)
1:100

0 2.5 5 10
HORIZONTAL SCALE (METERS)
1:250

CROSS SECTION ALONG LEFT LANE BENT 4
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

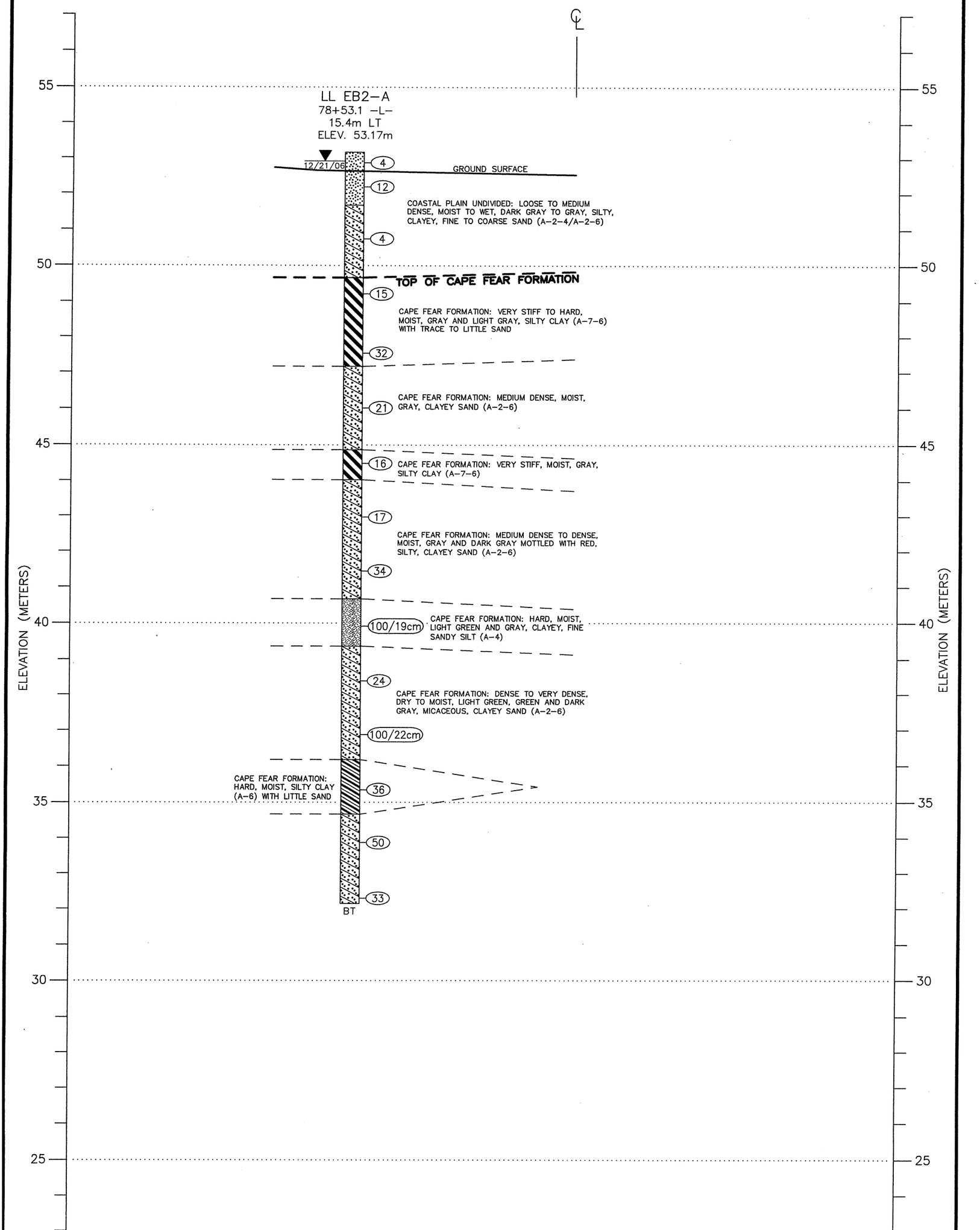
REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 11



CROSS SECTION ALONG LEFT LANE BENT 5
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 12



0 1 2 4
VERTICAL SCALE (METERS)
1:100

0 2.5 5 10
HORIZONTAL SCALE (METERS)
1:250

CROSS SECTION ALONG LEFT LANE END BENT 2
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 13

SHEET: 16 OF 59

MACTEC

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** C. Fridette
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL EB1-A	**BORING LOCATION** 76+40.2	**OFFSET** 16.2 m LT	**ALIGNMENT** -L-	**0 HR.** ND
COLLAR ELEV. 54.35 m	**NORTHING** 152,528.1 m	**EASTING** 616,315.0 m		**24 HR.** 0.98
TOTAL DEPTH 19.85 m	**DRILL MACHINE** D-50 ATV	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/14/06	**COMPLETED** 12/15/06	**SURFACE WATER DEPTH (m)** NA		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
54.35					Ground Surface				
54.35	0.00	3	3	4	7		W		Coastal Plain Undivided: Gray, clayey, silty, fine SAND (A-2-4)
53.29	1.06	5	5	7	12		M		
51.77	2.58	8	10	7	17		Sat.		
50.30	4.05	4	6	7	13		Sat.		50.75 — 3.60 — Coastal Plain Undivided: Gray, silty, clayey, fine SAND (A-2-6)
48.77	5.58	8	12	16	28		Sat.		49.35 — 5.00 — Cape Fear Fm: Gray-white, fine sandy CLAY (A-6) Shelby tube pushed from 5.49m to 6.10m. No recovery, tube twisted off in hole and could not be retrieved. Pushed in offset boring
47.20	7.15	6	9	10	19		Sat.		47.85 — 6.50 — Cape Fear Fm: Gray and gray-white, silty, clayey, fine to coarse SAND (A-2-6)
45.67	8.68	4	5	6	11		Sat.		
44.15	10.20	4	7	9	16		W		44.55 — 9.80 — Cape Fear Fm: Gray, fine to coarse sandy, CLAY (A-6)
42.62	11.73	14	16	17	33		W		43.35 — 11.00 — Cape Fear Fm: Gray, silty, clayey, fine to coarse SAND (A-2-7)
41.11	13.24	13	26	45	71		W		
39.58	14.77	18	26	33	59		W		
38.04	16.31	12	18	16	34		W		
36.51	17.84	11	20	22	42		W		36.85 — 17.50 — Cape Fear Fm: Gray-white, silty, fine to coarse sandy, CLAY (A-6)
									35.85 — 18.50

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

MACTEC

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 17 OF 59

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** C. Fridette
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL EB1-A	**BORING LOCATION** 76+40.2	**OFFSET** 16.2 m LT	**ALIGNMENT** -L-	**0 HR.** ND
COLLAR ELEV. 54.35 m	**NORTHING** 152,528.1 m	**EASTING** 616,315.0 m		**24 HR.** 0.98
TOTAL DEPTH 19.85 m	**DRILL MACHINE** D-50 ATV	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/14/06	**COMPLETED** 12/15/06	**SURFACE WATER DEPTH (m)** NA		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
35.35					Continued from previous page				
34.95	19.40	20	35	49	84		W		Cape Fear Fm: Gray-white, silty, clayey, fine to coarse SAND (A-2-6) *(continued)*
									34.50 — 19.85 — Boring terminated at 19.85m (Elev. 34.50m) in Cape Fear Fm: Very dense, silty, clayey, fine to coarse SAND (A-2-6)

Bits Used: 7.0cm Side Discharge Finger Bit

Drilling Fluid Properties: ND

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL B1-A	**BORING LOCATION** 76+70.1	**OFFSET** 17.8 m LT	**ALIGNMENT** -L-	**0 HR.** 0.35
COLLAR ELEV. 50.72 m	**NORTHING** 152,542.2 m	**EASTING** 616,341.5 m		**24 HR.** ND
TOTAL DEPTH 19.87 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/11/06	**COMPLETED** 12/11/06	**SURFACE WATER DEPTH (m)** NA		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
50.72					Ground Surface				
50.72	0.00	2	2	2	4		W		0.00
50.40	0.32								Coastal Plain Undivided: Light orange, silty, fine to coarse SAND (A-2-4) with trace gravel
49.62	1.10								Coastal Plain Undivided: Light brown, sandy, CLAY (A-6)
49.38	1.34	3	4	7	11		M		Cape Fear Fm: Light gray and gray, sandy, silty, CLAY (A-6)
48.36	2.36	12	24	38	62		M		Pushed shelby tube from 1.80m to 2.41m, Recovery=0.56m (92%)
47.22	3.50								Cape Fear Fm: Gray and gray mottled with orange and green, silty, clayey, SAND (A-2-6) locally micaceous and trace gravel
46.38	4.34	6	10	14	24		M		
44.86	5.86	4	7	8	15		M		
43.39	7.33	8	5	6	11		M		
41.87	8.85	5	10	12	22		M		
40.34	10.38	8	14	24	38		M		
38.82	11.90	57	100/9cm		100/9cm		D		
37.29	13.43	14	18	20	38		M		
37.06	13.66								Cape Fear Fm: Gray, silty, CLAY (A-6)
36.02	14.70								Cape Fear Fm: Gray, orange and green, clayey SAND (A-2-6) locally with mica
35.77	14.95	12	26	34	60		M		
34.25	16.47	15	20	24	44		M		
32.72	18.00	14	25	28	53		M		

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 18 OF 59

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL B1-A	**BORING LOCATION** 76+70.1	**OFFSET** 17.8 m LT	**ALIGNMENT** -L-	**0 HR.** 0.35
COLLAR ELEV. 50.72 m	**NORTHING** 152,542.2 m	**EASTING** 616,341.5 m		**24 HR.** ND
TOTAL DEPTH 19.87 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/11/06	**COMPLETED** 12/11/06	**SURFACE WATER DEPTH (m)** NA		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
31.72					Continued from previous page				
31.20	19.52	19	42	58	100/30cm		M		Cape Fear Fm: Gray, orange and green, clayey SAND (A-2-6) locally with mica *(continued)*
30.85	19.87								Boring terminated at 19.87m (Elev. 30.85m) in Cape Fear Fm: Very dense, clayey, SAND (A-2-6)

Bits Used: 10.0cm & 7.3cm Side Discharge Wing Bit

Drilling Fluid Properties: 1.4 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

MACTEC

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL B2-A	**BORING LOCATION** 77+07.1	**OFFSET** 14.0 m LT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.43 m	**NORTHING** 152,554.4 m	**EASTING** 616,376.6 m		**24 HR.** Boring
TOTAL DEPTH 23.75 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/5/06	**COMPLETED** 12/6/06	**SURFACE WATER DEPTH (m)** 0.94		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
47.43									
47.43	0.00	1	1	1	2		Sat.		Mudline Alluvium: MUCK
45.62	1.81	WOH	WOH	WOH	WOH 0	SS-11	Sat.		SS-11 testing not completed due to insufficient sample quantity.
44.10	3.33	6	4	3	7	SS-12	W		44.73 — 2.70 Alluvium: Gray, fine to coarse SAND and GRAVEL (A-1-b) with trace silt/clay
42.11	5.32	6	10	14	24		M		42.83 — 4.60 Cape Fear Fm: Gray, silty, CLAY (A-6)
40.58	6.85	14	18	19	37	SS-13	M		41.23 — 6.20 Cape Fear Fm: Gray with orange Fe stained zones, clayey, SAND (A-2-5) with trace gravel
39.06	8.37	14	22	36	58		M		
37.54	9.89	35	52	48/10cm	100/25cm	SS-14	14.3%		38.30 — 9.13 Cape Fear Fm: Gray, sandy SILT (A-4)
36.01	11.42	23	50	50/7cm	100/22cm		D		36.43 — 11.00 Cape Fear Fm: Gray and red mottled, silty, CLAY (A-6) with little sand
34.49	12.94	30	37	63	100/30cm	SS-15	M		34.93 — 12.50 Cape Fear Fm: Gray, greenish gray, light green, green, and dark gray, locally mottled with red, clayey, SAND (A-2-7) with trace mica
32.97	14.46	15	25	22	47		M		
31.45	15.98	15	28	33	61	SS-16	M		
29.92	17.51	16	27	28	55		M		
28.39	19.04								

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

MACTEC

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL B2-A	**BORING LOCATION** 77+07.1	**OFFSET** 14.0 m LT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.43 m	**NORTHING** 152,554.4 m	**EASTING** 616,376.6 m		**24 HR.** Boring
TOTAL DEPTH 23.75 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/5/06	**COMPLETED** 12/6/06	**SURFACE WATER DEPTH (m)** 0.94		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
28.43					Continued from previous page				
26.87	20.56	21	32	35	67		M		Cape Fear Fm: Gray, greenish gray, light green, green, and dark gray, locally mottled with red, clayey, SAND (A-2-7) with trace mica *(continued)* — 20.00
25.34	22.09	24	35	53	88		M		27.43 — Cape Fear Fm: Light green and green mottled with red and orange, silty, CLAY (A-6) with trace sand
23.82	23.61	28	100/13cm		100/13cm	SS-17	18.8%		24.43 — 23.00 Cape Fear Fm: Greenish gray, sandy, SILT (A-4) with very thin beds of moderately indurated mudstone
		100/14cm			100/14cm		M		23.68 — 23.75 Boring terminated at 23.75m (Elev. 23.68m) in Cape Fear Fm: Hard, sandy, SILT (A-4) with very thinly bedded, moderately indurated, mudstone

Bits Used: 7.3cm Side Discharge Wing Bit

Drilling Fluid Properties: 1.03 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL B3-A	**BORING LOCATION** 77+42.0	**OFFSET** 14.0 m LT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.45 m	**NORTHING** 152,569.2 m	**EASTING** 616,408.2 m		**24 HR.** Boring
TOTAL DEPTH 19.30 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/5/06	**COMPLETED** 12/5/06	**SURFACE WATER DEPTH (m)** 0.80		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
47.45					Mudline				
47.45	0.00	1	1	1	2		Sat.		Alluvium: MUCK with wood fragments
46.95	0.50								
46.83	0.62	1	1	1	2		W		Alluvium: Gray, sandy, CLAY (A-6) with wood fragments
45.95	1.50								
45.31	2.14	WOH	WOH	WOH	WOH 0		Sat.		Alluvium: MUCK
44.45	3.00								
43.78	3.67	3	1	1	2	SS-18	M		Alluvium: Gray, fine to coarse sandy, silty, CLAY (A-6) with trace wood
43.05	4.40								
42.26	5.19	3	5	3	8	SS-19	23.9%		Alluvium: Gray, fine to coarse sandy, SILT (A-4)
41.45	6.00								
40.80	6.65	5	7	7	14		W		Alluvium: Gray, silty, fine to coarse SAND (A-2-4) with trace gravel
40.60	6.85								
39.28	8.17	10	15	23	38		M		Cape Fear Fm: Gray, clayey, fine to coarse SAND (A-2-6)
37.75	9.70	13	59	41/9cm	100/24cm		W		
36.95	10.50								
36.23	11.22	20	23	37	60		M		Cape Fear Fm: Gray, mottled red and light green, silty CLAY (A-6) with little sand
35.45	12.00								
34.70	12.75	22	30	54	84		M		Cape Fear Fm: Gray, green, and greenish gray, silty, clayey, fine to coarse SAND (A-2-6)
33.18	14.27	11	13	15	28		M		
31.65	15.80	18	23	30	53		M		
30.12	17.33	15	31	33	64		M		
28.60	18.85								

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 20 OF 59

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL B3-A	**BORING LOCATION** 77+42.0	**OFFSET** 14.0 m LT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.45 m	**NORTHING** 152,569.2 m	**EASTING** 616,408.2 m		**24 HR.** Boring
TOTAL DEPTH 19.30 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/5/06	**COMPLETED** 12/5/06	**SURFACE WATER DEPTH (m)** 0.80		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
28.45					Continued from previous page				
		18	25	33	58		M		
28.15	19.30								Boring terminated at 19.30m (Elev. 28.15m) in Cape Fear Fm: Very dense, clayey, SAND (A-2-6)

Bits Used: 7.3cm Side Discharge Wing Bit

Drilling Fluid Properties: 1.03 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL B4-A	**BORING LOCATION** 77+79.4	**OFFSET** 17.1 m LT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.59 m	**NORTHING** 152,587.9 m	**EASTING** 616,440.8 m		**24 HR.** Boring
TOTAL DEPTH 19.77 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/4/06	**COMPLETED** 12/4/06	**SURFACE WATER DEPTH (m)** 0.58		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
47.59									Mudline
47.59	0.00	2	14	4	18				Invalid due to wood fragments
									Alluvium: MUCK and wood fragments
46.09	1.50	2	1	1	2		Sat.		
45.19	2.40	2	2	2	4				
44.35	3.24								Cape Fear Fm: Gray, silty, sandy, CLAY (A-6)
43.51	4.08	2	4	6	10		M		
41.99	5.60	6	7	9	16		M		
41.09	6.50								Cape Fear Fm: Gray and light gray, clayey, SAND (A-2-6) with mica
40.47	7.12	8	15	23	38		M		
38.94	8.65	11	11	11	22		M		
37.42	10.17	6	6	9	15		M		
36.39	11.20								Cape Fear Fm: Gray mottled with light green and red, silty, CLAY (A-6) with trace sand
35.89	11.70	16	30	39	69		M		
35.09	12.50								Cape Fear Fm: Gray, dark gray, and greenish gray, locally mottled with red and light green, silty, clayey, SAND (A-2-6) with mica and trace gravel
34.37	13.22	20	21	34	55		M		
32.84	14.75	15	22	30	52		M		
31.32	16.27	15	31	42	73		M		
29.79	17.80	19	23	25	48		M		

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 21 OF 59

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL B4-A	**BORING LOCATION** 77+79.4	**OFFSET** 17.1 m LT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.59 m	**NORTHING** 152,587.9 m	**EASTING** 616,440.8 m		**24 HR.** Boring
TOTAL DEPTH 19.77 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/4/06	**COMPLETED** 12/4/06	**SURFACE WATER DEPTH (m)** 0.58		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
28.59									Continued from previous page
28.27	19.32	22	18	18	36		M		
27.82	19.77								Boring terminated at 19.77m (Elev. 27.82m) in Cape Fear Fm: Dense, clayey, SAND (A-2-6) with trace gravel

Bits Used: 7.3cm Side Discharge Wing Bit

Drilling Fluid Properties: 1.03 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

MACTEC

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL B5-A	**BORING LOCATION** 78+12.4	**OFFSET** 19.2 m LT	**ALIGNMENT** -L-	**0 HR.** 0.00
COLLAR ELEV. 48.56 m	**NORTHING** 152,603.7 m	**EASTING** 616,469.8 m		**24 HR.** 0.15
TOTAL DEPTH 19.85 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/13/06	**COMPLETED** 12/13/06	**SURFACE WATER DEPTH (m)** NA		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
48.56					Ground Surface				
48.56	0.00	1	2	3	5		M		Cape Fear Fm: Light gray, mottled with orange, silty CLAY (A-7-6) with trace roots and sand
47.44	1.12	4	3	5	8		M		Shelby tube pushed from 1.66m to 2.27m, Recovery=0.19m (31%)
46.71	1.85								Cape Fear Fm: Gray, sandy, CLAY (A-6) with trace gravel
46.11	2.45	4	7	7	14		M		Shelby tube pushed from 3.01m to 3.61m, Recovery=0.53m (88%)
45.06	3.50								Cape Fear Fm: Gray and red mottled, silty, CLAY (A-7-6)
44.94	3.62	3	5	8	13		M		
44.19	4.37	4	6	7	13		M		
43.26	5.30								Cape Fear Fm: Gray and greenish gray, clayey, SAND (A-2-6) with mica
42.88	5.68	5	6	7	13		M		
41.36	7.20	7	9	11	20		M		
40.61	7.95								Cape Fear Fm: Light green, clayey, SILT (A-4) with trace fine sand and mica
39.83	8.73	10	14	23	37		M		
39.11	9.45								Cape Fear Fm: Light green and gray, silty, clayey, fine to coarse SAND (A-2-6) with mica
38.31	10.25	8	11	12	23		M		
36.78	11.78	16	16	24	40		W		
36.48	12.08								Cape Fear Fm: Dark gray and gray, silty, CLAY (A-6) with trace fine sand
35.26	13.30	19	40	60	100/30cm		M		
34.66	13.90								Cape Fear Fm: Light green and green, locally mottled with orange and red, silty, clayey, SAND (A-2-6) with mica
33.73	14.83	17	41	43	84		M		
32.21	16.35	9	15	18	33		M		
30.68	17.88	17	36	52	88		M		

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 22 OF 59

MACTEC

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL B5-A	**BORING LOCATION** 78+12.4	**OFFSET** 19.2 m LT	**ALIGNMENT** -L-	**0 HR.** 0.00
COLLAR ELEV. 48.56 m	**NORTHING** 152,603.7 m	**EASTING** 616,469.8 m		**24 HR.** 0.15
TOTAL DEPTH 19.85 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/13/06	**COMPLETED** 12/13/06	**SURFACE WATER DEPTH (m)** NA		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
29.56					Continued from previous page				
29.16	19.40	14	24	26	50		M		
28.71	19.85								Boring terminated at 19.85m (Elev. 28.71m) in Cape Fear Fm: Dense, clayey, SAND (A-2-6) with mica Bits Used: 10.0cm & 7.3cm Side Discharge Wing Bit Drilling Fluid Properties: 1.04 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL EB2-A	**BORING LOCATION** 78+53.1	**OFFSET** 15.4 m LT	**ALIGNMENT** -L-	**0 HR.** 0.00
COLLAR ELEV. 53.17 m	**NORTHING** 152,617.5 m	**EASTING** 616,508.3 m		**24 HR.** 0.25
TOTAL DEPTH 21.03 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/19/06	**COMPLETED** 12/20/06	**SURFACE WATER DEPTH (m)** NA		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
53.17					Ground Surface				53.17 0.00
53.17	0.00	2	2	2	4		M		Coastal Plain Undivided: Dark gray to gray, silty, fine to coarse SAND (A-2-4)
52.49	0.68	4	6	6	12		W		51.67 1.50 Coastal Plain Undivided: Gray, clayey, fine to coarse SAND (A-2-6)
51.04	2.13	4	2	2	4		W		
49.52	3.65	4	7	8	15		M		49.67 3.50 Cape Fear Fm: Gray and light gray, silty, CLAY (A-7-6) with trace to little sand
47.84	5.33	6	13	19	32		M		47.17 6.00 Cape Fear Fm: Gray, clayey SAND (A-2-6)
46.32	6.85	8	10	11	21		M		
44.79	8.38	3	7	9	16		M		44.87 8.30 Cape Fear Fm: Gray, silty CLAY (A-7-6)
43.27	9.90	6	7	10	17		M		44.03 9.14 Cape Fear Fm: Gray and dark gray mottled with red, silty, clayey SAND (A-2-6)
41.74	11.43	12	17	17	34		M		
40.22	12.95	50	50/4cm		100/19cm		M		40.67 12.50 Cape Fear Fm: Light green and gray, clayey, fine sandy SILT (A-4)
38.69	14.48	8	11	13	24		M		39.37 13.80 Cape Fear Fm: Light green and dark gray, micaceous, clayey SAND (A-2-6)
37.17	16.00	27	68	32/7cm	100/22cm		D		
35.64	17.53	8	11	25	36		M		36.17 17.00 Cape Fear Fm: Light green, silty, CLAY (A-6) with little sand
34.17	19.00								34.67 18.50

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 23 OF 59

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL EB2-A	**BORING LOCATION** 78+53.1	**OFFSET** 15.4 m LT	**ALIGNMENT** -L-	**0 HR.** 0.00
COLLAR ELEV. 53.17 m	**NORTHING** 152,617.5 m	**EASTING** 616,508.3 m		**24 HR.** 0.25
TOTAL DEPTH 21.03 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/19/06	**COMPLETED** 12/20/06	**SURFACE WATER DEPTH (m)** NA		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
34.17					Continued from previous page				
32.59	20.58	18	24	26	50		M		Cape Fear Fm: Green and light green, micaceous, clayey SAND (A-2-6) *(continued)*
		9	14	19	33		M		32.14 21.03 Boring terminated at 21.03m (Elev. 32.14m) in Cape Fear Fm: Dense, clayey, SAND (A-2-6) with mica

Bits Used: 7.3cm Side Discharge Wing Bit

Drilling Fluid Properties: 1.04 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

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:Dual Bridges over Cross Creek on -L- / 6468-06-1600

PROJECT:NCDOT 35196.1.3 **COUNTY:Cumberland** **OWNER: N.C.D.O.T.**

DATE SAMPLED: November 2006 **RECEIVED: 12/10/06** **REPORTED BY: MACTEC**

SAMPLED FROM: LL B2-A

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-11 *	SS-12	SS-13	SS-14	SS-15	SS-16
Retained 4.75 mm Sieve	(%)		0.2	0.0	0.0	1.6	0.2
Passing 2.00 mm Sieve	(%)		88.4	99.8	99.9	93.3	97.2
Passing 425 µm Sieve	(%)		48.2	72.0	91.6	44.4	46.9
Passing 75 µm Sieve	(%)		7.4	30.6	59.8	25.9	24.2

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)		62.6	54.8	15.4	63.1	67.5
Fine Sand Ret - 53 µm	(%)		31.3	16.9	34.4	10.3	8.8
Silt 0.05 - 0.005 mm	(%)		2.4	18.5	32.8	2.5	8.3
Clay < 0.005 mm	(%)		3.7	9.7	17.3	24.1	15.3

Moisture Content	(%)	ND	NA	NA	14.3	NA	NA
Liquid Limit, L.L.		ND	20	46	26	48	44
Plasticity Index, P.I.		ND	NP	NP	9	25	22
AASHTO Classification		ND	A-1-b	A-2-5(0)	A-4(3)	A-2-7(2)	A-2-7(1)
Organic Content	(%)	ND	ND	ND	ND	ND	ND

Boring No.		LL B2-A	LL B2-A	LL B2-A	LL B2-A	LL B2-A	LL B2-A
Station		77+07.1	77+07.1	77+07.1	77+07.1	77+07.1	77+07.1
Offset		14.0m LT	14.0m LT	14.0m LT	14.0m LT	14.0m LT	14.0m LT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (m)	From	1.81	3.33	6.85	9.89	12.94	15.98
	to	2.26	3.78	7.30	10.29	13.39	16.43

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

* Sample SS-11 was not enough material for testing.

Submitted by: Zeek Bice Johnson
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:Dual Bridges over Cross Creek on -L- / 6468-06-1600

PROJECT:NCDOT 35196.1.3 **COUNTY:Cumberland** **OWNER: N.C.D.O.T.**

DATE SAMPLED: December 2006 **RECEIVED: 12/10/06** **REPORTED BY: MACTEC**

SAMPLED FROM: LL B2-A, LL B3-A

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-17	SS-18	SS-19			
Retained 4.75 mm Sieve	(%)	0.0	0.0	0.0			
Passing 2.00 mm Sieve	(%)	100.0	99.7	100.0			
Passing 425 µm Sieve	(%)	94.0	65.9	97.5			
Passing 75 µm Sieve	(%)	63.1	48.6	51.0			

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	11.9	41.5	9.7			
Fine Sand Ret - 53 µm	(%)	31.3	12.0	47.0			
Silt 0.05 - 0.005 mm	(%)	27.7	14.9	28.9			
Clay < 0.005 mm	(%)	29.1	31.5	14.4			

Moisture Content	(%)	18.8	ND	23.9			
Liquid Limit, L.L.		37	38	22			
Plasticity Index, P.I.		20	17	NP			
AASHTO Classification		A-6(10)	A-6(5)	A-4(0)			
Organic Content	(%)	ND	ND	ND			

Boring No.		LL B2-A	LL B3-A	LL B3-A			
Station		77+07.1	77+42.0	77+42.0			
Offset		14.0m LT	14.0m LT	14.0m LT			
Alignment		-L-	-L-	-L-			
Depth (m)	From	22.09	3.67	5.19			
	to	22.37	4.12	5.64			

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

Submitted by: Zeek Bice Johnson
Laboratory Manager

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 35196.1.3 TIP: X-0002B COUNTY: CUMBERLAND

DESCRIPTION(1): DUAL BRIDGES OVER CROSS CREEK ON -L-

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): Fine to coarse sand (A-1-b); and sandy clay (A-6)

Channel Bank Material(8): Silty, clayey, fine to coarse sand (A-2-4/A-2-6); and sandy, silty clay (A-7-6)

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

Floodplain Width(10): 140 meters

Floodplain Cover(11): Cypress trees, brush; and up to 1 meter of water

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

Channel Migration Tendency(13): None

Observations and Other Comments: Most of the site from Bent 1 to Bent 5 is under water. Main channel of the creek is not well defined. Very low-flow environment.

Reported by: MACTEC Engineering and Consulting, Inc. **Date:** 12/21/2006

DESIGN SCOUR ELEVATIONS(14) Feet ____ Meters X

BENTS

	B1	B2	B3	B4	B5
100-year	N/A	45.99	46.26	46.38	48.05
500-year	N/A	45.81	46.11	46.23	47.95

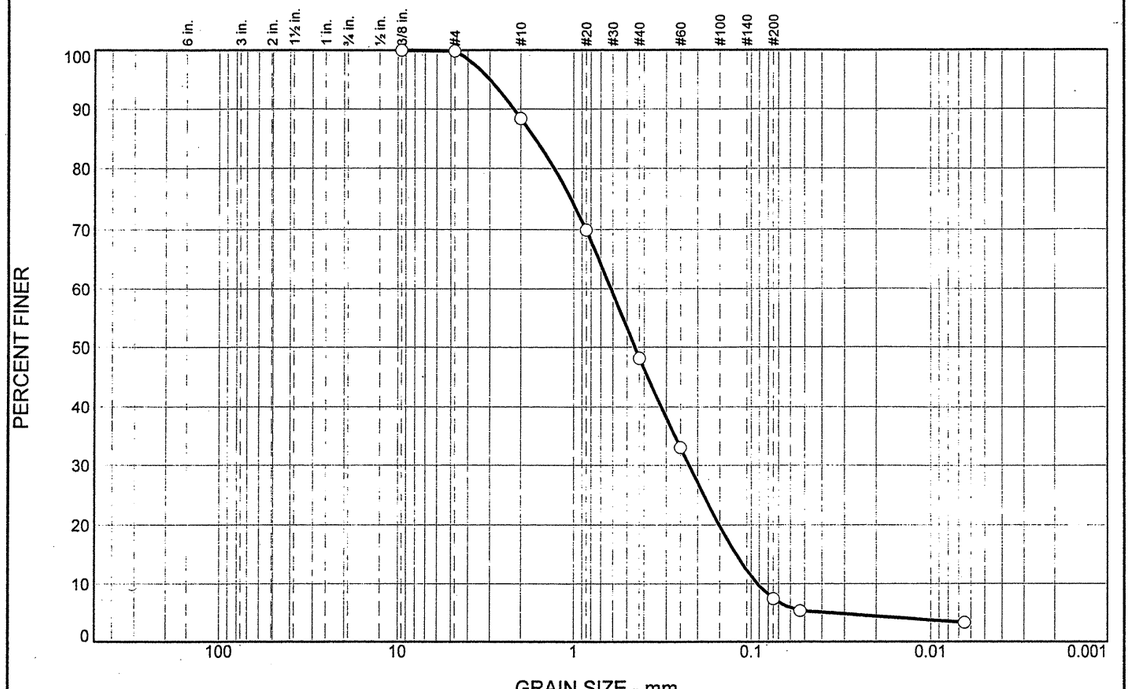
Comparison of DSE to Hydraulics Unit theoretical scour:
DSE calculations based on values in the Bridge Survey and Hydraulic Design Report dated 12/6/05.

DSE determined by: **Date:** 1/22/2007

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank	Bed	Bed					
Sample No.	SS-12	SS-18					
Retained #4	0.2	0					
Passed #10	88.4	99.7					
Passed #40	48.2	65.9					
Passed #200	7.4	48.6					
Coarse Sand	62.6	41.5					
Fine Sand	31.3	12					
Silt	2.4	14.9					
Clay	3.7	31.5					
LL	20	38					
PI	NP	17					
AASHTO	A-1-b	A-6(5)					
Station	77+07.1	77+42.0					
Offset	14.0m LT	14.0m LT					
Depth	3.33-3.78	3.67-4.12					

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	11.4	40.2	40.8	7.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.8		
#10	88.4		
#20	69.9		
#40	48.2		
#60	33.1		
#200	7.4		
#270	5.4		

* (no specification provided)

Material Description

GRAY SANDY SILT.

Atterberg Limits

PL= NP LL= 20 PI= NP

Coefficients

D_{85}= 1.6541 D_{60}= 0.6144 D_{50}= 0.4504
D_{30}= 0.2233 D_{15}= 0.1218 D_{10}= 0.0925
C_u= 6.64 C_c= 0.88

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

SPECIFIC GRAVITY IS ASSUMED.
ENTIRE SAMPLE WAS TESTED.

Sample Number: SS-12
Source of Sample: BORING LLB2-A **Depth:** 3.33-3.78 **Date:** 12/05/06

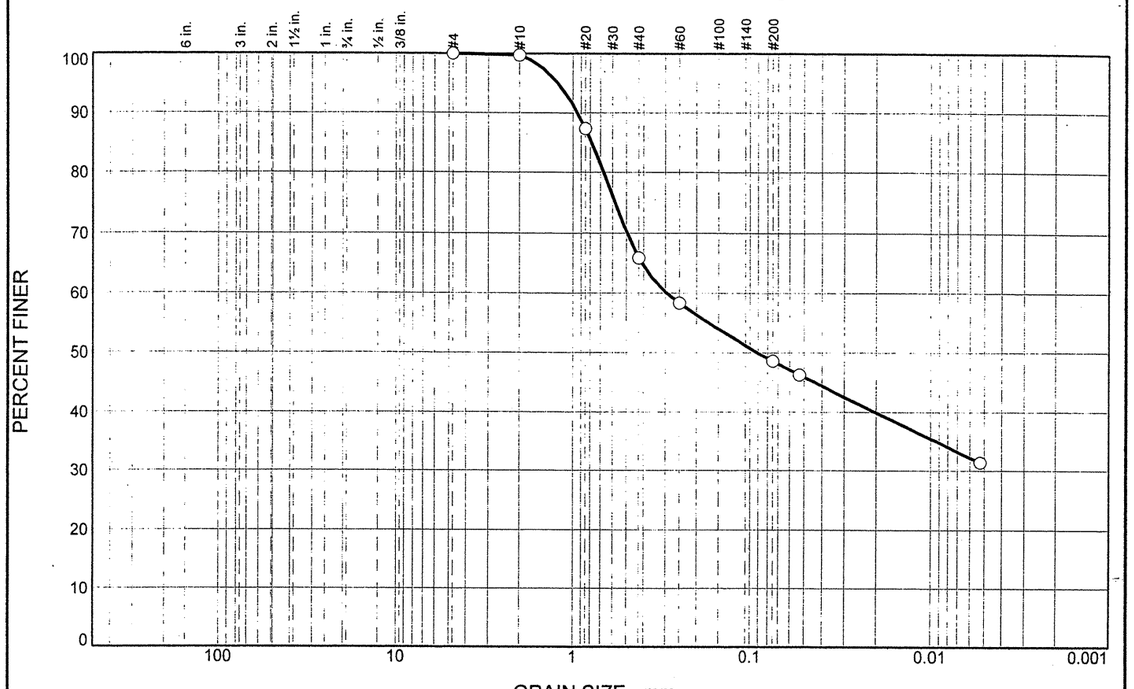
MACTEC, Inc.

Raleigh, North Carolina

Client: NCDOT
Project: Dual Bridges over Cross Creek
Project No: 6468061600.05 **Figure**

Tested By: LBJ **Checked By:** ABS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	33.8	17.3	48.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	87.4		
#40	65.9		
#60	58.3		
#200	48.6		
#270	46.3		

* (no specification provided)

Material Description

GRAY SILTY SANDY CLAY.

Atterberg Limits

PL= 21 LL= 38 PI= 17

Coefficients

D_{85}= 0.7832 D_{60}= 0.2956 D_{50}= 0.0908
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO= A-6(5)

Remarks

SPECIFIC GRAVITY IS ASSUMED.
ENTIRE SAMPLE WAS TESTED.

Sample Number: SS-18
Source of Sample: BORING LLB3-A **Depth:** 3.67-4.12 **Date:** 12/5/06

MACTEC, Inc.

Raleigh, North Carolina

Client: NCDOT
Project: Dual Bridges over Cross Creek
Project No: 6468061600.05 **Figure**

Tested By: LBJ **Checked By:** ABS

Site Photos
MACTEC Proj. No. 6468-06-1660

View looking up-station along approach to End Bent 1

View looking toward center line along End Bent 1

Dual Bridges over Cross Creek on -L- (Left Lane)
NCDOT Proj. No. 35196.1.3 (X-0002B)

View looking up-station at boring LL EB1-A

View looking down-station at boring LL B1-A

Site Photos
MACTEC Proj. No. 6468-06-1660

Dual Bridges over Cross Creek on -L- (Left Lane)
NCDOT Proj. No. 35196.1.3 (X-0002B)

View looking along Left Lane Bent 1 from center line

View looking down-station along Left Lane from Bent 4

View looking up-station from Bent 1 to Bent 2 along center line

View looking along Left Lane Bent 5 from center line

Site Photos
MACTEC Proj. No. 6468-06-1660

View looking down-station at boring LL EB2-A

View looking toward center line along End Bent 2

Dual Bridges over Cross Creek on -L- (Left Lane)
NCDOT Proj. No. 35196.1.3 (X-0002B)

View looking down-station along approach to Left Lane End Bent 2

WOODS

WOODS

EXCAVATED AREA

T3-5014
ELEV=53.538

LL EB1-A
LL B1-A
LL B2-A
LL B3-A
LL B4-A
LL B5-A
LL EB2-A

RL EB1-B
RL B1-B
RL B2-A
RL B2-B
RL B3-A
RL B3-B
RL B4-A
RL B4-B
RL B5-B
RL EB2-B

76+00
77+22
78+84
80+62

-L-

N 64° 56' 54.8" E

WOODS

WOODS

WOODS

3.0 SOIL

1200

SKEW=90°

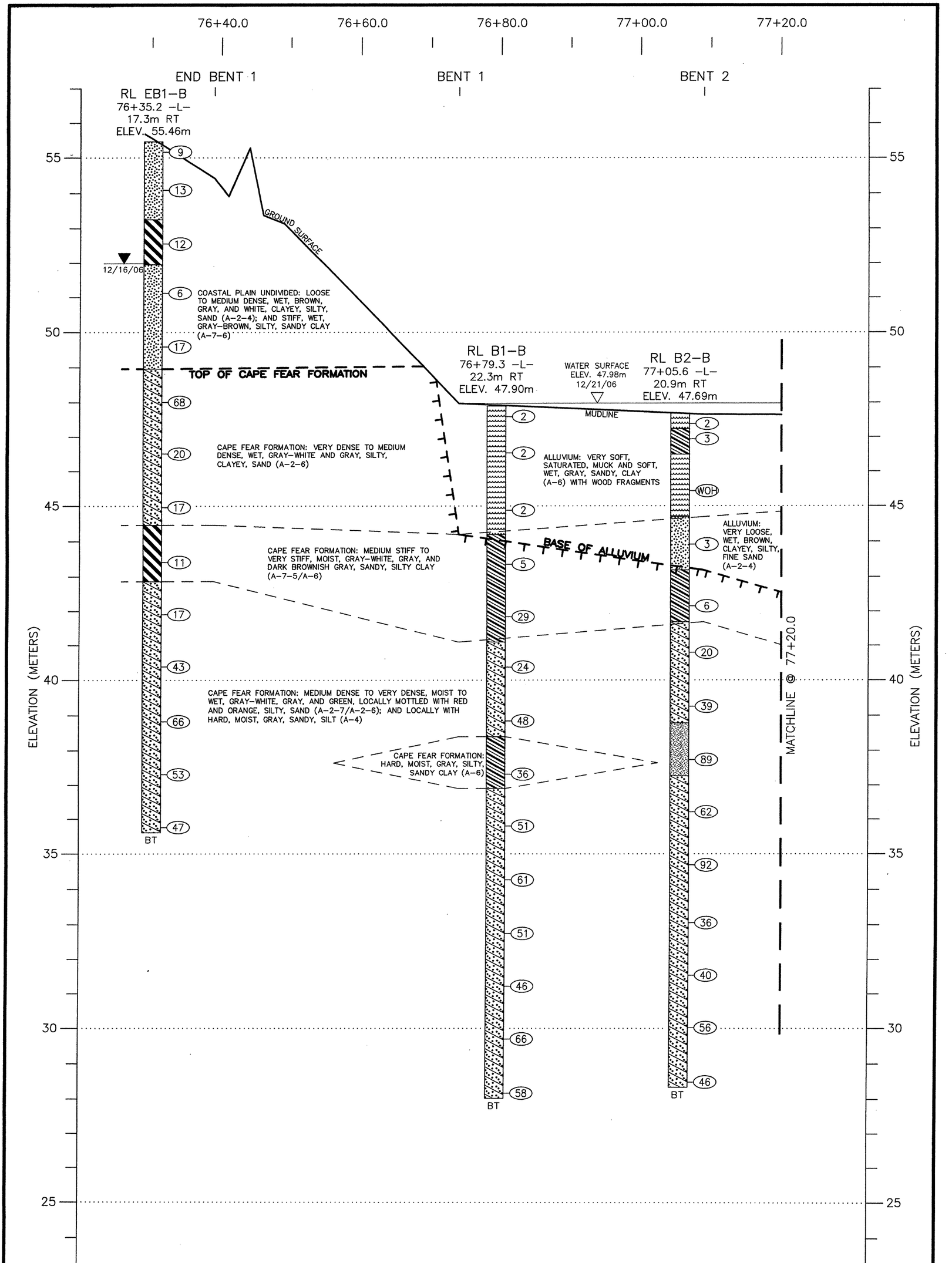
0 10 20 40
HORIZONTAL SCALE (METER)
1:1000

NAD 83

BORING LOCATION PLAN
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING & CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB : 6468-06-1600
	ENG CHECK: S.J.C.	DWG: 14



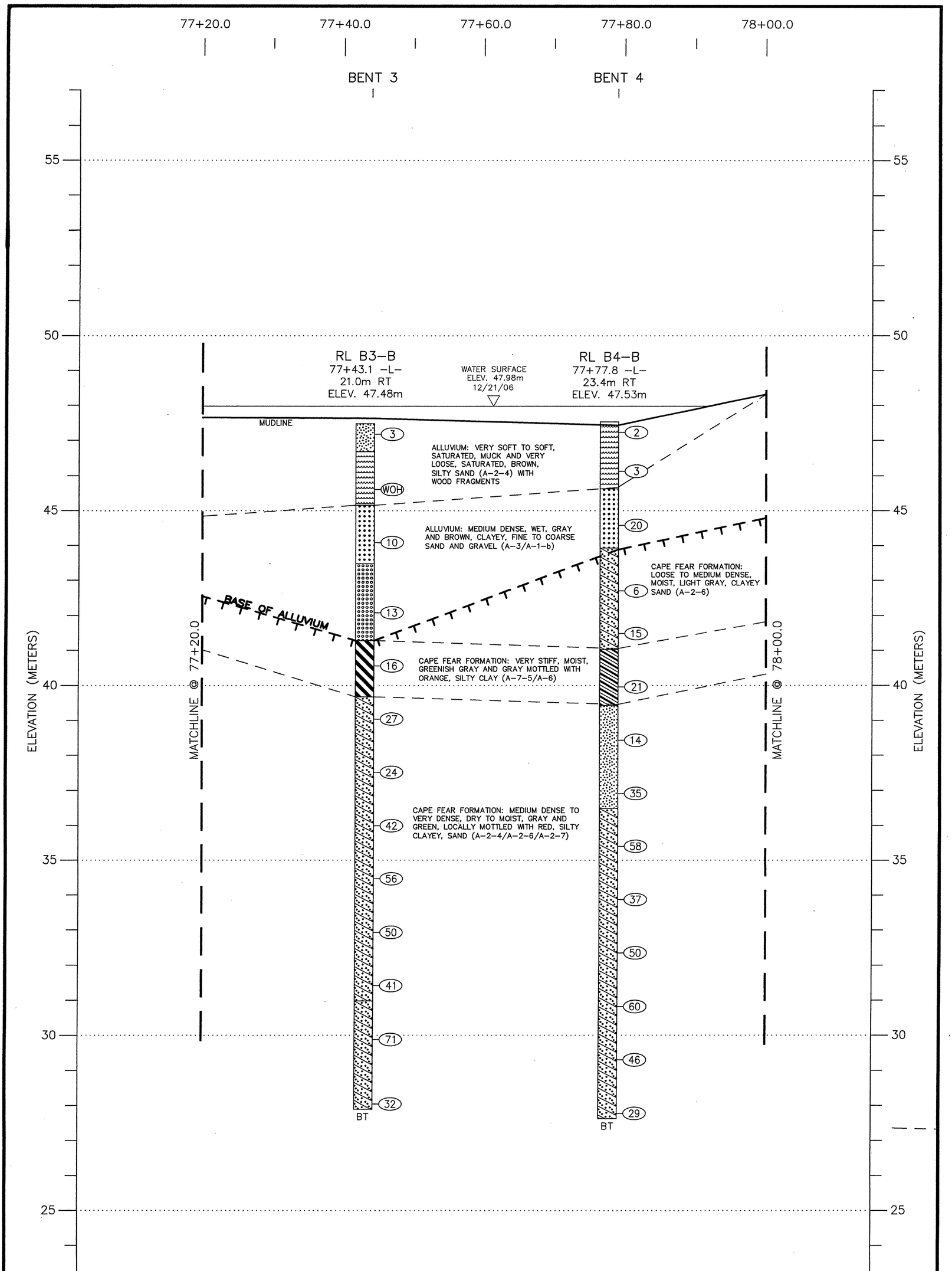
0 1 2 4
VERTICAL SCALE (METERS)
1:100

0 5 10 20
HORIZONTAL SCALE (METERS)
1:500

PROFILE 22m RIGHT OF -L-
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 15



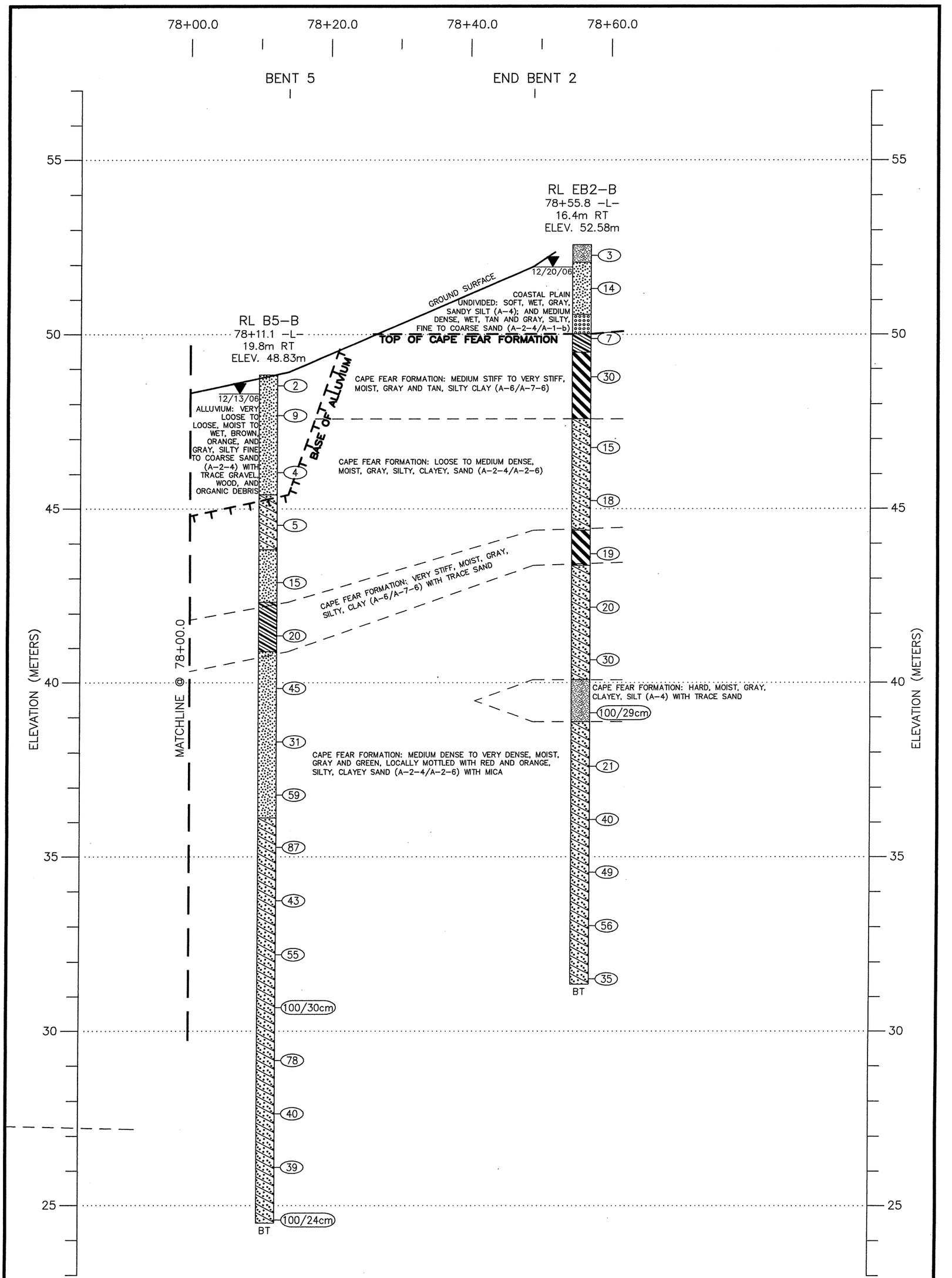
0 1 2 4
VERTICAL SCALE (METERS)
1:100

0 5 10 20
HORIZONTAL SCALE (METERS)
1:500

PROFILE 22m RIGHT OF -L-
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 16



0 1 2 4
VERTICAL SCALE (METERS)
1:100

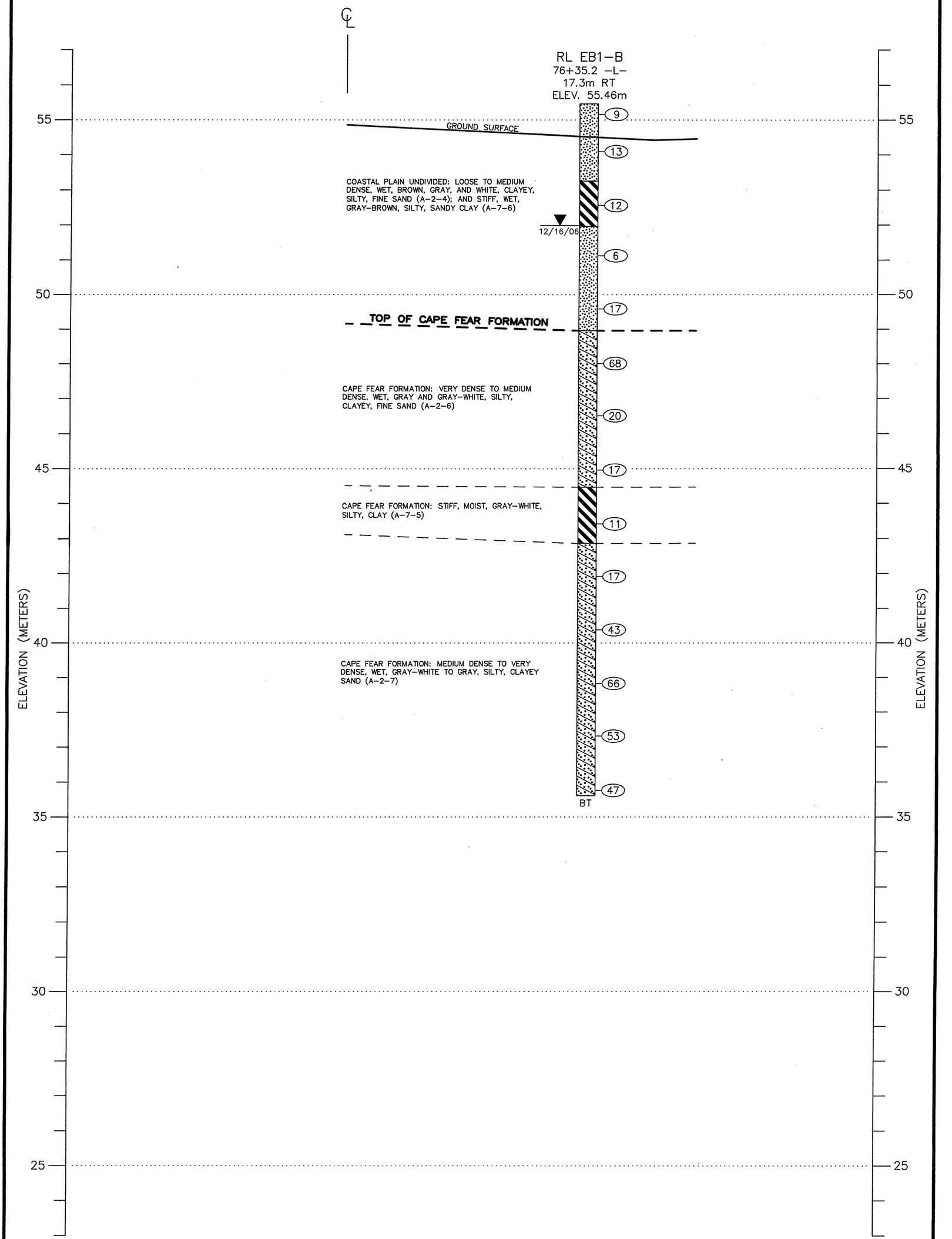
0 5 10 20
HORIZONTAL SCALE (METERS)
1:500

PROFILE 22m RIGHT OF -L-
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 17

SHEET 33 OF 59



0 1 2 4
VERTICAL SCALE (METERS)
1:100

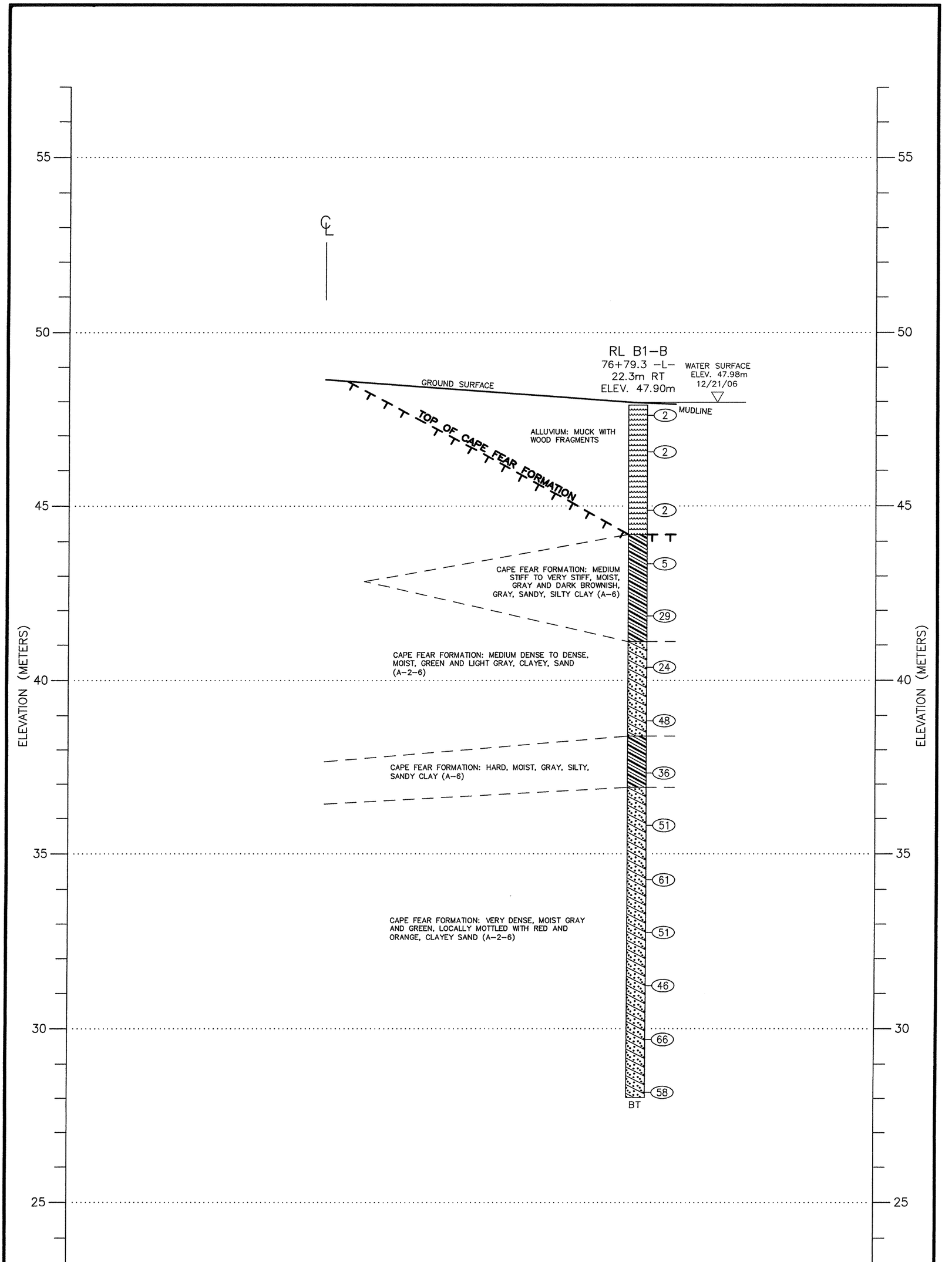
0 2.5 5 10
HORIZONTAL SCALE (METERS)
1:250

CROSS SECTION ALONG RIGHT LANE END BENT 1
DUAL BRIDGES OVER CROSS CREEK ON –L–
NCDOT PROJECT NO. 35196.1.3 (X–0002B)
F.A. No. NHF–DPR–0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468–06–1600
	ENG CHECK: W.B.D.	DWG: 18

SHEET 34 OF 59



0 1 2 4
VERTICAL SCALE (METERS)
1:100

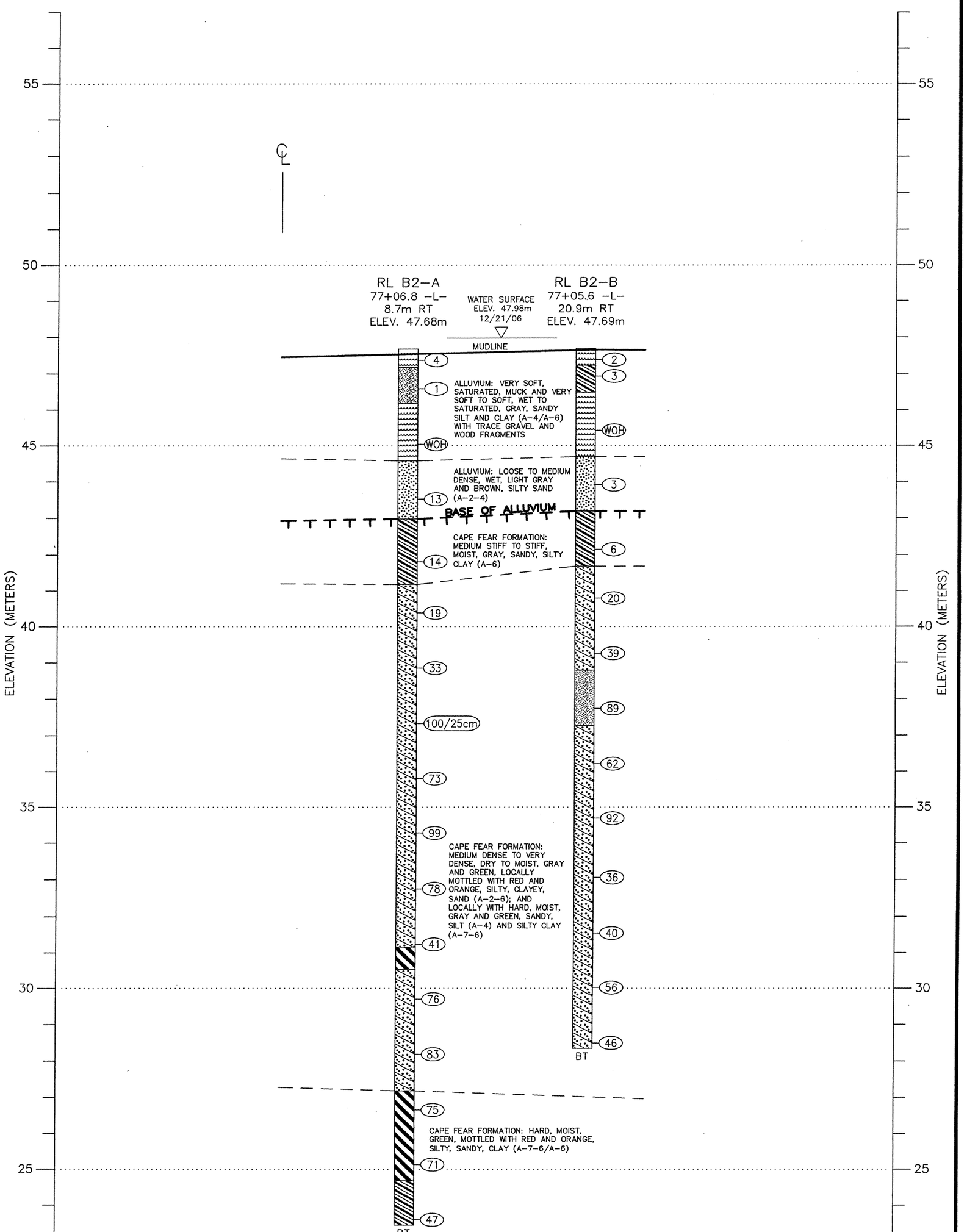
0 2.5 5 10
HORIZONTAL SCALE (METERS)
1:250

CROSS SECTION ALONG RIGHT LANE BENT 1
DUAL BRIDGES OVER CROSS CREEK ON –L–
NCDOT PROJECT NO. 35196.1.3 (X–0002B)
F.A. No. NHF–DPR–0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468–06–1600
	ENG CHECK: W.B.D.	DWG: 19

SHEET: 35 OF 59



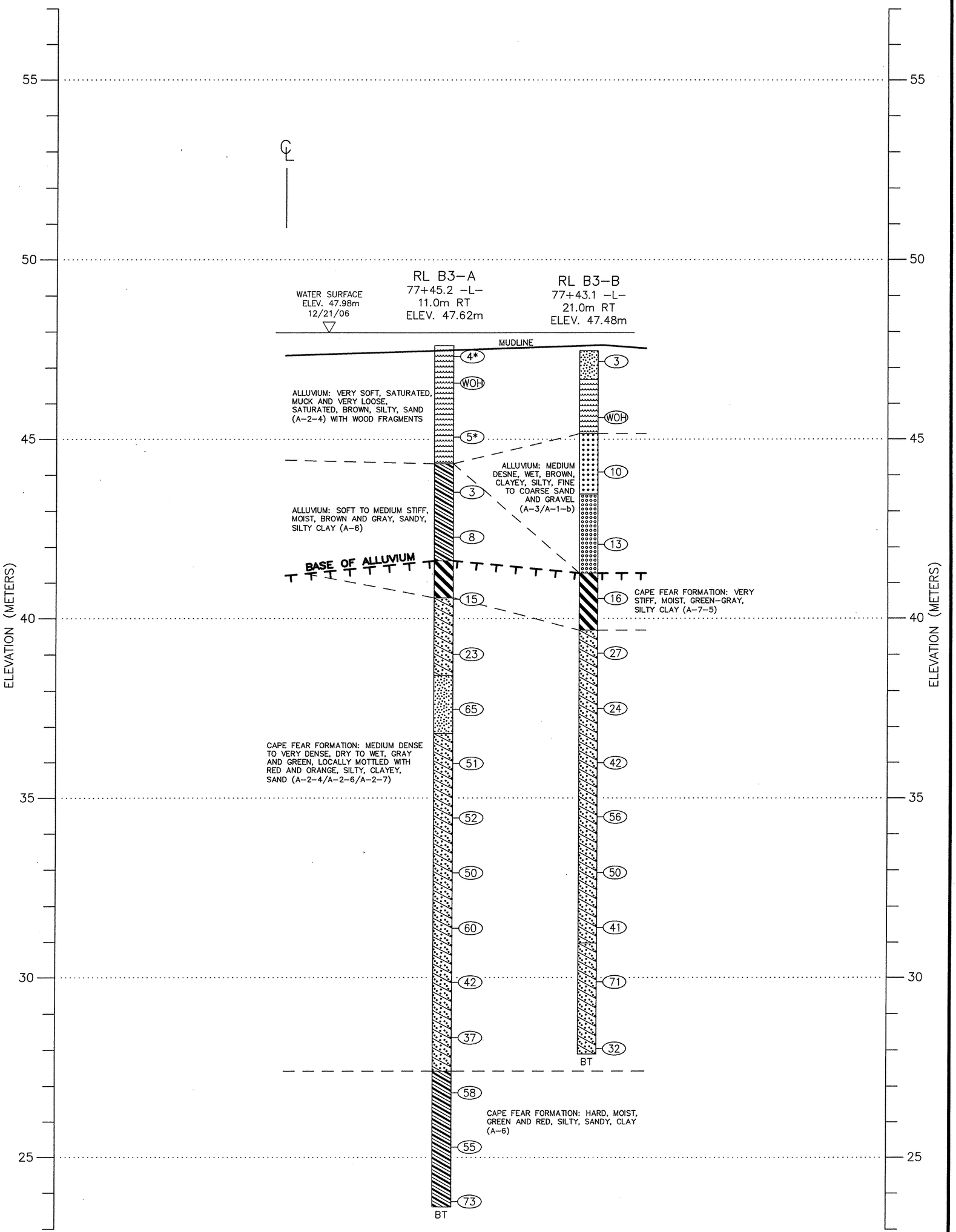
0 1 2 4
VERTICAL SCALE (METERS)
1:100

0 2.5 5 10
HORIZONTAL SCALE (METERS)
1:250

CROSS SECTION ALONG RIGHT LANE BENT 2
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 20



* INVALID DUE TO WOOD FRAGMENTS

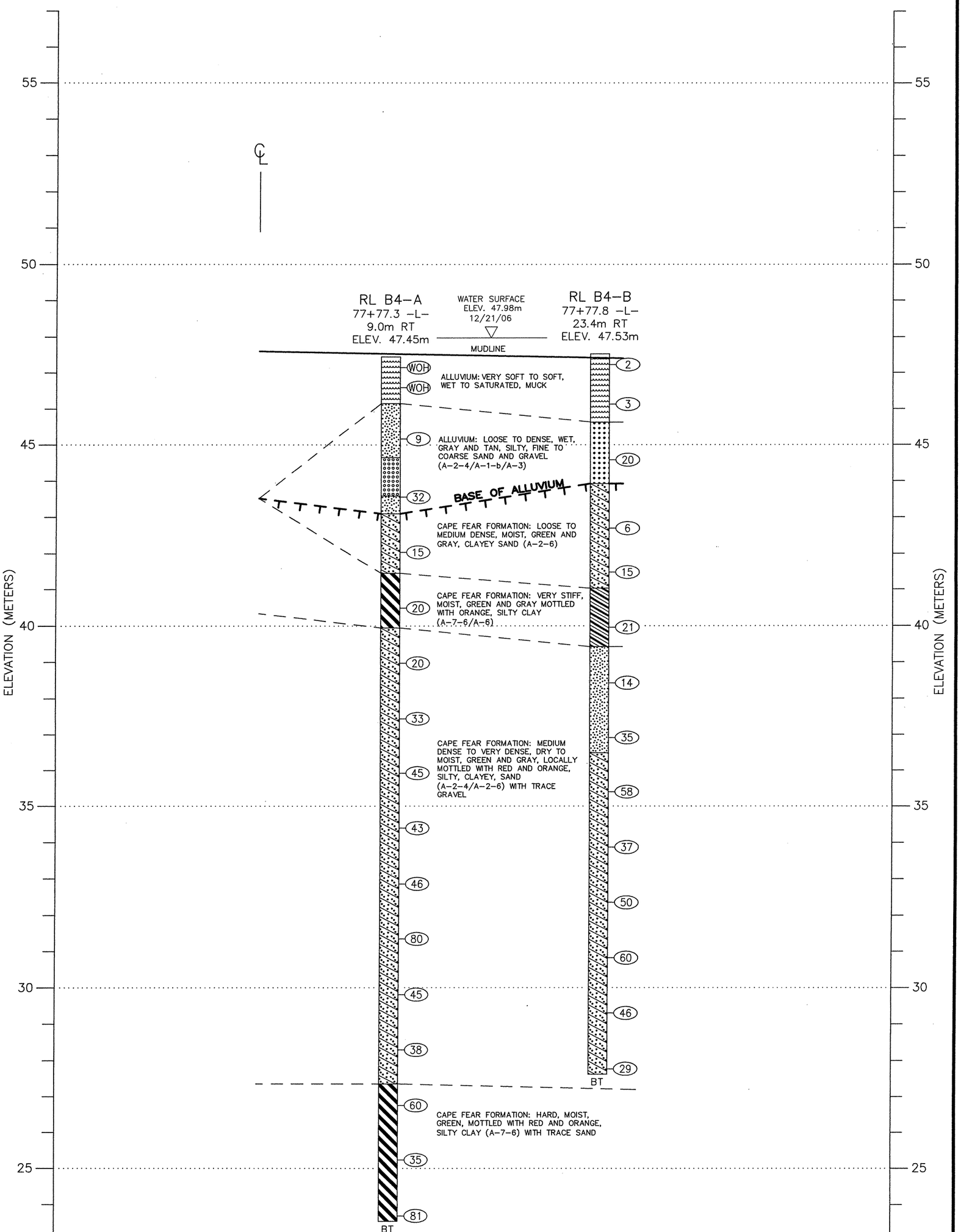
0 1 2 4
VERTICAL SCALE (METERS)
1:100

0 2.5 5 10
HORIZONTAL SCALE (METERS)
1:250

CROSS SECTION ALONG RIGHT LANE BENT 3
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 21



0 1 2 4
VERTICAL SCALE (METERS)
1:100

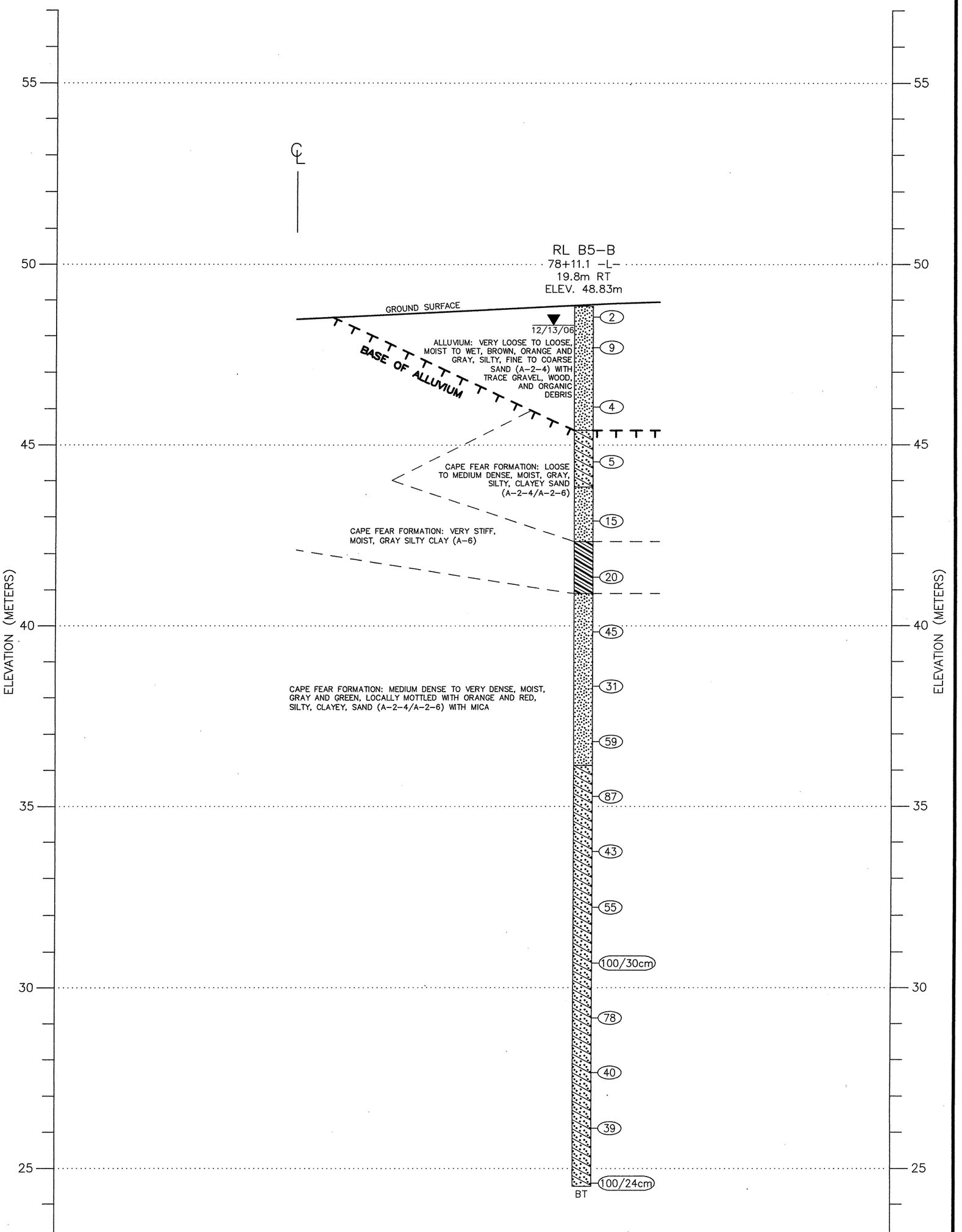
0 2.5 5 10
HORIZONTAL SCALE (METERS)
1:250

CROSS SECTION ALONG RIGHT LANE BENT 4
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 22

SHEET 38 OF 69



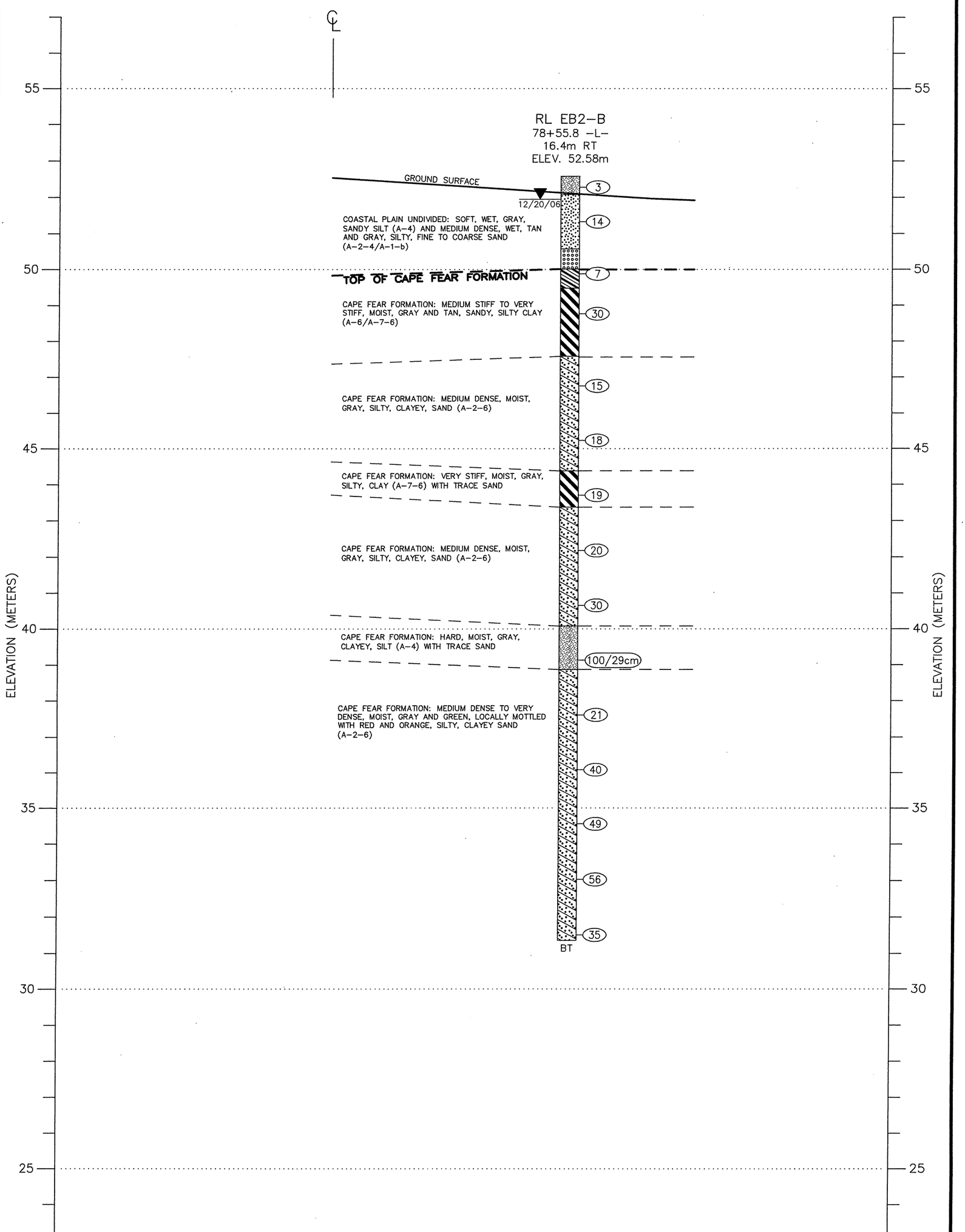
0 1 2 4
VERTICAL SCALE (METERS)
1:100

0 2.5 5 10
HORIZONTAL SCALE (METERS)
1:250

CROSS SECTION ALONG RIGHT LANE BENT 5
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 23



0 1 2 4
VERTICAL SCALE (METERS)
1:100

0 2.5 5 10
HORIZONTAL SCALE (METERS)
1:250

CROSS SECTION ALONG RIGHT LANE END BENT 2
DUAL BRIDGES OVER CROSS CREEK ON -L-
NCDOT PROJECT NO. 35196.1.3 (X-0002B)
F.A. No. NHF-DPR-0100(002)
CUMBERLAND COUNTY, NORTH CAROLINA

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REVISIONS	DRAWN: R.R.	DATE: 01/12/07
01/26/07	DFT CHECK: M.B.L.	JOB: 6468-06-1600
	ENG CHECK: W.B.D.	DWG: 24

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** C. Fridette
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL EB1-B	**BORING LOCATION** 76+35.2	**OFFSET** 17.3 m RT	**ALIGNMENT** -L-	**0 HR.** ND
COLLAR ELEV. 55.46 m	**NORTHING** 152,495.7 m	**EASTING** 616,324.7 m		**24 HR.** 3.47
TOTAL DEPTH 19.85 m	**DRILL MACHINE** D-50 ATV	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/15/06	**COMPLETED** 12/15/06	**SURFACE WATER DEPTH (m)** NA		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
55.46					Ground Surface				55.46 0.00
55.46	0.00	3	5	4	9 13		W		Coastal Plain Undivided: Brown and gray-brown, clayey, silty, fine SAND (A-2-4)
54.39	1.07						W		
52.86	2.60	3	5	8	12		W		53.26 2.20 Coastal Plain Undivided: Gray-brown, silty, fine to coarse sandy, CLAY (A-7-6)
51.42	4.04	5	4	8		SS-20	W		51.96 3.50 Coastal Plain Undivided: Gray and gray-white, clayey, silty, fine SAND (A-2-4)
49.89	5.57	1	2	4	6		W		
48.31	7.15	10	9	8	17		W		48.96 6.50 Cape Fear Fm: Gray-white and gray, silty, clayey, fine SAND (A-2-6)
46.81	8.65	12	25	43	68		W		
45.26	10.20	6	10	10	20	SS-21	W		
43.72	11.74	7	8	9	17		W		44.46 11.00 Cape Fear Fm: Gray-white, silty CLAY (A-7-5)
42.21	13.25	4	5	6	11	SS-22	29.9%		
40.68	14.78	5	6	11	17		W		42.86 12.60 Cape Fear Fm: Gray-white to gray, silty, clayey, fine to coarse SAND (A-2-7)
39.13	16.33	12	19	24	43	SS-23	W		
37.61	17.85	24	33	33	66		W		
		24	27	26	53		W		

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 41 OF 59

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** C. Fridette
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL EB1-B	**BORING LOCATION** 76+35.2	**OFFSET** 17.3 m RT	**ALIGNMENT** -L-	**0 HR.** ND
COLLAR ELEV. 55.46 m	**NORTHING** 152,495.7 m	**EASTING** 616,324.7 m		**24 HR.** 3.47
TOTAL DEPTH 19.85 m	**DRILL MACHINE** D-50 ATV	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/15/06	**COMPLETED** 12/15/06	**SURFACE WATER DEPTH (m)** NA		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
36.46					Continued from previous page				
36.06	19.40	16	22	25	47		W		35.61 19.85 Cape Fear Fm: Gray-white to gray, silty, clayey, fine to coarse SAND (A-2-7) *(continued)*

Boring terminated at 19.85m (Elev. 35.61m) in Cape Fear Fm: Dense, silty, clayey, fine to coarse SAND (A-2-7)

Bits Used: 7.0cm Side-Discharge Finger Bit

Drilling Fluid Properties: ND

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B1-B	**BORING LOCATION** 76+79.3	**OFFSET** 22.3 m RT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.90 m	**NORTHING** 152,509.8 m	**EASTING** 616,366.8 m		**24 HR.** Boring
TOTAL DEPTH 19.88 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual
DATE STARTED 12/7/06	**COMPLETED** 12/8/06	**SURFACE WATER DEPTH (m)** 0.11	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
47.90					Mudline				
47.90	0.00	1	1	1	2		Sat.		Alluvium: Muck with wood fragments- No recovery, based on drill response and cuttings
46.83	1.07								
		1	1	1	2		Sat.		
45.18	2.72								
		2	1	1	2		Sat.		
43.66	4.24								
		2	1	4	5		M		
42.14	5.76								
		8	13	16	29	SS-24	14.4%		
40.67	7.23								
		6	10	14	24		M		
39.15	8.75								
		23	22	26	48		M		
37.62	10.28								
		14	15	21	36	SS-25	14.9%		
36.10	11.80								
		18	25	26	51		M		
34.57	13.33								
		16	26	35	61		M		
33.05	14.85								
		19	23	28	51	SS-26	M		
31.52	16.38								
		15	21	25	46		M		
30.00	17.90								
		18	32	34	66		M		

44.20 — 3.70: Cape Fear Fm: Gray and dark brownish gray, sandy, silty, CLAY (A-6)

41.10 — 6.80: Cape Fear Fm: Green and light gray, clayey SAND (A-2-6)

38.40 — 9.50: Cape Fear Fm: Gray, silty, sandy CLAY (A-6)

36.90 — 11.00: Cape Fear Fm: Gray, green, and green mottled with red and orange, clayey, SAND (A-2-6)

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 42 OF 59

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B1-B	**BORING LOCATION** 76+79.3	**OFFSET** 22.3 m RT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.90 m	**NORTHING** 152,509.8 m	**EASTING** 616,366.8 m		**24 HR.** Boring
TOTAL DEPTH 19.88 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual
DATE STARTED 12/7/06	**COMPLETED** 12/8/06	**SURFACE WATER DEPTH (m)** 0.11	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
28.90					Continued from previous page				
28.47	19.43								
		21	33	25	58		M		Cape Fear Fm: Gray, green, and green mottled with red and orange, clayey, SAND (A-2-6) *(continued)*
28.02	19.88								Boring terminated at 19.88m (Elev. 28.02m) in Cape Fear Fm: Very dense, clayey, SAND (A-2-6)

Bits Used: 7.3cm Side Discharge Wing Bit

Drilling Fluid Properties: 1.03 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B2-A	**BORING LOCATION** 77+06.8	**OFFSET** 8.7 m RT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.68 m	**NORTHING** 152,533.7 m	**EASTING** 616,385.9 m		**24 HR.** Boring
TOTAL DEPTH 24.23 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/18/06	**COMPLETED** 12/18/06	**SURFACE WATER DEPTH (m)** 0.41		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
47.68					Mudline				
47.68	0.00	2	1	3	4		Sat.		Alluvium: MUCK with wood and plant debris (47.68 / 0.00)
46.89	0.79	1	0	1	1		Sat.		Alluvium: Gray, sandy, clayey, SILT (A-4) with trace gravel and wood fragments (47.18 / 0.50)
45.34	2.34	WOH	WOH	WOH	WOH 0		Sat.		Alluvium: MUCK (46.18 / 1.50)
43.82	3.86	6	7	6	13		W		Alluvium: Light gray, silty, fine to coarse SAND (A-2-4) (44.58 / 3.10)
42.11	5.57	3	6	8	14		M		Cape Fear Fm: Light to dark gray, silty, sandy CLAY (A-6) (42.98 / 4.70)
40.68	7.00	6	9	10	19		M		Cape Fear Fm: Light greenish gray, light gray, green, and gray mottled with red and orange, clayey SAND (A-2-6) with trace gravel (41.18 / 6.50)
39.15	8.53	7	17	16	33		M		
37.63	10.05	20	49	51/10cm	100/25cm		D		
36.10	11.58	20	32	41	73		M		
34.58	13.10	23	40	59	99		D		
33.05	14.63	29	36	42	78		M		
31.53	16.15	12	17	24	41		M		Cape Fear Fm: Green, silty CLAY (A-7-6) (31.15 / 16.53)
30.00	17.68	21	31	45	76		M		Cape Fear Fm: Dark gray, silty, clayey SAND (A-2-6) (30.53 / 17.15)

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 43 OF 59

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B2-A	**BORING LOCATION** 77+06.8	**OFFSET** 8.7 m RT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.68 m	**NORTHING** 152,533.7 m	**EASTING** 616,385.9 m		**24 HR.** Boring
TOTAL DEPTH 24.23 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/18/06	**COMPLETED** 12/18/06	**SURFACE WATER DEPTH (m)** 0.41		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
28.68					Continued from previous page				
28.48	19.20	22	35	48	83		M		Cape Fear Fm: Dark gray, silty, clayey SAND (A-2-6) *(continued)*
26.95	20.73	20	33	42	75		M		Cape Fear Fm: Green mottled with red and orange, silty CLAY (A-7-6) (27.18 / 20.50)
25.43	22.25	23	33	38	71		M		
23.90	23.78	15	21	26	47		M		Cape Fear Fm: Green mottled with red and orange, silty, sandy CLAY (A-6) (24.68 / 23.00)
									Boring terminated at 24.23m (Elev. 23.45m) in Cape Fear Fm: Hard, sandy, CLAY (A-6) (23.45 / 24.23)

Bits Used: 7.3cm Side Discharge Wing Bit

Drilling Fluid Properties: 1.03-1.04 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B2-B	**BORING LOCATION** 77+05.6	**OFFSET** 20.9 m RT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.69 m	**NORTHING** 152,522.3 m	**EASTING** 616,390.1 m		**24 HR.** Boring
TOTAL DEPTH 19.35 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/7/06	**COMPLETED** 12/7/06	**SURFACE WATER DEPTH (m)** 1.16		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
47.69					Mudline				
47.69	0.00	1	1	1	2		Sat.		47.69 0.00
47.24	0.45								Alluvium: Muck with wood fragments - No recovery 47.24 0.45
		5	2	1	3		W		Alluvium: Gray, sandy CLAY (A-6) with wood
45.73	1.96								46.49 1.20
		WOH	WOH	WOH	WOH 0		Sat.		Alluvium: Muck with wood fragments
44.22	3.47								44.69 3.00
		WOH	WOH	3	3		W		Alluvium: Brown, clayey, silty, fine SAND (A-2-4)
42.45	5.24								43.19 4.50
		2	2	4	6		M		Cape Fear Fm: Dark gray, silty, CLAY (A-6) with trace fine sand
41.09	6.60								41.69 6.00
		5	8	12	20		M		Cape Fear Fm: Green and gray, clayey SAND (A-2-6)
39.56	8.13								
		13	19	20	39		M		
38.04	9.65								38.79 8.90
		16	29	60	89	SS-10	14.1%		Cape Fear Fm: Gray, sandy, SILT (A-4)
36.51	11.18								37.27 10.42
		15	24	38	62		M		Cape Fear Fm: Gray, green, and greenish gray, locally mottled with orange and red, micaceous, silty, clayey, SAND (A-2-6)
34.99	12.70								
		21	42	50	92		M		
33.36	14.33								
		13	17	19	36		M		
31.84	15.85								
		14	19	21	40		M		
30.32	17.37								
		16	27	29	56		M		
28.79	18.90								

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B2-B	**BORING LOCATION** 77+05.6	**OFFSET** 20.9 m RT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.69 m	**NORTHING** 152,522.3 m	**EASTING** 616,390.1 m		**24 HR.** Boring
TOTAL DEPTH 19.35 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/7/06	**COMPLETED** 12/7/06	**SURFACE WATER DEPTH (m)** 1.16		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
28.69					Continued from previous page				
		16	19	27	46		M		28.34 19.35
									Boring terminated at 19.35m (Elev. 28.34m) in Cape Fear Fm: Dense, clayey, SAND (A-2-6)
									Bits Used: 7.3cm Side Discharge Wing Bit
									Drilling Fluid Properties: 1.03 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B3-A	**BORING LOCATION** 77+45.2	**OFFSET** 11.0 m RT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.62 m	**NORTHING** 152,547.8 m	**EASTING** 616,421.7 m		**24 HR.** Boring
TOTAL DEPTH 24.00 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual
DATE STARTED 12/15/06	**COMPLETED** 12/15/06	**SURFACE WATER DEPTH (m)** 0.97	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
47.62					Mudline				
47.62	0.00	1	1	3	4		Sat.		Alluvium: Muck with wood fragments
46.88	0.74		Invalid due to wood						
		WOH	WOH	WOH	0 WOH		Sat.		
45.36	2.26								
		1	1	4	5		Sat.		
43.83	3.79		Invalid due to wood						
44.32	3.30								Alluvium: Dark brown to dark gray, sandy, silty CLAY (A-6)
		2	1	2	3		M		Shelby tube pushed from 4.29 m to 4.90 m, No recovery
42.58	5.04								
		1	3	5	8		M		
41.62	6.00								Cape Fear Fm: Light green, silty CLAY (A-7-5)
40.84	6.78	4	6	9	15		M		
40.58	7.04								Cape Fear Fm: Gray and light green, silty, clayey, SAND (A-2-6)
39.31	8.31	5	9	14	23		M		
37.79	9.83								
		13	33	32	65		W		
38.42	9.20								Cape Fear Fm: Gray, silty, fine to coarse SAND (A-2-4)
36.27	11.35								
36.82	10.80	13	27	24	51		M		Cape Fear Fm: Gray, green, and green mottled with red and orange, clayey, SAND (A-2-6)
34.74	12.88								
		15	27	25	52		M		
33.22	14.40								
		16	21	29	50		D		
31.69	15.93								
		14	24	36	60		M		
30.17	17.45								
		13	19	23	42		M		
28.64	18.98								

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 45 OF 59

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B3-A	**BORING LOCATION** 77+45.2	**OFFSET** 11.0 m RT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.62 m	**NORTHING** 152,547.8 m	**EASTING** 616,421.7 m		**24 HR.** Boring
TOTAL DEPTH 24.00 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual
DATE STARTED 12/15/06	**COMPLETED** 12/15/06	**SURFACE WATER DEPTH (m)** 0.97	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
28.62					Continued from previous page				
		15	17	20	37		M		Cape Fear Fm: Gray, green, and green mottled with red and orange, clayey, SAND (A-2-6) *(continued)*
27.42	20.20								
27.12	20.50								Cape Fear Fm: Green and red, silty, sandy CLAY (A-6)
		17	26	32	58		M		
25.59	22.03								
		19	25	30	55		M		
24.07	23.55								
		26	33	40	73		M		
23.62	24.00								Boring terminated at 24.00m (Elev. 23.62m) in Cape Fear Fm: Hard, sandy, CLAY (A-6)

Bits Used: 10.0 cm & 7.3cm Side Discharge Wing Bit

Drilling Fluid Properties: 1.03-1.04 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B3-B	**BORING LOCATION** 77+43.1	**OFFSET** 21.0 m RT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.48 m	**NORTHING** 152,537.8 m	**EASTING** 616,424.1 m		**24 HR.** Boring
TOTAL DEPTH 19.59 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/1/06	**COMPLETED** 12/1/06	**SURFACE WATER DEPTH (m)** 0.90		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
47.48					Mudline				
47.48	0.00	1	1	2	3		Sat.		Alluvium: Brown, silty, fine to coarse SAND (A-2-4) with trace wood and organic debris
46.68	0.80								Alluvium: Muck with trace wood
45.91	1.57	WOH	WOH	WOH	WOH 0		Sat.		
45.15	2.33								Alluvium: Grayish brown, clayey, fine to coarse SAND (A-3)
44.39	3.09	1	3	7	10	SS-1	W		
43.48	4.00								Alluvium: Light brown, silty, fine to coarse sandy, GRAVEL (A-1-b)
42.38	5.10	4	6	7	13	SS-2	W		
41.28	6.20								Cape Fear Fm: Greenish gray, silty, CLAY (A-7-5)
40.86	6.62	4	7	9	16	SS-3	32.1%		
39.68	7.80								Cape Fear Fm: Gray and greenish gray mottled with red, clayey SAND (A-2-7)
39.34	8.14	11	13	14	27		D		
37.81	9.67	8	9	15	24		M		
36.29	11.19	11	16	26	42		M		
34.77	12.71	16	24	32	56		D		
33.23	14.25	12	23	27	50	SS-4	D		
31.71	15.77	13	18	23	41		M		
30.98	16.50								Cape Fear Fm: Gray, clayey, fine to coarse SAND (A-2-6)
30.18	17.30	20	30	41	71		M		

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 46 OF 59

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B3-B	**BORING LOCATION** 77+43.1	**OFFSET** 21.0 m RT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.48 m	**NORTHING** 152,537.8 m	**EASTING** 616,424.1 m		**24 HR.** Boring
TOTAL DEPTH 19.59 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/1/06	**COMPLETED** 12/1/06	**SURFACE WATER DEPTH (m)** 0.90		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
28.48					Continued from previous page				
28.34	19.14	9	15	17	32	SS-5	W		
27.89	19.59								Boring terminated at 19.59m (Elev. 27.89m) in Cape Fear Fm: Dense, clayey, fine to coarse SAND (A-2-6)

Bits Used: 7.3cm Side Discharge Wing Bit

Drilling Fluid Properties: 1.02 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B4-A	**BORING LOCATION** 77+77.3	**OFFSET** 9.0 m RT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.45 m	**NORTHING** 152,563.3 m	**EASTING** 616,449.9 m		**24 HR.** Boring
TOTAL DEPTH 23.91 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual
DATE STARTED 12/14/06	**COMPLETED** 12/14/06	**SURFACE WATER DEPTH (m)** 0.94	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
47.45					Mudline				
47.45	0.00	WOH	WOH	WOH	0		Sat.		Alluvium: Muck with wood and trace sandy clay
46.89	0.56	WOH	WOH	WOH	0		Sat.		47.45 0.00
45.46	1.99	3	6	3	9		W		Alluvium: Gray, silty, fine to coarse SAND (A-2-4) 46.15 1.30
43.86	3.59	13	20	12	32		W		Alluvium: Tan, coarse SAND and GRAVEL (A-1-B) 44.65 2.80
42.34	5.11	5	8	7	15		M		Alluvium: Gray, silty, fine SAND (A-2-4) with gravel 43.59 3.86
40.79	6.66	6	9	11	20		M		Cape Fear Fm: Light green, clayey SAND (A-2-6) 43.10 4.35
39.27	8.18	8	8	12	20		M		Cape Fear Fm: Light green, silty CLAY (A-7-6) 41.45 6.00
37.74	9.71	5	11	22	33		M		Cape Fear Fm: Light green to green, gray to light gray, and light green mottled with red and orange, silty, clayey, SAND (A-2-6) with trace gravel 39.95 7.50
36.22	11.23	10	19	26	45		M		
34.69	12.76	13	17	26	43		M		
33.16	14.29	14	24	22	46		M		
31.64	15.81	17	31	49	80		M		
30.11	17.34	12	20	25	45		M		
28.59	18.86								

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 47 OF 59

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B4-A	**BORING LOCATION** 77+77.3	**OFFSET** 9.0 m RT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.45 m	**NORTHING** 152,563.3 m	**EASTING** 616,449.9 m		**24 HR.** Boring
TOTAL DEPTH 23.91 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual
DATE STARTED 12/14/06	**COMPLETED** 12/14/06	**SURFACE WATER DEPTH (m)** 0.94	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
28.45					Continued from previous page				
27.05	20.40	12	19	19	38		M		Cape Fear Fm: Light green and green mottled with red and orange, silty CLAY (A-7-6) with trace sand 27.35 20.10
25.53	21.92	16	24	36	60		M		
23.99	23.46	13	13	22	35		M		
		22	31	50	81		M		23.54 23.91
									Boring terminated at 23.91m (Elev. 23.54m) in Cape Fear Fm: Hard, silty CLAY (A-7-6)
									Bits Used: 7.3cm Side Discharge Wing Bit
									Drilling Fluid Properties: 1.03-1.04 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B4-B	**BORING LOCATION** 77+77.8	**OFFSET** 23.4 m RT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.53 m	**NORTHING** 152,550.5 m	**EASTING** 616,456.5 m		**24 HR.** Boring
TOTAL DEPTH 19.91 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual
DATE STARTED 11/30/06	**COMPLETED** 11/30/06	**SURFACE WATER DEPTH (m)** 0.49	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
47.53					Mudline				
47.53	0.00	1	1	1	2		W		Alluvium: Muck
46.43	1.10	1	2	1	3		W		47.53 — 0.00
44.88	2.65	5	8	12	20	SS-6	W		Alluvium: Light gray, fine to coarse SAND (A-3)
43.00	4.53	2	2	4	6		M		45.63 — 1.90
41.78	5.75	4	5	10	15		M		Cape Fear Fm: Light gray, clayey SAND (A-2-6)
40.26	7.27	7	10	11	21		M		43.93 — 3.60
38.73	8.80	5	7	7	14	SS-7	M		Cape Fear Fm: Light gray mottled with orange, silty, CLAY (A-6)
37.21	10.32	5	15	20	35	SS-8	M		41.03 — 6.50
35.70	11.83	14	20	38	58		D		Cape Fear Fm: Light gray and gray, clayey, silty, fine to coarse SAND (A-2-4)
34.17	13.36	13	17	20	37		M		39.43 — 8.10
32.65	14.88	11	20	30	50		M		Cape Fear Fm: Gray and greenish gray mottled with red, silty, clayey SAND (A-2-6)
31.12	16.41	15	26	34	60		M		36.48 — 11.05
29.60	17.93	13	18	28	46	SS-9	M		

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 48 OF 59

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B4-B	**BORING LOCATION** 77+77.8	**OFFSET** 23.4 m RT	**ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.53 m	**NORTHING** 152,550.5 m	**EASTING** 616,456.5 m		**24 HR.** Boring
TOTAL DEPTH 19.91 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual
DATE STARTED 11/30/06	**COMPLETED** 11/30/06	**SURFACE WATER DEPTH (m)** 0.49	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
28.53					Continued from previous page				
28.07	19.46	8	12	17	29		M		Cape Fear Fm: Gray and greenish gray mottled with red, silty, clayey SAND (A-2-6) *(continued)*
									27.62 — 19.91
									Boring terminated at 19.91m (Elev. 27.62m) in Cape Fear Fm: Medium dense, clayey SAND (A-2-6)
									Bits Used: 7.3cm Side Discharge Wing Bit
									Drilling Fluid Properties: 1.02 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B5-B	**BORING LOCATION** 78+11.1	**OFFSET** 19.8 m RT	**ALIGNMENT** -L-	**0 HR.** 0.10
COLLAR ELEV. 48.83 m	**NORTHING** 152,567.9 m	**EASTING** 616,485.1 m		**24 HR.** 0.53
TOTAL DEPTH 24.33 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/12/06	**COMPLETED** 12/12/06	**SURFACE WATER DEPTH (m)** NA		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
48.83					Ground Surface		M		
48.83	0.00	1	1	1	2				Alluvium: Light brown, light brown-orange, and light gray to dark brown, silty, fine to coarse SAND (A-2-4) with trace gravel, wood, and organic debris
47.98	0.85	4	5	4	9		W		
46.35	2.48	3	2	2	4		W		
45.40	3.43								Cape Fear Fm: Gray and light gray, silty, clayey, SAND (A-2-6)
44.83	4.00	2	2	3	5		M		
43.83	5.00								Cape Fear Fm: Light gray, clayey, SAND (A-2-4)
43.19	5.64	4	6	9	15	SS-27	M		
42.33	6.50								Cape Fear Fm: Gray, silty CLAY (A-6)
41.66	7.17	6	8	12	20		M		
40.90	7.93								Cape Fear Fm: Light greenish gray and gray, clayey, silty, SAND (A-2-4) with mica
40.14	8.69	13	21	24	45	SS-28	M		
38.61	10.22	12	14	17	31	C	M		
37.09	11.74	13	27	32	59	SS-29	M		
36.13	12.70								Cape Fear Fm: Gray, dark gray, light green, greenish gray, and green, locally mottled with orange and red, silty, clayey, SAND (A-2-6)
35.57	13.26	13	33	54	87		M		
34.04	14.79	15	18	25	43		M		
32.51	16.32	18	28	27	55		M		
30.99	17.84	40	60/15cm		100/30cm		M		

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 49 OF 59

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL B5-B	**BORING LOCATION** 78+11.1	**OFFSET** 19.8 m RT	**ALIGNMENT** -L-	**0 HR.** 0.10
COLLAR ELEV. 48.83 m	**NORTHING** 152,567.9 m	**EASTING** 616,485.1 m		**24 HR.** 0.53
TOTAL DEPTH 24.33 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/12/06	**COMPLETED** 12/12/06	**SURFACE WATER DEPTH (m)** NA		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
29.83					Continued from previous page				
29.46	19.37	9	34	44	78		M		Cape Fear Fm: Gray, dark gray, light green, greenish gray, and green, locally mottled with orange and red, silty, clayey, SAND (A-2-6) *(continued)*
27.94	20.89	16	22	18	40		M		
26.41	22.42	13	15	24	39	SS-30	M		
24.89	23.94	24	56	44/9cm	100/24cm		D		
24.50	24.33								Boring terminated at 24.33m (Elev. 24.50m) in Cape Fear Fm: Very dense, silty, clayey, SAND (A-2-6)

Bits Used: 7.3cm Side Discharge Wing Bit

Drilling Fluid Properties: 1.04 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL EB2-B	**BORING LOCATION** 78+55.8	**OFFSET** 16.4 m RT	**ALIGNMENT** -L-	**0 HR.** 0.00
COLLAR ELEV. 52.58 m	**NORTHING** 152,589.9 m	**EASTING** 616,524.1 m		**24 HR.** 0.63
TOTAL DEPTH 21.22 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/19/06	**COMPLETED** 12/19/06	**SURFACE WATER DEPTH (m)** NA		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
52.58					Ground Surface		W		52.58 0.00
52.58	0.00	2	1	2	3		W		Coastal Plain Undivided: Dark gray, sandy, SILT (A-4) 52.08 0.50
51.63	0.95	5	7	7	14		W		Coastal Plain Undivided: Tan and gray, silty, fine to coarse SAND (A-2-4)
50.18	2.40	1	3	4	7		W		50.58 2.00 Coastal Plain Undivided: Tan, fine to coarse SAND (A-1-b) 50.01 2.57
49.07	3.51	5	12	18	30		M		Cape Fear Fm: Light gray, silty CLAY (A-6) with trace to little fine sand 49.48 3.10 Shelby tube pushed from 2.90m to 3.51m, recovery=0.61m (100%) Cape Fear Fm: Light gray and tan, silty CLAY (A-7-6)
47.06	5.52	4	6	9	15		M		47.58 5.00 Cape Fear Fm: Light gray to gray, silty, clayey SAND (A-2-6)
45.53	7.05	4	8	10	18		M		
44.01	8.57	4	7	12	19		M		44.38 8.20 Cape Fear Fm: Gray, silty CLAY (A-7-6) with trace sand 43.38 9.20
42.48	10.10	8	10	10	20		M		Cape Fear Fm: Gray, silty, clayey, SAND (A-2-6)
40.96	11.62	8	13	17	30		M		40.08 12.50 Cape Fear Fm: Gray, clayey SILT (A-4) with trace sand
39.43	13.15	57	43/14cm		100/29cm		M		38.88 13.70 Cape Fear Fm: Gray, green, and green mottled with red and orange, silty, clayey, fine to coarse SAND (A-2-6) with mica
37.91	14.67	8	10	11	21		M		
36.38	16.20	15	19	21	40		M		
34.86	17.72	12	20	29	49		M		

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 50 OF 59

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. RL EB2-B	**BORING LOCATION** 78+55.8	**OFFSET** 16.4 m RT	**ALIGNMENT** -L-	**0 HR.** 0.00
COLLAR ELEV. 52.58 m	**NORTHING** 152,589.9 m	**EASTING** 616,524.1 m		**24 HR.** 0.63
TOTAL DEPTH 21.22 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual	
DATE STARTED 12/19/06	**COMPLETED** 12/19/06	**SURFACE WATER DEPTH (m)** NA		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
33.58					Continued from previous page				
33.33	19.25	14	25	31	56		M		Cape Fear Fm: Gray, green, and green mottled with red and orange, silty, clayey, fine to coarse SAND (A-2-6) with mica *(continued)*
31.81	20.77	10	16	19	35		M		31.36 21.22 Boring terminated at 21.22m (Elev. 31.36m) in Cape Fear Fm: Dense, clayey, SAND (A-2-6) with mica

Bits Used: 10.0cm & 7.3cm Side Discharge Wing Bit

Drilling Fluid Properties: 1.04 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

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:Dual Bridges over Cross Creek on -L- / 6468-06-1600

PROJECT:NCDOT 35196.1.3 **COUNTY:Cumberland** **OWNER: N.C.D.O.T.**

DATE SAMPLED: November 2006 **RECEIVED: 12/06/06** **REPORTED BY: MACTEC**

SAMPLED FROM: RL B3-B, RL B4-B

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	(%)	0.0	0.5	0.0	0.0	0.1	0.0
Passing 2.00 mm Sieve	(%)	99.7	93.9	96.9	99.9	98.0	99.6
Passing 425 µm Sieve	(%)	78.9	29.2	82.6	52.6	40.0	55.7
Passing 75 µm Sieve	(%)	8.8	1.9	51.7	13.5	18.8	1.4

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	48.0	85.5	18.3	75.3	80.0	74.3
Fine Sand Ret - 53 µm	(%)	43.3	11.9	35.4	14.8	2.0	25.0
Silt 0.05 - 0.005 mm	(%)	3.1	0.7	18.5	2.2	5.7	0.4
Clay < 0.005 mm	(%)	5.5	1.8	27.9	7.7	12.2	0.3

Moisture Content	(%)	ND	ND	32.1	NA	NA	ND
Liquid Limit, L.L.		21	20	55	45	30	20
Plasticity Index, P.I.		NP	NP	25	29	11	NP
AASHTO Classification		A-3	A-1-b	A-7-5(0)	A-2-7(0)	A-2-6(0)	A-3
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 B4-B
Station		77+43.1	77+43.1	77+43.1	77+43.1	77+43.1	77+77.8
Offset		21.0m RT	21.0m RT	21.0m RT	21.0m RT	21.0m RT	23.4m RT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (m)	From	3.09	5.10	6.62	14.50	19.14	2.65
	to	3.54	5.55	7.07	14.70	19.59	3.10

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

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:Dual Bridges over Cross Creek on -L- / 6468-06-1600

PROJECT:NCDOT 35196.1.3 **COUNTY:Cumberland** **OWNER: N.C.D.O.T.**

DATE SAMPLED: Nov./Dec. 2006 **RECEIVED: Dec. 6, 10, 22, 2006** **REPORTED BY: MACTEC**

SAMPLED FROM: RL B4-B, RL B2-B, RL EB1-B

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-7	SS-8	SS-9	SS-10	SS-20	SS-21
Retained 4.75 mm Sieve	(%)	0.0	0.0	1.4	0.0	0.0	0.0
Passing 2.00 mm Sieve	(%)	99.7	99.0	96.1	100.0	100.0	99.4
Passing 425 µm Sieve	(%)	96.7	71.4	70.1	90.2	96.5	69.4
Passing 75 µm Sieve	(%)	12.0	22.3	29.4	54.5	66.7	25.6

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	5.1	57.2	41.2	17.9	6.5	49.2
Fine Sand Ret - 53 µm	(%)	87.1	28.0	31.5	37.6	32.4	26.6
Silt 0.05 - 0.005 mm	(%)	1.0	8.8	8.2	29.2	19.8	6.1
Clay < 0.005 mm	(%)	6.8	6.1	19.0	15.3	41.3	18.1

Moisture Content	(%)	NA	NA	NA	14.1	ND	ND
Liquid Limit, L.L.		28	23	33	23	49	26
Plasticity Index, P.I.		3	3	17	5	28	12
AASHTO Classification		A-2-4(0)	A-2-4(0)	A-2-6(1)	A-4(0)	A-7-6(17)	A-2-6(0)
Organic Content	(%)	ND	ND	ND	ND	ND	ND

Boring No.		RL B4-B	RL B4-B	RL B4-B	RL B2-B	RL EB1-B	RL EB1-B
Station		77+77.8	77+77.8	77+77.8	77+05.6	76+35.2	76+35.2
Offset		23.4m RT	23.4m RT	23.4m RT	20.9m RT	17.3m RT	17.3m RT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (m)	From	8.80	10.20	17.93	9.65	2.60	8.65
	to	9.25	10.77	18.38	10.10	3.05	9.10

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

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:Dual Bridges over Cross Creek on -L- / 6468-06-1600

PROJECT:NCDOT 35196.1.3 **COUNTY:Cumberland** **OWNER: N.C.D.O.T.**

DATE SAMPLED: December 2006 **RECEIVED: 12/22/06** **REPORTED BY: MACTEC**

SAMPLED FROM: RL EB1-B, RL B1-B, RL B5-B

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-22	SS-23	SS-24	SS-25	SS-26	SS-27
Retained 4.75 mm Sieve	(%)	0.0	0.0	0.0	0.0	0.0	0.0
Passing 2.00 mm Sieve	(%)	100.0	99.8	99.6	99.7	99.6	99.9
Passing 425 µm Sieve	(%)	99.7	59.6	82.0	80.2	66.7	57.4
Passing 75 µm Sieve	(%)	94.6	25.7	49.7	52.4	29.0	17.1

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	0.7	62.1	29.4	30.5	55.1	66.4
Fine Sand Ret - 53 µm	(%)	6.8	13.6	25.3	23.4	17.7	18.6
Silt 0.05 - 0.005 mm	(%)	22.3	8.7	21.0	5.0	6.6	8.0
Clay < 0.005 mm	(%)	70.2	15.5	24.3	41.1	20.6	7.0

Moisture Content	(%)	29.9	ND	14.4	14.9	NA	ND
Liquid Limit, L.L.		76	45	32	32	34	31
Plasticity Index, P.I.		41	20	16	16	11	NP
AASHTO Classification		A-7-5(48)	A-2-7(1)	A-6(4)	A-6(5)	A-2-6(0)	A-2-4(0)
Organic Content	(%)	ND	ND	ND	ND	ND	ND

Boring No.		RL EB1-B	RL EB1-B	RL B1-B	RL B1-B	RL B1-B	RL B5-B
Station		76+35.2	76+35.2	76+79.3	76+79.3	76+79.3	78+11.1
Offset		17.3m RT	17.3m RT	22.3m RT	22.3m RT	22.3m RT	19.8m RT
Alignment		-L-	-L-	-L-	-L-	-L-	-L-
Depth (m)	From	11.74	14.78	5.76	10.28	14.85	5.64
	to	12.19	15.23	6.21	10.73	15.30	6.09

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

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:Dual Bridges over Cross Creek on -L- / 6468-06-1600

PROJECT:NCDOT 35196.1.3 **COUNTY:Cumberland** **OWNER: N.C.D.O.T.**

DATE SAMPLED: December 2006 **RECEIVED: 12/22/06** **REPORTED BY: MACTEC**

SAMPLED FROM: RL B5-B

SUBMITTED BY: MACTEC ENGINEERING AND CONSULTING, INC.

1992 STANDARD SPECIFICATIONS

TEST RESULTS

Lab Sample No.		SS-28	SS-29	SS-30			
Retained 4.75 mm Sieve	(%)	0.0	0.0	0.0			
Passing 2.00 mm Sieve	(%)	100.0	99.7	99.4			
Passing 425 µm Sieve	(%)	99.6	73.8	60.3			
Passing 75 µm Sieve	(%)	24.6	25.7	25.3			

MINUS 2.00mm FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - 250 µm	(%)	1.6	43.6	59.9			
Fine Sand Ret - 53 µm	(%)	77.6	34.9	17.6			
Silt 0.05 - 0.005 mm	(%)	4.4	6.1	21.0			
Clay < 0.005 mm	(%)	16.4	15.3	1.5			

Moisture Content	(%)	ND	NA	NA			
Liquid Limit, L.L.		29	25	40			
Plasticity Index, P.I.		NP	7	15			
AASHTO Classification		A-2-4(0)	A-2-4(0)	A-2-6(0)			
Organic Content	(%)	ND	ND	ND			

Boring No.		RL B5-B	RL B5-B	RL B5-B			
Station		78+11.1	78+11.1	78+11.1			
Offset		19.8m RT	19.8m RT	19.8m RT			
Alignment		-L-	-L-	-L-			
Depth (m)	From	8.69	11.74	22.42			
	to	9.14	12.19	22.87			

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

Submitted by:
Laboratory Manager

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 35196.1.3 TIP: X-0002B COUNTY: CUMBERLAND

DESCRIPTION(1): DUAL BRIDGES OVER CROSS CREEK ON -L-

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): Silty fine to coarse sand (A-3); and sandy clay (A-6)

Channel Bank Material(8): Silty, clayey, fine to coarse sand (A-2-4/A-2-6); and sandy, silty clay (A-7-6)

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

Floodplain Width(10): 140 meters

Floodplain Cover(11): Cypress trees, brush; and up to 1 meter of water

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

Channel Migration Tendency(13): None

Observations and Other Comments: Most of the site from Bent 1 to Bent 5 is under water. Main channel of the creek is not well defined. Very low-flow environment.

Reported by: Michael B. [signature] **Date:** 12/21/2006
MACTEC Engineering and Consulting, Inc.

DESIGN SCOUR ELEVATIONS(14) Feet ____ Meters X

BENTS

	B1	B2	B3	B4	B5					
100-year	47.16	46.08	46.79	46.35	47.96					
500-year	47.01	45.88	46.64	46.19	47.9					

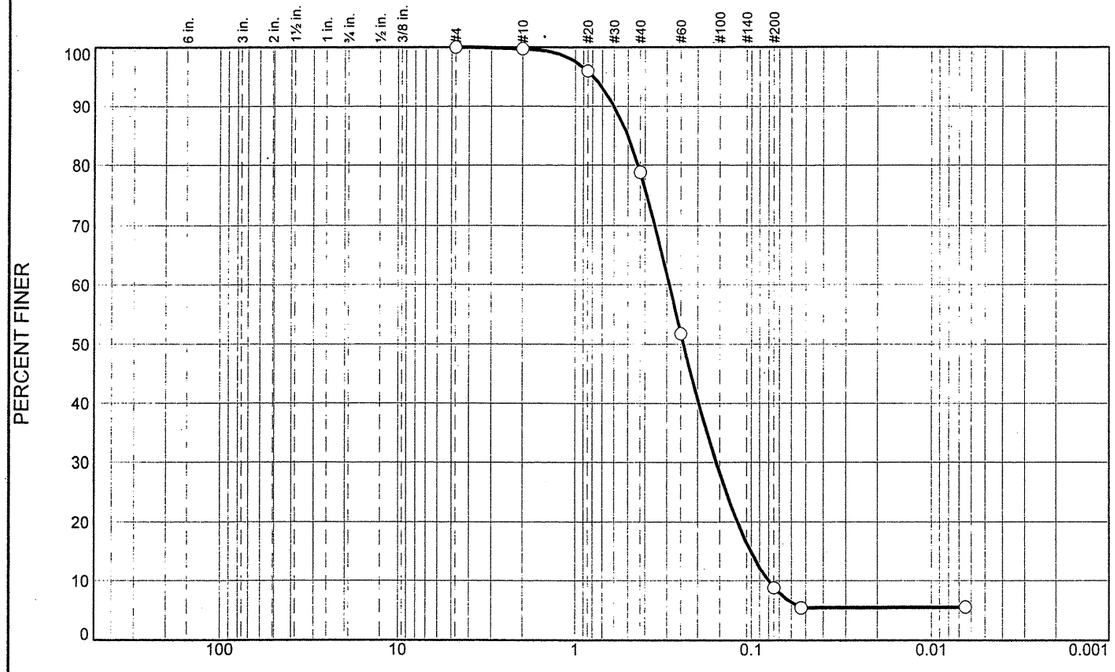
Comparison of DSE to Hydraulics Unit theoretical scour:
DSE calculations based on values in the Bridge Survey and Hydraulic Design Report dated 12/6/05.

DSE determined by: Bradley [signature] **Date:** 1/22/2007

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank	Bed	Bed	Bank	Bank	Bed	Bank	
Sample No.	SS-1	SS-6	SS-20	SS-21	SS-24	SS-27	
Retained #4	0	0	0	0	0	0	
Passed #10	99.7	99.6	100	99.4	99.6	99.9	
Passed #40	78.9	55.7	96.5	69.4	82	57.4	
Passed #200	8.8	1.4	66.7	25.6	49.7	17.1	
Coarse Sand	48	74.3	6.5	49.2	29.4	66.4	
Fine Sand	43.3	25	32.4	26.6	25.3	18.6	
Silt	3.1	0.4	19.8	6.1	21	8	
Clay	5.5	0.3	41.3	18.1	24.3	7	
LL	21	20	49	26	32	31	
PI	NP	NP	28	12	16	NP	
AASHTO	A-3	A-3	A-7-6(17)	A-2-6(0)	A-6(4)	A-2-4(0)	
Station	77+43.1	77+78.8	76+35.2	76+35.2	76+79.3	78+11.1	
Offset	21.0m RT	23.4m RT	17.3m RT	17.3m RT	22.3m RT	19.8m RT	
Depth	3.09-3.54m	2.65-3.10m	2.60-3.05	8.65-9.10	5.76-6.21	5.64-6.09	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	20.8	70.1	8.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	96.0		
#40	78.9		
#60	51.8		
#200	8.8		
#270	5.4		

* (no specification provided)

Material Description

GRAYISH BROWN CLAYEY FINE TO COARSE SAND.

Atterberg Limits

PL= NP LL= 21 PI= NP

Coefficients

D_{85}= 0.5016 D_{60}= 0.2911 D_{50}= 0.2414
D_{30}= 0.1572 D_{15}= 0.1011 D_{10}= 0.0808
C_u= 3.60 C_c= 1.05

Classification

USCS= SP-SM AASHTO= A-3

Remarks

Sample Number: SS-1
Source of Sample: BORING RLB3-B **Depth:** 3.09-3.54 **Date:** 12/1/06

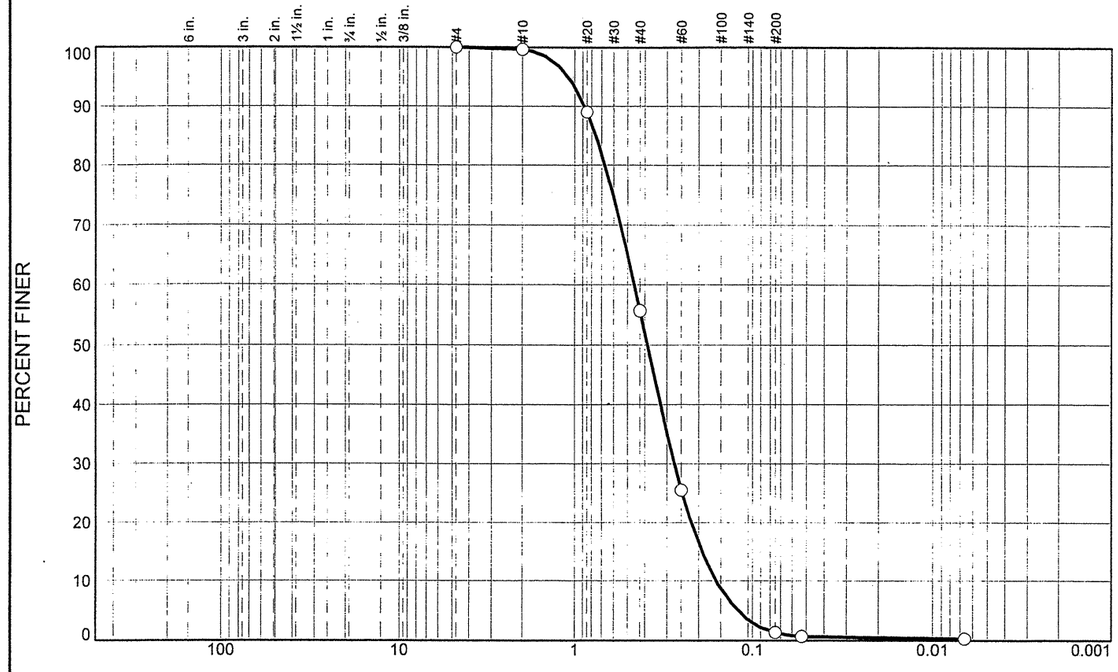
MACTEC, Inc.

Raleigh, North Carolina

Client: NCDOT
Project: Dual Bridges over Cross Creek
Project No: 6468061600.05 **Figure**

Tested By: LBJ **Checked By:** ABS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	43.9	54.3	1.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.6		
#20	89.0		
#40	55.7		
#60	25.6		
#200	1.4		
#270	0.7		

* (no specification provided)

Material Description

LIGHT GRAY SAND.

Atterberg Limits

PL= NP LL= 20 PI= NP

Coefficients

D_{85}= 0.7572 D_{60}= 0.4571 D_{50}= 0.3863
D_{30}= 0.2733 D_{15}= 0.1913 D_{10}= 0.1597
C_u= 2.86 C_c= 1.02

Classification

USCS= SP AASHTO= A-3

Remarks

Sample Number: SS-6
Source of Sample: BORING - RLB4-B **Depth:** 2.65-3.10 **Date:** 11-30-06

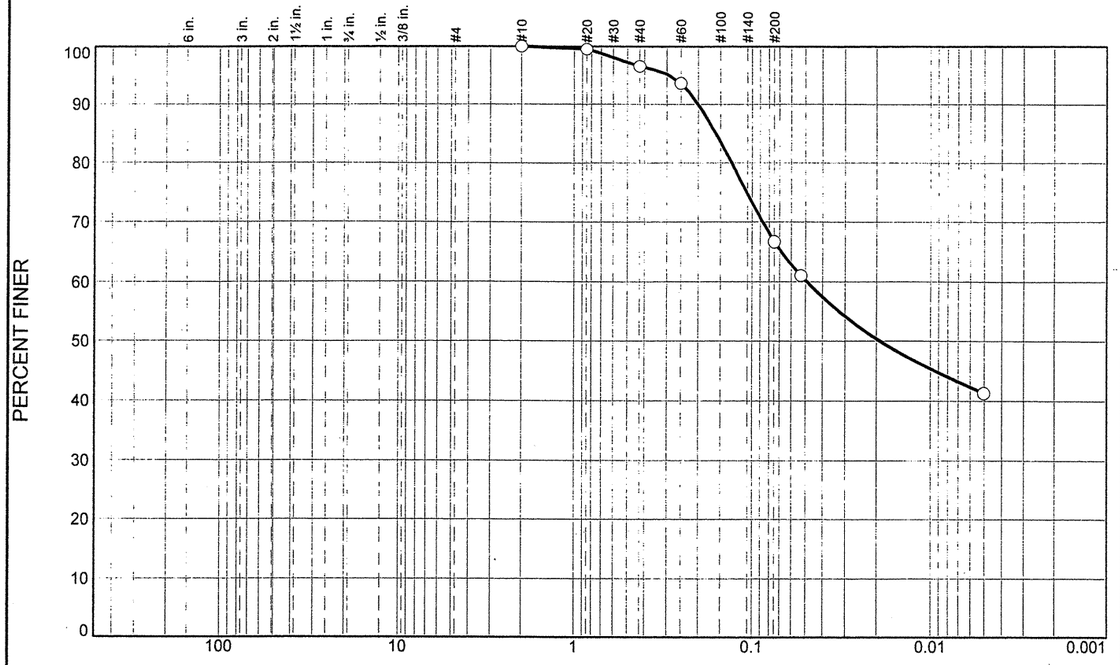
MACTEC, Inc.

Raleigh, North Carolina

Client: NCDOT
Project: Dual Bridges over Cross Creek
Project No: 6468061600.05 **Figure**

Tested By: LBJ **Checked By:** ABS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	3.5	29.8	25.4	41.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.5		
#40	96.5		
#60	93.5		
#200	66.7		
#270	61.1		

* (no specification provided)

Material Description

Light brown to orange and light gray to dark brown silty fine to coarse sand with trace of gravel.

Atterberg Limits

PL= 21 LL= 49 PI= 28

Coefficients

D_{85}= 0.1588 D_{60}= 0.0489 D_{50}= 0.0191
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(17)

Remarks

ENTIRE SAMPLE WAS TESTED.

Sample Number: SS-20
Source of Sample: BORING RL-EB1-B **Depth:** 2.60-3.05m **Date:** 12-12-06

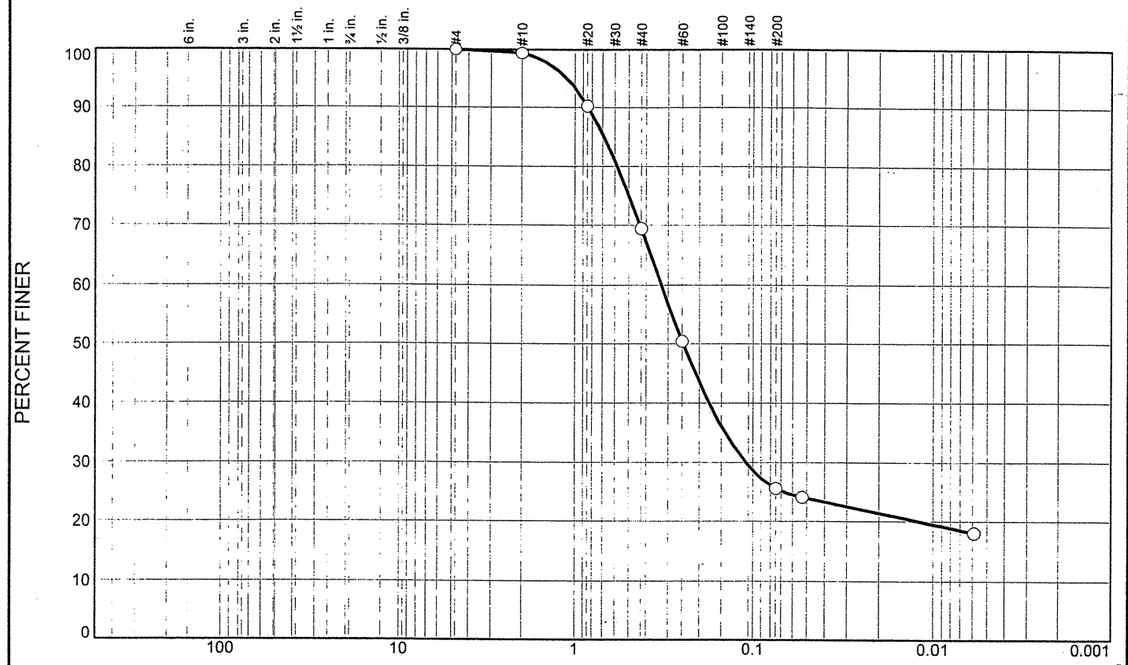
MACTEC, Inc.

Raleigh, North Carolina

Client: NCDOT
Project: Dual Bridges over Cross Creek
Project No: 6468061600.05 **Figure**

Tested By: GS **Checked By:** CJ

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.6	30.0	43.8	25.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.4		
#20	90.3		
#40	69.4		
#60	50.5		
#200	25.6		
#270	24.1		

* (no specification provided)

Material Description

Light greenish gray sandy silt.

Atterberg Limits

PL= 14 LL= 26 PI= 12

Coefficients

D_{85}= 0.6862 D_{60}= 0.3281 D_{50}= 0.2466
D_{30}= 0.1096 D_{15}= D_{10}=
C_u= C_c=

Classification

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

Remarks

ENTIRE SAMPLE WAS TESTED.

Sample Number: SS-21
Source of Sample: BORING RL-EB1-B **Depth:** 8.65-9.10m **Date:** 12-12-06

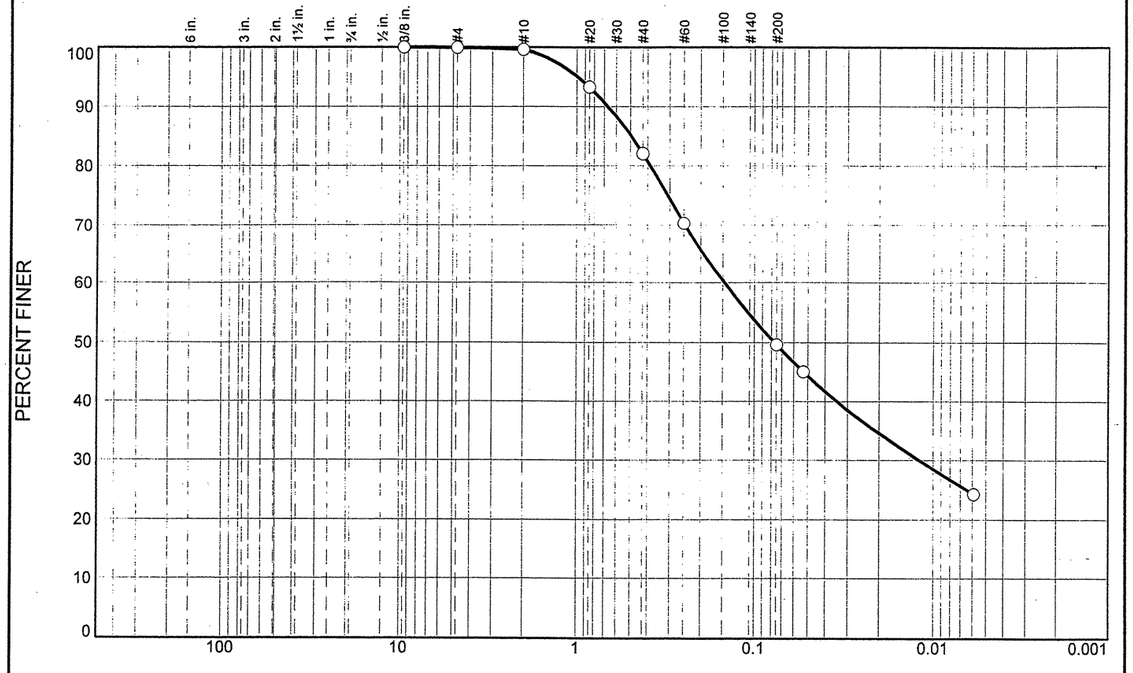
MACTEC, Inc.

Raleigh, North Carolina

Client: NCDOT
Project: Dual Bridges over Cross Creek
Project No: 6468061600.05 **Figure**

Tested By: GS **Checked By:** CJ

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	17.6	32.3	49.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	100.0		
#10	99.6		
#20	93.3		
#40	82.0		
#60	70.3		
#200	49.7		
#270	45.1		

* (no specification provided)

Material Description

Light gray sandy silty clay.

Atterberg Limits

PL= 16 LL= 32 PI= 16

Coefficients

D_{85}= 0.4950 D_{60}= 0.1467 D_{50}= 0.0769
D_{30}= 0.0120 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO= A-6(4)

Remarks

ENTRIE SAMPLE WAS TESTED.

Sample Number: SS-24
Source of Sample: BORING RLB1-B **Depth:** 5.76-6.21m **Date:** 12-12-06

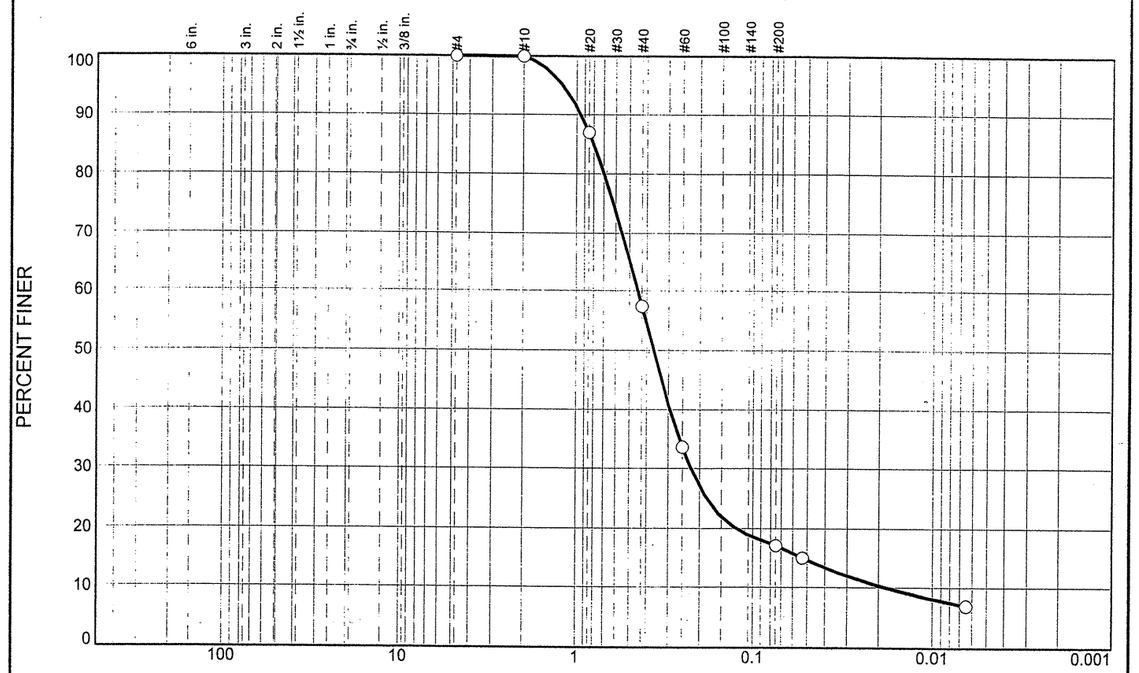
MACTEC, Inc.

Raleigh, North Carolina

Client: NCDOT
Project: Dual Bridges over Cross Creek
Project No: 6468061600.05 **Figure**

Tested By: GS **Checked By:** CJ

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	42.5	40.3	17.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	87.0		
#40	57.4		
#60	33.6		
#200	17.1		
#270	15.0		

* (no specification provided)

Material Description

light gray silty sand.

Atterberg Limits

PL= NP LL= 31 PI= NP

Coefficients

D_{85}= 0.8000 D_{60}= 0.4478 D_{50}= 0.3653
D_{30}= 0.2238 D_{15}= 0.0532 D_{10}= 0.0184
C_u= 24.38 C_c= 6.09

Classification

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

Remarks

ENTIRE SAMPLE WAS TESTED.

Sample Number: SS-27
Source of Sample: RLB5-B **Depth:** 5.64-6.09m **Date:** 12-12-06

MACTEC, Inc.

Raleigh, North Carolina

Client: NCDOT
Project: Dual Bridges over Cross Creek
Project No: 6468061600.05 **Figure**

Tested By: GS **Checked By:** CJ

Site Photos
MACTEC Proj. No. 6468-06-1660

View looking up-station along approach to Right Lane End Bent 1

View looking down-station along Right Lane from boring RL EB1-B

Dual Bridges over Cross Creek on -L- (Right Lane)
NCDOT Proj. No. 35196.1.3 (X-0002B)

View looking toward center line along Right Lane End Bent 1

View looking along Right Lane Bent 1 from center line

View looking down-station along Right Lane from Bent 4

View looking down-station along Right Lane from Bent 5

View looking along Right Lane Bent 5 from center line

View looking up-station along Right Lane from Bent 5

Site Photos
MACTEC Proj. No. 6468-06-1660

Dual Bridges over Cross Creek on -L- (Right Lane)
NCDOT Proj. No. 35196.1.3 (X-0002B)

View looking down-station along Right Lane End Bent 2

View looking down-station along approach to Right Lane End Bent 2

ID: X-0002CA

PROJECT: 35196.3.19

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	GEOTECHNICAL REPORT
4	SITE PLAN
5	PROFILE
6-8	BORE LOG(S)
9	SOIL TEST RESULTS

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 35196.3.19 (X-0002CA)

COUNTY CUMBERLAND

PROJECT DESCRIPTION FAYETTEVILLE OUTER LOOP FROM 2.09KM EAST OF NC 87-210 TO US 401

SITE DESCRIPTION SITE 1 ON RELOCATED SR 1600 (-Y-REV.) OVER FAYETTEVILLE OUTER LOOP (-L-) AT -Y-REV. STATION 18+40

GEOLOGIST

DEAN ARGENBRIGHT
GREENVILLE REGIONAL
ENGINEERING
GEOLOGIST

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	35196.3.19 (X-0002CA)	1	9

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.

THIS SUBSURFACE INFORMATION WAS ORIGINALLY ASSEMBLED AS STATE PROJECT 35196.1.2 (X-0002C), BUT IS BEING LET AS 35196.3.19 (X-0002CA)

PERSONNEL

J.R. SWARTLEY

R.E. SMITH

W.N. CHERRY

INVESTIGATED BY F.M. WESCOTT III

CHECKED BY D.N. ARGENBRIGHT

SUBMITTED BY D.N. ARGENBRIGHT

DATE JUNE, 2007

NORTH CAROLINA LICENSED SEAL 1050 GEOLOGIST D.N. ARGENBRIGHT 6-11-07

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N.C. DEPARTMENT OF TRANSPORTATION. NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS

METRIC

PROJECT REFERENCE NO.	SHEET NO.
35196.1.2 (X-0002C)	2 OF 9

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 30 CM 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 #40 #200	50 MX 30 MX 15 MX	58 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
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 (kN/m^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<25
	SOFT	2 TO 4	25 TO 50
	MEDIUM STIFF	4 TO 8	50 TO 100
	STIFF	8 TO 15	100 TO 200
	VERY STIFF	15 TO 30	200 TO 400
	HARD	>30	>400

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
	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		
	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PLASTIC RANGE (PI)		
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
- 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-45B
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 152mm CONTINUOUS FLIGHT AUGER
- [ ] 203mm HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 75 mm STEEL TEETH
- [ ] TRICONE _____ mm 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 3 CM 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 30 CM 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 BLOWS PER 30 CM*
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 BLOWS PER 30 CM*
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 6 MM 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 13 MM DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 25 MM 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 25 MM OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 3 M
WIDE	3 TO 10 M
MODERATELY CLOSE	30 TO 100 CM
CLOSE	5 TO 30 CM
VERY CLOSE	LESS THAN 5 CM

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 1 M
THICKLY BEDDED	0.5 - 1 M
THINLY BEDDED	0.05 - 0.5 M
VERY THINLY BEDDED	10 - 50 MM
THICKLY LAMINATED	2.5 - 10 MM
THINLY LAMINATED	< 2.5 MM

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 10 CM 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) OF A 63.5 KG HAMMER FALLING 0.76 M REQUIRED TO PRODUCE A PENETRATION OF 30 CM INTO SOIL WITH A 5 CM OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 3 CM 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 10 CM DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK: BL-22 -L- STA. 102+03.121 15.360m LT

ELEVATION: 70.77 M

NOTES:

SITE 1

REVISED 02/23/06

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

June 11, 2007

STATE PROJECT: 35196.1.2 X-0002C
F. A. PROJECT: NHF-DRP-0100(002)
COUNTY: Cumberland
DESCRIPTION: Fayetteville Outer Loop from 2.09km East of NC 87-210 to US 401

SUBJECT: Geotechnical Report - Bridge Foundation Investigation for Site 1 on Relocated SR 1600 (-Y- REV.) over Fayetteville Outer Loop (-L-) at -Y-REV. Station 18+40

Site Description

The proposed bridge site is located along a relocated SR 1600 (McArthur Road) alignment over the proposed -L- alignment. Based on the proposed design, the new structure will have two spans with a total length of 106 meters. The bents will have a skew of 40 degrees.

One Standard Penetration Test (SPT) boring was made at or near each proposed bent location to provide subsurface information relative to foundation design. The borings were made with ATV mounted CME-45B drill machine and were advanced by rotary drill methods using bentonite drilling fluid.

The bridge site is located in the Coastal Plain Physiographic Province and is underlain by Recent upland deposits and Cretaceous age soils of the Cape Fear Formation. Topography at the site is nearly flat to gentle sloping. Elevations at the site range from 68± to 70± meters. During this investigation, water levels within the boreholes were measured at elevations ranging from 64± to 69± meters.

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT
1589 MAIL SERVICE CENTER
RALEIGH NC 27699-1589

TELEPHONE: 919-250-4088
FAX: 919-250-4237

WEBSITE: WWW.DOH.DOT.STATE.NC.US

LOCATION:
CENTURY CENTER COMPLEX
ENTRANCE B-2
1020 BIRCH RIDGE DRIVE
RALEIGH NC

Soil Description

Subsurface conditions at the site are relatively uniform. Upland surficial soils generally consist of up to 1± meter of very loose to loose sand (A-2-4) and up to 1.5± meters of medium stiff to very stiff sandy clayey silt (A-5) and sandy clay (A-6). Moisture contents of tested cohesive samples were 14 percent. The upland deposits are underlain by 7± to 15± meters of very loose to dense sand (A-1-b, A-2-4, A-3). A very soft to soft sandy silt (A-4) layer was noted in Bent 1 and End Bent 2 within the granular deposits. Soils belonging to the Cretaceous age Cape Fear Formation underlie the granular deposits at elevations ranging from 53± to 59± meters. Soils of the Cape Fear Formation consist of soft to hard silty clay (A-7-5, A-7-6) and sandy clayey silt (A-4).

Based on the proposed design, approximately 3± meters of embankment will be placed at End Bent 1 and 2. Approximately 2.9 meters of natural ground will be removed from Bent 1. Additional fill will be required for construction of the end bent and side slopes. Borrow meeting Coastal Plain criteria is available in nearby areas.

Note

The Geotechnical foundation report is based on the Preliminary General Drawing Report dated February 26, 2007. If significant changes are made in the design or location of the proposed structure, the subsurface information should be reviewed and modified as necessary.

Prepared By:

Fred M. Wescott III
Project Geological Engineer

PROJECT REFERENCE NO.	SHEET
X-0002C SITE 1	4 OF 9

SITE PLAN

0 10 20
METERS

SKEW = 40°

-N-

EB1-A

18+00

103+00

0+80

-Y LOOP D-

EB1 BENT LINE

EB2 BENT LINE

B1-A

0+00

POS STA. 102+62.953 -L-
POT STA. 18+40.043 -Y-REV.

-Y LOOP B-

0+40

-L-

B1 BENT LINE

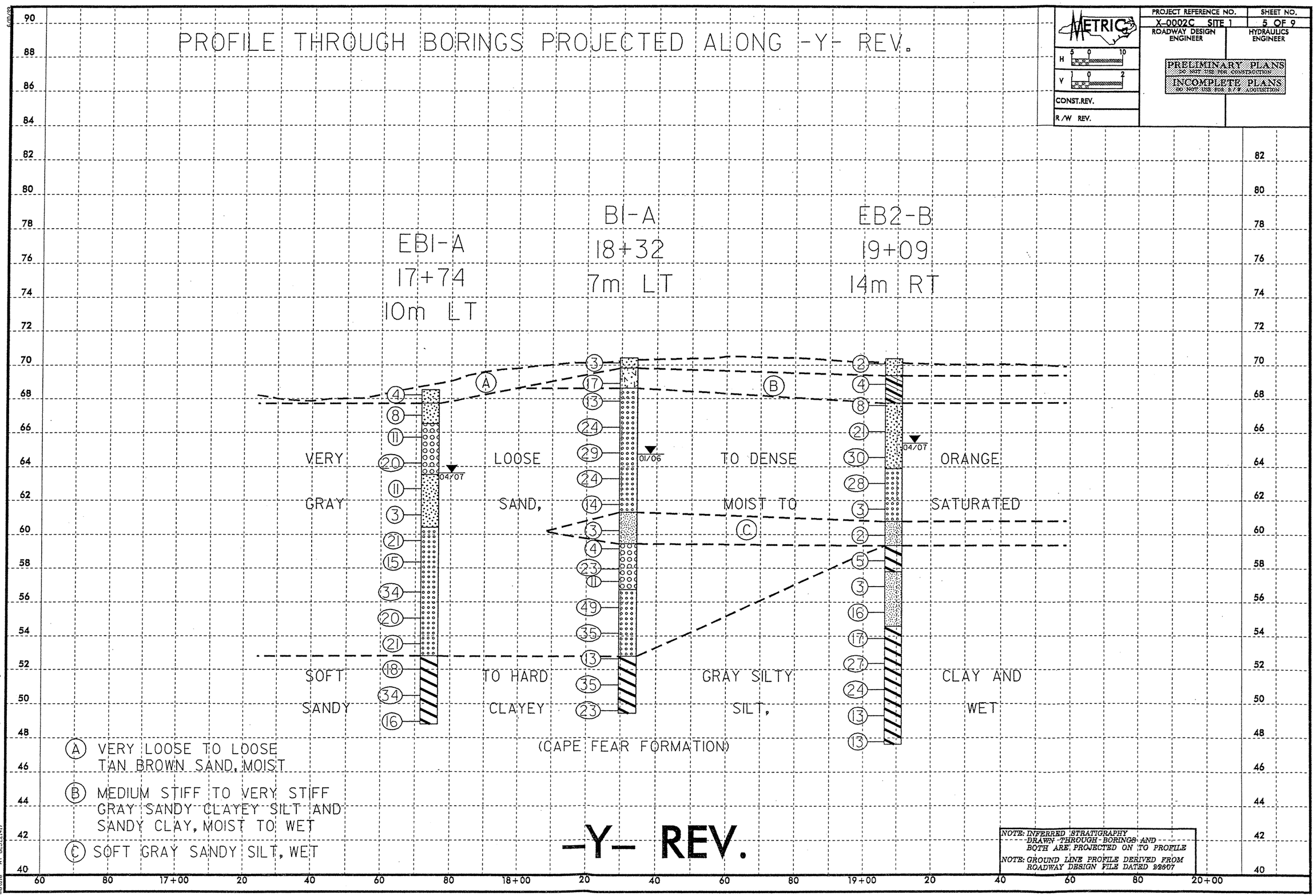
0+00

-Y_REV

19+00

102+00

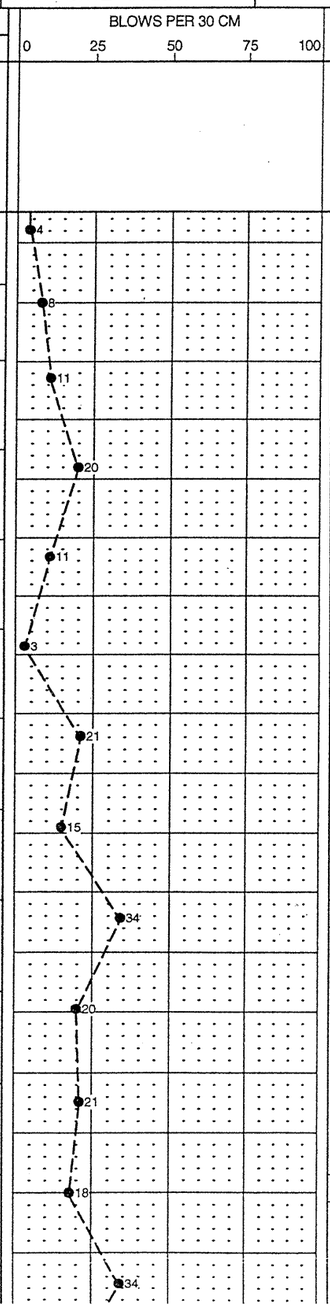
EB2-B


PROFILE THROUGH BORINGS PROJECTED ALONG -Y- REV.
METRIC
PROJECT REFERENCE NO.
X-0002C SITE 1
SHEET NO.
5 OF 9
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
H
V
CONST.REV.
R/W REV.
EB1-A
17+74
10m LT
B1-A
18+32
7m LT
EB2-B
19+09
14m RT
VERY GRAY SOFT SANDY
LOOSE SAND, TO HARD CLAYEY
TO DENSE MOIST TO GRAY SILTY SILT,
ORANGE SATURATED CLAY AND WET
04/07
01/06
04/07
(CAPE FEAR FORMATION)
A VERY LOOSE TO LOOSE TAN BROWN SAND, MOIST
B MEDIUM STIFF TO VERY STIFF GRAY SANDY CLAYEY SILT AND SANDY CLAY, MOIST TO WET
C SOFT GRAY SANDY SILT, WET
-Y- REV.
NOTE: INFERRED STRATIGRAPHY DRAWN THROUGH BORINGS AND BOTH ARE PROJECTED ON TO PROFILE
NOTE: GROUND LINE PROFILE DERIVED FROM ROADWAY DESIGN FILE DATED 2/26/07
17+00
18+00
19+00
20+00

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

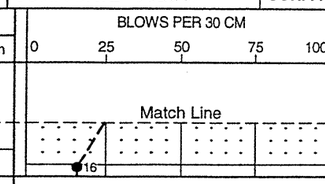
PROJECT NO. 35196.1.2	ID. X-0002C	COUNTY CUMBERLAND	GEOLOGIST Swartley, J. R.
SITE DESCRIPTION SITE 1 ON RELOCATED SR 1600 (-Y-REV.) OVER FAYETTEVILLE OUTER LOOP (-L-)			GROUND WTR (m)
BORING NO. EB1-A	STATION 17+74.0	OFFSET 10.0m LT	ALIGNMENT -Y-REV.	0 HR. N/A
COLLAR ELEV. 68.52 m	TOTAL DEPTH 19.72 m	NORTHING 154,242.0	EASTING 618,091.0	24 HR. 4.90
DRILL MACHINE CME-45B	DRILL METHOD Mud Rotary		HAMMER TYPE Automatic
START DATE 04/20/07	COMP. DATE 04/20/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (m) / DEPTH (m))
70								
68.52	0.00							68.52 GROUND SURFACE 0.00
		1	2	2				BROWN SAND, MOIST
67.30	1.22							67.72 0.80
		5	4	4	SS-15			
66.02	2.50							66.52 2.00
		4	5	6				
64.50	4.02							
		8	10	10	SS-16			
62.97	5.55							63.52 5.00
		4	5	6				ORANGE GRAY SAND, MOIST TO SATURATED
61.45	7.07							
		2	2	1				
59.92	8.60							60.42 8.10
		4	8	13				
58.40	10.12							
		3	6	9				
56.87	11.65							
		16	20	14	SS-17			
55.35	13.17							
		6	9	11				
53.82	14.70							
		9	9	12				
52.30	16.22							52.82 15.70
		3	7	11	SS-18			
50.78	17.74							GRAY SILTY CLAY, WET (CAPE FEAR FORMATION)
		10	14	20				



PROJECT NO. 35196.1.2	ID. X-0002C	COUNTY CUMBERLAND	GEOLOGIST Swartley, J. R.
SITE DESCRIPTION SITE 1 ON RELOCATED SR 1600 (-Y-REV.) OVER FAYETTEVILLE OUTER LOOP (-L-)			GROUND WTR (m)
BORING NO. EB1-A	STATION 17+74.0	OFFSET 10.0m LT	ALIGNMENT -Y-REV.	0 HR. N/A
COLLAR ELEV. 68.52 m	TOTAL DEPTH 19.72 m	NORTHING 154,242.0	EASTING 618,091.0	24 HR. 4.90
DRILL MACHINE CME-45B	DRILL METHOD Mud Rotary		HAMMER TYPE Automatic
START DATE 04/20/07	COMP. DATE 04/20/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
50								
49.25	19.27							
		7	9	7				48.80 19.72



Boring Terminated at Elevation 48.80 m in very stiff silty clay

OT BORE DOUBLE X0002C_GEO_BRDG.GPJ NC_DOT.GDT 06/08/07

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** CUMBERLAND	**GEOLOGIST** Quick, K. B.
SITE DESCRIPTION SITE 1 ON RELOCATED SR 1600 (-Y-REV.) OVER FAYETTEVILLE OUTER LOOP (-L-)			**GROUND WTR (m)**
BORING NO. B1-A	**STATION** 18+32.0	**OFFSET** 7.0m LT	**ALIGNMENT** -Y-REV. — **0 HR.** N/A
COLLAR ELEV. 70.43 m	**TOTAL DEPTH** 20.98 m	**NORTHING** 154,194.0	**EASTING** 618,124.0 — **24 HR.** 5.70
DRILL MACHINE CME-45C	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 01/24/06	**COMP. DATE** 01/24/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (m)	DEPTH (m)
71										
70.43	0.00								70.43 GROUND SURFACE	0.00
		1	2	1	3				TAN SAND, MOIST	
69.21	1.22								69.83	0.60
		4	6	11	17	SS-1	14%		GRAY SANDY CLAYEY SILT, MOIST	
68.14	2.29								68.63	1.80
		5	7	6	13	SS-2				
66.62	3.81									
		7	10	14	24				ORANGE GRAY SAND, MOIST TO SATURATED	
65.10	5.33									
		7	14	15	29					
63.58	6.85									
		7	9	15	24	SS-3				
62.06	8.37									
		3	5	9	14					
60.54	9.89									
		1	2	1	3	SS-4	14%			
59.46	10.97								61.33	9.10
		1	1	3	4	SS-5			GRAY SANDY SILT, WET	
58.24	12.19								59.46	10.97
		7	13	10	23					
57.50	12.93									
		7	5	6	11				TAN SAND, SATURATED	
55.98	14.45								56.73	13.70
		11	21	28	49	SS-6				
54.46	15.97									
		12	11	24	35					
52.94	17.49									
		9	6	7	13	SS-7	14%		52.79	17.64
51.42	19.01								GRAY SILTY CLAY, WET (CAPE FEAR FORMATION)	
		9	15	20	35					

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** CUMBERLAND	**GEOLOGIST** Quick, K. B.
SITE DESCRIPTION SITE 1 ON RELOCATED SR 1600 (-Y-REV.) OVER FAYETTEVILLE OUTER LOOP (-L-)			**GROUND WTR (m)**
BORING NO. B1-A	**STATION** 18+32.0	**OFFSET** 7.0m LT	**ALIGNMENT** -Y-REV. — **0 HR.** N/A
COLLAR ELEV. 70.43 m	**TOTAL DEPTH** 20.98 m	**NORTHING** 154,194.0	**EASTING** 618,124.0 — **24 HR.** 5.70
DRILL MACHINE CME-45C	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
START DATE 01/24/06	**COMP. DATE** 01/24/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
51					Match Line				
49.90	20.53								49.45 20.98
		6	10	13	23				Boring Terminated at Elevation 49.45 m in very stiff silty clay

NCDOT BORE DOUBLE X0002C_GEO_BRDG.GPJ NC_DOT.GDT 06/08/07

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** CUMBERLAND	**GEOLOGIST** Swartley, J. R.	
SITE DESCRIPTION SITE 1 ON RELOCATED SR 1600 (-Y-REV.) OVER FAYETTEVILLE OUTER LOOP (-L-)				**GROUND WTR (m)**
BORING NO. EB2-B	**STATION** 19+09.0	**OFFSET** 14.0m RT	**ALIGNMENT** -Y-REV.	**0 HR.** N/A
COLLAR ELEV. 70.39 m	**TOTAL DEPTH** 22.76 m	**NORTHING** 154,121.0	**EASTING** 618,155.0	**24 HR.** 5.00
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 04/18/17	**COMP. DATE** 04/18/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (m)	DEPTH (m)
71											
70.39	0.00								GROUND SURFACE	70.39	0.00
69.17	1.22	1	1	1	2				BROWN SAND, MOIST	69.39	1.00
67.89	2.50	2	2	2	4	SS-9			ORANGE SANDY CLAY, MOIST TO WET	67.74	2.65
66.37	4.02	2	4	4	8	SS-10					
64.85	5.54	4	7	14	21		▼		ORANGE GRAY SAND, SATURATED	63.89	6.50
63.32	7.07	11	14	16	30						
61.80	8.59	10	14	14	28						
60.27	10.12	4	1	2	3	SS-11				60.79	9.60
58.75	11.64	1	1	1	2	SS-12			GRAY SANDY SILT, WET	59.35	11.04
57.22	13.17	1	2	3	5	SS-13			GRAY SILTY CLAY, WET (CAPE FEAR FORMATION)	57.79	12.60
55.70	14.69	2	1	2	3						
54.17	16.22	9	7	9	16				YELLOW GRAY SANDY CLAYEY SILT, WET	54.59	15.80
52.65	17.74	4	8	9	17	SS-14					
51.13	19.26	7	11	16	27				GRAY SILTY CLAY, WET		
		7	11	13	24						

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** CUMBERLAND	**GEOLOGIST** Swartley, J. R.	
SITE DESCRIPTION SITE 1 ON RELOCATED SR 1600 (-Y-REV.) OVER FAYETTEVILLE OUTER LOOP (-L-)				**GROUND WTR (m)**
BORING NO. EB2-B	**STATION** 19+09.0	**OFFSET** 14.0m RT	**ALIGNMENT** -Y-REV.	**0 HR.** N/A
COLLAR ELEV. 70.39 m	**TOTAL DEPTH** 22.76 m	**NORTHING** 154,121.0	**EASTING** 618,155.0	**24 HR.** 5.00
DRILL MACHINE CME-45B	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic	
START DATE 04/18/17	**COMP. DATE** 04/18/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
51					Match Line				
49.60	20.79	3	5	8	13				GRAY SILTY CLAY, WET *(continued)*
48.08	22.31	5	7	6	13				
47.63	22.76								Boring Terminated at Elevation 47.63 m in very stiff silty clay

NCDOT BORE DOUBLE X0002C_GEO_BRDG.GPJ NC_DOT.GDT 06/08/07

X-0002C
Site 1 on Relocated SR 1600 (-Y-REV.) over Fayetteville Outer Loop (-L-)

HOLE #	SAMPLE #	PASS 10	PASS 40	PASS 200	CSESAND	FINESAND	SI	CL	LL	PI	CLASS	DEPTH	MOIST.	ORG.
B1-A	SS-1	100	95	63	9.5	29.5	12.4	48.5	50	9	A-5(7)	1.22-1.67	13.9	
	SS-2	NOT	ENOUGH	SAMPLE								2.29-2.74		
	SS-3	99	56	4	70.8	25.9	1.3	2.0	21	NP	A-3(0)	6.85-7.30		
	SS-4	99	85	46	28.7	35.2	17.9	18.2	28	7	A-4(1)	9.89-10.34	14.4	
	SS-5	83	13	2	90.4	7.3	0.3	2.0	23	NP	A-1-b(0)	10.97-11.42		
	SS-6	99	53	6	75.0	20.6	0.3	4.0	19	NP	A-3(0)	14.45-14.90		
	SS-7	100	97	85	4.9	14.8	25.8	54.6	42	12	A-7-5(12)	17.64-17.94	14.4	
EB2-B	SS-9	98	83	47	25.8	30.2	17.9	26.2	34	19	A-6(5)	1.22-1.67		
	SS-10	100	75	21	50.1	30.0	1.8	18.1	25	7	A-2-4(0)	2.65-2.95		
	SS-11	87	61	8	56.7	34.6	0.6	8.0	21	NP	A-3(0)	8.59-9.04		
	SS-12	100	86	39	37.2	28.4	12.3	22.1	27	10	A-4(1)	10.12-10.57		
	SS-13	100	99	95	1.4	9.9	32.4	56.3	58	28	A-7-5(32)	11.64-12.09		
	SS-14	100	98	92	2.8	7.6	17.1	72.4	59	35	A-7-6(36)	16.22-16.67		
EB1-A	SS-15	100	92	15	59.8	26.2	2.0	12.1	22	NP	A-2-4(0)	1.22-1.67		
	SS-16	100	41	5	75.7	20.3	2.0	2.0	25	NP	A-1-b(0)	4.02-4.47		
	SS-17	100	53	6	76.1	18.9	3.0	2.0	20	NP	A-3(0)	11.65-12.10		
	SS-18	100	98	90	3.4	10.7	19.5	66.4	49	27	A-7-6(26)	16.22-16.67		

ID: X-0002CA

PROJECT: 35196.3.19

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3-5	SITE PLAN AND PROFILES
6	SOIL TEST RESULTS

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

DEAN ARGENBRIGHT
GREENVILLE REGIONAL
ENGINEERING
GEOLOGIST

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	35196.3.19 (X-0002CA)	1	6

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 35196.3.19 (X-0002CA)

COUNTY CUMBERLAND

PROJECT DESCRIPTION NC 24 EXT. (FAYETTEVILLE OUTER LOOP) FROM 1.3 MILES EAST OF NC 87-210 TO WEST OF US 401

SITE DESCRIPTION NOISE WALL RIGHT OF -L- STA. 83+40

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.

THIS SUBSURFACE INFORMATION WAS ORIGINALLY ASSEMBLED AS STATE PROJECT 35196.1.2 (X-0002C), BUT IS BEING LET AS 35196.3.19 (X-0002CA)

PERSONNEL

T. C. BOTTOMS

J. R. SWARTLEY

W. N. CHERRY

R. E. SMITH

L. W. DAIL

INVESTIGATED BY F. M. WESCOTT III

CHECKED BY D. N. ARGENBRIGHT

SUBMITTED BY D. N. ARGENBRIGHT

DATE JANUARY, 2007

NORTH CAROLINA LICENSED SEAL 1050 GEOLOGIST D. N. ARGENBRIGHT

1-8-07

DRAWN BY: T. T. WALKER, F. M. WESCOTT III

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.

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

PROJECT REFERENCE NO.	SHEET NO.
35196.1.2 (X-0002C)	2 OF 6

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 30 CM 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 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
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 (kN/m^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<25
	SOFT	2 TO 4	25 TO 50
	MEDIUM STIFF	4 TO 8	50 TO 100
	STIFF	8 TO 15	100 TO 200
	VERY STIFF	15 TO 30	200 TO 400
	HARD	>30	>400

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
	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
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%
MODERATELY ORGANIC	5 - 10%	12 - 20%
HIGHLY ORGANIC	>10%	>20%

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SOUNDING ROD
- SPT, CPT, DPT, DMT, PMT, VST — 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
- [X] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 152mm CONTINUOUS FLIGHT AUGER
- [ ] 203mm HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 75 mm STEEL TEETH
- [ ] TRICONE _____ mm 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 3 CM 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 30 CM 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 BLOWS PER 30 CM*
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 BLOWS PER 30 CM*
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 6 MM 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 13 MM DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 25 MM 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 25 MM OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 3 M
WIDE	3 TO 10 M
MODERATELY CLOSE	30 TO 100 CM
CLOSE	5 TO 30 CM
VERY CLOSE	LESS THAN 5 CM

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 1 M
THICKLY BEDDED	0.5 - 1 M
THINLY BEDDED	0.05 - 0.5 M
VERY THINLY BEDDED	10 - 50 MM
THICKLY LAMINATED	2.5 - 10 MM
THINLY LAMINATED	< 2.5 MM

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 10 CM 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) OF A 63.5 KG HAMMER FALLING 0.76 M REQUIRED TO PRODUCE A PENETRATION OF 30 CM INTO SOIL WITH A 5 CM OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 3 CM 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 10 CM DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK:

ELEVATION:

NOTES:

REVISED 02/23/06

PROJECT REFERENCE NO.	SHEET NO.
X-0002C	3 of 6

METRIC

HORIZONTAL 5 0 10

VERTICAL 1 0 2

84+00

85+00

CAT-1

GRAU 350

025 025 025

- L -

FAYETTEVILLE OUTER LOOP

N 64°56'54.8" E

025 025 025

PROP. EXPRESSWAY GUTTER

SECTION

PROP. GUARDRAIL

CAT-1

L=160m

PROP. NOISE WALL

STA. 85+00 -L- 24m RT.

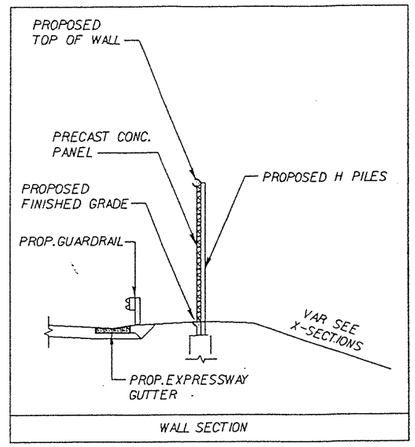
L=80m

STA. 85+77 -L- 45m RT.

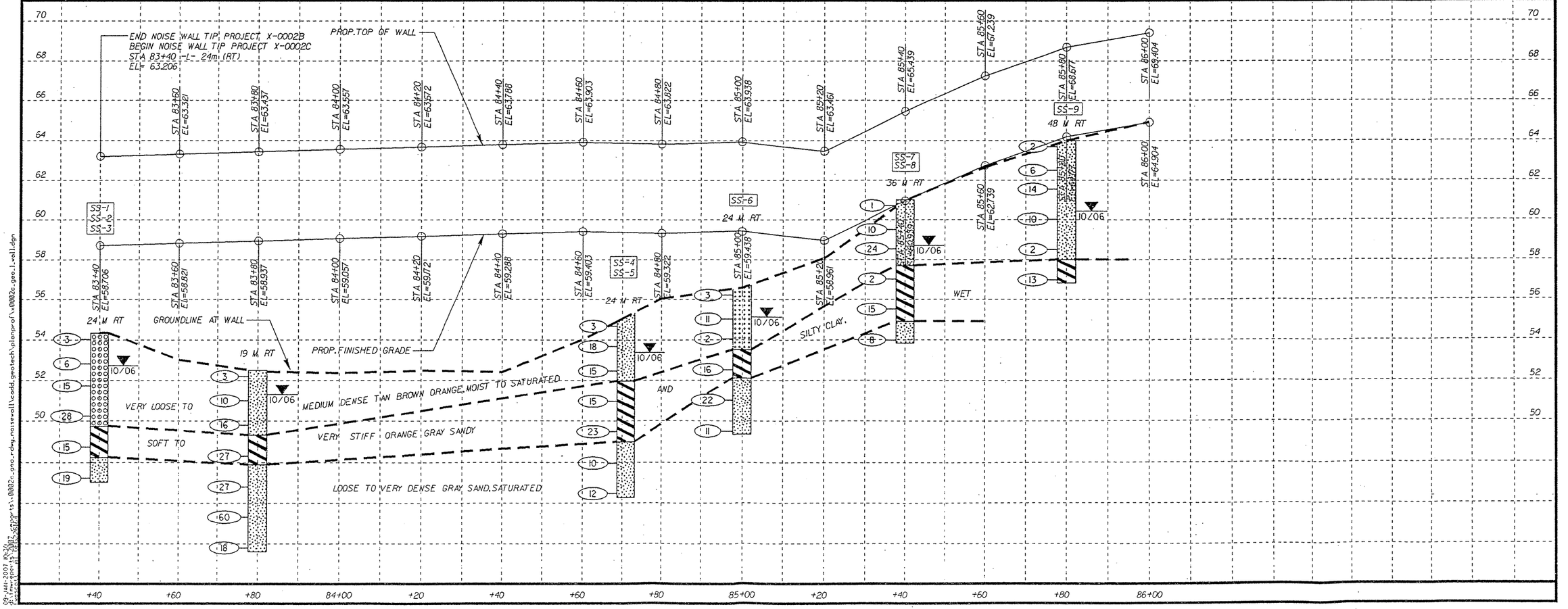
L=100m

END NOISE WALL TIP PROJECT X-0002B
BEGIN NOISE WALL TIP PROJECT X-0002C
STA. 83+40 -L- 24m RT.

MATCHLINE STA 86+00 -L- SEE SHEET 2-U



WALL SECTION



09-JAN-2007 (Fri 2)
C:\Projects\...\0002c_geo_rdwy_noisewall\eadd_geotech\planprof\x0002c_geo_1_wall.dgn

8/17/99

METRIC

HORIZONTAL

VERTICAL

PROJECT REFERENCE NO.	SHEET NO.
X-0002C	4 of 6

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

87+00

88+00

MATCHLINE STA 86+00 -L- SEE SHEET 2-T

MATCHLINE STA 88+80 -L- SEE SHEET 2-V

025 | 025 | 025 | 03 | 04 | 045

- L -

N 64° 56' 54.8" E

FAYETTEVILLE OUTER LOOP

025 | 02 | 01 | 00 | 01 | 02 | 03 | 04 | 045

SECTION

PROP. NOISE WALL

L=100m

L=90m

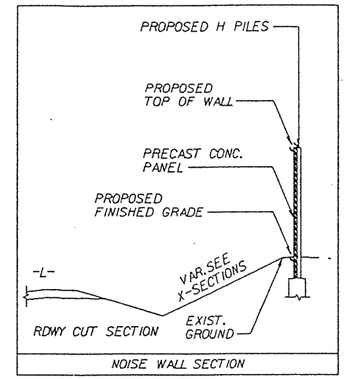
L=70m

120m

STA. 86+77 -L-
48m RT.

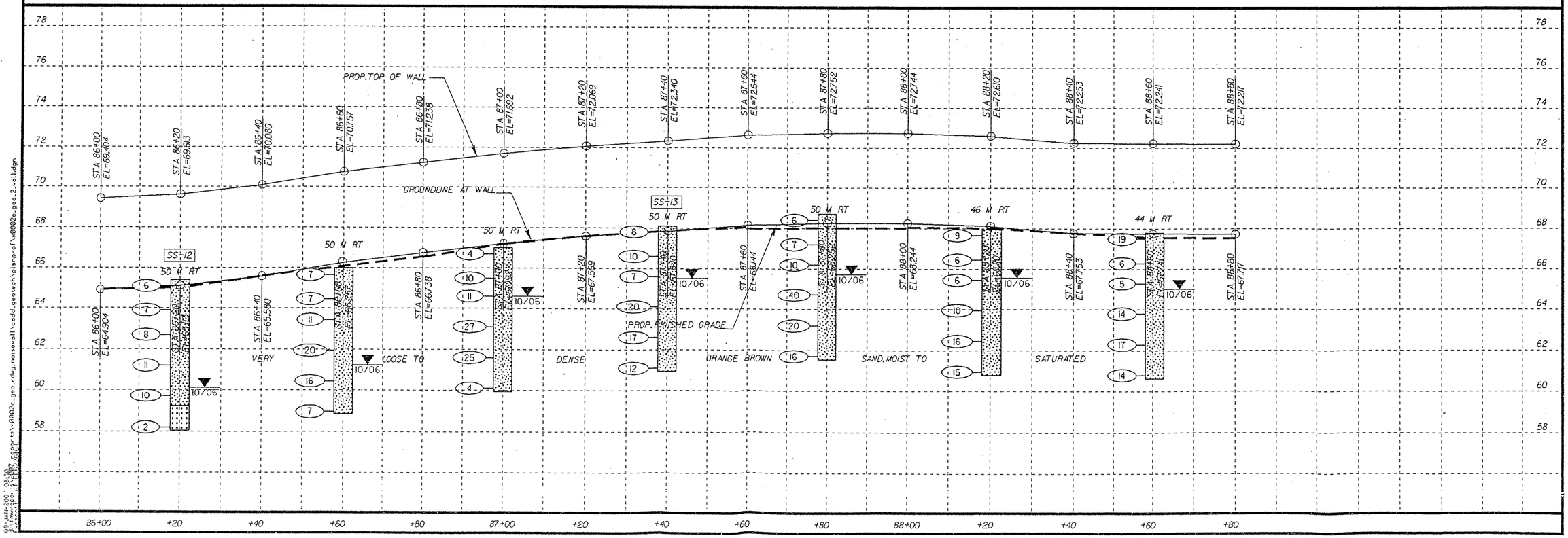
STA. 87+66 -L-
47m RT.

STA. 88+34 -L-
43m RT.



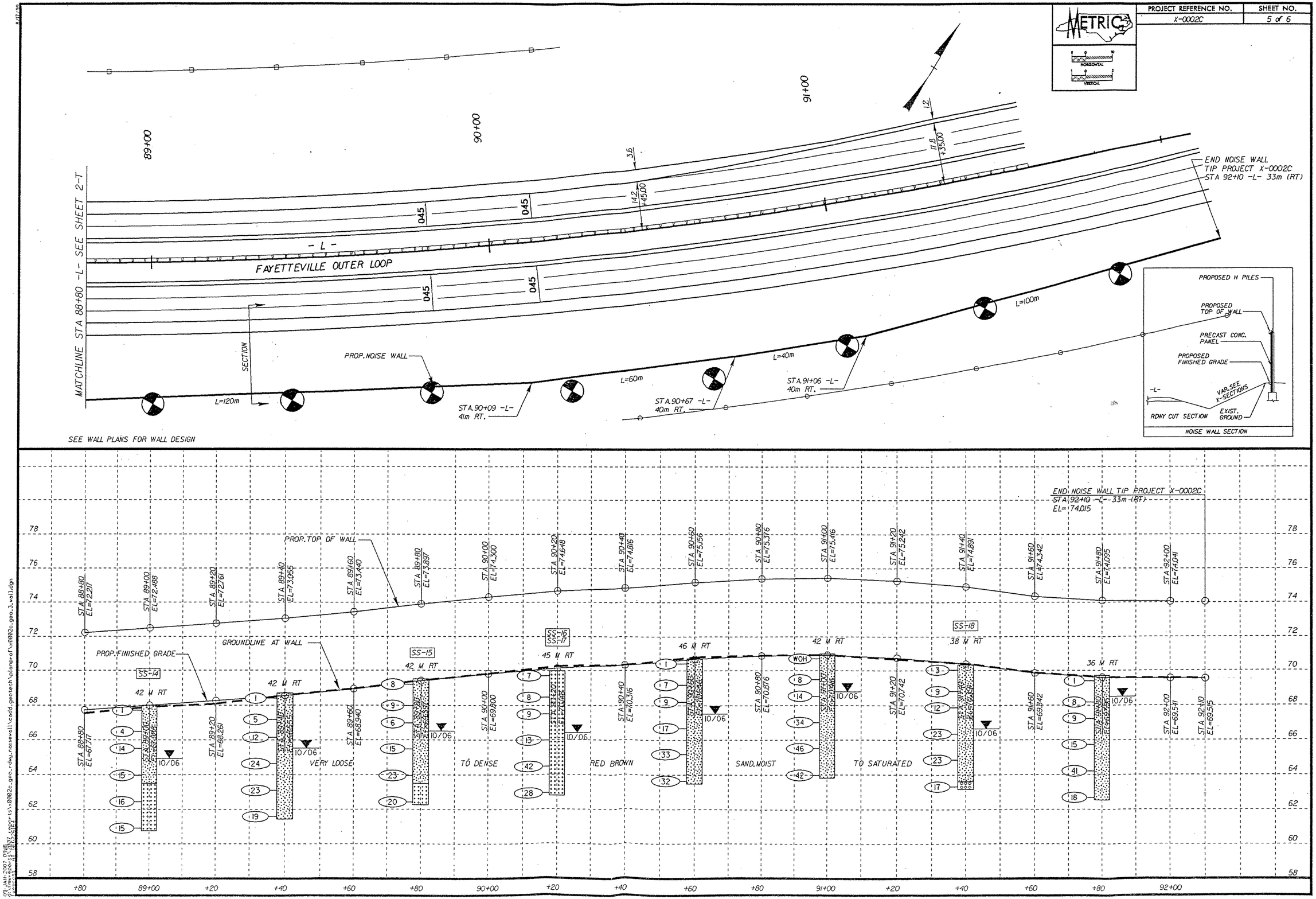
NOISE WALL SECTION

SEE WALL PLANS FOR WALL DESIGN



09-JAN-2001 08:30
C:\projects\0002c_geo_rdwy_noise_wall\cadd_geotech\plan_prof\x0002c_geo_2_wall.dgn

PROJECT REFERENCE NO.	SHEET NO.
X-0002C	5 of 6



Proj. No. 35196.1.2
ID No. X-0002C
County: CUMBERLAND

HOLE #	SAMPLE #	PASS 10	PASS 40	PASS 200	CSESAND	FINESAND	SI	CL	LL	PI	CLASS	DEPTH	MOIST.	ORG.
83+40	SS-1	100	43	4	78.1	18.4	1.9	1.6	18	NP	A-1-b(0)	2.30-2.75		
24m RT	SS-2	100	94	88	7.8	6.0	18.5	67.7	50	27	A-7-6(26)	5.30-5.75		
	SS-3	100	75	31	55.7	14.8	5.9	23.6	29	6	A-2-4(0)	6.80-7.25		
84+71	SS-4	100	98	96	2.4	3.0	24.9	69.7	63	19	A-7-5(27)	3.70-4.15		
24m RT	SS-5	100	56	12	77.1	11.6	3.7	7.6	17	NP	A-2-4(0)	6.70-7.15		
85+00	SS-6	100	75	14	74.9	12.0	5.5	7.6	22	NP	A-2-4(0)	6.72-7.17		
24m RT														
85+40	SS-7	100	78	15	44.6	41.4	6.3	7.6	21	NP	A-2-4(0)	2.16-2.61		
36m RT	SS-8	100	83	71	25.0	4.2	21.1	49.6	48	16	A-7-5(12)	3.68-4.13	24.3	
85+80	SS-9	100	92	82	12.0	9.8	22.5	55.7	51	26	A-7-6(23)	6.72-7.17		
48m RT														
86+20	SS-12	100	55	9	71.3	20.0	5.1	3.6	17	NP	A-3(0)	6.90-7.35		
50m RT														
87+40	SS-13	100	64	17	54.3	30.8	5.3	9.6	11	NP	A-2-4(0)	1.20-1.65		
50m RT														
89+00	SS-14	95	51	7	61.3	31.6	2.3	4.8	22	NP	A-3(0)	5.26-5.71		
42m RT														
89+80	SS-15	100	64	14	59.1	28.6	3.5	8.8	20	NP	A-2-4(0)	2.22-2.67		
42m RT														
90+20	SS-16	100	56	6	68.5	26.4	2.3	2.8	17	NP	A-3(0)	1.22-1.67		
45m RT	SS-17	100	51	5	75.7	19.6	1.9	2.8	21	NP	A-3(0)	5.24-5.69		
91+40	SS-18	100	39	10	79.7	11.2	4.3	4.8	22	NP	A-1-b(0)	6.72-7.17		
38m RT														

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	35196.3.19 (X-0002CA) 35196.3.20 (X-0002CB)	1	14

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 35196.3.19 (X-0002CA) / 35196.3.20 (X-0002CB)

COUNTY CUMBERLAND

PROJECT DESCRIPTION NC 24 EXT. (FAYETTEVILLE OUTER LOOP) FROM 1.3 MILES EAST OF NC 87-210 TO WEST OF US 401

SITE DESCRIPTION RETAINING WALLS LEFT OF -Y4- STA. 10+40, RIGHT OF -L- STA. 142+20, LEFT OF -L- STA. 143+00 AND RIGHT AND LEFT OF -L- STA. 147+00

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3-10	SITE PLAN AND PROFILES
11-14	SOIL TEST RESULTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

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

THIS SUBSURFACE INFORMATION WAS ORIGINALLY ASSEMBLED AS STATE PROJECT 35196.1.2 (X-0002C), BUT IS BEING LET AS 35196.3.19 (X-0002CA) AND 35196.3.20 (X-0002CB)

PERSONNEL
D. S. CANADY
D. W. DIXON
D. S. TIGNOR

INVESTIGATED BY F. M. WESCOTT III
CHECKED BY D. N. ARGENBRIGHT
SUBMITTED BY D. N. ARGENBRIGHT
DATE JUNE, 2007

NORTH CAROLINA LICENSED SEAL 1050 GEOLOGIST D. N. ARGENBRIGHT 6-1-07

PROJECT: 35196.3.19 / 35196.3.20 ID: X-0002CA / X-0002CB

DRAWN BY: C. P. TURNER, F. M. WESCOTT III

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.

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

PROJECT REFERENCE NO.	SHEET NO.
35196.1.2 (X-0002C)	2 OF 14

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 30 CM 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 (kN/m^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<25
	SOFT	2 TO 4	25 TO 50
	MEDIUM STIFF	4 TO 8	50 TO 100
	STIFF	8 TO 15	100 TO 200
	VERY STIFF	15 TO 30	200 TO 400
	HARD	>30	>400

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
	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
- 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
- [X] CME-45B
- [ ] CME-550
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 152mm CONTINUOUS FLIGHT AUGER
- [ ] 203mm HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 75 mm STEEL TEETH
- [ ] TRICONE _____ mm 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 3 CM 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 30 CM 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 BLOWS PER 30 CM*
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 BLOWS PER 30 CM*
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 6 MM 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 13 MM DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 25 MM 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 25 MM OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 3 M
WIDE	3 TO 10 M
MODERATELY CLOSE	30 TO 100 CM
CLOSE	5 TO 30 CM
VERY CLOSE	LESS THAN 5 CM

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 1 M
THICKLY BEDDED	0.5 - 1 M
THINLY BEDDED	0.05 - 0.5 M
VERY THINLY BEDDED	10 - 50 MM
THICKLY LAMINATED	2.5 - 10 MM
THINLY LAMINATED	< 2.5 MM

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 10 CM 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) OF A 63.5 KG HAMMER FALLING 0.76 M REQUIRED TO PRODUCE A PENETRATION OF 30 CM INTO SOIL WITH A 5 CM OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 3 CM 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 10 CM DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK: _____

ELEVATION: _____

NOTES:

REVISED 02/23/06

PROJECT REFERENCE NO.	SHEET
X-0002C	3

SITE PLAN

0 10 20

METERS

NAD 83
NC GRID

5+60

5+00

-Y- RAMP D

F

BEG WALL -Y4-
STA 10+20 LT

END WALL -Y4-
STA 10+80 LT

10+00

-Y4-

N 31° 09' 06.3" W

-Y4-

11+00

N 20° 59' 20.3" E

REVISIONS

ELIMINATE "PARCEL 111 - CHANGED TO 110

PAVEMENT-BRIDGE RELATIONSHIP FOR -L- OVER -Y12-
(SEE SHEET 2L FOR A LARGER DETAIL VIEW)

-Y12- RAMP A
PI Sta 1+69.854
Rt = 60.000
Lt = 90.000
ST = 20.095

PI Sta 4+24.726
Δ = 43° 08' 22.5" (LT)
D = 19.098
L = 80.866
R = 150.000

-Y12- RAMP B
PI Sta 3+55.595
Δ = 90° 00' 00.0" (RT)
D = 63.662
L = 157.080
R = 90.000

-Y12- RAMP C
PI Sta 5+07.306
Rt = 60.000
Lt = 90.000
ST = 20.095

PI Sta 8+07.306
Δ = 90° 00' 22.5" (LT)
D = 19.098
L = 75.000
R = 150.000
SSD = 200.000
RD = 60.000
DS = 60 mph

-Y12- RAMP D
PI Sta 1+07.306
Rt = 60.000
Lt = 90.000
ST = 20.095

PI Sta 4+82.306
Δ = 90° 00' 22.5" (RT)
D = 19.098
L = 75.000
R = 300.000

-Y12- RAMP A
PI Sta 1+69.854
Rt = 60.000
Lt = 90.000
ST = 20.095

PI Sta 4+24.726
Δ = 43° 08' 22.5" (LT)
D = 19.098
L = 80.866
R = 150.000

-Y12- RAMP B
PI Sta 3+55.595
Δ = 90° 00' 00.0" (RT)
D = 63.662
L = 157.080
R = 90.000
SSD = 200.000
RD = 60.000
DS = 40 mph

-Y12- RAMP B
PI Sta 5+26.099
Δ = 90° 00' 00.0" (LT)
D = 63.662
L = 157.080
R = 90.000
SSD = 200.000
RD = 60.000
DS = 30 mph

-Y12-
PI Sta 1+69.854
Rt = 60.000
Lt = 90.000
ST = 20.095

PI Sta 4+24.726
Δ = 43° 08' 22.5" (RT)
D = 19.098
L = 80.866
R = 150.000

-Y12-
PI Sta 5+26.099
Δ = 90° 00' 00.0" (LT)
D = 63.662
L = 157.080
R = 90.000

-Y12- RAMP D
PI Sta 1+07.306
Rt = 60.000
Lt = 90.000
ST = 20.095

PI Sta 4+82.306
Δ = 90° 00' 22.5" (RT)
D = 19.098
L = 75.000
R = 300.000
SSD = 200.000
RD = 60.000
DS = 30 mph

NAD 83
NC GRID

METRIC

PROJECT REFERENCE NO. | SHEET NO.
R-2000BD | 4
R/W SHEET NO.
ROADWAY DESIGN | STRUCTURES ENGINEER

CONST. SEQ.
R/W SEQ.

DOCUMENT 1 OF 10 [illegible]

TRAFFIC DIAGRAM

28,680 / 38,800	-Y12-	2008 ADT 2030 ADT
8,990 / 10,400	10040 / 13,500	-L-
29,270 / 50,500	12,600 / 17,000	11,080 / 15,300 / 28,820 / 46,400
-Y12-	33,360 / 46,500	

100
EDWIN G. OESTERHERR
DB 486 PG 121

108
VIOLA FARMER
DB 379 PG 296

107
JOHN MACGARD
DB 2467 PG 104

CLIFTON L. FARMER
DB 106 PG 222

-Y12- PC 1+72.220
-Y12- PT 15+03.789 (LB) =
-Y12- PT 15+03.789 (LA)
-Y12- PT 15+03.789
-Y12- STA 15+03.789
END CONSTRUCTION

-Y12- RAMP B PT 8+04.552
-Y12- RAMP B PC 7+95.972
-Y12- RAMP C PT 9+04.763
-Y12- RAMP B TS 7+27.306 =
-Y12- RAMP B POT 7+27.306
-Y12- RAMP B SC 7+87.306
-L- POT 146+39.09 =
-Y12- POT 15+64.600
-Y12- RAMP C TS 7+06.646
-Y12- RAMP C SC 7+86.646
-Y12- RAMP C PC 7+77.052
-Y12- RAMP C PT 8+03.578
-Y12- RAMP C POT 8+10.294
-Y12- RAMP D PT 3+95.363 =
-Y12- POT 15+30.576 (L,400 LT)
-Y12- RAMP M PT 3+90.063
-Y12- RAMP D PT 5+13.142 =
-Y12- POT 15+93.286 (0,600 RT)
-Y12- RAMP M PC 3+62.879
-Y12- RAMP M S 82° 29' 27.6" W
-Y12- RAMP A SC 3+48.720
-Y12- RAMP B PT 8+04.645
-Y12- RAMP D SC 4+34.088
-Y12- RAMP D PC 4+95.492
-Y12- RAMP A PT 4+90.143 =
-Y12- POT 15+04.482 (1,200 LT)
-Y12- RAMP D PT 4+98.637 =
-Y12- POT 14+82.003 (1,900 RT)
-Y12- RAMP D TS 3+74.087 =
-Y12- RAMP D POT 3+74.087
-Y12- RAMP A
-Y12- RAMP D
-Y12- RAMP M
S 18° 02' 40.7" W
-Y12- N 18° 02' 40.7" E 1,900.0'

FAYETTEVILLE OUTER LOOP
-L-
-Y12- RAMP B
-Y12- RAMP C
N 77° 49' 57" E
N 80° 52' 27.8" E
S 82° 29' 27.6" W
S 18° 02' 40.7" W
N 18° 02' 40.7" E 1,900.0'

MATCHLINE STA. 147+60
SEE SHEET 5

FOR DITCH DETAILS SEE SHEET 2-S
FOR -L- PROFILE SEE SHEET 4B AND 4C
FOR -Y9- PROFILE SEE SHEET 6D
FOR -Y12- RAMP B PROFILE SEE SHEET 9-S 9E
FOR -Y12- RAMP B PROFILE SEE SHEET 9E
FOR -Y12- RAMP C PROFILE SEE SHEET 5J
FOR -Y12- RAMP D PROFILE SEE SHEET 5J

LOCATION:
TIP NO.: COUNTY:
DESIGNED BY: DATE:
CHECKED BY: DATE:

PROJECT REFERENCE NO.	SHEET NO.
X-0002C	5
R/W SHEET NO.	

METRIC

5 0 10

CONST.REV.

R/W REV.

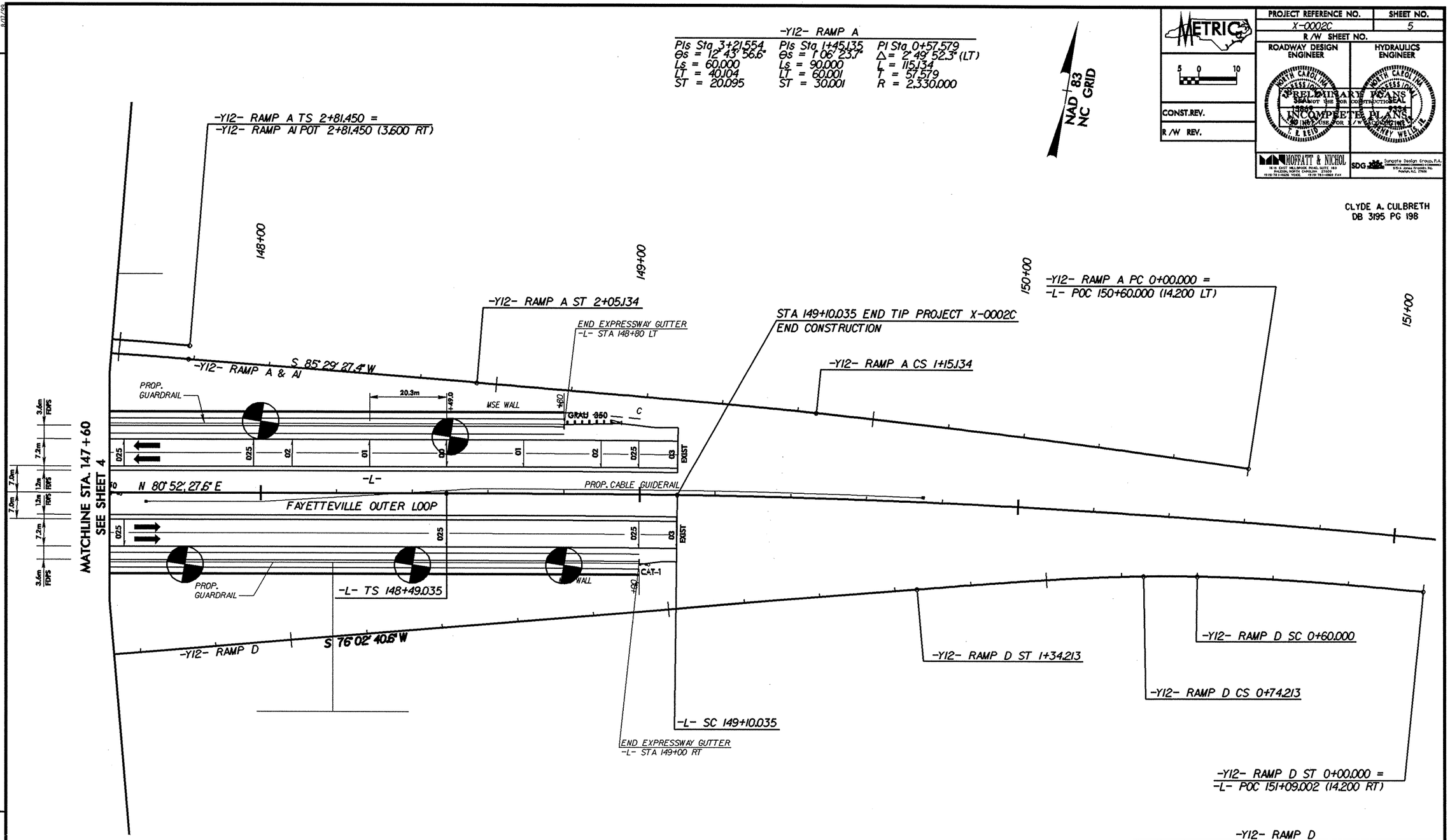
ROADWAY DESIGN ENGINEER | HYDRAULICS ENGINEER

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

MOFFATT & NICHOL
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA 27609
(919) 781-4626 VOICE (919) 781-4669 FAX

SDG Sungate Design Group, P.A.
(Formerly Ralph Whitehead Associates)
8-5-A Jones Franklin Rd.
Raleigh, N.C. 27606

CLYDE A. CULBRETH
DB 3195 PG 198



-L-

PIs Sta 148+89.702	PI Sta 153+82.341
θs = 0° 45' 00.0"	Δ = 22° 55' 04.4" (RT)
Ls = 61.000	L = 931.983
LT = 40.667	T = 472.306
ST = 20.334	R = 2,330.000
	SE = 0.025
	RO = 61.000
	DS = 110 kph

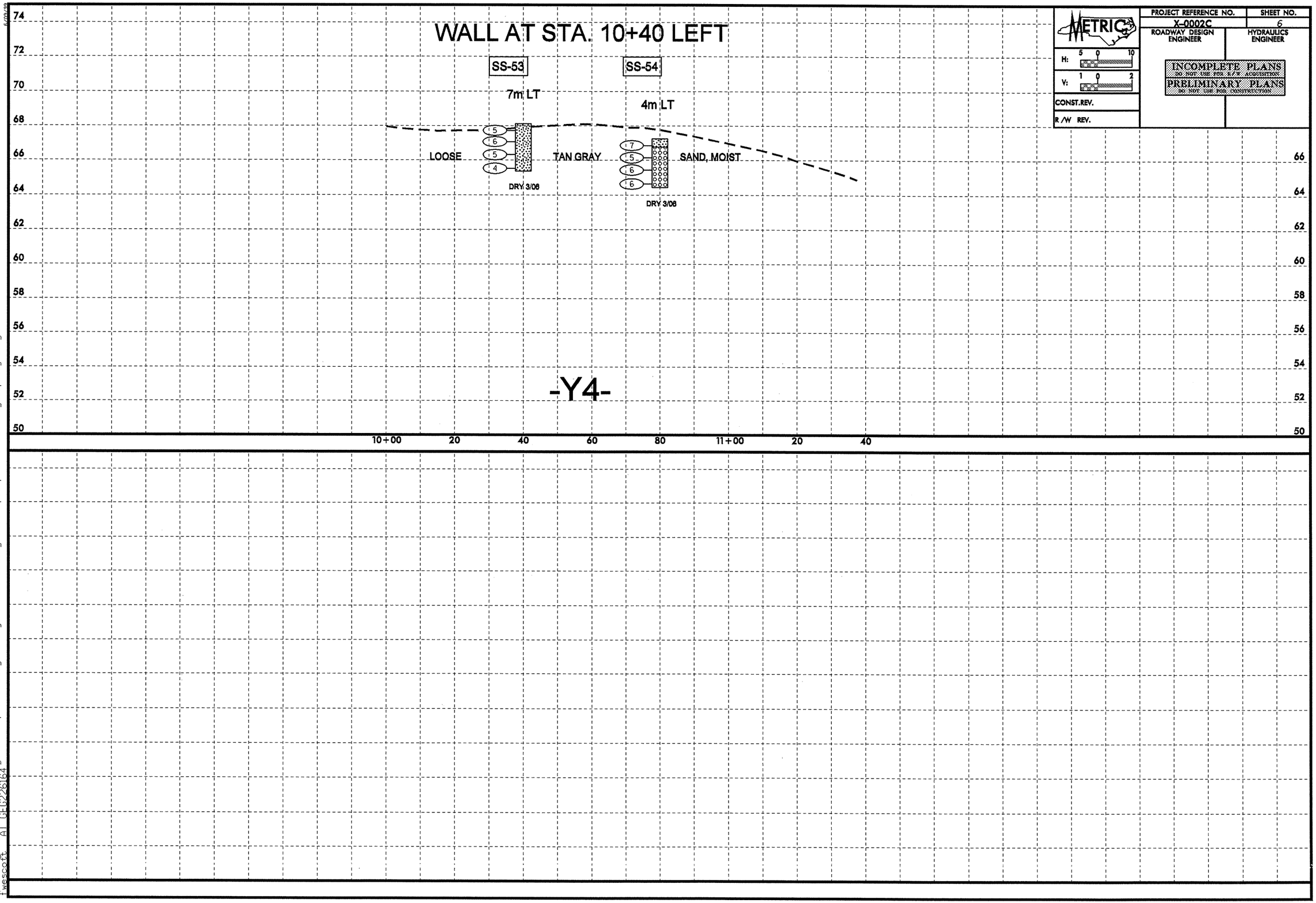
-Y12- RAMP D

PIs Sta 0+36.841	PI Sta 0+67.107	PIs Sta 0+94.222
θs = 0° 44' 31.7"	Δ = 1° 51' 48.5" (LT)	θs = 3° 56' 00.1"
θs = 3° 56' 00.4"	L = 14.213	Ls = 60.000
Ls = 60.000	T = 7.107	LT = 40.010
LT = 36.841	R = 437.000	ST = 20.009
ST = 23.189		

REVISIONS

x0002c_rdy_psh25.dgn

FOR -L- PROFILE SEE SHEET 43



27-APR-2007 08:59
I:\ero\greenville investigation\tip\x0002c_geo_rdwy_retwall\cadd_geotech\planprof\x-0002c_geo_pfi_y42.dgn
fwescott AT GEG226164

WALL AT –L– STA. 143+00 LEFT

PROJECT REFERENCE NO.	SHEET NO.
X0002C	7
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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

CONST.REV.
R/W REV.

SS-75, SS-76, SS-77, SS-78 — 19m LT
SS-93, SS-94, SS-95, SS-96 — 19m LT
SS-105, SS-106, SS-107, SS-108, SS-109, SS-110, SS-111 — 19m LT
SS-28, SS-29, SS-30, SS-31, SS-32 — 19m LT
SS-85, SS-86, SS-87, SS-88, SS-89, SS-90, SS-91 — 23m LT

VERY LOOSE TO MEDIUM
VERY SOFT TO MEDIUM GRAY SANDY AND SILTY WET
LOOSE TO MEDIUM DENSE
VERY STIFF TO HARD
STIFF CLAY,
GRAY SILTY AND
GRAY SAND AND CLAYEY
DENSE
TAN GRAY SAND AND
VERY SOFT TO SOFT CLAY, WET
SAND, SATURATED
SANDY CLAY, WET
(CAPE FEAR FORMATION)
CLAYEY SAND,
BLACK MUCK
VERY SOFT SILT AND WET
MOIST TO SATURATED
AND ORGANIC
GRAY SANDY SANDY CLAY,

A VERY LOOSE BLACK ORGANIC SAND, SATURATED

B DENSE GRAY SAND AND CLAYEY SAND, SATURATED (CAPE FEAR FORMATION)

143+00 20 40 60 80 144+00 20 40 60 80 145+00 20 40 60 80 146+00 20 40 60

WALL AT –L– STA. 147+00 LEFT

LOOSE TO DENSE TAN SAND, MOIST (ROADWAY EMBANKMENT)

SS-38, SS-39, ST-2, SS-40, SS-41, SS-42, SS-43 — 19m LT
SS-49, SS-50, SS-51, SS-52 — 19m LT
SS-58, ST-3, SS-59, SS-60, SS-61 — 19m LT
SS-62, SS-63, SS-64 — 15m LT

VERY LOOSE TO
VERY LOOSE
VERY SOFT TO
MEDIUM DENSE
HARD GRAY
(CAPE FEAR FORMATION)
LOOSE TAN SAND AND
TO MEDIUM DENSE TAN
MEDIUM STIFF TAN GRAY
GRAY SAND AND CLAYEY
SANDY SILT AND SILTY
CLAYEY SAND, MOIST
SAND,
SILTY AND SANDY
SAND, SATURATED
(CAPE FEAR FORMATION)
AND SANDY
TO SATURATED
SATURATED
CLAY, WET
CLAY, WET

ST-2 (X-0002DA)
ST-3 (X-0002DA)

A MEDIUM STIFF TO STIFF GRAY SANDY SILT AND SILTY AND SANDY CLAY, MOIST TO WET

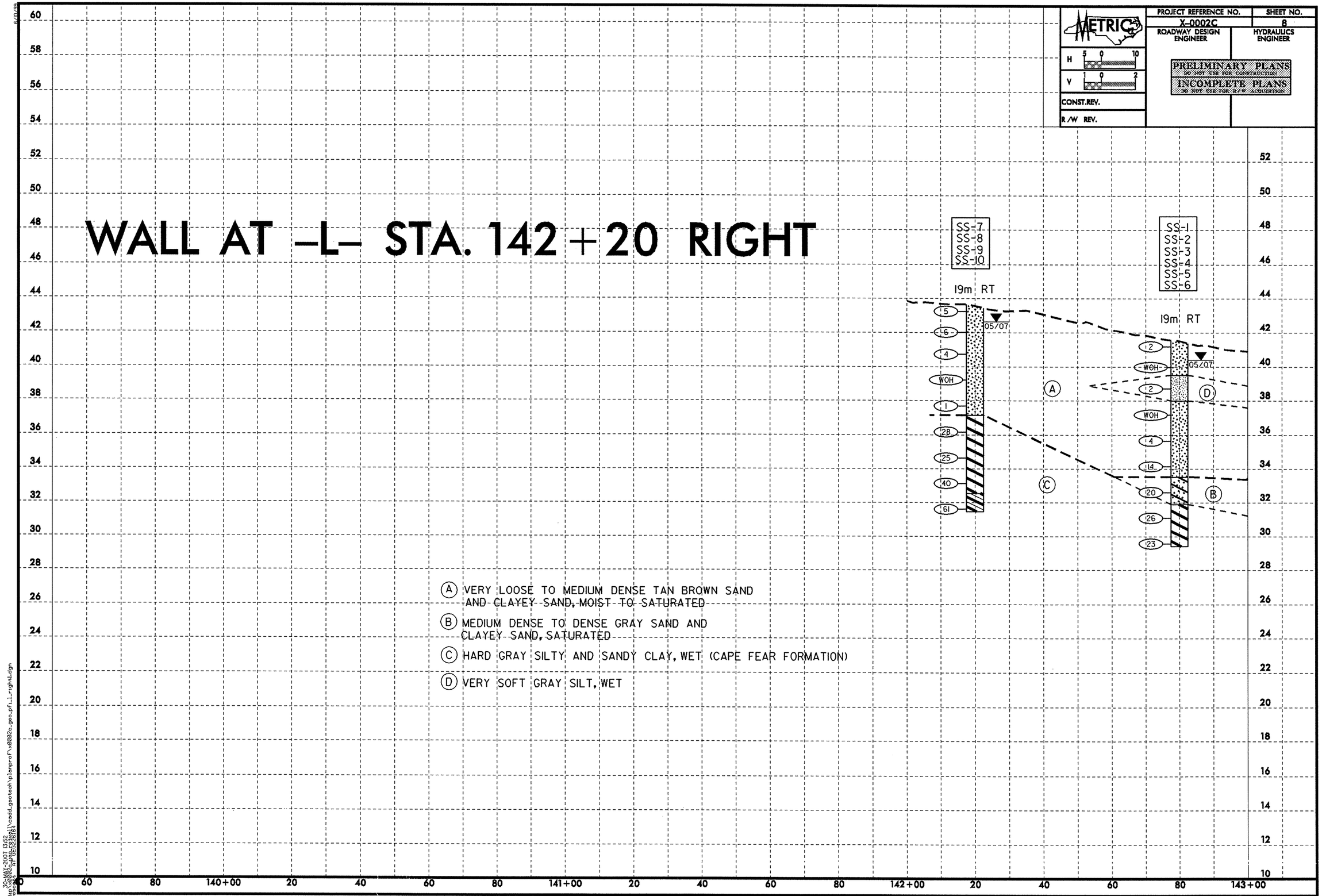
B VERY SOFT TO SOFT SLIGHTY ORGANIC SANDY SILT AND SILTY CLAY, WET

C DENSE TO VERY DENSE GRAY SAND, SATURATED (CAPE FEAR FORMATION)

D OLD TRASH PILE (ARTIFICAL FILL)

147+00 20 40 60 80 148+00 20 40 60 80 149+00 20 40 60 80 150+00 20

30-MAY-2007 13:24
J:\ero_greenville\projects\investigation\tip\x0002c_geo_retwall\cadd_geotech\planprof\x0002c_geo_pf1_left5.dgn
wescott



METRIC
PROJECT REFERENCE NO.
X-0002C
SHEET NO.
8
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
H
V
CONST.REV.
R/W REV.
WALL AT -L- STA. 142+20 RIGHT
SS-7
SS-8
SS-9
SS-10
SS-1
SS-2
SS-3
SS-4
SS-5
SS-6
19m RT
19m RT
05/07
05/07
5
6
4
WOH
1
28
25
40
61
2
WOH
2
WOH
4
14
20
26
23
A
B
C
D
(A) VERY LOOSE TO MEDIUM DENSE TAN BROWN SAND AND CLAYEY SAND, MOIST TO SATURATED
(B) MEDIUM DENSE TO DENSE GRAY SAND AND CLAYEY SAND, SATURATED
(C) HARD GRAY SILTY AND SANDY CLAY, WET (CAPE FEAR FORMATION)
(D) VERY SOFT GRAY SILT, WET
60
58
56
54
52
50
48
46
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
60
80
140+00
20
40
60
80
141+00
20
40
60
80
142+00
20
40
60
80
143+00

WALL AT –L– STA. 142+20 RIGHT

METRIC	PROJECT REFERENCE NO.	SHEET NO.
H 5 0 10	X-0002C	9
V 1 0 2	ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
CONST.REV.	PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	
R/W REV.	INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION	

SS-68
SS-69
SS-70
SS-71
19m RT

SS-72
SS-73
SS-74
19m RT
02/98

SS-97
SS-98
SS-99
SS-100
SS-101
SS-102
SS-103
SS-104
19m RT
03/98

SS-23
SS-24
SS-25
SS-26
SS-27
19m RT
02/98

SS-9
SS-10
SS-11
SS-12
SS-13
SS-14
SS-15
19m RT
02/98

SS-16
SS-17
SS-18
SS-19
ST-1
SS-20
SS-21
SS-22
19m RT
02/98

GRAY SILTY AND SANDY

VERY SOFT TO VERY STIFF CLAY AND SILT, MOIST TO WET

VERY LOOSE GRAY SAND, TO LOOSE SATURATED

VERY SOFT TO STIFF GRAY SILTY AND SANDY CLAY, MOIST TO WET

ST-1 (X-0002DA)

Ⓐ VERY LOOSE TO MEDIUM DENSE TAN BROWN SAND AND CLAYEY SAND, MOIST TO SATURATED

Ⓑ MEDIUM DENSE TO DENSE GRAY SAND AND CLAYEY SAND, SATURATED

Ⓒ HARD GRAY SILTY AND SANDY CLAY, WET (CAPE FEAR FORMATION)

Ⓓ VERY SOFT TO SOFT BLACK MODERATELY ORGANIC SAND, ORGANIC CLAY AND MUCK, WET

DENSE TO VERY DENSE GRAY SATURATED (CAPE FEAR FORMATION)

SAND AND CLAYEY SAND,

HARD GRAY SANDY SILT, WET

SILTY AND SANDY CLAY AND

143+00 20 40 60 80 144+00 20 40 60 80 145+00 20 40 60 80 146+00 20 40

5/00/98
30-MAY-2017 13:29
c:\projects\0002c\geotech\plansprof\x0002c_geo_prf_1_right2.dgn

PROJECT REFERENCE NO.	SHEET NO.
X-0002C	10
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

METRIC

H 5 0 10

V 1 0 2

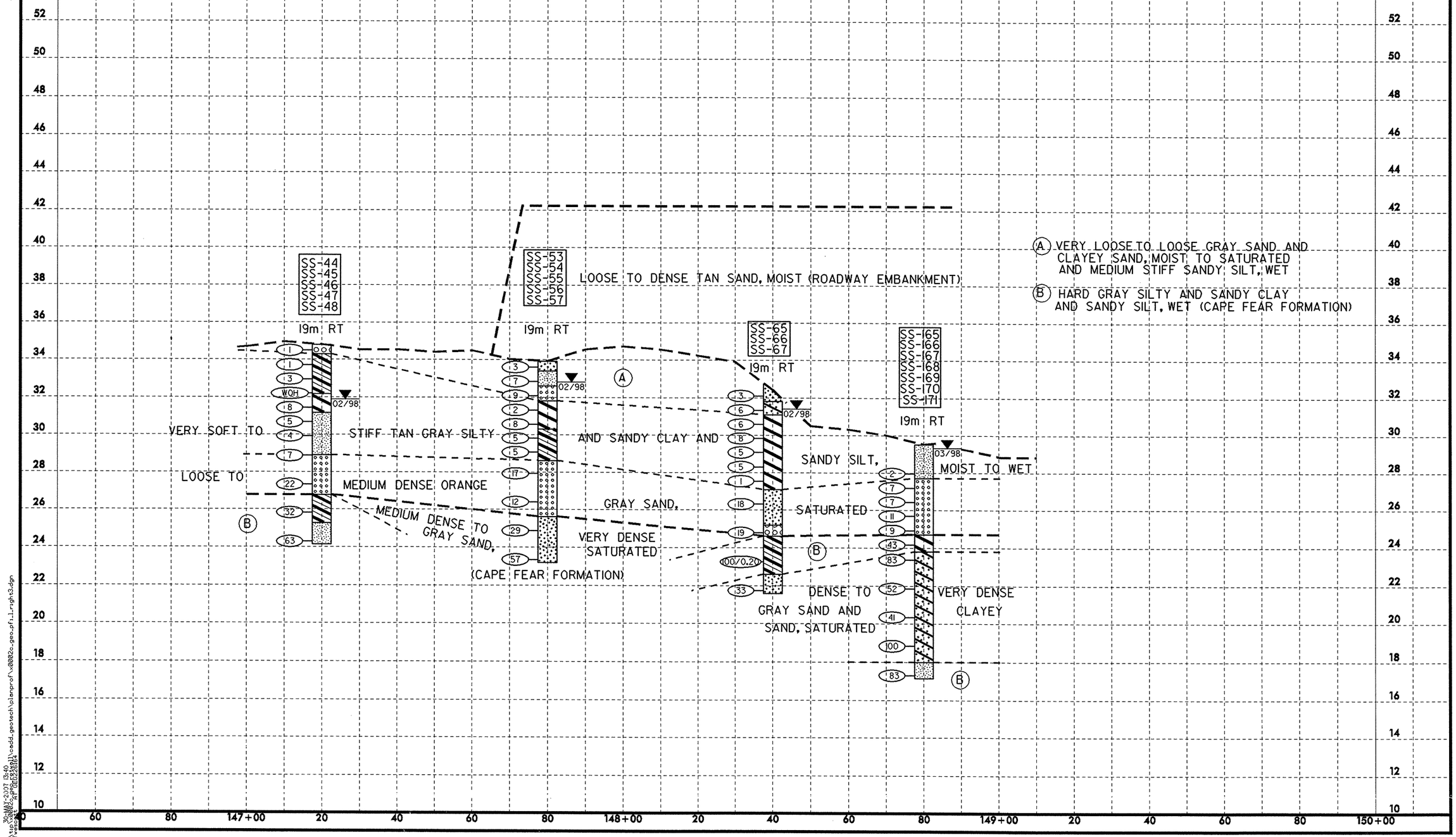
CONST.REV.

R/W REV.

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

WALL AT -L- STA. 147+00 RIGHT



Soil Sample Test Results -Y4-

SAMPLE NO.	STATION	OFFSET	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	2.0 mm	425 um	75 um		
SS-53	10+40	7m LT	0.76-1.21	A-2-4(0)	17	NP	58.5	29.7	7.4	4.4	99	62	13		
SS-54	10+80	4m LT	0.80-1.30	A-1-b(0)	19	NP	74.5	16.4	6.6	2.4	96	43	9		

Soil Sample Test Results -L- RIGHT

SAMPLE NO.	STATION	OFFSET	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	2.0 mm	425 um	75 um		
SS-7	142+20	19m RT	0.00-0.45	A-2-4(0)	15	NP	48.7	27.8	13.0	10.5	100	71	24		
SS-8	142+20	19m RT	4.02-4.47	A-2-4(0)	15	NP	50.7	27.0	12.2	10.1	100	70	23		
SS-9	142+20	19m RT	7.02-7.52	A-7-5(2)	42	11	34.3	22.1	14.8	28.8	100	81	45		
SS-10	142+20	19m RT	11.64-12.09	A-6(6)	39	13	28.2	15.4	35.7	20.7	100	82	57		
SS-1	142+80	19m RT	0.00-0.45	A-2-4(0)	20	NP	37.9	33.1	18.5	10.5	100	78	29		
SS-2	142+80	19m RT	2.50-2.95	A-4(0)	36	8	47.9	16.4	11.0	24.7	100	69	36		
SS-3	142+80	19m RT	4.02-4.47	A-2-4(0)	27	6	43.4	22.1	11.8	22.7	100	73	35		
SS-4	142+80	19m RT	5.54-5.99	A-2-4(0)	30	7	47.7	19.1	12.6	20.7	100	68	34		
SS-5	142+80	19m RT	8.59-9.04	A-2-6(0)	32	11	56.4	19.5	7.5	16.6	100	68	25		
SS-6	142+80	19m RT	10.11-10.56	A-7-6(16)	43	18	8.9	8.3	31.6	51.1	100	95	84	14.3	
SS-68	143+33	19m RT	2.28-2.73	A-6(1)	30	15	41.2	24.8	15.8	18.2	100	75	36	25.1	
SS-69	143+33	19m RT	4.56-5.01	A-7-5(30)	61	28	7.9	2.8	24.6	64.6	100	95	89	51.1	
SS-70	143+33	19m RT	7.30-7.75	A-2-6(1)	37	16	53.7	20.4	17.8	8.1	88	57	24	17	
SS-71	143+33	19m RT	10.34-10.79	A-7-6(3)	41	12	12.3	47.1	30.5	10.1	100	95	48	25	
SS-72	143+80	19m RT	0.76-1.21	A-2-6(1)	30	15	38.4	29.9	13.5	18.2	100	79	35	24.5	
SS-73	143+80	19m RT	4.56-5.01	A-6(3)	34	18	23.8	38.0	18.0	20.2	100	92	41	23.9	
SS-74	143+80	19m RT	8.75-9.20	A-6(1)	40	12	29.9	37.2	24.8	8.1	100	81	39	23.1	
SS-97	144+25	19m RT	0.76-1.21	A-7-6(9)	49	27	38.4	13.3	13.9	34.3	100	78	49	21.3	
SS-98	144+25	19m RT	2.28-2.73	A-6(6)	37	19	32.1	19.6	13.9	34.3	100	83	51	23.3	
SS-99	144+25	19m RT	3.80-4.25	A-6(3)	31	16	37.4	23.2	13.1	26.3	98	77	43		
SS-100	144+25	19m RT	4.56-5.01	A-7-5(8)	61	20	41.0	8.9	15.8	34.3	100	68	51	154.8	25.0
SS-101	144+25	19m RT	7.20-7.65	A-4(4)	30	7	6.9	28.7	44.2	20.2	100	94	76	49.2	3.8
SS-102	144+25	19m RT	8.73-9.18	A-6(3)	31	12	29.1	30.3	32.5	8.1	100	85	47	13.8	
SS-103	144+25	19m RT	10.25-10.70	A-2-6(1)	40	16	52.7	20.6	20.6	6.1	97	61	30		

Soil Sample Test Results -L- RIGHT

SAMPLE NO.	STATION	OFFSET	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	2.0 mm	425 um	75 um		
SS-104	144+25	19m RT	11.78-12.23	A-7-6(8)	41	16	16.0	29.3	44.6	10.1	100	91	62	27.7	
SS-23	145+00	19m RT	0.76-1.21	A-6(8)	38	19	21.6	25.3	22.8	30.3	100	91	57	20.9	
SS-24	145+00	19m RT	3.04-3.49	A-6(2)	35	14	44.6	17.0	10.1	28.3	100	71	39	69.9	
SS-25	145+00	19m RT	3.80-4.25	A-2-5(0)	68	NP	53.7	14.9	19.2	12.1	100	60	33		
SS-26	145+00	19m RT	2.53-2.98	A-2-4(0)	24	NP	3.2	78.0	14.7	4.0	100	99	23	33.4	
SS-27	145+00	19m RT	12.10-12.55	A-2-7(1)	44	14	47.9	24.2	23.8	4.0	100	65	33		
SS-9	145+60	19m RT	1.52-1.97	A-2-6(1)	30	15	43.6	23.2	10.9	22.2	100	76	35	15.1	
SS-10	145+60	19m RT	3.80-4.25	A-7-5(11)	49	15	24.0	12.5	47.3	16.2	100	82	68	33.6	
SS-11	145+60	19m RT	4.56-5.01	A-6(19)	39	19	2.0	4.0	53.5	10.4	100	98	96		
SS-12	145+60	19m RT	5.96-6.41	A-6(9)	33	12	2.8	19.4	55.6	22.2	100	98	84	26.7	
SS-13	145+60	19m RT	9.00-9.45	A-2-4(0)	38	10	39.8	30.1	26.1	4.0	98	78	32	18.3	
SS-14	145+60	19m RT	10.52-10.97	A-7-5(3)	46	13	34.5	27.7	31.7	6.1	100	77	43		
SS-15	145+60	19m RT	12.04-12.49	A-6(1)	33	12	14.3	51.3	28.3	6.1	100	98	39	20.0	
SS-16	145+87	19m RT	0.76-1.21	A-7-6(3)	43	21	49.3	16.0	8.5	26.3	100	67	36		
SS-17	145+87	19m RT	1.56-2.01	A-6(2)	32	17	36.6	29.1	10.1	24.2	100	81	36	20.5	
SS-18	145+87	19m RT	2.28-2.73	A-7-6(18)	50	27	19.0	13.5	19.0	48.5	100	88	70	22.1	
SS-19	145+87	19m RT	3.98-4.43	A-7-6(30)	50	27	1.2	2.0	44.2	52.5	100	99	98	34.3	
ST-1	145+87	19m RT	5.32-5.93	A-6(14)	37	18	2.6	18.2	45.1	34.1	98	96	83	32.3	
SS-20	145+87	19m RT	5.93-6.48	A-6(13)	35	14	0.6	15.4	55.8	28.3	100	100	90	17.9	
SS-21	145+87	19m RT	9.01-9.46	A-2-7(1)	42	17	51.3	23.0	21.6	4.0	95	62	27	19.1	
SS-22	145+87	19m RT	12.06-13.51	A-4(0)	33	7	31.9	37.6	28.5	2.0	100	82	36	19.1	
SS-44	147+20	19m RT	0.76-1.21	A-6(6)	31	17	22.0	26.7	29.1	22.2	100	87	57	18.5	
SS-45	147+20	19m RT	3.04-3.49	A-7-6(39)	58	36	1.6	3.8	40.0	54.5	100	99	96	29.2	
SS-46	147+20	19m RT	4.56-5.01	A-4(1)	25	5	2.0	44.0	33.7	20.2	100	99	63		
SS-47	147+20	19m RT	7.14-7.59	A-3(0)	16	NP	75.2	19.6	3.2	2.0	100	65	6		
SS-48	147+20	19m RT	8.56-9.11	A-6(7)	38	20	0.8	20.4	48.5	30.3	100	99	86		
SS-53	147+80	19m RT	0.76-1.21	A-4(0)	24	8	12.5	53.5	15.8	18.2	100	97	39		
SS-54	147+80	19m RT	2.28-2.73	A-7-5(38)	65	32	3.2	1.8	26.3	68.7	100	98	96	53.6	
SS-55	147+80	19m RT	3.80-4.25	A-6(13)	40	14	7.1	10.5	60.2	22.2	99	94	85		
SS-56	147+80	19m RT	4.56-5.01	A-6(17)	38	20	0.8	20.4	48.5	30.3	100	99	86		

Soil Sample Test Results -L- RIGHT

SAMPLE NO.	STATION	OFFSET	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	2.0 mm	425 um	75 um		
SS-57	147+80	19m RT	8.73-9.18	A-2-4(0)	18	3	55.8	18.6	19.6	6.1	100	78	28		
SS-65	148+40	19m RT	1.52-1.97	A-7-6(33)	57	29	1.0	4.8	33.5	60.6	22.2	99	94	85.0	
SS-66	148+40	19m RT	8.84-9.29	A-6(1)	35	12	40.2	24.4	25.3	10.1	100	84	37	17.5	
SS-67	148+40	19m RT	10.36-10.81	A-2-4(0)	34	10	48.5	34.5	14.9	2.0	100	70	21	21.8	
SS-165	148+80	19m RT	1.24-1.69	A-4(2)	25	7	3.2	46.1	30.5	20.2	100	99	59		
SS-166	148+80	19m RT	2.00-2.45	A-3(0)	48	NP	79.8	16.0	4.2	0.0	100	64	6		
SS-167	148+80	19m RT	3.52-3.97	A-3(0)	16	NP	77.0	19.6	3.4	0.0	100	61	7		
SS-168	148+80	19m RT	5.04-5.49	A-7-6(4)	44	16	28.1	31.9	29.9	10.1	100	88	45	27.6	
SS-169	148+80	19m RT	5.82-6.27	A-2-6(1)	34	13	37.8	31.5	20.6	10.1	98	83	34		
SS-170	148+80	19m RT	8.86-9.31	A-2-6(0)	40	20	76.0	12.7	7.3	4.0	100	54	13		
SS-171	148+80	19m RT	11.90-12.35	A-4(4)	32	10	20.0	31.7	38.2	10.1	100	88	63	18.0	

Soil Sample Test Results -L- LEFT

SAMPLE NO.	STATION	OFFSET	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	2.0 mm	425 um	75 um		
SS-75	143+50	19m LT	2.28-2.73	A-2-4(0)	20	5	43.0	32.5	14.3	10.1	100	77	28	21.8	
SS-76	143+50	19m LT	3.80-4.25	A-7-6(18)	55	32	23.0	14.9	17.6	44.4	100	88	63	31.7	
SS-77	143+50	19m LT	5.75-6.20	A-2-5(0)	47	NP	60.6	23.0	14.3	2.0	100	58	19	84.6	20.9
SS-78	143+50	19m LT	11.83-12.28	A-2-4(0)	25	NP	43.0	39.6	15.4	2.0	100	79	19		
SS-93	144+10	19m LT	1.52-1.97	A-6(2)	33	17	43.0	22.0	16.8	18.2	100	75	37	17.1	
SS-94	144+10	19m LT	3.80-4.25	A-6(1)	30	13	41.2	25.1	15.6	18.2	100	77	36	24.9	
SS-95	144+10	19m LT	5.81-6.26	A-2-6(1)	40	20	62.8	13.3	13.7	10.1	97	58	25	21.6	
SS-96	144+10	19m LT	7.33-7.78	A-7-5(8)	57	17	37.0	9.3	31.5	22.2	97	68	54		
SS-105	144+60	19m LT	0.76-1.21	A-2-4(0)	24	4	69.9	16.0	4.0	10.1	97	56	14		
SS-106	144+60	19m LT	2.28-2.73	A-7-5(24)	60	21	7.9	4.4	27.1	60.6	100	95	88	74.5	
SS-107	144+60	19m LT	3.04-3.49	A-7-5(28)	67	28	14.7	4.8	17.8	62.6	100	89	82	54.6	16.0
SS-108	144+60	19m LT	3.80-4.25	A-1-b(0)	122	NP	60.6	14.1	17.2	8.1	90	47	24		64.8
SS-109	144+60	19m LT	4.56-5.01	A-7-5(31)	58	28	2.6	2.4	34.3	60.6	100	95	88	74.5	10.3
SS-110	144+60	19m LT	8.78-9.23	A-2-6(1)	38	16	56	23.4	12.5	8.1	100	62	25		
SS-111	144+60	19m LT	10.30-10.75	A-6(9)	38	13	5.9	30.5	53.5	10.1	100	97	71	19.9	
SS-28	145+20	19m LT	1.52-1.97	A-1-b(0)	18	NP	84.8	14.9	0.2	0.0	97	49	0		

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL B2-A	**BORING LOCATION** 77+07.1	**OFFSET** 14.0 m LT **ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.43 m	**NORTHING** 152,554.4 m	**EASTING** 616,376.6 m	**24 HR.** Boring
TOTAL DEPTH 23.75 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual
DATE STARTED 12/5/06	**COMPLETED** 12/6/06	**SURFACE WATER DEPTH (m)** 0.94	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
47.43					Mudline				
47.43	0.00	1	1	1	2		Sat.		Alluvium: MUCK
45.62	1.81	WOH	WOH	WOH	WOH 0	SS-11	Sat.		SS-11 testing not completed due to insufficient sample quantity.
44.10	3.33								Alluvium: Gray, fine to coarse SAND and GRAVEL (A-1-b) with trace silt/clay (2.70)
42.11	5.32	6	4	3	7	SS-12	W		
40.58	6.85	6	10	14	24		M		Cape Fear Fm: Gray, silty, CLAY (A-6) (4.60)
39.06	8.37	14	18	19	37	SS-13	M		Cape Fear Fm: Gray with orange Fe stained zones, clayey, SAND (A-2-5) with trace gravel (6.20)
37.54	9.89	14	22	36	58		M		
36.01	11.42	35	52	48/10cm	100/25cm	SS-14	14.3%		Cape Fear Fm: Gray, sandy SILT (A-4) (9.13)
34.49	12.94	23	50	50/7cm	100/22cm		D		Cape Fear Fm: Gray and red mottled, silty, CLAY (A-6) with little sand (11.00)
32.97	14.46	30	37	63	100/30cm	SS-15	M		Cape Fear Fm: Gray, greenish gray, light green, green, and dark gray, locally mottled with red, clayey, SAND (A-2-7) with trace mica (12.50)
31.45	15.98	15	25	22	47		M		
29.92	17.51	15	28	33	61	SS-16	M		
28.39	19.04	16	27	28	55		M		

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 19 OF 59

SHEET 2 OF 2

PROJECT NO. 35196.1.3	**ID.** X-0002B	**COUNTY** Cumberland	**GEOLOGIST** S. Lehman
SITE DESCRIPTION Dual Bridges over Cross Creek on -L- (MACTEC Project No. 6468-06-1600)			**GROUND WATER (m)**
BORING NO. LL B2-A	**BORING LOCATION** 77+07.1	**OFFSET** 14.0 m LT **ALIGNMENT** -L-	**0 HR.** Water
COLLAR ELEV. 47.43 m	**NORTHING** 152,554.4 m	**EASTING** 616,376.6 m	**24 HR.** Boring
TOTAL DEPTH 23.75 m	**DRILL MACHINE** CME-45 Marsh Buggy	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** 63.5 Kg Manual
DATE STARTED 12/5/06	**COMPLETED** 12/6/06	**SURFACE WATER DEPTH (m)** 0.94	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
28.43					Continued from previous page				
26.87	20.56	21	32	35	67		M		Cape Fear Fm: Gray, greenish gray, light green, green, and dark gray, locally mottled with red, clayey, SAND (A-2-7) with trace mica *(continued)* (20.00)
25.34	22.09	24	35	53	88		M		Cape Fear Fm: Light green and green mottled with red and orange, silty, CLAY (A-6) with trace sand
23.82	23.61	28	100/13cm		100/13cm	SS-17	18.8%		(23.00)
		100/14cm			100/14cm		M		Cape Fear Fm: Greenish gray, sandy, SILT (A-4) with very thin beds of moderately indurated mudstone (23.75)
									Boring terminated at 23.75m (Elev. 23.68m) in Cape Fear Fm: Hard, sandy, SILT (A-4) with very thinly bedded, moderately indurated, mudstone

Bits Used: 7.3cm Side Discharge Wing Bit

Drilling Fluid Properties: 1.03 g/cm^3

NCDOT BORE SINGLE 1600 CROSS CREEK.GPJ NC_DOT.GDT 1/12/07