STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1(U-0071)	1	21

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1(U-0071) F.A. PROJ. NHF-76-1(2)

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION NORFOLK & SOUTHERN AND CSX RAILROAD BRIDGES OVER US 70

INVENTORY

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4-6	PROFILES
7-11	CROSS SECTIONS
12-18	BORE LOGS & CORE REPORTS
19	ROCK CORE TEST RESULTS
20	CORE PHOTOGRAPHS
21	SITE PHOTOGRAPH

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

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PERSONNEL

N.D. MOHS

TERRACON

INVESTIGATED BY N.D. MOHS

CHECKED BY N.T. ROBERSON

SUBMITTED BY N.D. MOHS

DATE DECEMBER 2012

NORTH CAROLINA LICENSED SEAL 2124 GEOLOGIST NATHAN DANIEL MOHS 12/21/12

PROJECT: 34745.1.1

ID: U-0071

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 REFERENCE NO.	SHEET NO.
34745.1.1(U-0071)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING # 10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
# 40	30 MX	50 MX	51 MN											
# 200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

ABBREVIATIONS

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

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [x] CME-450
- [ ] _____

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

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

CORE SIZE:
- [ ] -B_____
- [x] -N Q
- [ ] -H_____

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK: BL-108: -BL- STATION 64+21.58

ELEVATION: 413.63 FT.

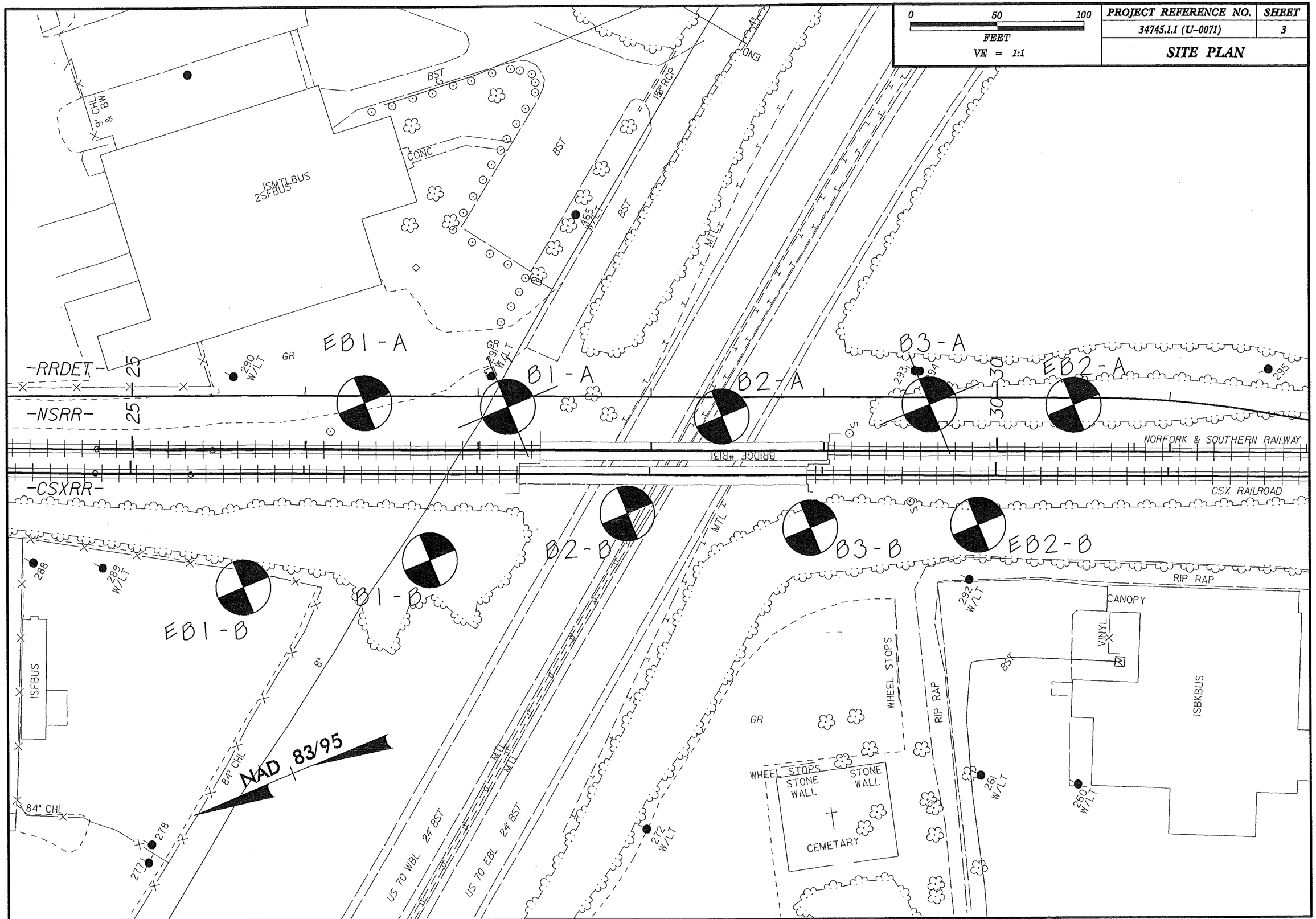
NOTES:

REVISED 09/23/09

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	3

SITE PLAN

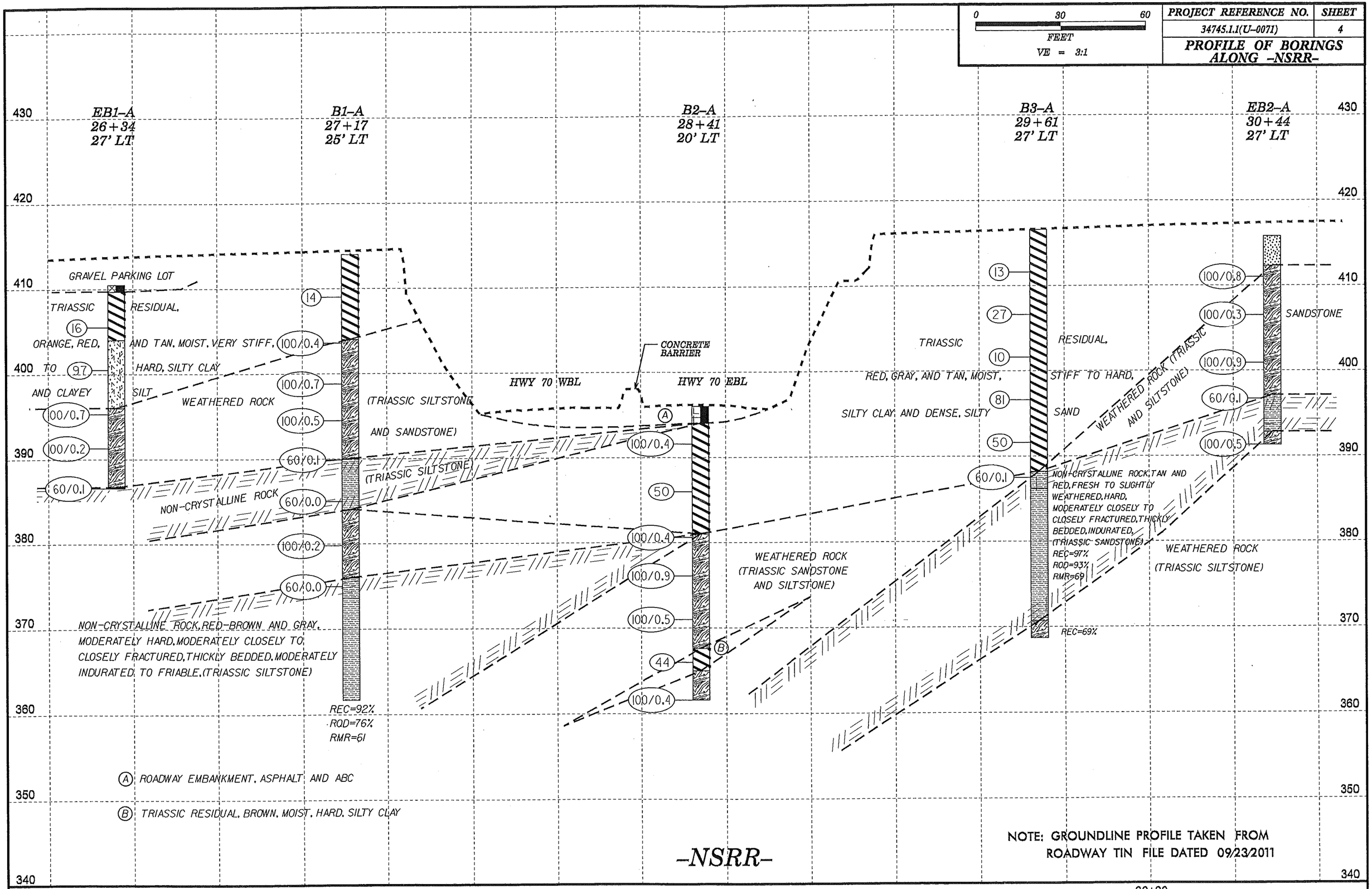
0 50 100
FEET
VE = 1:1



PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	4

PROFILE OF BORINGS ALONG -NSRR-

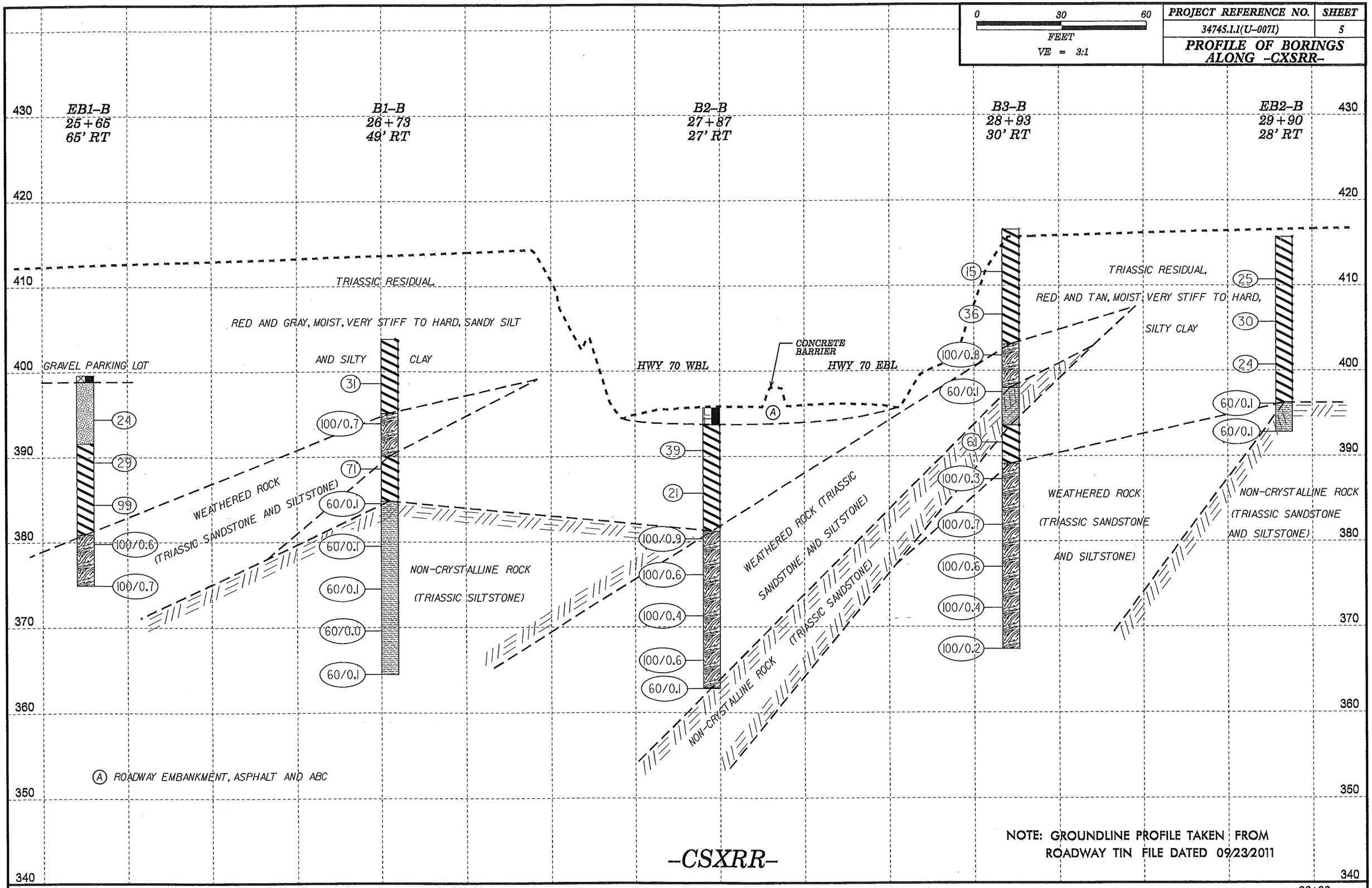
0 30 60
FEET
VE = 3:1



NOTE: GROUNDLINE PROFILE TAKEN FROM ROADWAY TIN FILE DATED 09/23/2011

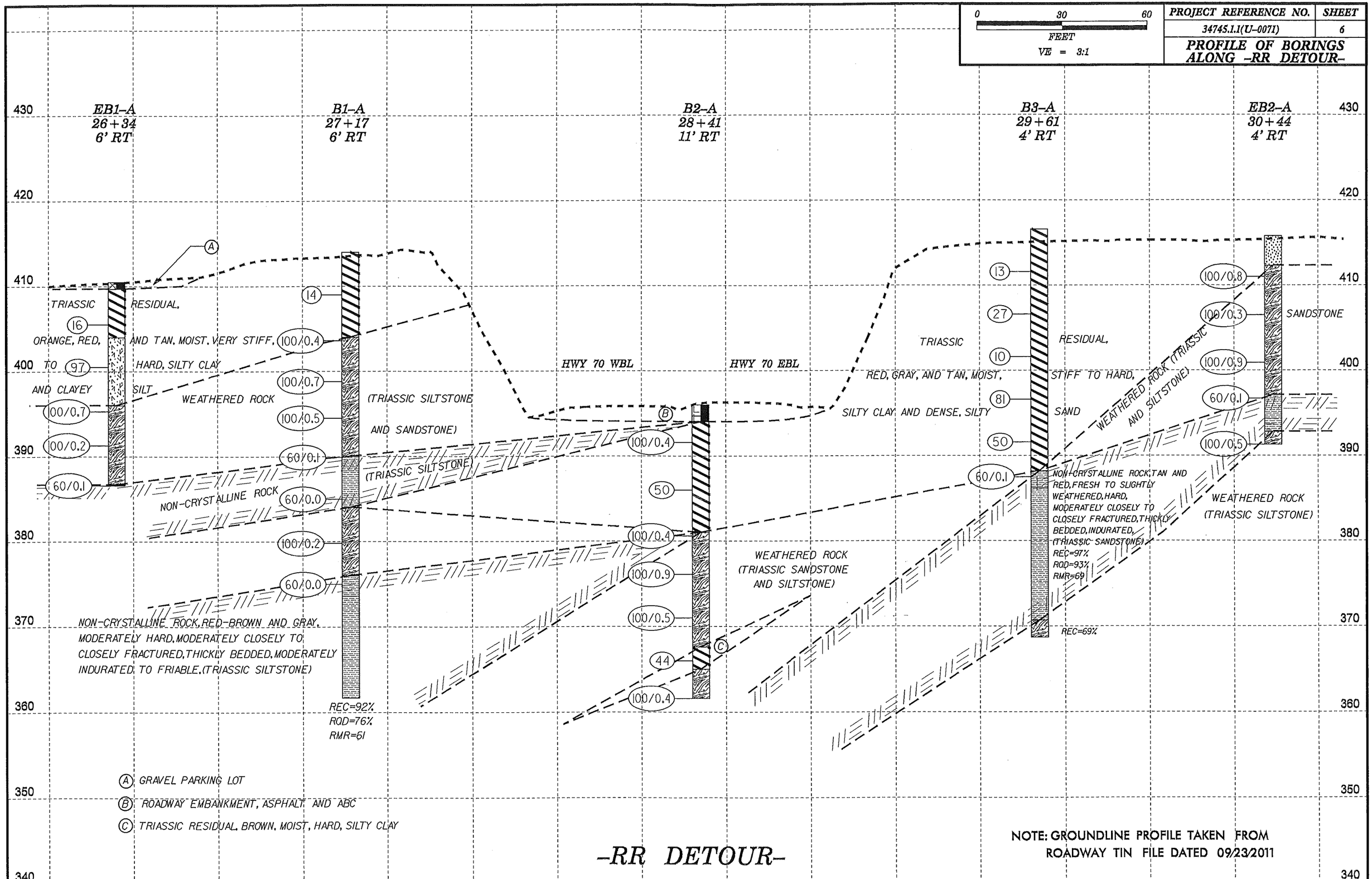
PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	5

PROFILE OF BORINGS ALONG -CXSRR-

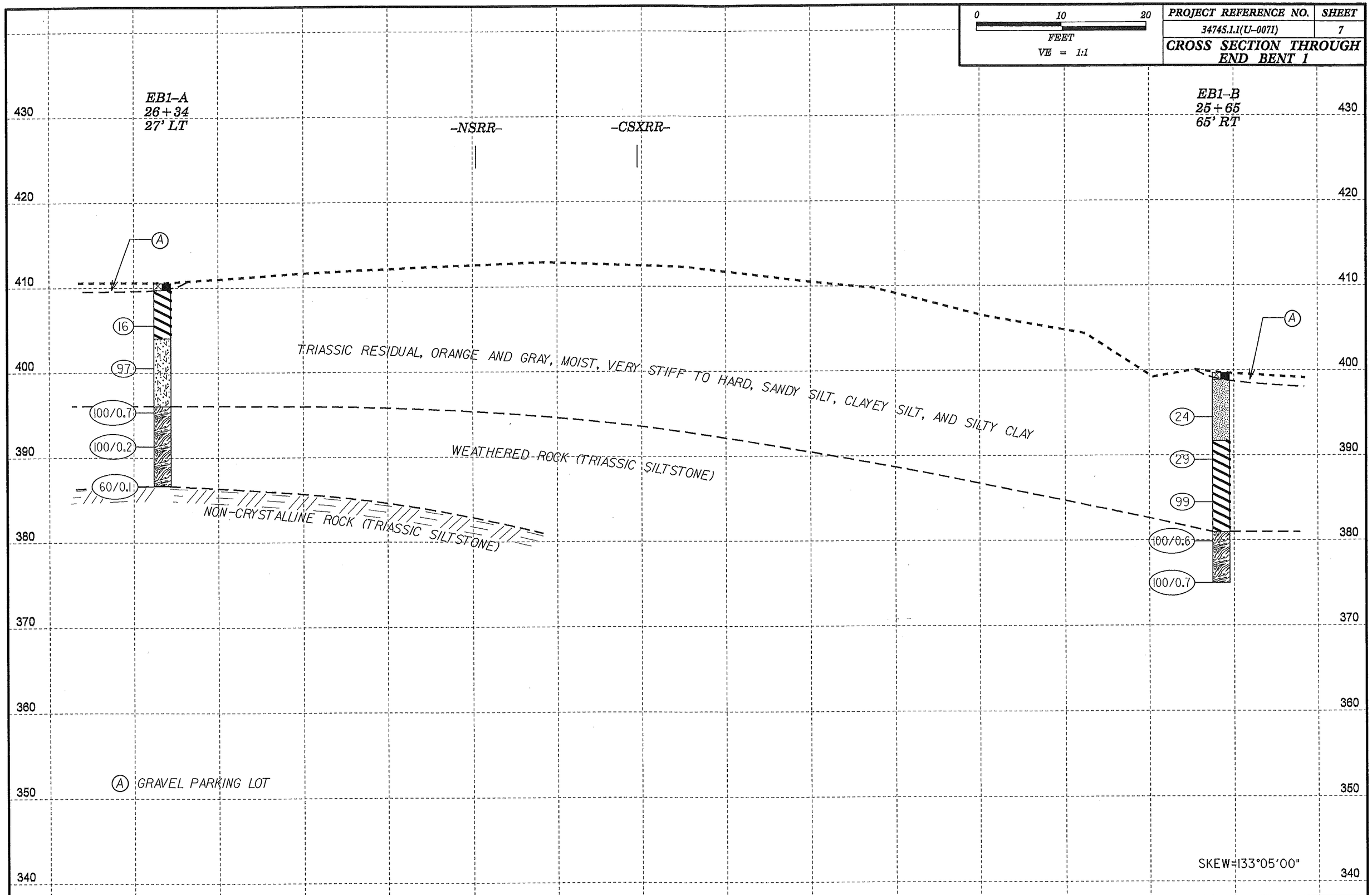


PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	6

PROFILE OF BORINGS ALONG -RR DETOUR-



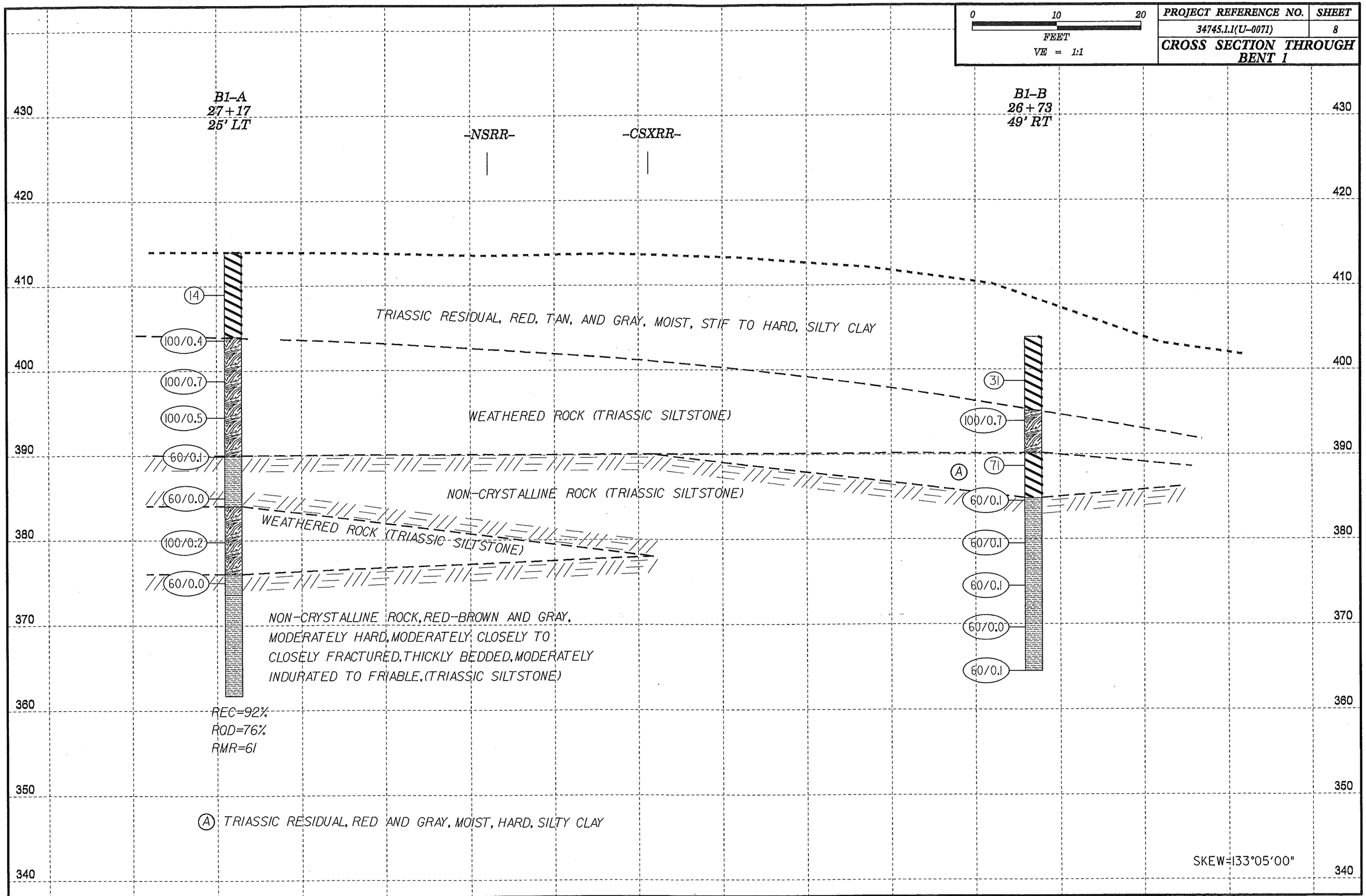
PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	7
CROSS SECTION THROUGH END BENT 1	



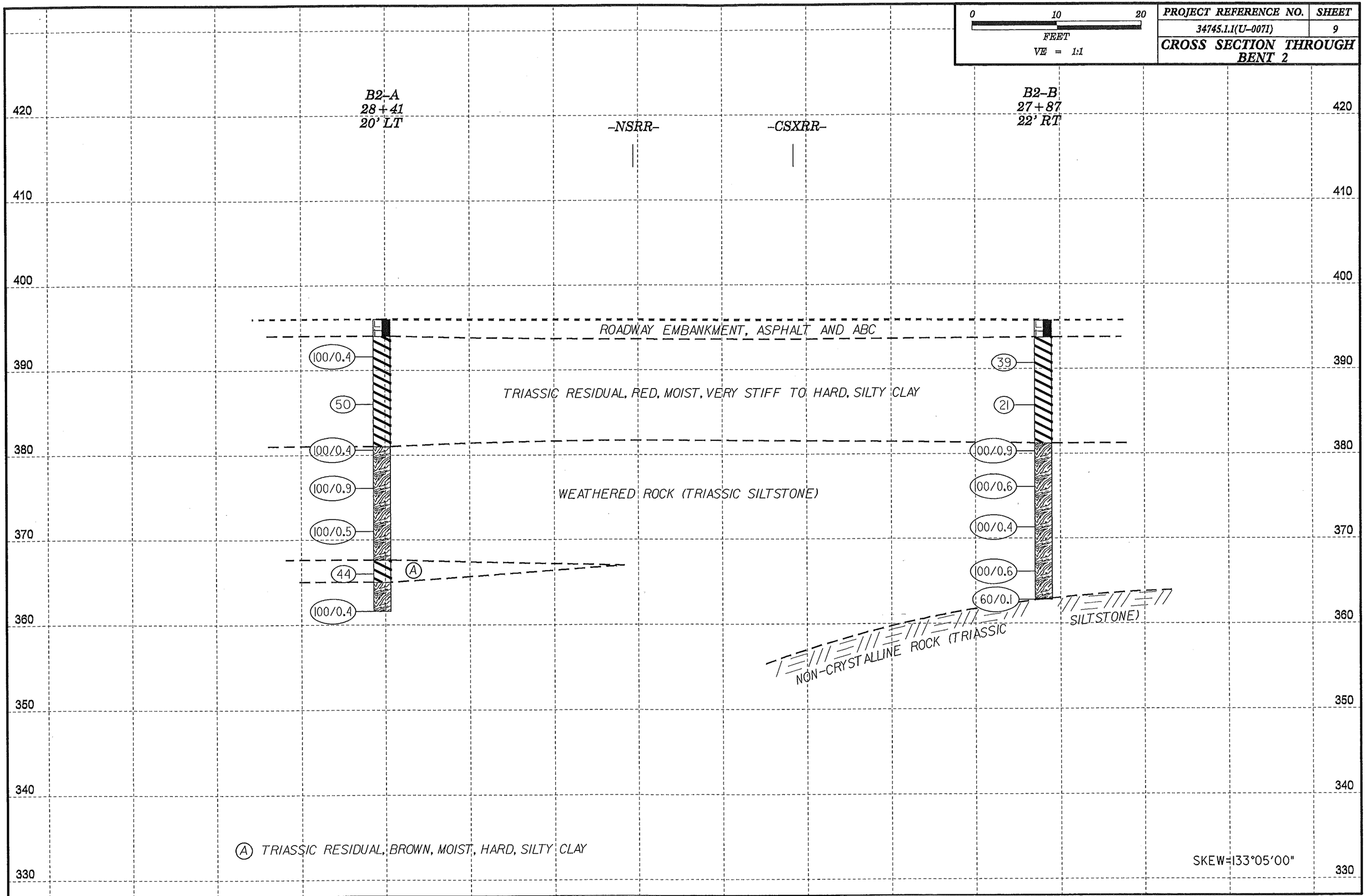
PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	8

CROSS SECTION THROUGH BENT 1

0 10 20
FEET
VE = 1:1



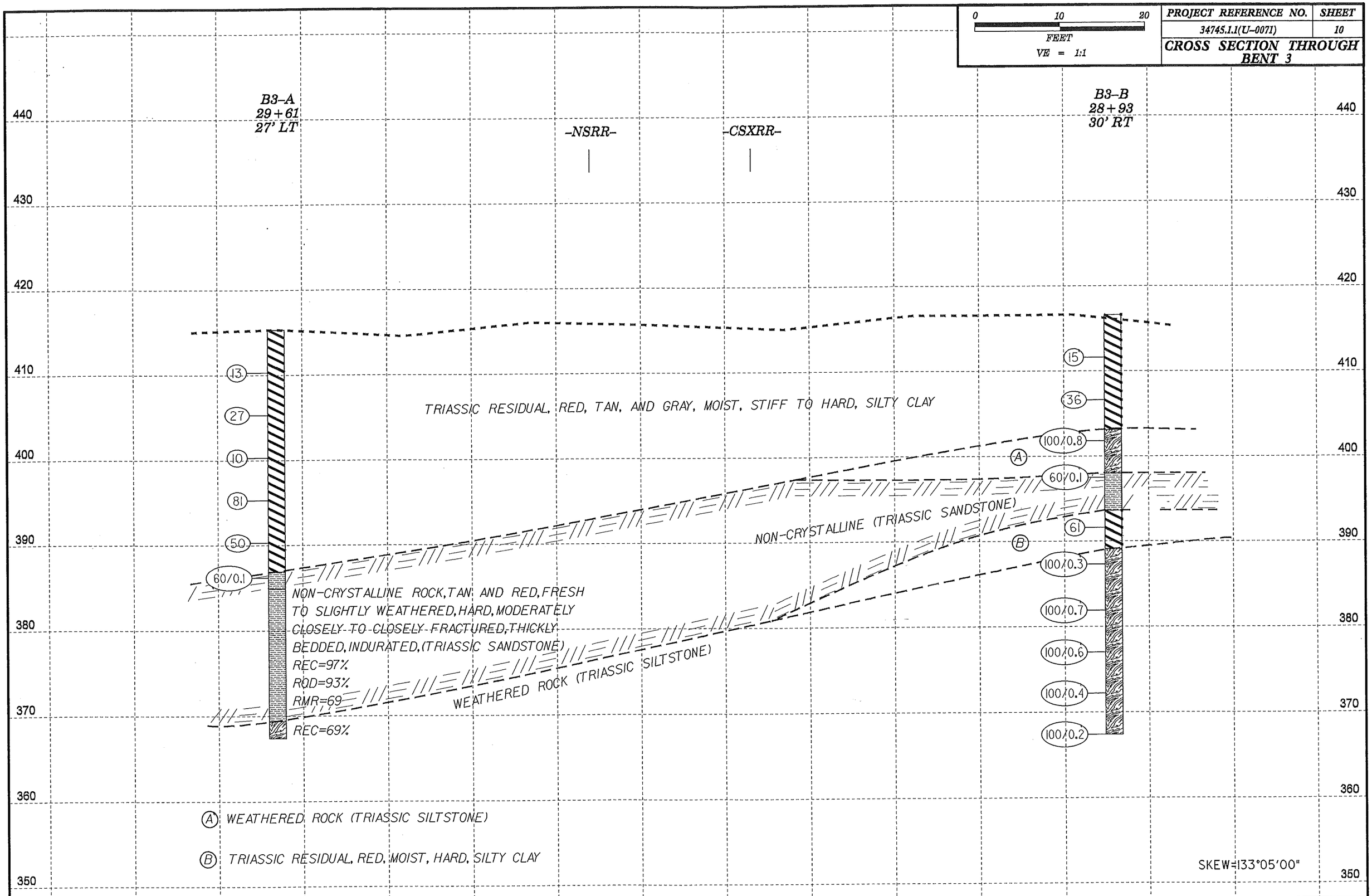
PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	9
CROSS SECTION THROUGH BENT 2	



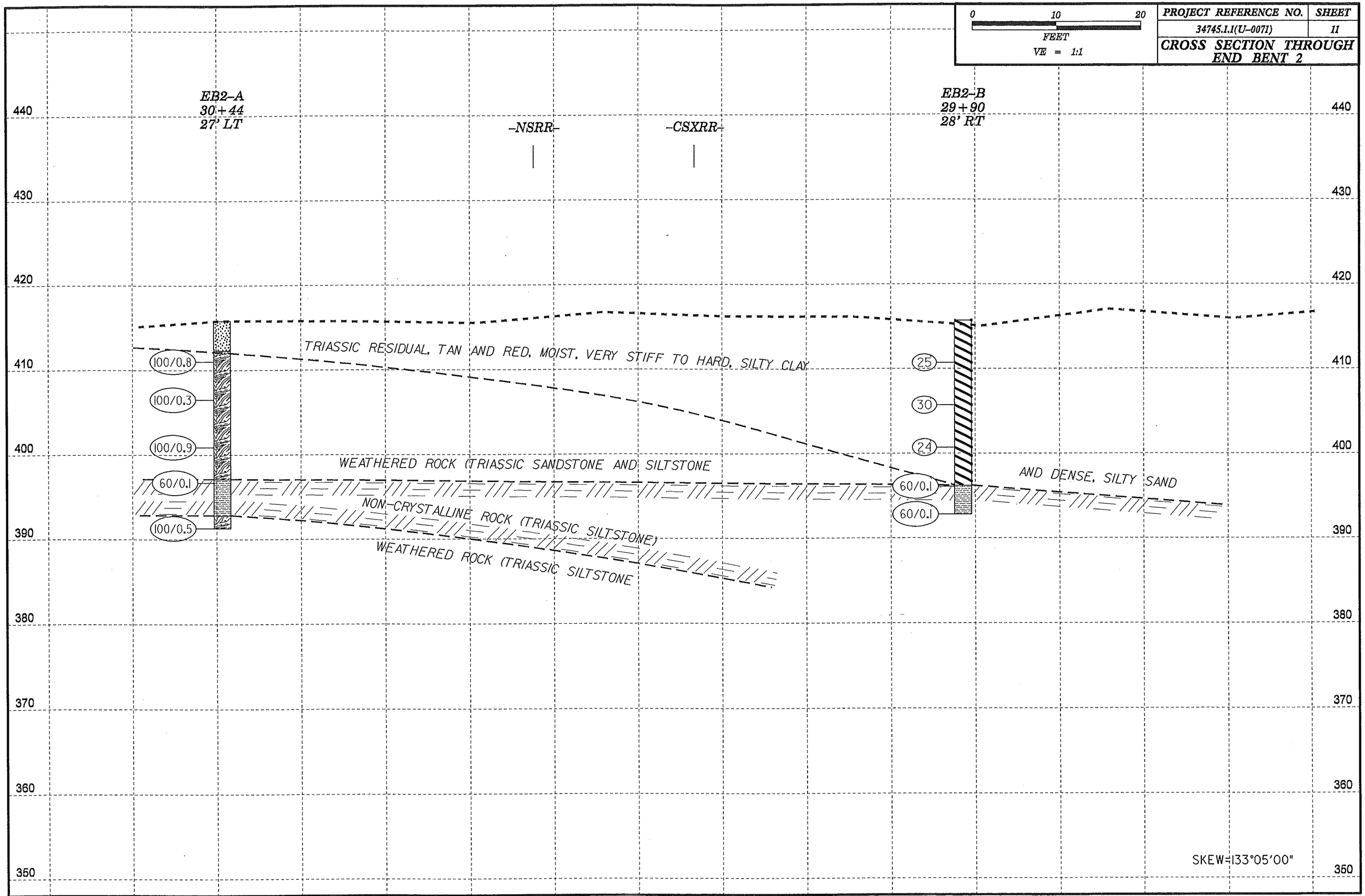
PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	10

CROSS SECTION THROUGH BENT 3

0 10 20
FEET
VE = 1:1



PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	11
CROSS SECTION THROUGH END BENT 2	



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.	
SITE DESCRIPTION NORFOLK & SOUTHERN AND CSX RAILROAD BRIDGES OVER US 70				GROUND WTR (ft)
BORING NO. EB1-A	STATION 26+34	OFFSET 27 ft LT	ALIGNMENT -NSRR-	0 HR. Dry
COLLAR ELEV. 410.5 ft	TOTAL DEPTH 23.9 ft	NORTHING 813,923	EASTING 2,041,309	24 HR. Dry
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 01/12/12	COMP. DATE 01/12/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
415											
410										410.5 GROUND SURFACE	0.0
										409.7 ARTIFICIAL FILL: GRAVEL PARKING LOT	0.8
	406.5	4.0	7	7	9	16		M		TRIASSIC RESIDUAL: ORANGE, SILTY CLAY	
405										404.0 DARK RED, CLAYEY SILT	6.5
	401.5	9.0	12	29	68	97		M			
400											
	396.5	14.0	18	59	41/0.2	100/0.7				396.0 WEATHERED ROCK (TRIASSIC SILTSTONE)	14.5
395											
	391.5	19.0	100/0.2			100/0.2					
390											
	386.7	23.8	60/0.1			60/0.1				386.7 / 386.6 NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	23.8 / 23.9

Boring Terminated with Standard Penetration Test Refusal at Elevation 386.6 ft in NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.	
SITE DESCRIPTION NORFOLK & SOUTHERN AND CSX RAILROAD BRIDGES OVER US 70				GROUND WTR (ft)
BORING NO. EB1-B	STATION 25+65	OFFSET 65 ft RT	ALIGNMENT -CSXRR-	0 HR. Dry
COLLAR ELEV. 399.6 ft	TOTAL DEPTH 24.7 ft	NORTHING 814,028	EASTING 2,041,238	24 HR. 4.5
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 01/13/12	COMP. DATE 01/13/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
400										
										399.6 GROUND SURFACE 0.0
										398.8 ARTIFICIAL FILL: GRAVEL PARKING LOT 0.8
395	395.4	4.2	5	9	15	24		M		TRIASSIC RESIDUAL: GRAY, SANDY SILT
										391.6 RED, SILTY CLAY 8.0
390	390.4	9.2	5	11	18	29		M		
385	385.4	14.2	19	39	60	99		M		
380	380.4	19.2	57	43/0.1		100/0.6				380.9 WEATHERED ROCK (TRIASSIC SILTSTONE) 18.7
375	375.6	24.0	43	57/0.2		100/0.7				374.9 24.7

Boring Terminated by Auger Refusal at Elevation 374.9 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION NORFOLK & SOUTHERN AND CSX RAILROAD BRIDGES OVER US 70			GROUND WTR (ft)
BORING NO. B1-A	STATION 27+17	OFFSET 25 ft LT	ALIGNMENT -NSRR- / 0 HR. N/A
COLLAR ELEV. 414.0 ft	TOTAL DEPTH 52.3 ft	NORTHING 813,847	EASTING 2,041,275 / 24 HR. 9.4
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 01/24/12	COMP. DATE 01/24/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
415										414.0 GROUND SURFACE	0.0
										TRIASSIC RESIDUAL RED AND TAN, SILTY CLAY	
410	410.0	4.0	4	6	8	14		M			
405	405.0	9.0	7	19	100/0.4	100/0.4				404.0	10.0
										WEATHERED ROCK (TRIASSIC SILTSTONE)	
400	400.0	14.0	22	38	62/0.2	100/0.7					
395	395.0	19.0	100/0.5			100/0.5					
390	390.0	24.0	60/0.1			60/0.1				390.0	24.0
										NON-CRYSTALLINE ROCK TRIASSIC SILTSTONE AND SANDSTONE)	
385	385.0	29.0	60/0.0			60/0.0				384.0	30.0
										WEATHERED ROCK (TRIASSIC SILTSTONE)	
380	380.0	34.0	100/0.2			100/0.2					
										376.0	38.0
375	375.0	39.0	60/0.0			60/0.0				NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE) 373.6	40.4
370							RS-1			RED-BROWN AND GRAY, MODERATELY TO SEVERELY WEATHERED, MODERATELY HARD, MODERATELY CLOSELY TO CLOSELY FRACTURED, THICKLY BEDDED, MODERATELY INDURATED TO FRIABLE, NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE) REC=92% RQD=76% RMR=61	
365										361.7	52.3
										Boring Terminated at Elevation 361.7 ft In NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION NORFOLK & SOUTHERN AND CSX RAILROAD BRIDGES OVER US 70			GROUND WTR (ft)
BORING NO. B1-A	STATION 27+17	OFFSET 25 ft LT	ALIGNMENT -NSRR- / 0 HR. N/A
COLLAR ELEV. 414.0 ft	TOTAL DEPTH 52.3 ft	NORTHING 813,847	EASTING 2,041,275 / 24 HR. 9.4
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 01/24/12	COMP. DATE 01/24/12	SURFACE WATER DEPTH N/A
CORE SIZE NQ	TOTAL RUN 11.9 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
373.6											Begin Coring @ 40.4 ft	
	373.6	40.4	1.9	4:20/1.0 5:00/0.9	(0.9) 47%	(0.0) 0%		(10.9) 92%	(9.1) 76%		373.6 RED-BROWN AND GRAY, MODERATELY TO SEVERELY WEATHERED, MODERATELY HARD, MODERATELY CLOSELY TO CLOSELY FRACTURED, THICKLY BEDDED, MODERATELY INDURATED TO FRIABLE, NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE) REC=92% RQD=76% RMR=61	40.4
	371.7	42.3	5.0	3:13/1.0 1:58/1.0 2:08/1.0 3:58/1.0 3:00/1.0	(5.0) 100%	(4.6) 92%	RS-1					
370												
	366.7	47.3	5.0	3:12/1.0 2:47/1.0 2:33/1.0 3:00/1.0 3:15/1.0	(5.0) 100%	(4.5) 90%						
365												
	361.7	52.3									361.7 Boring Terminated at Elevation 361.7 ft In NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	52.3

NCDOT BORE DOUBLE U0071_GEO_NS&CSX_BH.GPJ NC_DOT.GDT 12/21/12

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Mohs, N. D.
SITE DESCRIPTION NORFOLK & SOUTHERN AND CSX RAILROAD BRIDGES OVER US 70			**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 26+73	**OFFSET** 49 ft RT	**ALIGNMENT** -CSXRR- / **0 HR.** N/A
COLLAR ELEV. 403.8 ft	**TOTAL DEPTH** 39.3 ft	**NORTHING** 813,923	**EASTING** 2,041,211 / **24 HR.** 6.0 Caved
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 01/17/12	**COMP. DATE** 01/17/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
405										403.8 GROUND SURFACE	0.0
400	399.6	4.2	5	10	21	31		M		TRIASSIC RESIDUAL RED AND GRAY, SILTY CLAY	
395	394.6	9.2	67	33/0.2		100/0.7				395.1	8.7
										WEATHERED ROCK (TRIASSIC SILTSTONE)	
390	389.6	14.2	20	28	43	71		M		390.1	13.7
										TRIASSIC RESIDUAL RED AND GRAY, SILTY CLAY	
385	384.6	19.2	60/0.1			60/0.1				384.8	19.0
										NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	
380	379.6	24.2	60/0.1			60/0.1					
375	374.6	29.2	60/0.1			60/0.1					
370	369.6	34.2	60/0.0			60/0.0					
365	364.6	39.2	60/0.1			60/0.1				364.5	39.3
										Boring Terminated with Standard Penetration Test Refusal at Elevation 364.5 ft in NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION NORFOLK & SOUTHERN AND CSX RAILROAD BRIDGES OVER US 70			GROUND WTR (ft)
BORING NO. B2-A	STATION 28+41	OFFSET 20 ft LT	ALIGNMENT -NSRR- / 0 HR. 10.0
COLLAR ELEV. 396.0 ft	TOTAL DEPTH 34.4 ft	NORTHING 813,735	EASTING 2,041,223 / 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 01/19/12	COMP. DATE 01/19/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
400											
395										396.0 GROUND SURFACE	0.0
										394.7 ROADWAY EMBANKMENT	1.3
										394.0 ASPHALT	2.0
	392.0	4.0	100/0.4			100/0.4		M		392.0 ABC	4.0
390										391.0 TRIASSIC RESIDUAL RED, SILTY CLAY	5.0
	387.0	9.0	3	26	24	50		M		* AUGER PLUG	
385											
	382.0	14.0	15	13	100/0.4	100/0.4				381.0 WEATHERED ROCK (TRIASSIC SILTSTONE)	15.0
380											
	377.0	19.0	41	59/0.4		100/0.9					
375											
	372.0	24.0	100/0.5			100/0.5					
370											
	367.0	29.0	14	16	28	44		M		367.6 TRIASSIC RESIDUAL BROWN, SILTY CLAY	28.4
365										365.0 WEATHERED ROCK (TRIASSIC SILTSTONE)	31.0
	362.0	34.0	100/0.4			100/0.4				361.6 Boring Terminated at Elevation 361.6 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)	34.4

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION NORFOLK & SOUTHERN AND CSX RAILROAD BRIDGES OVER US 70			GROUND WTR (ft)
BORING NO. B2-B	STATION 27+87	OFFSET 22 ft RT	ALIGNMENT -CSXRR- / 0 HR. 17.8
COLLAR ELEV. 395.7 ft	TOTAL DEPTH 32.9 ft	NORTHING 813,807	EASTING 2,041,192 / 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 01/18/12	COMP. DATE 01/18/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
400										
395										395.7 GROUND SURFACE 0.0
										394.4 ROADWAY EMBANKMENT 1.3
										393.7 ASPHALT 2.0
	391.7	4.0	6	12	27	39		M		ABC
390										TRIASSIC RESIDUAL RED, SILTY CLAY
	386.7	9.0	12	11	10	21		M		
385										
	381.7	14.0	10	23	77/0.4	100/0.9				381.2 WEATHERED ROCK (TRIASSIC SILTSTONE) 14.5
380										
	376.7	19.0	55	45/0.1		100/0.6				
375										
	371.7	24.0	100/0.4			100/0.4				
370										
	366.7	29.0	60	40/0.1		100/0.6				
365										
	362.9	32.8	60/0.1			60/0.1				362.9 NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE) 32.8
										362.8 Boring Terminated with Standard Penetration Test Refusal at Elevation 362.8 ft in NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE) 32.9

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION NORFOLK & SOUTHERN AND CSX RAILROAD BRIDGES OVER US 70			GROUND WTR (ft)
BORING NO. B3-A	STATION 29+61	OFFSET 27 ft LT	ALIGNMENT -NSRR- / 0 HR. N/A
COLLAR ELEV. 415.3 ft	TOTAL DEPTH 47.9 ft	NORTHING 813,621	EASTING 2,041,183 / 24 HR. 7.5
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 01/20/12	COMP. DATE 01/20/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
420											
415										415.3 GROUND SURFACE	0.0
										TRIASSIC RESIDUAL RED AND GRAY, SILTY CLAY	
410	411.3	4.0	3	3	10	13		M			
405	406.3	9.0	6	11	16	27		M			
400	401.3	14.0	3	4	6	10		M			
395	396.3	19.0	19	35	46	81		M			
390	391.3	24.0	6	15	35	50		M			
385	386.3	29.0	60/0.1			60/0.1	RS-2			386.9	28.4
										NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE) 384.9	30.4
380										GRAY, TAN AND RED, FRESH TO SLIGHTLY WEATHERED, HARD, MODERATELY CLOSELY TO CLOSELY FRACTURED, THICKLY BEDDED, INDURATED, NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE) REC=97% RQD=93% RMR=69	
375											
370										370.0	45.3
										WEATHERED ROCK (TRIASSIC SILTSTONE) 367.4	47.9
										Boring Terminated at Elevation 367.4 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION NORFOLK & SOUTHERN AND CSX RAILROAD BRIDGES OVER US 70			GROUND WTR (ft)
BORING NO. B3-A	STATION 29+61	OFFSET 27 ft LT	ALIGNMENT -NSRR- / 0 HR. N/A
COLLAR ELEV. 415.3 ft	TOTAL DEPTH 47.9 ft	NORTHING 813,621	EASTING 2,041,183 / 24 HR. 7.5
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 01/20/12	COMP. DATE 01/20/12	SURFACE WATER DEPTH N/A
CORE SIZE NQ	TOTAL RUN 17.5 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
384.9											Begin Coring @ 30.4 ft	
	384.9	30.4	2.5	1:00/0.5 4:52/1.0 3:27/1.0	(2.0) 80%	(1.8) 72%	RS-2	(14.4) 97%	(13.8) 93%		384.9 GRAY, TAN AND RED, FRESH TO SLIGHTLY WEATHERED, HARD, MODERATELY CLOSELY TO CLOSELY FRACTURED, THICKLY BEDDED, INDURATED, NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE) REC=97% RQD=93% RMR=69	30.4
	382.4	32.9										
380			5.0	4:20/1.0 3:18/1.0 3:00/1.0 3:19/1.0 2:47/1.0	(5.0) 100%	(5.0) 100%						
	377.4	37.9										
375			5.0	3:28/1.0 2:47/1.0 2:40/1.0 1:58/1.0 2:28/1.0	(5.0) 100%	(4.6) 92%						
	372.4	42.9										
370			3.0	3:50/1.0 3:18/1.0 4:54/1.0	(2.4) 80%	(2.4) 80%					370.0	45.3
	369.4	45.9						(1.8) 69%			WEATHERED ROCK (TRIASSIC SILTSTONE)	
	367.4	47.9	2.0	6:50/1.0 6:10/1.0	(1.8) 90%	(1.8) 90%					367.4	47.9
											Boring Terminated at Elevation 367.4 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Mohs, N. D.
SITE DESCRIPTION NORFOLK & SOUTHERN AND CSX RAILROAD BRIDGES OVER US 70			**GROUND WTR (ft)**
BORING NO. B3-B	**STATION** 28+93	**OFFSET** 30 ft RT	**ALIGNMENT** -CSXRR- — **0 HR.** Dry
COLLAR ELEV. 416.6 ft	**TOTAL DEPTH** 49.2 ft	**NORTHING** 813,712	**EASTING** 2,041,144 — **24 HR.** 22.0
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 01/23/12	**COMP. DATE** 01/23/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
420											
										416.6 GROUND SURFACE	0.0
415										**TRIASSIC RESIDUAL** RED AND TAN, SILTY CLAY	
	412.6	4.0	5	7	8	15		M			
410											
	407.6	9.0	9	14	22	36		M			
405											
	402.6	14.0	24	76/0.3		100/0.8				403.1	13.5
400										**WEATHERED ROCK** (TRIASSIC SANDSTONE)	
	397.6	19.0	60/0.1			60/0.1				398.0	18.6
395										**NON-CRYSTALLINE ROCK** (TRIASSIC SANDSTONE)	
	392.6	24.0	11	16	45	61		M		393.6	23.0
390										**TRIASSIC RESIDUAL** RED, SILTY CLAY	
	387.6	29.0	100/0.3			100/0.3				389.1	27.5
385										**WEATHERED ROCK** (TRIASSIC SANDSTONE AND SILTSTONE)	
	382.6	34.0	38	62/0.2		100/0.7					
380											
	377.6	39.0	72	28/0.1		100/0.6					
375											
	372.6	44.0	100/0.4			100/0.4					
370											
	367.6	49.0	100/0.2			100/0.2				367.4	49.2
										Boring Terminated at Elevation 367.4 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)	

NCDOT BORE DOUBLE U0071_GEO_NS&CSX_BH.GPJ NC_DOT.GDT 12/21/12

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.	
SITE DESCRIPTION NORFOLK & SOUTHERN AND CSX RAILROAD BRIDGES OVER US 70				GROUND WTR (ft)
BORING NO. EB2-A	STATION 30+44	OFFSET 27 ft LT	ALIGNMENT -NSRR-	0 HR. Dry
COLLAR ELEV. 415.8 ft	TOTAL DEPTH 24.5 ft	NORTHING 813,545	EASTING 2,041,151	24 HR. Dry
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 01/12/12	COMP. DATE 01/12/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
420											
415										415.8 GROUND SURFACE	0.0
										TRIASSIC RESIDUAL TAN, SILTY SAND	
										412.3	3.5
	411.8	4.0	15	85/0.3		100/0.8				WEATHERED ROCK (TRAISSIC SILTSTONE AND SANDSTONE)	
410											
	406.8	9.0	100/0.3			100/0.3					
405											
	401.8	14.0	34	66/0.4		100/0.9					
400											
	396.8	19.0	60/0.1			60/0.1				397.1 NON-CRYSTALLINE ROCK TRIASSIC SILTSTONE)	18.7
395										392.8	23.0
	391.8	24.0	100/0.5			100/0.5				391.3 WEATHERED ROCK TRIASSIC SILTSTONE)	24.5
										Boring Terminated at Elevation 391.3 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)	

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.	
SITE DESCRIPTION NORFOLK & SOUTHERN AND CSX RAILROAD BRIDGES OVER US 70				GROUND WTR (ft)
BORING NO. EB2-B	STATION 29+90	OFFSET 28 ft RT	ALIGNMENT -CSXRR-	0 HR. Dry
COLLAR ELEV. 415.7 ft	TOTAL DEPTH 22.9 ft	NORTHING 813,622	EASTING 2,041,108	24 HR. Dry
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 01/13/12	COMP. DATE 01/13/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
420										
415										415.7 GROUND SURFACE 0.0
										TRIASSIC RESIDUAL RED, SILTY CLAY
	411.7	4.0	5	10	15	25		M		
410										
	406.7	9.0	11	13	17	30		M		
405										
	401.7	14.0	6	8	16	24		M		
400										
	396.7	19.0	36	60/0.1		60/0.1				396.2 19.5
395										NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)
	392.9	22.8	60/0.1			60/0.1				392.8 22.9
										Boring Terminated with Standard Penetration Test Refusal at Elevation 392.8 ft in NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)

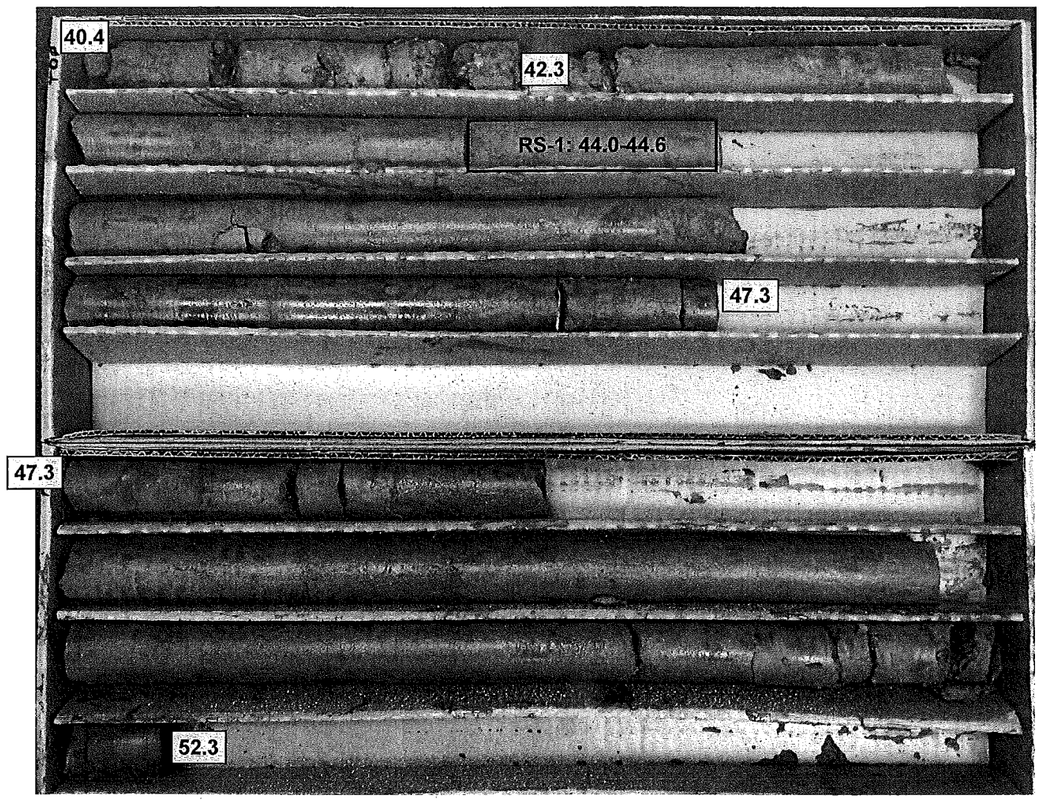
ROCK TEST RESULTS

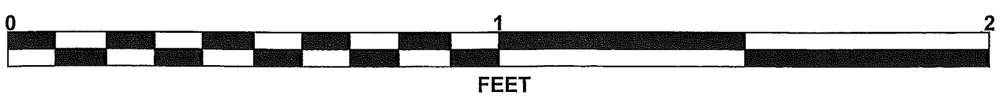
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	H/D RATIO	UNIT WT lbs/ft3	Ultimate lbf	Ultimate ksi	Ultimate (corrected) ksi	Sec. Mod. @ 40% Mpsi
RS-1	25' LT	27+17	44.0-44.6	2.19	157.5	12050	4.49	4.54	.335
RS-2	27' LT	29+61	30.6-31.1	2.22	158	30900	11.44	11.58	2.61

CORE PHOTOGRAPHS

B1-A

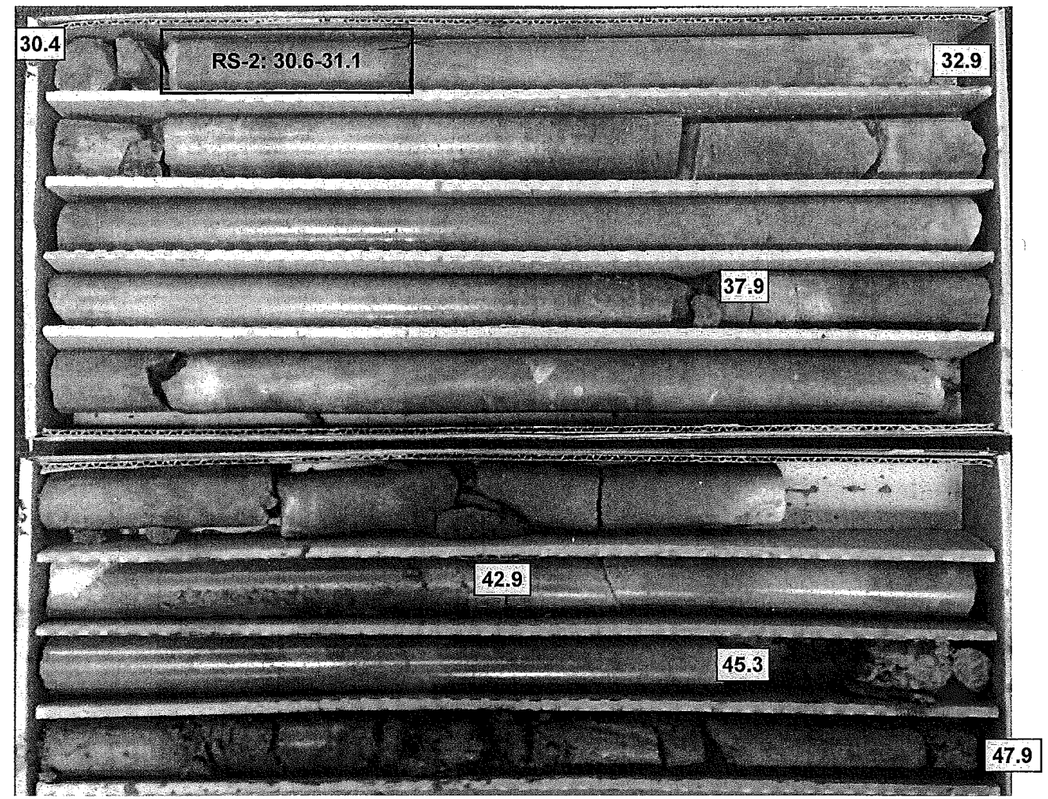
BOXES 1 & 2: 40.4 - 52.3 FEET

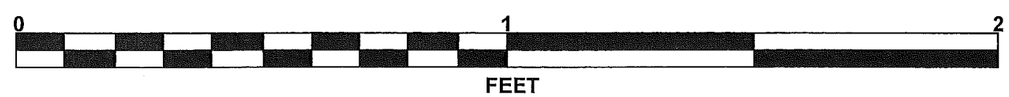




B3-A

BOXES 1 & 2: 30.4 - 47.9 FEET





SITE PHOTOGRAPH

NORFOLK & SOUTHERN AND CSX RAILROAD BRIDGES OVER US 70

Looking North at Bent 2

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1 (U-0071)	1	11

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1 (U-0071) F.A. PROJ. NHF-76-1(2)

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION BRIDGE AT -L- STATION 44+09 OVER -Y1- (NC 98/HOLLOWAY STREET)

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5, 6	CROSS SECTIONS
7-10	BORE LOGS
11	SITE PHOTOGRAPHS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

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

PERSONNEL

N.D. MOHS

J.I. MILKOVITS, JR.

T.T. WALKER

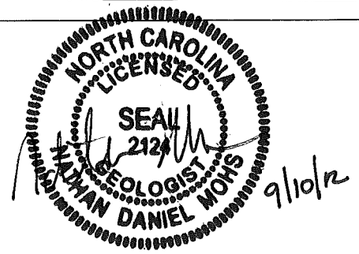
SUMMIT ENGINEERING

INVESTIGATED BY N.D. MOHS

CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE SEPTEMBER 2012



PROJECT: 34745.1.1

ID: U-0071

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 REFERENCE NO.	SHEET NO.
34745.1.1 (U-0071)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING # 10	50 MX	50 MX	51 MN									GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
# 40	30 MX	50 MX	10 MX											
# 200	15 MX	25 MX		35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/026 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT DPT DMT VST PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

ABBREVIATIONS

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

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

EQUIPMENT USED ON SUBJECT PROJECT

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

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

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

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

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK: BL-104: BL STATION 39+22.92

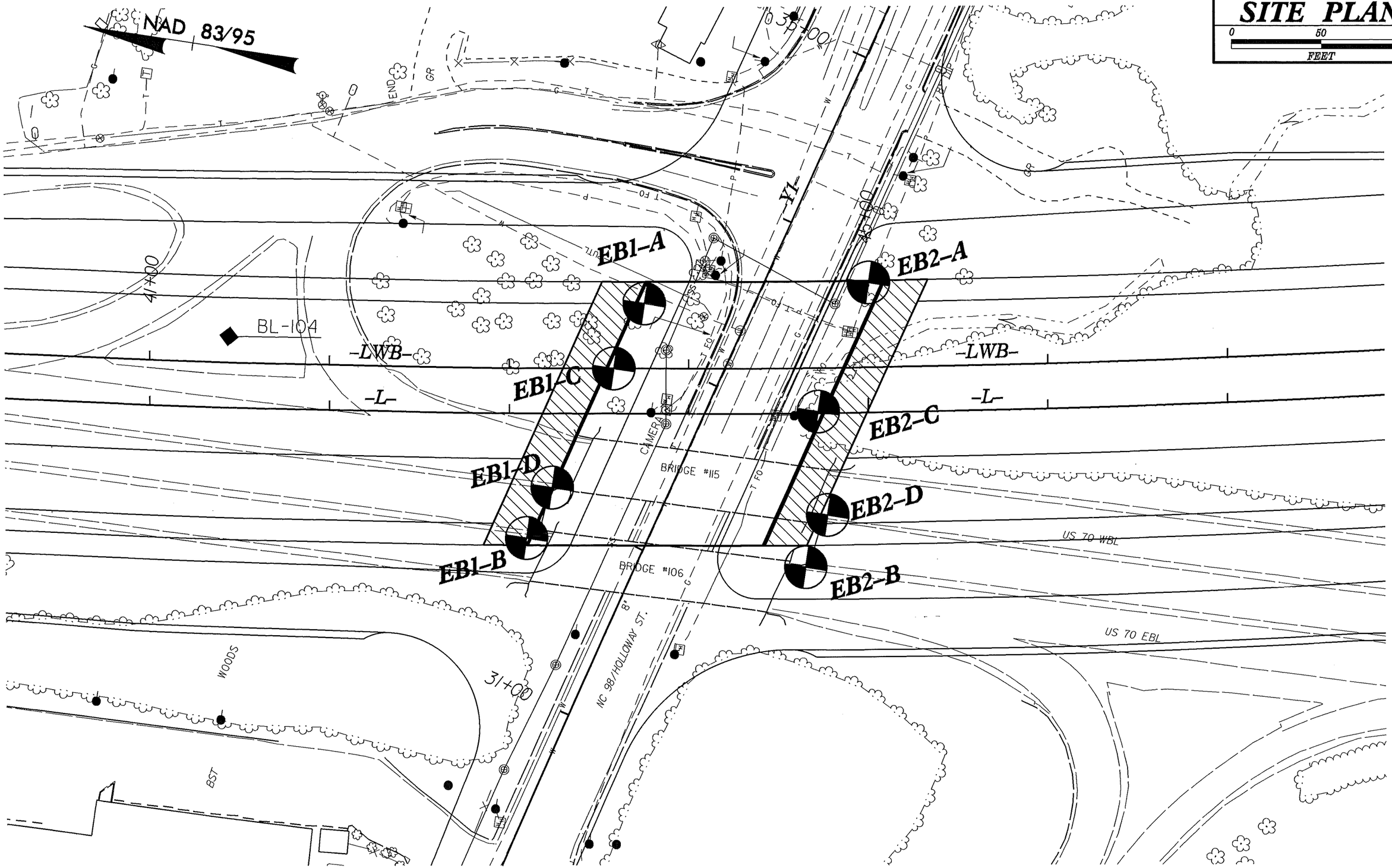
ELEVATION: 382.78 FT.

NOTES:

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	3

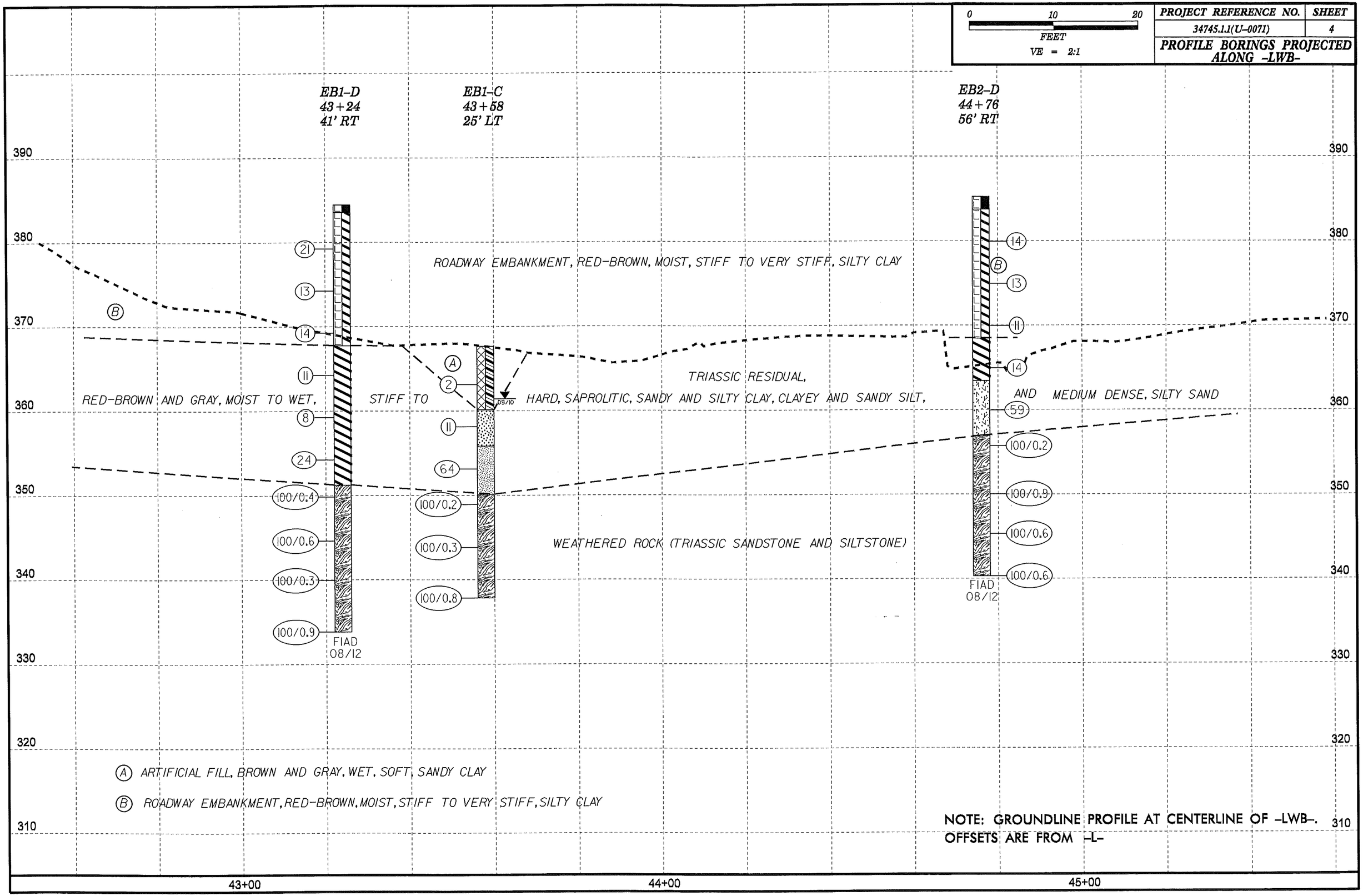
SITE PLAN

0 50 100
FEET



PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	4

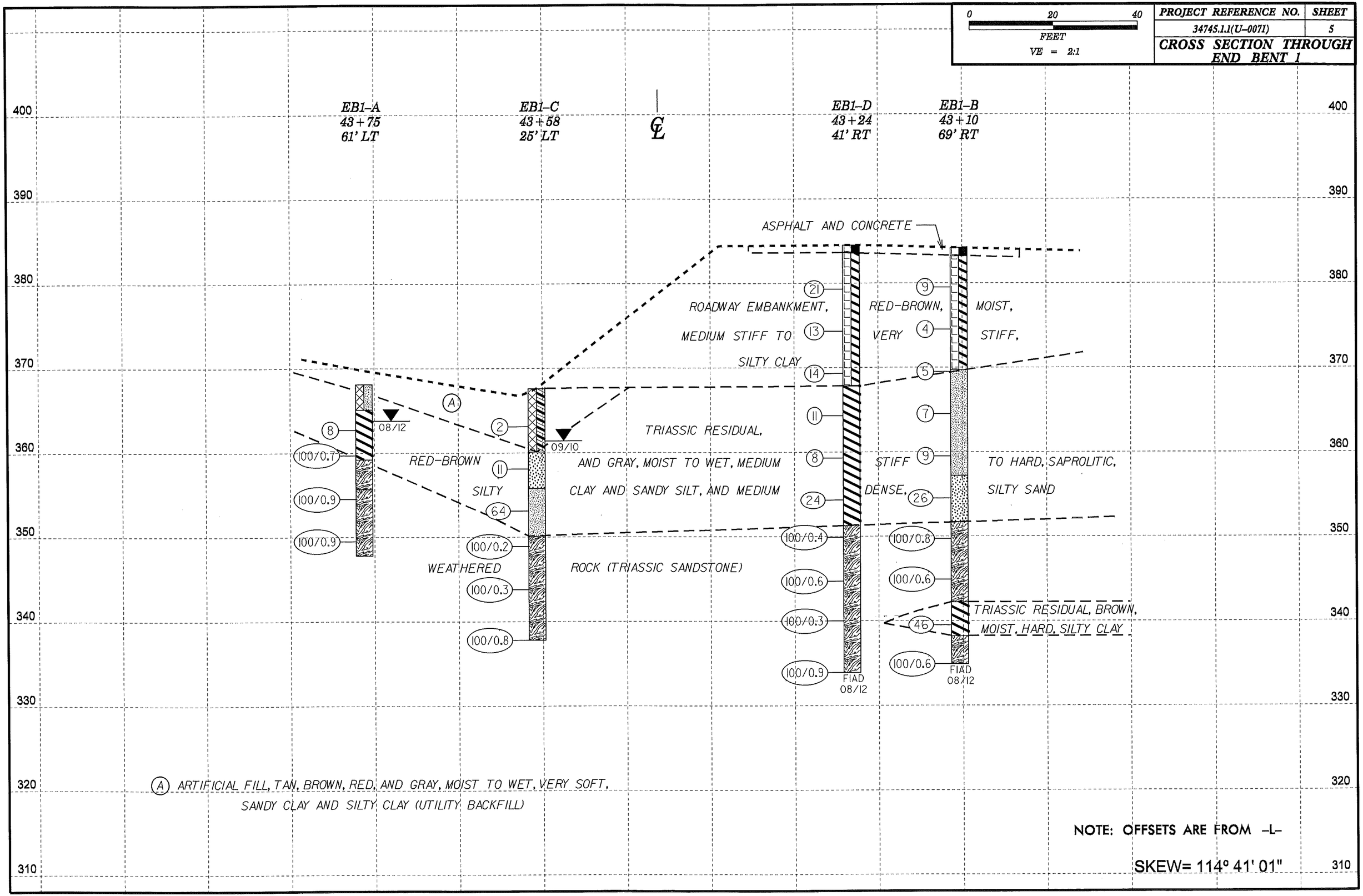
PROFILE BORINGS PROJECTED ALONG -LWB-



PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	5

CROSS SECTION THROUGH END BENT 1

0 20 40
FEET
VE = 2:1



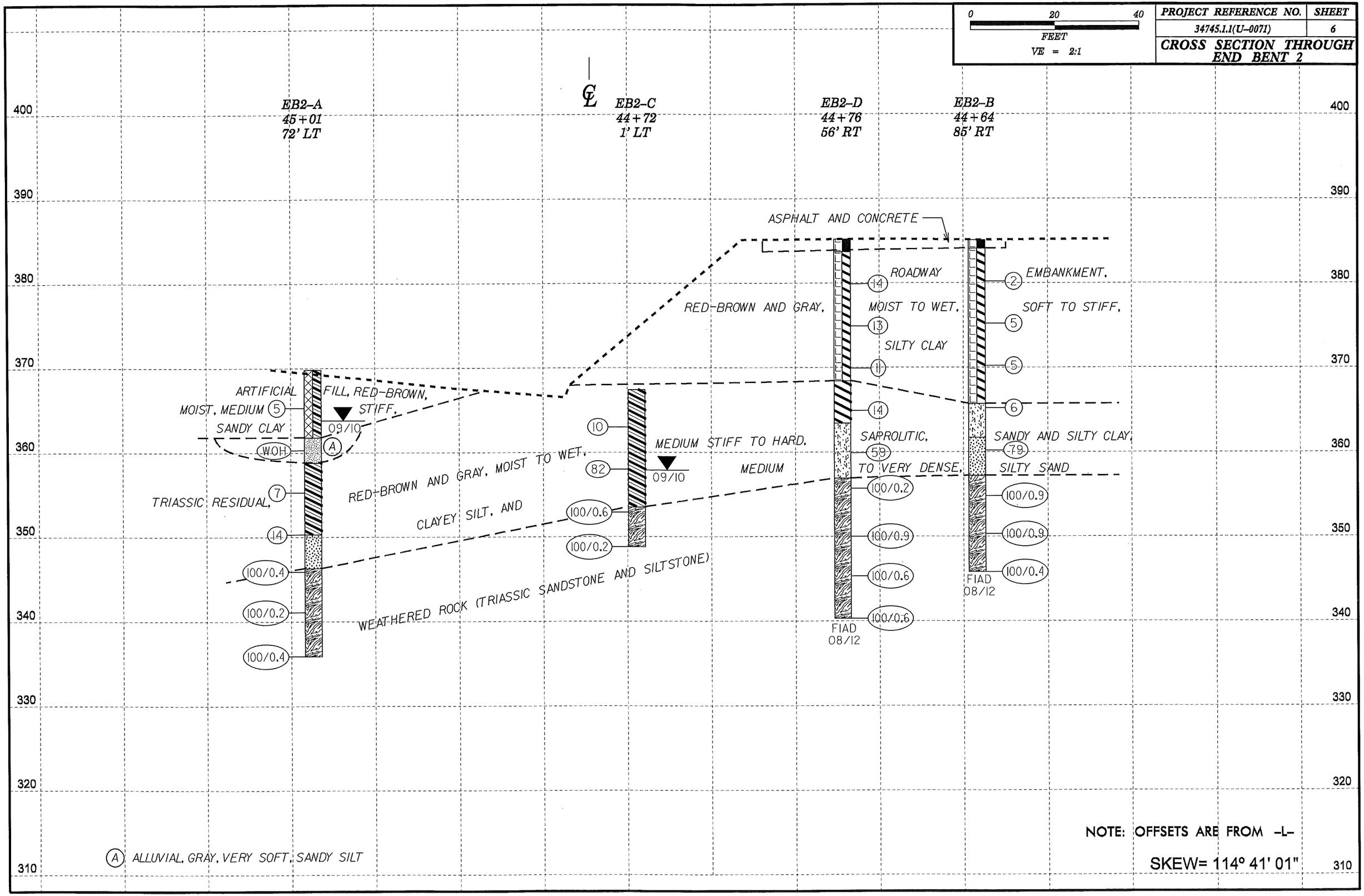
(A) ARTIFICIAL FILL, TAN, BROWN, RED, AND GRAY, MOIST TO WET, VERY SOFT, SANDY CLAY AND SILTY CLAY (UTILITY BACKFILL)

NOTE: OFFSETS ARE FROM -L-

SKEW= 114° 41' 01"

PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	6

CROSS SECTION THROUGH END BENT 2



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Milkovits, J. I.
SITE DESCRIPTION BRIDGE AT -L- STATION 44+09 OVER -Y1- (NC 98/HOLLOWAY STREET)			**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 43+75	**OFFSET** 61 ft LT	**ALIGNMENT** -L-	**0 HR.** 16.9
COLLAR ELEV. 368.1 ft	**TOTAL DEPTH** 20.3 ft	**NORTHING** 815,780	**EASTING** 2,040,680	**24 HR.** 6.0
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 08/14/12	**COMP. DATE** 08/14/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
370											
										368.1 GROUND SURFACE	0.0
										ARTIFICIAL FILL TAN-RED, SANDY SILT WITH ROCK	
365										365.1	3.0
	363.7	4.4	2	3	5	8		M		**TRIASSIC RESIDUAL** RED-GRAY, SILTY CLAY	
360										359.2	8.9
	358.7	9.4	51	49/0.2		100/0.7				**WEATHERED ROCK** (TRIASSIC SILTSTONE)	
355										355.7	12.4
	353.7	14.4	40	60/0.4		100/0.9				(TRIASSIC SANDSTONE)	
350											
	348.7	19.4	10	90/0.4		100/0.9				347.8	20.3
										Boring Terminated at Elevation 347.8 ft in WEATHERED ROCK (TRIASSIC SANDSTONE)	

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Contract Geologist
SITE DESCRIPTION BRIDGE AT -L- STATION 44+09 OVER -Y1- (NC 98/HOLLOWAY STREET)			**GROUND WTR (ft)**
BORING NO. EB1-C	**STATION** 43+58	**OFFSET** 25 ft LT	**ALIGNMENT** -L-	**0 HR.** WET
COLLAR ELEV. 367.6 ft	**TOTAL DEPTH** 29.8 ft	**NORTHING** 815,791	**EASTING** 2,040,642	**24 HR.** 6.2
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 09/08/10	**COMP. DATE** 09/08/10	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
370										
										367.6 GROUND SURFACE 0.0
										ARTIFICIAL FILL BROWN AND GRAY, SANDY CLAY
365	364.1	3.5	1	1	1	2		W		
360	359.1	8.5	2	4	7	11		M		360.1 7.5 **TRIASSIC RESIDUAL** GRAY AND RED, SILTY SAND
355	354.1	13.5	23	31	33	64		M		355.8 11.8 GRAY AND BROWN, SANDY SILT
350	349.1	18.5	100/0.2			100/0.2				350.1 17.5 **WEATHERED ROCK** (TRIASSIC SANDSTONE)
345	344.1	23.5	100/0.3			100/0.3				
340	339.1	28.5	7	41	59/0.3	100/0.8				337.8 29.8
										Boring Terminated at Elevation 337.8 ft in WEATHERED ROCK (TRIASSIC SANDSTONE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Milkovits, J. I.
SITE DESCRIPTION BRIDGE AT -L- STATION 44+09 OVER -Y1- (NC 98/HOLLOWAY STREET)			**GROUND WTR (ft)**
BORING NO. EB1-D	**STATION** 43+24	**OFFSET** 41 ft RT	**ALIGNMENT** -L- — **0 HR.** WET
COLLAR ELEV. 384.4 ft	**TOTAL DEPTH** 50.6 ft	**NORTHING** 815,815	**EASTING** 2,040,572 — **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 08/10/12	**COMP. DATE** 08/10/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
385										384.4 GROUND SURFACE	0.0
										383.5 ASPHALT	0.9
										ROADWAY EMBANKMENT RED-BROWN, SILTY CLAY	
380	380.2	4.2	8	9	12	21		M			
375	375.2	9.2	3	5	8	13		M			
370	370.2	14.2	3	5	9	14		M			
										367.7	16.7
										TRIASSIC RESIDUAL RED-BROWN-GRAY, SILTY CLAY	
365	365.2	19.2	3	4	7	11		M			
360	360.2	24.2	1	4	4	8		M			
355	355.2	29.2	4	9	15	24		M			
										351.2	33.2
										WEATHERED ROCK (TRIASSIC SILTSTONE)	
350	350.2	34.2	100/0.4			100/0.4					
345	345.2	39.2	62	38/0.1		100/0.6					
340	340.2	44.2	100/0.3			100/0.3					
335	335.2	49.2	27	37	63/0.4	100/0.9					
										333.8	50.6
										Boring Terminated at Elevation 333.8 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)	

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Mohs, N. D.
SITE DESCRIPTION BRIDGE AT -L- STATION 44+09 OVER -Y1- (NC 98/HOLLOWAY STREET)			**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 43+10	**OFFSET** 69 ft RT	**ALIGNMENT** -L- — **0 HR.** Caved
COLLAR ELEV. 384.3 ft	**TOTAL DEPTH** 49.3 ft	**NORTHING** 815,825	**EASTING** 2,040,542 — **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 08/13/12	**COMP. DATE** 08/13/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
385										384.3 GROUND SURFACE 0.0
										382.7 ASPHALT AND CONCRETE 1.6
										ROADWAY EMBANKMENT RED-BROWN, SILTY CLAY
380	380.6	3.7	3	4	5	9		M		
375	375.6	8.7	3	2	2	4		M		
370	370.6	13.7	2	2	3	5		M		369.8 14.5
										TRIASSIC RESIDUAL GRAY, SANDY SILT
365	365.6	18.7	4	4	3	7		M		
360	360.6	23.7	2	4	5	9		M		357.3 27.0
										TAN, SILTY SAND (SAPROLITIC)
355	355.6	28.7	10	11	15	26		M		351.8 32.5
										WEATHERED ROCK (TRIASSIC SANDSTONE)
350	350.6	33.7	40	60/0.3		100/0.8				
345	345.6	38.7	79	21/0.1		100/0.6				342.3 42.0
										TRIASSIC RESIDUAL BROWN, SILTY CLAY
340	340.6	43.7	10	21	25	46				338.3 46.0
										WEATHERED ROCK (TRIASSIC SILTSTONE)
335	335.6	48.7	67	33/0.1		100/0.6				335.0 49.3
										Boring Terminated at Elevation 335.0 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)

NCDOT BORE DOUBLE U0071_GEO_BH_L_OVER_NC98.GPJ NC_DOT.GDT 9/10/12

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Milkovits, J. I.
SITE DESCRIPTION BRIDGE AT -L- STATION 44+09 OVER -Y1- (NC 98/HOLLOWAY STREET)			**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 45+01	**OFFSET** 72 ft LT	**ALIGNMENT** -L- — **0 HR.** 23.5
COLLAR ELEV. 369.9 ft	**TOTAL DEPTH** 33.9 ft	**NORTHING** 815,658	**EASTING** 2,040,711 — **24 HR.** 6.0
DRILL RIG/HAMMER EFF./DATE RFO0067 CME-550X 77% 03/15/2010		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Conley, H. R.	**START DATE** 09/20/10	**COMP. DATE** 09/20/10	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
370										369.9 GROUND SURFACE	0.0
	366.4	3.5	3	2	3	5		M		**ARTIFICIAL FILL** RED-BROWN, SANDY CLAY	
365										361.9	8.0
	361.4	8.5	WOH	WOH	WOH	0		W		**ALLUVIAL** GRAY, SANDY SILT	
360										358.9	11.0
	356.4	13.5	3	3	4	7		W		**TRIASSIC RESIDUAL** GRAY-BROWN, SANDY CLAY	
355											
	351.4	18.5	1	3	11	14		M		350.4	19.5
350										BROWN, SILTY SAND	
	346.4	23.5	100/0.4			100/0.4				346.4	23.5
345										**WEATHERED ROCK** (TRIASSIC SANDSTONE)	
	341.4	28.5	100/0.2			100/0.2					
340											
	336.4	33.5	100/0.4			100/0.4				336.0	33.9
										Boring Terminated at Elevation 336.0 ft in WEATHERED ROCK (TRIASSIC SANDSTONE)	

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Milkovits, J. I.
SITE DESCRIPTION BRIDGE AT -L- STATION 44+09 OVER -Y1- (NC 98/HOLLOWAY STREET)			**GROUND WTR (ft)**
BORING NO. EB2-C	**STATION** 44+72	**OFFSET** 1 ft LT	**ALIGNMENT** -L- — **0 HR.** Dry
COLLAR ELEV. 367.4 ft	**TOTAL DEPTH** 18.6 ft	**NORTHING** 815,675	**EASTING** 2,040,636 — **24 HR.** 9.5
DRILL RIG/HAMMER EFF./DATE RFO0067 CME-550X 77% 03/15/2010		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Conley, H. R.	**START DATE** 09/20/10	**COMP. DATE** 09/20/10	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
370										367.4 GROUND SURFACE 0.0
	364.0	3.4	5	5	5	10		M		**TRIASSIC RESIDUAL** TAN-BROWN, SANDY CLAY
365										
	359.0	8.4	15	29	53	82		M		
360										
	354.0	13.4	23	74	26/0.1	100/0.6				353.5 13.9
355										**WEATHERED ROCK** (TRIASSIC SANDSTONE)
	349.0	18.4	100/0.2			100/0.2				348.8 18.6
350										Boring Terminated at Elevation 348.8 ft in WEATHERED ROCK (TRIASSIC SANDSTONE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION BRIDGE AT -L- STATION 44+09 OVER -Y1- (NC 98/HOLLOWAY STREET)			GROUND WTR (ft)
BORING NO. EB2-D	STATION 44+76	OFFSET 56 ft RT	ALIGNMENT -L-
COLLAR ELEV. 385.2 ft	TOTAL DEPTH 44.9 ft	NORTHING 815,661	EASTING 2,040,580
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 08/09/12	COMP. DATE 08/09/12	SURFACE WATER DEPTH N/A

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

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
385.2										GROUND SURFACE	0.0
383.7										PAVEMENT STRUCTURE/ASPHALT/CONCRETE	1.5
	380.9	4.3	6	6	8	14		M		ROADWAY EMBANKMENT RED-BROWN, SILTY CLAY	
	375.9	9.3	4	6	7	13		M			
	370.9	14.3	3	4	7	11		M			
368.4										TRIASSIC RESIDUAL RED-BROWN-GRAY, SILTY CLAY	16.8
	365.9	19.3	4	6	8	14		M			
363.4										BROWN-TAN-GRAY, SAPROLITIC, CLAYEY SILT	21.8
	360.9	24.3	12	23	36	59		M			
356.9										WEATHERED ROCK (TRIASSIC SILTSTONE)	28.3
	355.9	29.3	100/0.2			100/0.2					
	350.9	34.3	41	59/0.4		100/0.9					
	345.9	39.3	62	38/0.1		100/0.6					
340.3	340.9	44.3	74	26/0.1		100/0.6				Boring Terminated at Elevation 340.3 ft in WEATHERED ROCK (TRIASSIC SILTSONE)	44.9

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION BRIDGE AT -L- STATION 44+09 OVER -Y1- (NC 98/HOLLOWAY STREET)			GROUND WTR (ft)
BORING NO. EB2-B	STATION 44+64	OFFSET 85 ft RT	ALIGNMENT -L-
COLLAR ELEV. 385.1 ft	TOTAL DEPTH 39.3 ft	NORTHING 815,669	EASTING 2,040,550
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 08/14/12	COMP. DATE 08/14/12	SURFACE WATER DEPTH N/A

GROUND WTR (ft)	
0 HR.	WET
24 HR.	FIAD

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
385.1										GROUND SURFACE 0.0
384.1										ASPHALT 1.0
	381.2	3.9	WOH	WOH	2	2		M		ROADWAY EMBANKMENT BROWN-GRAY, SILTY CLAY
	376.2	8.9	2	2	3	5		M		
	371.2	13.9	2	2	3	5		M		
365.7										TRIASSIC RESIDUAL GRAY, SAPROLITIC, CLAYEY SILT 19.4
	366.2	18.9	3	3	3	6		M		
361.7										GRAY, SAPROLITIC, SILTY SAND 23.4
	361.2	23.9	27	32	47	79		M		
357.2										WEATHERED ROCK (TRIASSIC SILTSTONE) 27.9
	356.2	28.9	27	39	61/0.4	100/0.9				
	351.2	33.9	45	55/0.4		100/0.9				
345.8	346.2	38.9	100/0.4							Boring Terminated at Elevation 345.8 ft in WEATHERED ROCK (TRIASSIC SILTSTONE) 39.3

SITE PHOTOGRAPH

Bridge on -L- over -Y1- (NC 98/Holloway St.)

View is toward End Bent 2

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1 (U-0071)	1	13

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1 (U-0071) F.A. PROJ. NHF-76-1(2)

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION DUAL BRIDGES AT -L- STATION 125+92 OVER -Y8- (ROWENA AVENUE)

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4, 5	PROFILES
6-8	CROSS SECTIONS
9-12	BORE LOGS
13	SITE PHOTOGRAPH

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N.C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

PERSONNEL

J.I. MILKOVITS, JR.

T.T. WALKER

SUMMIT ENGINEERING

INVESTIGATED BY N.D. MOHS

CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE AUGUST 2012

NORTH CAROLINA LICENSED GEOLOGIST 2124 NATHAN DANIEL MOHS 9/5/12

PROJECT: 34745.1.1

ID: U-0071

DRAWN BY: T.T. WALKER, N.D. MOHS

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NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PROJECT REFERENCE NO.	SHEET NO.
34745.1.1(U-0071)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING #10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#40	30 MX	50 MX	51 MN											
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

GRAIN SIZE MM: 305 | 75 | 2.0 | 0.25 | 0.05 | 0.005

GRAIN SIZE IN.: 12 | 3

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY), MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/026 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [x] CME-550
- [ ] PORTABLE HOIST
- [x] CME-450
- [ ] _____

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

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

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

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK: BY24-482: BL STATION 16+70.79

ELEVATION: 384.57 FT.

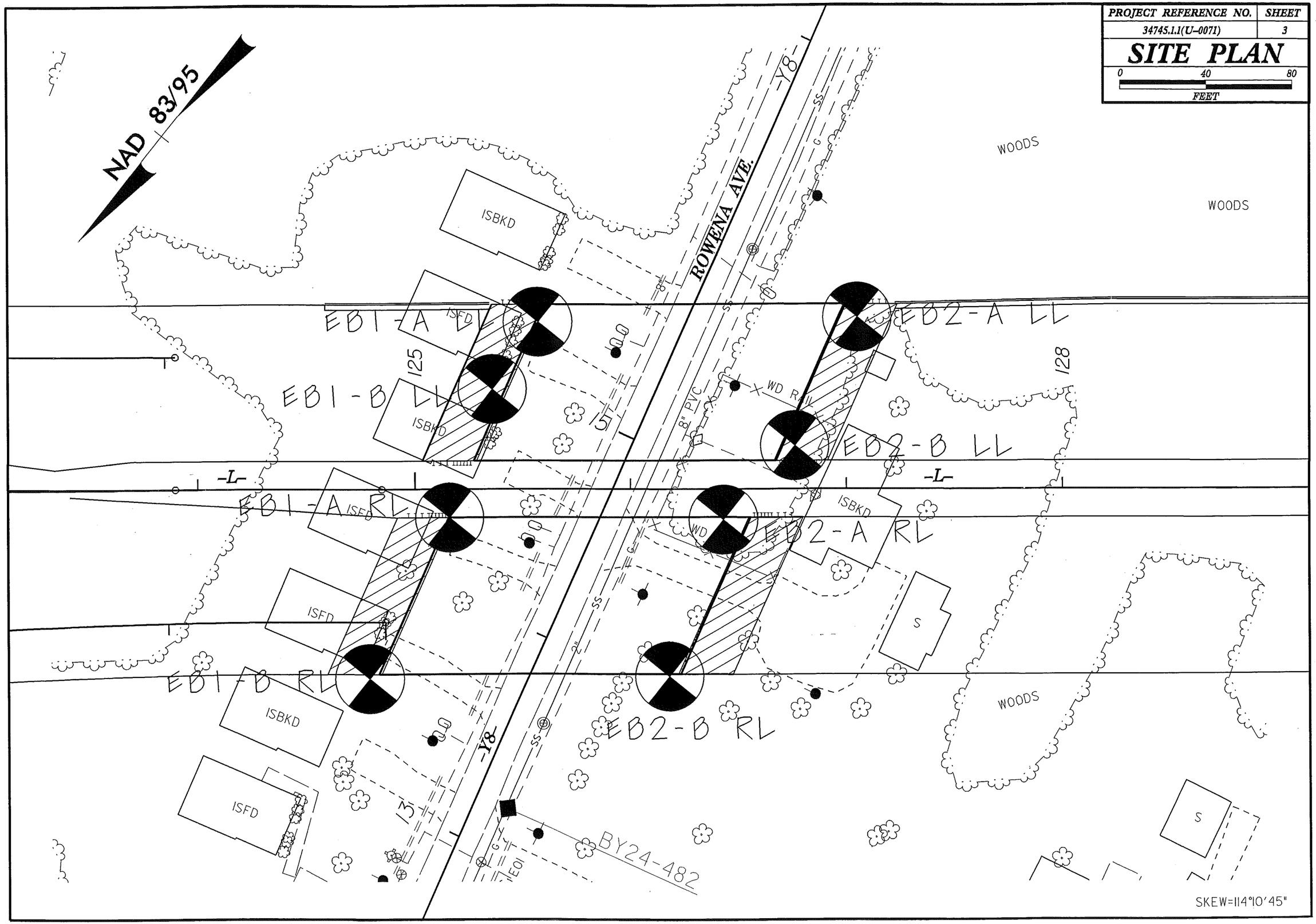
NOTES:

REVISED 09/23/09

PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	3

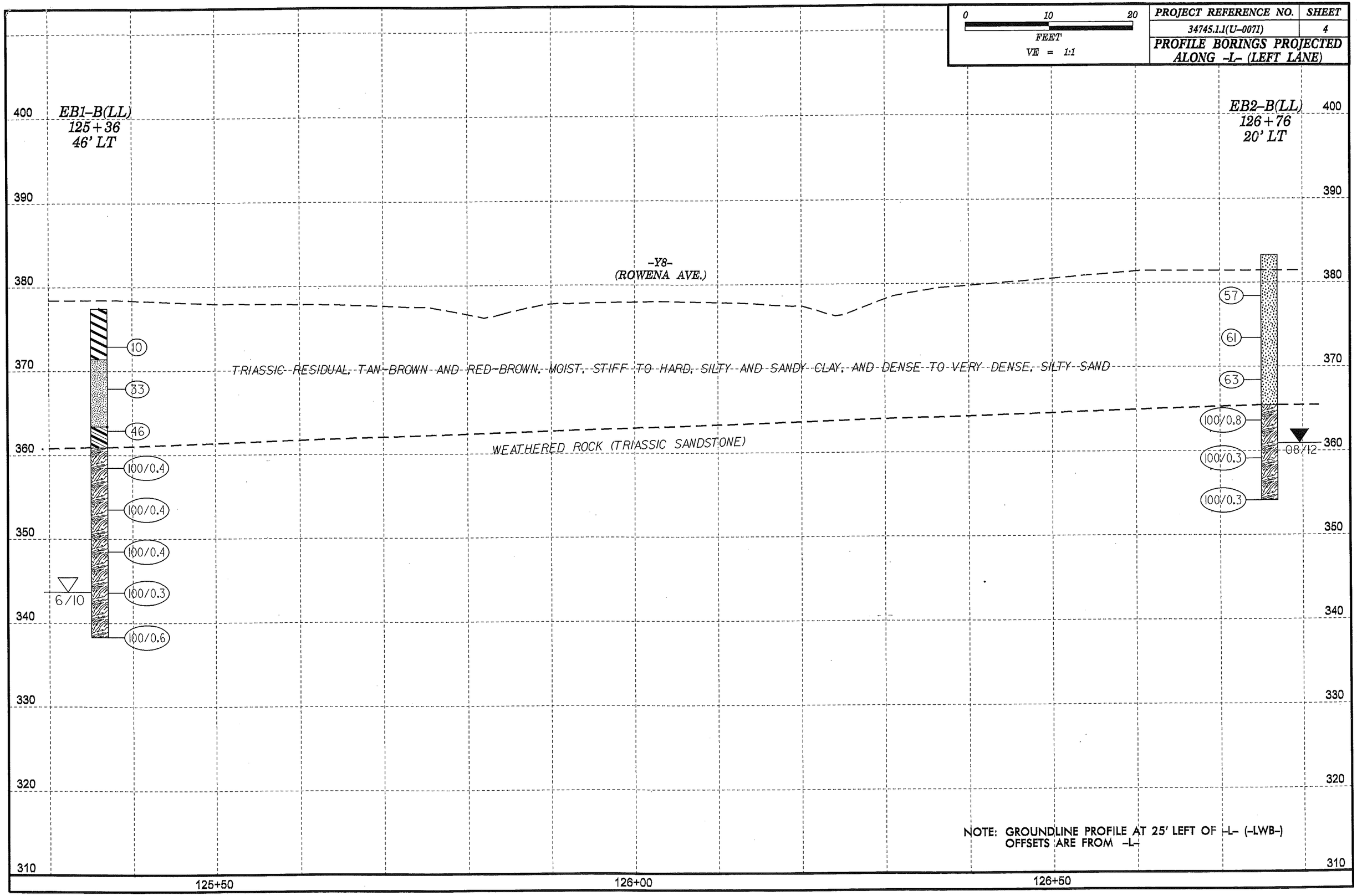
SITE PLAN

0 40 80
FEET



PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	4

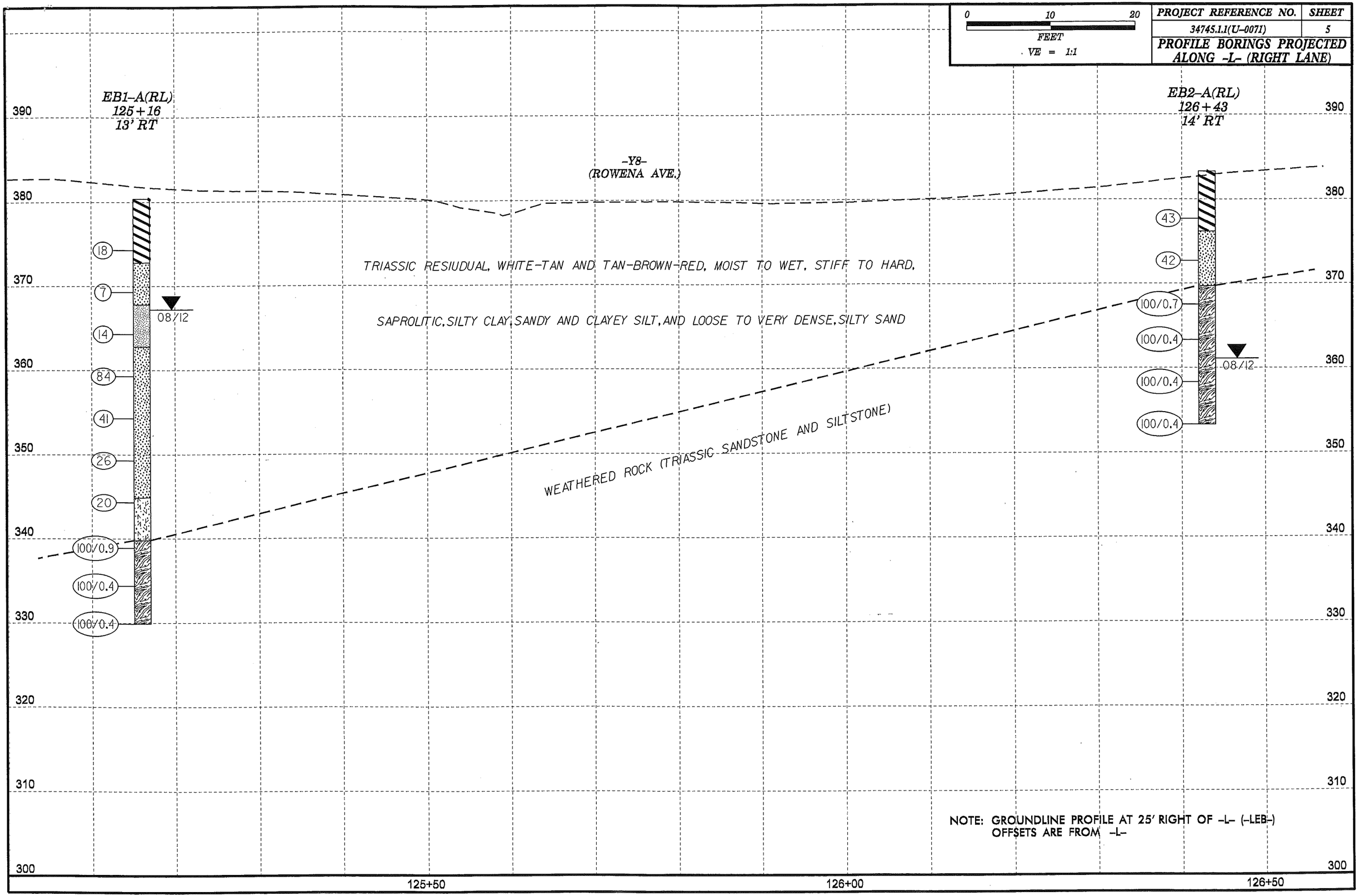
PROFILE BORINGS PROJECTED ALONG -L- (LEFT LANE)



NOTE: GROUNDLINE PROFILE AT 25' LEFT OF -L- (-LWB-)
OFFSETS ARE FROM -L-

PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	5

PROFILE BORINGS PROJECTED ALONG -L- (RIGHT LANE)

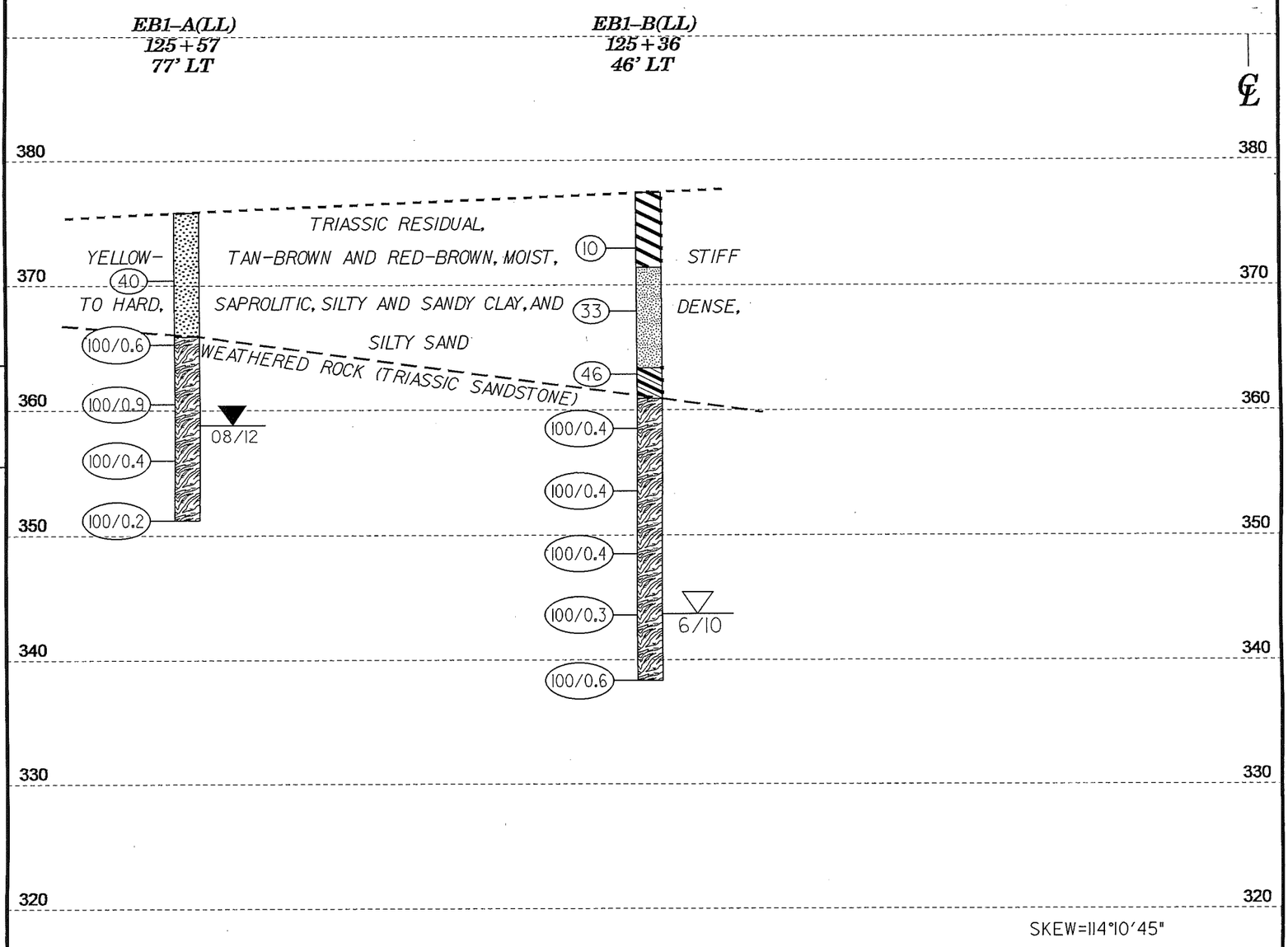


NOTE: GROUNDLINE PROFILE AT 25' RIGHT OF -L- (-LEB-)
OFFSETS ARE FROM -L-

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

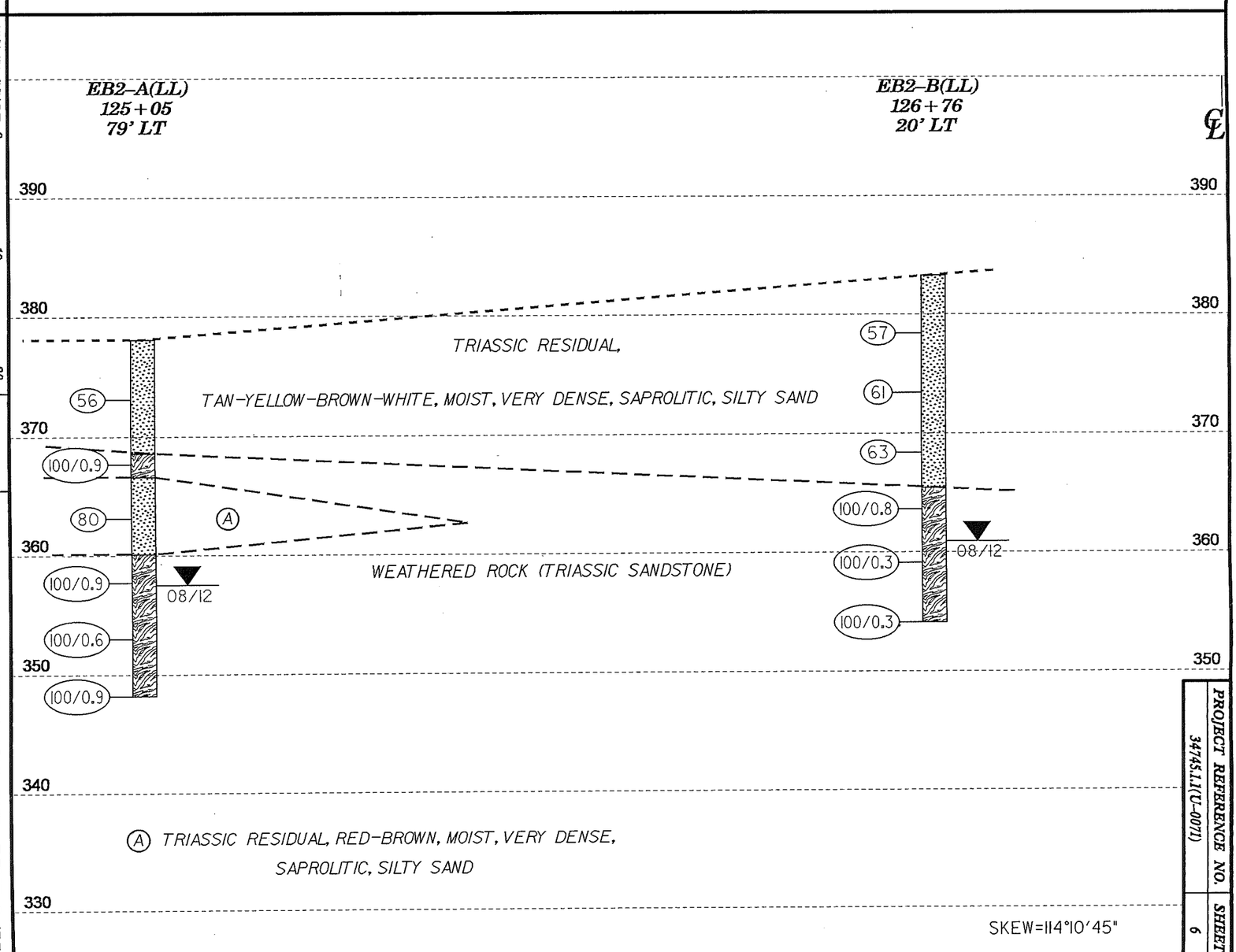
CROSS SECTION THROUGH END BENT 1 (LL)



HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

CROSS SECTION THROUGH END BENT 2 (LL)

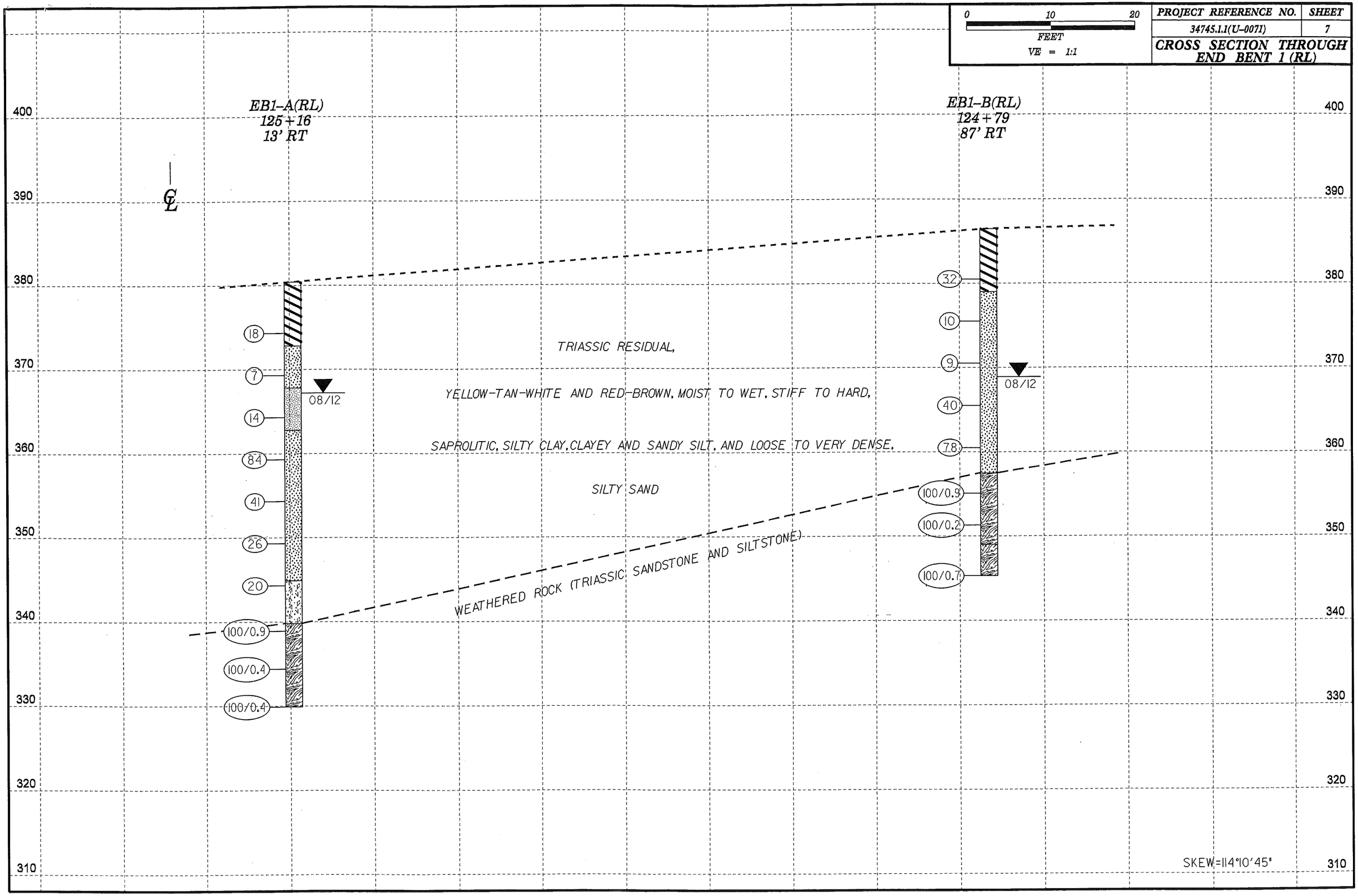


PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	6

PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	7

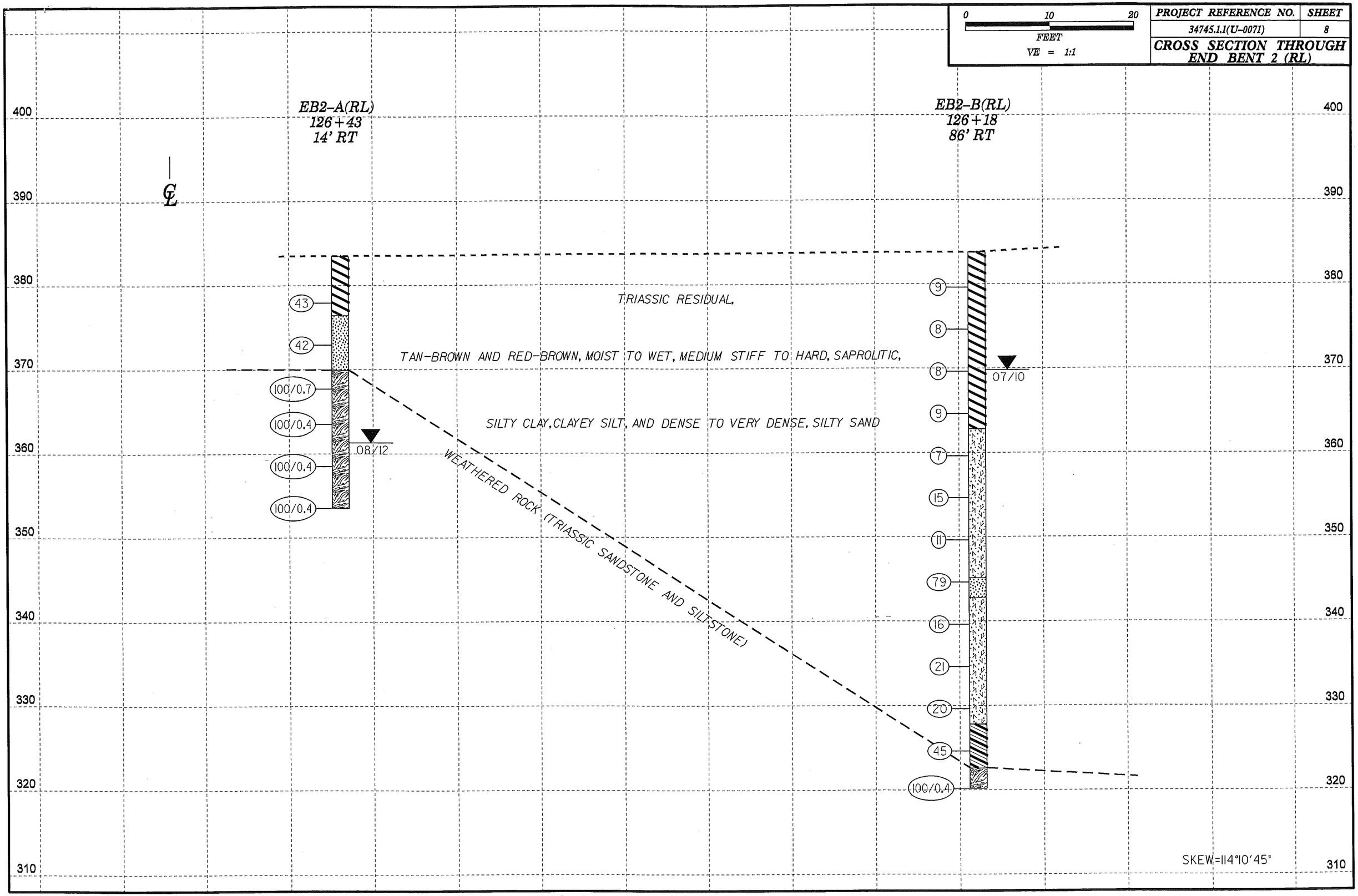
CROSS SECTION THROUGH END BENT 1 (RL)

0 10 20
FEET
VE = 1:1



PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	8

CROSS SECTION THROUGH END BENT 2 (RL)



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION DUAL BRIDGES AT -L- STATION 125+92 OVER -Y8- (ROWENA AVENUE)			GROUND WTR (ft)
BORING NO. EB1-A_LL	STATION 125+57	OFFSET 77 ft LT	ALIGNMENT -L- — 0 HR. Dry
COLLAR ELEV. 375.5 ft	TOTAL DEPTH 24.6 ft	NORTHING 808,491	EASTING 2,042,009 — 24 HR. 17.0
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 08/07/12	COMP. DATE 08/07/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
375.5										GROUND SURFACE	0.0
371.1		4.4	11	17	23	40		M		TRIASSIC RESIDUAL YELLOW-TAN-BROWN, SAPROLITIC, SILTY SAND	365.6 / 9.9
366.1		9.4	16	79	21/0.1	100/0.6				WEATHERED ROCK (TRIASSIC SANDSTONE)	
361.1		14.4	30	70/0.4		100/0.9					
356.1		19.4	100/0.4			100/0.4					
351.1		24.4	100/0.2			100/0.2				350.9 / 24.6	Boring Terminated at Elevation 350.9 ft in WEATHERED ROCK (TRIASSIC SANDSTONE)

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION DUAL BRIDGES AT -L- STATION 125+92 OVER -Y8- (ROWENA AVENUE)			GROUND WTR (ft)
BORING NO. EB1-B_LL	STATION 125+36	OFFSET 46 ft LT	ALIGNMENT -L- — 0 HR. 33.7
COLLAR ELEV. 377.1 ft	TOTAL DEPTH 39.1 ft	NORTHING 808,528	EASTING 2,042,006 — 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE RFO0067 CME-550X 77% 03/15/2010		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 06/30/10	COMP. DATE 06/30/10	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
377.1										GROUND SURFACE 0.0
373.6		3.5	3	4	6	10		M		TRIASSIC RESIDUAL ORANGE AND GRAY, SILTY CLAY 371.1 / 6.0
368.6		8.5	11	12	21	33		M		RED-BROWN, SANDY SILT 363.1 / 14.0
363.6		13.5	21	15	31	46		M		RED AND GRAY, SANDY CLAY 360.6 / 16.5
358.6		18.5	100/0.4			100/0.4				WEATHERED ROCK (TRIASSIC SANDSTONE)
353.6		23.5	100/0.4			100/0.4				
348.6		28.5	100/0.4			100/0.4				
343.6		33.5	100/0.3			100/0.3				
338.6		38.5	62	38/0.1		100/0.6				338.0 / 39.1 Boring Terminated at Elevation 338.0 ft in WEATHERED ROCK (TRIASSIC SANDSTONE)

BORING FROM ROADWAY INVESTIGATION. ELEVATION DETERMINED FROM .TIN FILE.

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION DUAL BRIDGES AT -L- STATION 125+92 OVER -Y8- (ROWENA AVENUE)			GROUND WTR (ft)
BORING NO. EB2-A_LL	STATION 127+05	OFFSET 79 ft LT	ALIGNMENT -L-
COLLAR ELEV. 378.6 ft	TOTAL DEPTH 29.9 ft	NORTHING 808,397	EASTING 2,041,895
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 08/06/12	COMP. DATE 08/06/12	SURFACE WATER DEPTH N/A

GROUND WTR (ft): 0 HR. Dry; 24 HR. 20.6

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
380										378.6 GROUND SURFACE	0.0
375	374.6	4.0	38	25	31	56		M		TRIASSIC RESIDUAL TAN-YELLOW-BROWN, SAPROLITIC, SILTY SAND	
370	369.6	9.0	34	56	44/0.4	100/0.9				369.1 WEATHERED ROCK (TRIASSIC SANDSTONE)	9.5
365	364.6	14.0	53	26	54	80		M		367.1 TRIASSIC RESIDUAL RED-BROWN, SAPROLITIC, SILTY SAND	11.5
360	359.6	19.0	14	31	69/0.4	100/0.9				360.6 WEATHERED ROCK (TRIASSIC SANDSTONE)	18.0
355	354.6	24.0	12	79	21/0.1	100/0.6					
350	349.6	29.0	10	90/0.4		100/0.9				348.7 Boring Terminated at Elevation 348.7 ft in WEATHERED ROCK (TRIASSIC SANDSTONE)	29.9

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION DUAL BRIDGES AT -L- STATION 125+92 OVER -Y8- (ROWENA AVENUE)			GROUND WTR (ft)
BORING NO. EB2-B_LL	STATION 126+76	OFFSET 20 ft LT	ALIGNMENT -L-
COLLAR ELEV. 381.7 ft	TOTAL DEPTH 29.2 ft	NORTHING 808,461	EASTING 2,041,880
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 08/06/12	COMP. DATE 08/06/12	SURFACE WATER DEPTH N/A

GROUND WTR (ft): 0 HR. Dry; 24 HR. 22.4

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
385										381.7 GROUND SURFACE	0.0
380	377.8	3.9	10	24	33	57		M		TRIASSIC RESIDUAL TAN-BROWN-RED TO TAN-BROWN-WHITE, SAPROLITIC , SILTY SAND	
375	372.8	8.9	13	28	33	61		M			
370	367.8	13.9	13	27	36	63		M		363.8 WEATHERED ROCK (TRIASSIC SANDSTONE)	17.9
365	362.8	18.9	37	63/0.3		100/0.8					
360	357.8	23.9	100/0.3			100/0.3					
355	352.8	28.9	100/0.3			100/0.3				352.5 Boring Terminated at Elevation 352.5 ft in WEATHERED ROCK (TRIASSIC SANDSTONE)	29.2

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION DUAL BRIDGES AT -L- STATION 125+92 OVER -Y8- (ROWENA AVENUE)			GROUND WTR (ft)
BORING NO. EB1-A_RL	STATION 125+16	OFFSET 13 ft RT	ALIGNMENT -L- — 0 HR. 25.4
COLLAR ELEV. 380.6 ft	TOTAL DEPTH 50.5 ft	NORTHING 808,587	EASTING 2,041,984 — 24 HR. 13.2
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 08/08/12	COMP. DATE 08/08/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
385											
380										380.6 GROUND SURFACE	0.0
										TRIASSIC RESIDUAL YELLOW-TAN-BROWN, SAPROLITIC, SILTY CLAY	
375	375.5	5.1	5	8	10	18		M		373.0	7.6
										YELLOW-TAN-WHITE, SAPROLTIC, SILTY SAND	
370	370.5	10.1	2	3	4	7		M		368.0	12.6
										GRAY-WHITE, SAPROLITIC, FINE SANDY SILT	
365	365.5	15.1	3	5	9	14		M		363.0	17.6
										WHITE-TAN, SAPROLITIC, SILTY SAND	
360	360.5	20.1	16	25	59	84		M			
355	355.5	25.1	20	21	20	41		M			
350	350.5	30.1	9	12	14	26		M			
345	345.5	35.1	4	8	12	20		M		345.1	35.5
										RED-BROWN-TAN, SAPROLITIC, CLAYEY SILT	
340	340.5	40.1	19	34	66/0.4	100/0.9				340.0	40.6
										WEATHERED ROCK (TRIASSIC SILTSTONE)	
335	335.5	45.1	28	72/0.4		100/0.9					
	330.5	50.1	100/0.4			100/0.4				330.1	50.5
										Boring Terminated at Elevation 330.1 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)	

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION DUAL BRIDGES AT -L- STATION 125+92 OVER -Y8- (ROWENA AVENUE)			GROUND WTR (ft)
BORING NO. EB1-B_RL	STATION 124+79	OFFSET 87 ft RT	ALIGNMENT -L- — 0 HR. 21.6
COLLAR ELEV. 386.1 ft	TOTAL DEPTH 41.2 ft	NORTHING 808,668	EASTING 2,041,967 — 24 HR. 17.6
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 08/08/12	COMP. DATE 08/12/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
390											
385										386.1 GROUND SURFACE	0.0
										TRIASSIC RESIDUAL YELLOW-BROWN, SAPROLITIC, SILTY CLAY	
380	381.1	5.0	5	14	18	32		M		378.6	7.5
										TAN-BROWN-WHITE TO TAN-YELLOW-BROWN, SAPROLITIC, SILTY SAND	
375	376.1	10.0	4	4	6	10		M			
370	371.1	15.0	3	3	6	9		M			
365	366.1	20.0	7	16	24	40		M			
360	361.1	25.0	18	34	44	78		M			
355	356.1	30.0	39	55	45/0.4	100/0.9				357.1	29.0
										WEATHERED ROCK (TRIASSIC SANDSTONE)	
350	351.1	35.0	100/0.2			100/0.2				348.6	37.5
										(TRIASSIC SILTSTONE)	
345	346.1	40.0	38	38	62/0.2	100/0.7				344.9	41.2
										Boring Terminated at Elevation 344.9 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION DUAL BRIDGES AT -L- STATION 125+92 OVER -Y8- (ROWENA AVENUE)			GROUND WTR (ft)
BORING NO. EB2-A-RL	STATION 126+43	OFFSET 14 ft RT	ALIGNMENT -L- — 0 HR. Dry
COLLAR ELEV. 382.7 ft	TOTAL DEPTH 30.0 ft	NORTHING 808,508	EASTING 2,041,885 — 24 HR. 22.2
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 87% 07/22/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 08/07/12	COMP. DATE 08/07/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
385										382.7 GROUND SURFACE	0.0
380	378.1	4.6	3	17	26	43		M		TRIASSIC RESIDUAL YELLOW-BROWN, SAPROLITIC, SILTY CLAY	
375	373.1	9.6	5	21	21	42		M		375.6 TAN-BROWN-RED, SAPROLITIC, SILTY SAND	7.1
370	368.1	14.6	27	68	32/0.2	100/0.7				369.1 WEATHERED ROCK (TRIASSIC SANDSTONE)	13.6
365	363.1	19.6	100/0.4			100/0.4					
360	358.1	24.6	100/0.4			100/0.4					
355	353.1	29.6	100/0.4			100/0.4				352.7 Boring Terminated at Elevation 352.7 ft in WEATHERED ROCK (TRIASSIC SANDSTONE)	30.0

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION DUAL BRIDGES AT -L- STATION 125+92 OVER -Y8- (ROWENA AVENUE)			GROUND WTR (ft)
BORING NO. EB2-B_RL	STATION 126+18	OFFSET 86 ft RT	ALIGNMENT -L- — 0 HR. 47.5
COLLAR ELEV. 380.5 ft	TOTAL DEPTH 63.6 ft	NORTHING 808,580	EASTING 2,041,859 — 24 HR. 14.0
DRILL RIG/HAMMER EFF./DATE RFO0067 CME-550X 77% 03/15/2010		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 06/30/10	COMP. DATE 06/30/10	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
385										
380										380.5 GROUND SURFACE 0.0
375	377.3	3.2	4	5	4	9		W		TRIASSIC RESIDUAL RED-BROWN TO TAN-BROWN, SILTY CLAY
370	372.3	8.2	4	4	4	8		W		
365	367.3	13.2	2	3	5	8		W		
360	362.3	18.2	2	4	5	9		W		359.5 21.0 TAN-BROWN, CLAYEY SILT
355	357.3	23.2	2	3	4	7		W		
350	352.3	28.2	4	7	8	15		W		
345	347.3	33.2	4	6	5	11		W		
340	342.3	38.2	10	45	34	79		W		341.8 38.7 BROWN AND WHITE, SILTY SAND 339.5 41.0 TAN-BROWN, CLAYEY SILT
335	337.3	43.2	4	7	9	16		W		
330	332.3	48.2	5	9	12	21		W		
325	327.3	53.2	5	9	11	20		W		324.5 56.0 GRAY, SANDY CLAY
320	322.3	58.2	12	19	26	45		W		319.3 61.2 WEATHERED ROCK (TRIASSIC SANDSTONE)
	317.3	63.2	100/0.4			100/0.4				316.9 63.6 Boring Terminated at Elevation 316.9 ft in WEATHERED ROCK (TRIASSIC SANDSTONE)

BORING FROM ROADWAY INVESTIGATION. ELEVATION DETERMINED FROM .TIN FILE.

SITE PHOTOGRAPH

Dual Bridges on -L- over -Y8- (Rowena Ave.)

View is to the South

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1 (U-0071)	1	3

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1 (U-0071) F.A. PROJ. NHF-76-1(2)

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION NOISE WALL FROM LEFT OF -US70FLY- STATION 16+50 TO RIGHT OF -L- STATION 132+50

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	WALL ENVELOPE

CAUTION NOTICE

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DATE MARCH 2013

NORTH CAROLINA LICENSED SEAL 2124 GEOLOGIST NATHAN DANIEL MOHS 3/19/13

DRAWN BY: N.D. MOHS

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PROJECT: 34745.1.1

ID: U-0071

PROJECT REFERENCE NO.	SHEET NO.
34745.1.1(U-0071)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING # 10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
# 40	30 MX	50 MX	51 MN											
# 200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

GRAIN SIZE MM: 305 | 76 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY), MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/126 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

ABBREVIATIONS

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

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

EQUIPMENT USED ON SUBJECT PROJECT

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

ADVANCING TOOLS:
- ☐ CLAY BITS
- ☐ 6" CONTINUOUS FLIGHT AUGER
- ■ 8" HOLLOW AUGERS
- ■ HARD FACED FINGER BITS
- ☐ TUNG.-CARBIDE INSERTS
- ☐ CASING ☐ W/ ADVANCER
- ☐ TRICONE ____" STEEL TEETH
- ☐ TRICONE ____" 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 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK: _____

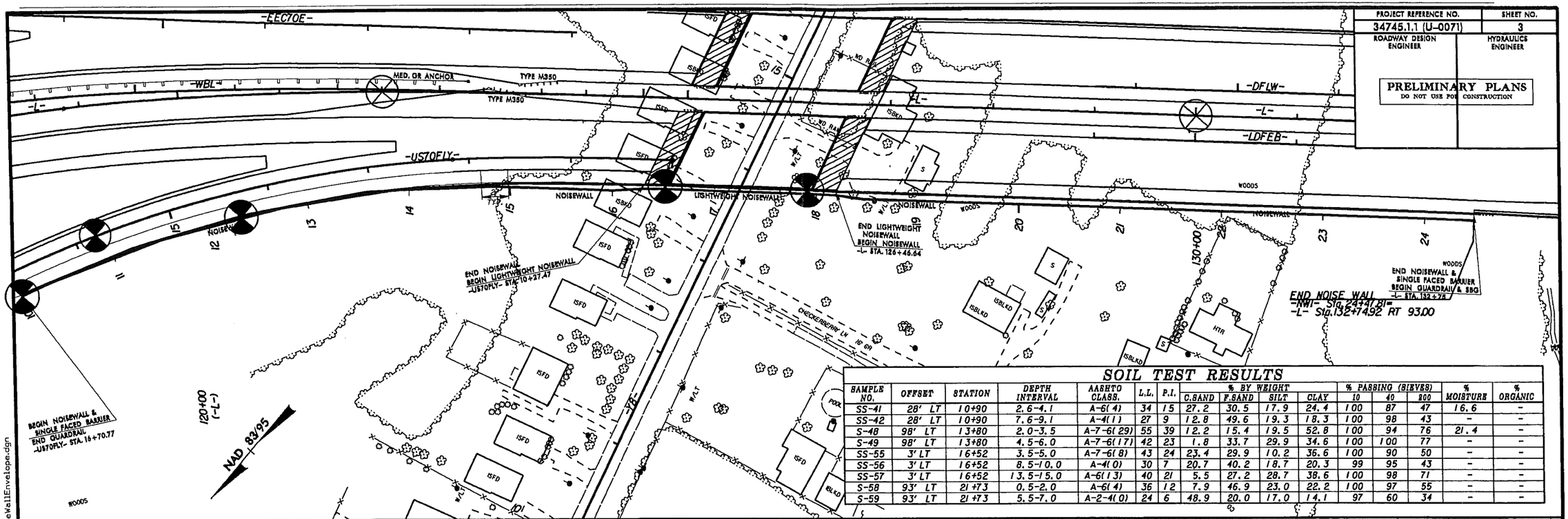
ELEVATION: _____ FT.

NOTES:

REVISED 09/23/09

PROJECT REFERENCE NO.	SHEET NO.
34745.1.1 (U-0071)	3
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

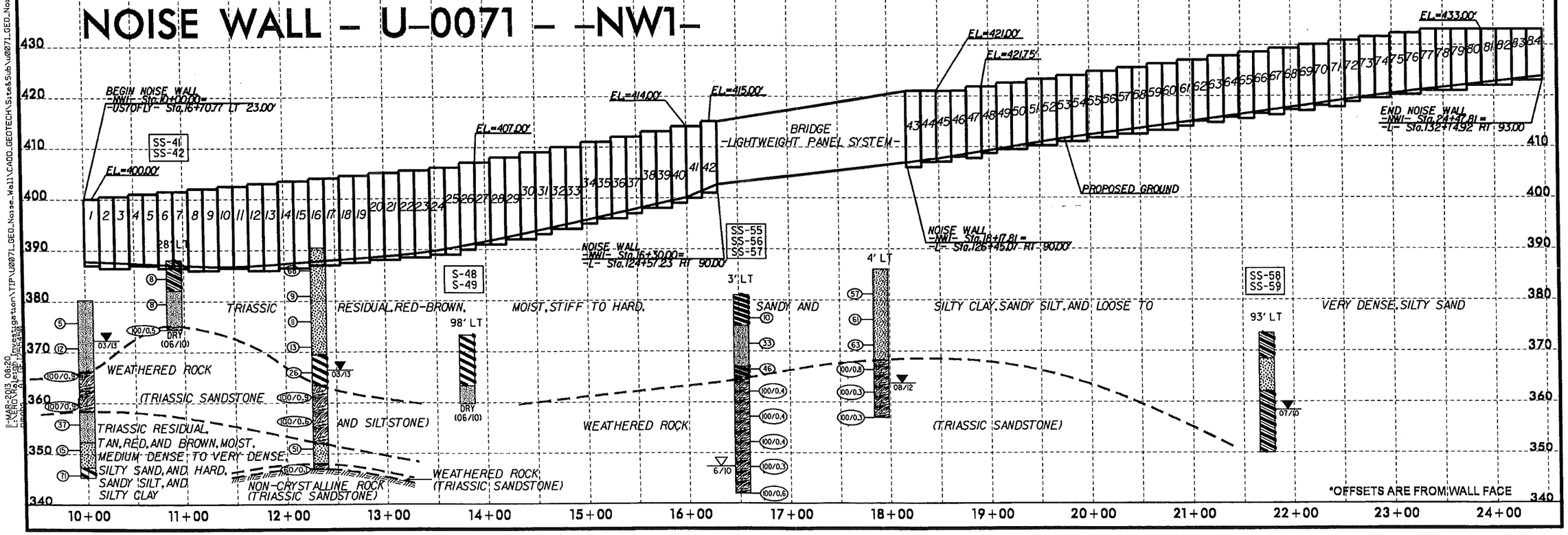
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



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-41	28' LT	10+90	2.6-4.1	A-6(4)	34	15	27.2	30.5	17.9	24.4	100	87	47	16.6	-
SS-42	28' LT	10+90	7.6-9.1	A-4(1)	27	9	12.8	49.6	19.3	18.3	100	98	43	-	-
S-48	98' LT	13+80	2.0-3.5	A-7-6(29)	55	39	12.2	15.4	19.5	52.8	100	94	76	21.4	-
S-49	98' LT	13+80	4.5-6.0	A-7-6(17)	42	23	1.8	33.7	29.9	34.6	100	100	77	-	-
SS-55	3' LT	16+52	3.5-5.0	A-7-6(8)	43	24	23.4	29.9	10.2	36.6	100	90	50	-	-
SS-56	3' LT	16+52	8.5-10.0	A-4(0)	30	7	20.7	40.2	18.7	20.3	99	95	43	-	-
SS-57	3' LT	16+52	13.5-15.0	A-6(13)	40	21	5.5	27.2	28.7	38.6	100	98	71	-	-
S-58	93' LT	21+73	0.5-2.0	A-6(4)	36	12	7.9	46.9	23.0	22.2	100	97	55	-	-
S-59	93' LT	21+73	5.5-7.0	A-2-4(0)	24	6	48.9	20.0	17.0	14.1	97	60	34	-	-

NOISE WALL – U-0071 – -NW1-



STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1 (U-0071)	1	8

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1 (U-0071) F.A. PROJ. NHF-76-1(2)

COUNTY DURHAM

PROJECT DESCRIPTION EAST END CONNECTOR BETWEEN US 70 AND NC 147 (DURHAM FREEWAY)

SITE DESCRIPTION CULVERT AT -L- STATION 133+41.46
CULVERT AT -Y3- STATION 34+45

CULVERT INVENTORY

PROJECT: 34745.1.1 ID: U-0071

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	-L- SITE PLAN
4	-L- PROFILE
5	-L- BORE LOG
6	-Y3- SITE PLAN
7	-Y3- PROFILE
8	-Y3- BORE LOGS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

PERSONNEL
J.I. MILKOVITS, JR.
O.B. OTI
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D.W. DIXON

INVESTIGATED BY N.D. MOHS
CHECKED BY N.T. ROBERSON
SUBMITTED BY N.T. ROBERSON
DATE AUGUST 2012

NORTH CAROLINA LICENSED GEOLOGIST 2124 NATHAN DANIEL MOHS SEAL
8/28/12

DRAWN BY: W.D. FIELDS, N.D. MOHS

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

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PROJECT REFERENCE NO.	SHEET NO.
34745.1.1 (U-0071)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING # 10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
# 40	30 MX	50 MX	51 MN											
# 200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				18 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 RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

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

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

GRAIN SIZE MM: 305 | 76 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS
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
- 25/026 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

ABBREVIATIONS

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

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

EQUIPMENT USED ON SUBJECT PROJECT

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

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

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

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

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

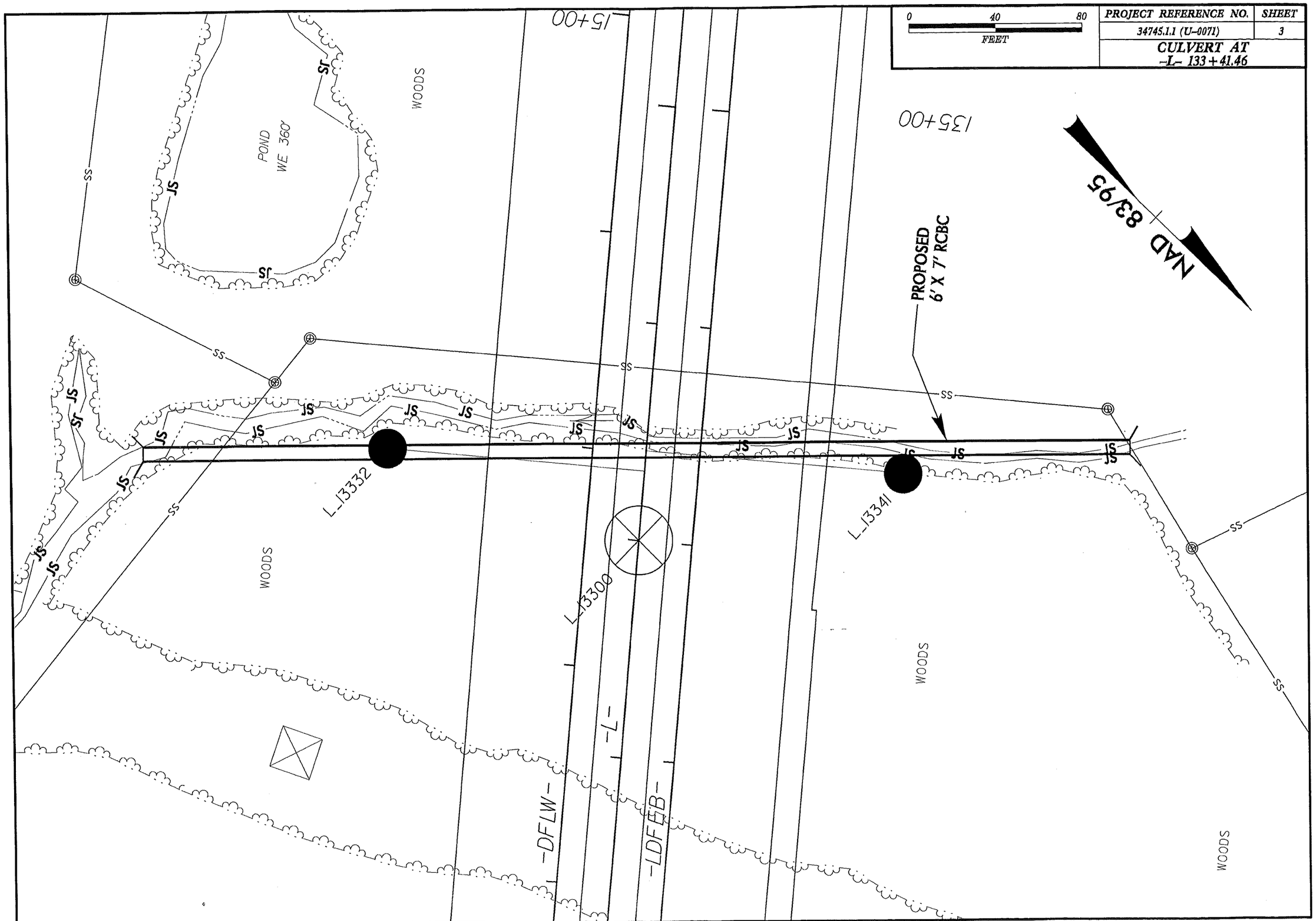
STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK:

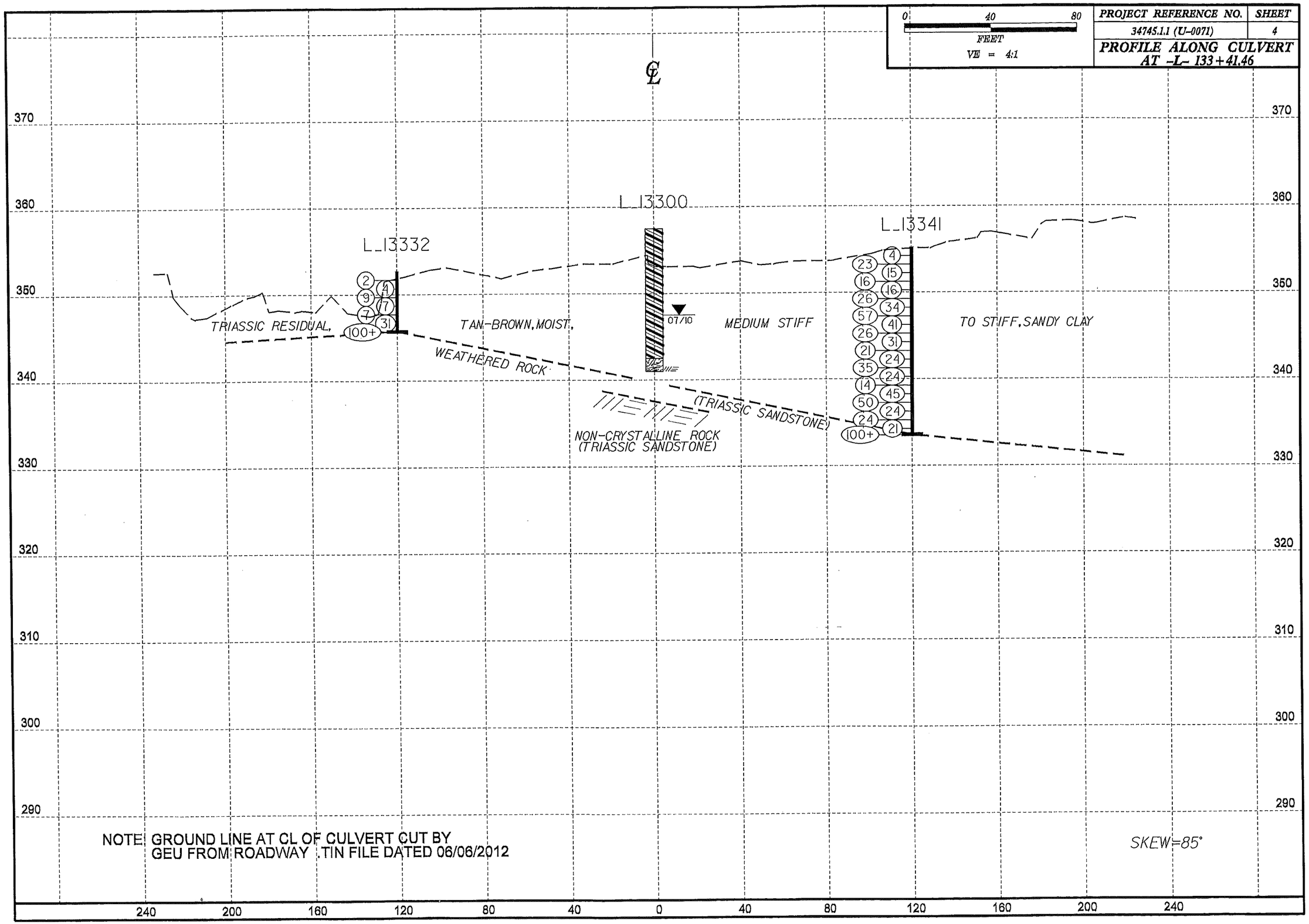
ELEVATION: FT.

NOTES:


0
40
80
FEET
PROJECT REFERENCE NO.
SHEET
34745.1.1 (U-0071)
3
CULVERT AT
-L- 133+41.46
NAD 83/95
135+00
15+00
PROPOSED
6' X 7' RCBC
POND
WE 360'
WOODS
WOODS
WOODS
WOODS
L_13332
L_13341
L_13300
-DFLW-
-L-
-LDFEB-
SS
JS

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	4

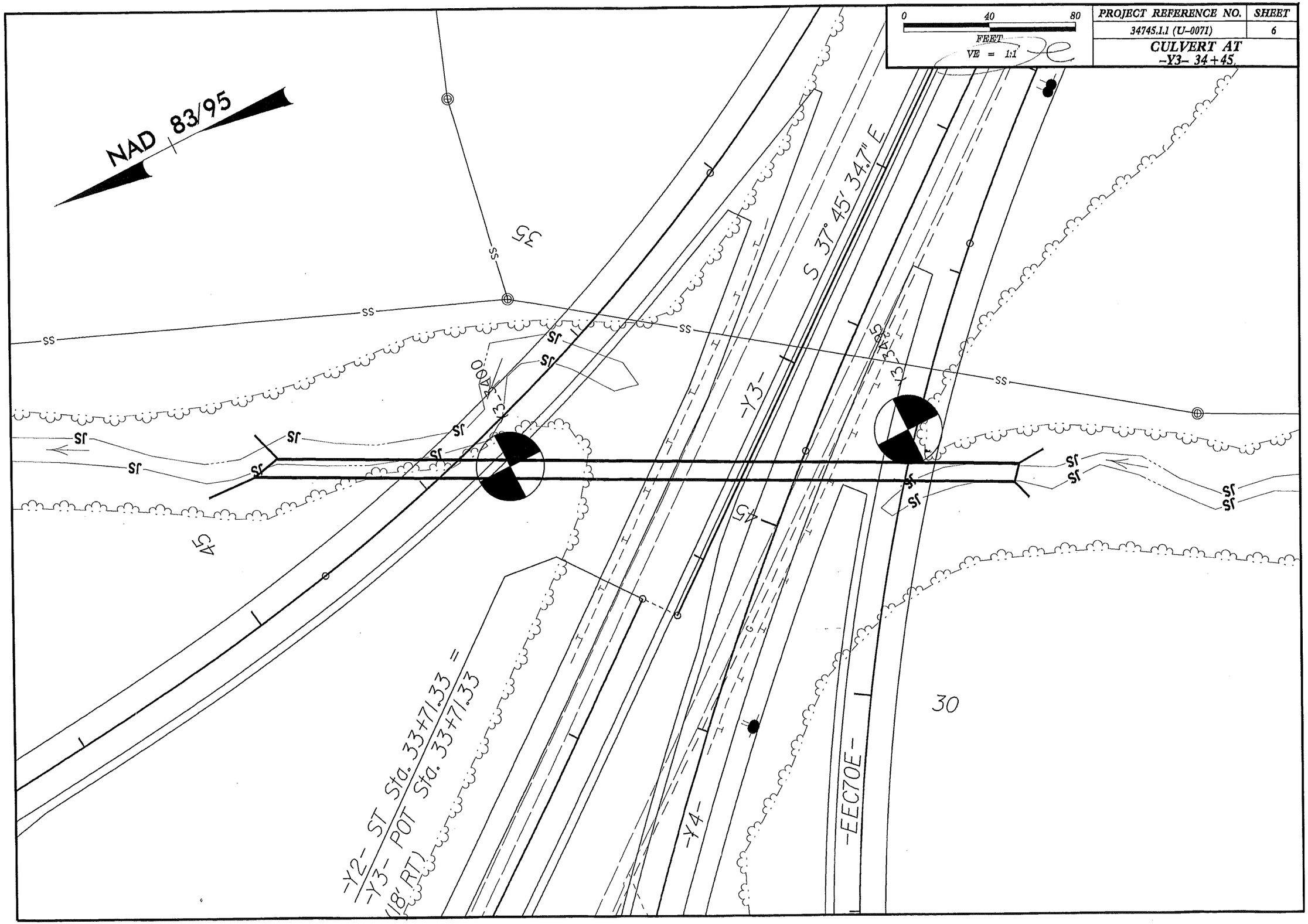
PROFILE ALONG CULVERT AT -L- 133+41.46



NOTE: GROUND LINE AT CL OF CULVERT CUT BY GEU FROM ROADWAY .TIN FILE DATED 06/06/2012

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION CULVERT AT -L- STATION 133+41.46			GROUND WTR (ft)
BORING NO. L_13300	STATION 133+00	OFFSET CL	ALIGNMENT -L- — 0 HR. Dry
COLLAR ELEV. 357.5 ft	TOTAL DEPTH 16.5 ft	NORTHING 808,086	EASTING 2,041,381 — 24 HR. 10.0
DRILL RIG/HAMMER EFF./DATE RFO0067 CME-550X 77% 03/15/2010		DRILL METHOD Solid Augers	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 07/14/10	COMP. DATE 07/14/10	SURFACE WATER DEPTH N/A

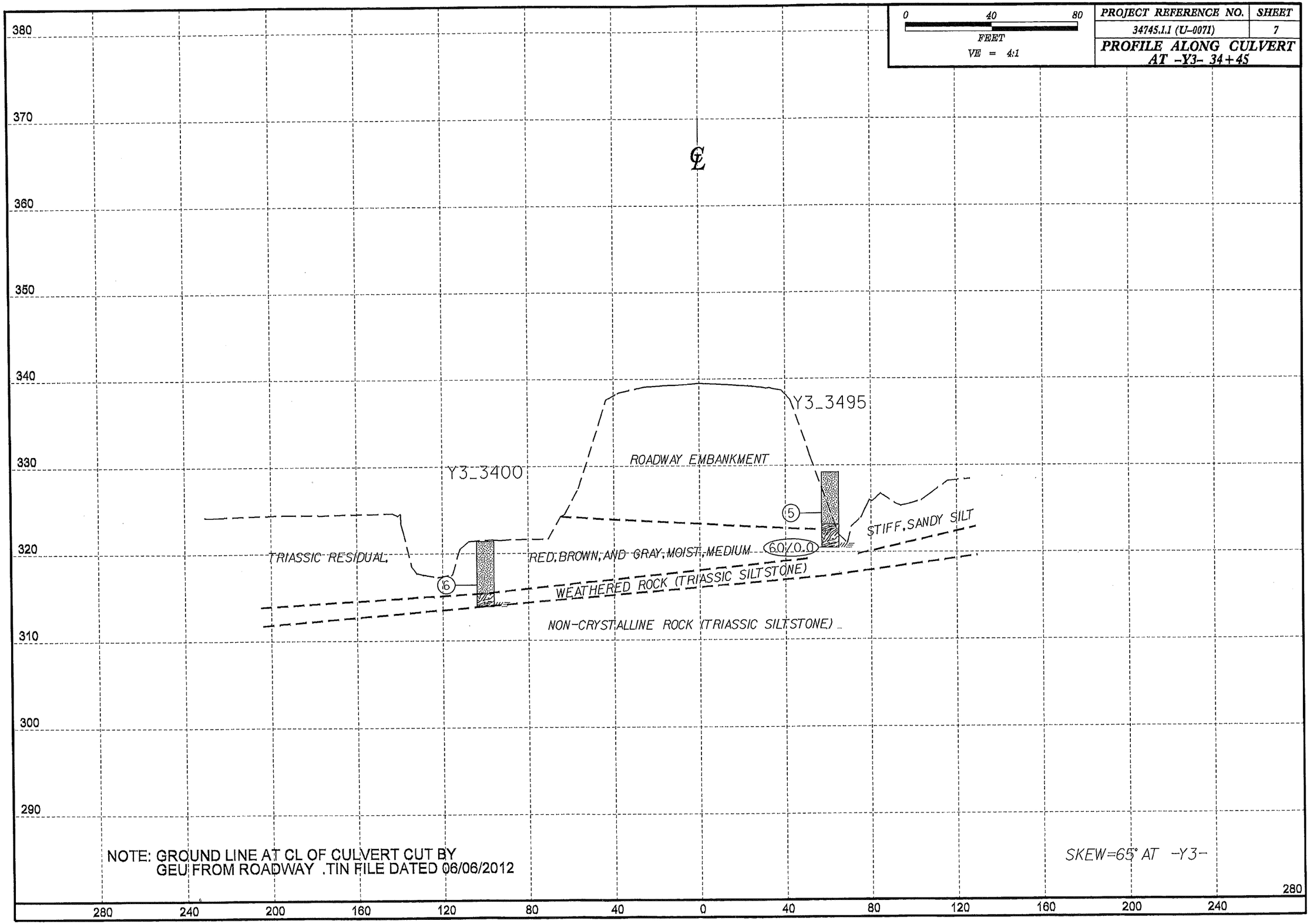
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
360										
										357.5 GROUND SURFACE 0.0
355										RESIDUAL TAN - BROWN, SANDY CLAY
350										
345										342.5 15.0
										341.0 WEATHERED ROCK (SANDSTONE) 16.5
										Boring Terminated BY AUGER REFUSAL at Elevation 341.0 ft ON NON CRYSTALLINE ROCK (SANDSTONE)


0 40 80
FEET
VE = 1:1
PROJECT REFERENCE NO.
34745.1.1 (U-0071)
SHEET
6
CULVERT AT
-Y3- 34+45
NAD 83/95
S 37° 45' 34.7" E
-Y3-
-Y4-
-EEC70E-
-Y2- ST Sta. 33+71.33 =
-Y3- POT Sta. 33+71.33
(18' RT)
35
45
30
SS
JS

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	7

PROFILE ALONG CULVERT AT -Y3- 34+45

0 40 80
FEET
VE = 4:1



NOTE: GROUND LINE AT CL OF CULVERT CUT BY GEU FROM ROADWAY .TIN FILE DATED 06/06/2012

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION CULVERT AT -Y3- STATION 34+45			GROUND WTR (ft)
BORING NO. Y3_3400	STATION 34+00	OFFSET 100 ft LT	ALIGNMENT -Y3-
COLLAR ELEV. 321.4 ft	TOTAL DEPTH 7.5 ft	NORTHING 809,206	EASTING 2,043,973
DRILL RIG/HAMMER EFF./DATE RFO0046 CME-550 63% 12/12/2005		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Dixon, D. W.	START DATE 06/23/10	COMP. DATE 06/23/10	SURFACE WATER DEPTH N/A

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

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
325											
										321.4 GROUND SURFACE	0.0
320										RESIDUAL TAN-BROWN, SANDY SILT	
	317.4	4.0	3	3	3	6		D			
315										315.4	6.0
										313.9 WEATHERED ROCK (TRIASSIC SILTSTONE)	7.5
										Boring Terminated BY AUGER REFUSAL at Elevation 313.9 ft ON NON CRYSTALLINE ROCK	

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION CULVERT AT -Y3- STATION 34+45			GROUND WTR (ft)
BORING NO. Y3_3495	STATION 34+95	OFFSET 61 ft RT	ALIGNMENT -Y3-
COLLAR ELEV. 329.2 ft	TOTAL DEPTH 8.7 ft	NORTHING 809,032	EASTING 2,043,903
DRILL RIG/HAMMER EFF./DATE RFO0046 CME-550 63% 12/12/2005		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Dixon, D. W.	START DATE 06/11/10	COMP. DATE 06/11/10	SURFACE WATER DEPTH N/A

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

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
330										
										329.2 GROUND SURFACE 0.0
										RESIDUAL BROWN - GRAY, SANDY SILT
325	325.5	3.7	2	2	3	5		M		
										323.2 6.0
										WEATHERED ROCK TRIASSIC SILTSTONE
	320.5	8.7	60/0.0			60/0.0				320.5 8.7
										Boring Terminated BY AUGER REFUSAL at Elevation 320.5 ft ON NON CRYSTALLINE ROCK (TRIASSIC SILTSTONE)

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1 (U-0071)	1	9

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1 (U-0071) F.A. PROJ. NHF-76-1-(2)

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION WALL 1A LEFT OF -L- STATION 14+30
WALL 1B LEFT OF -L- STATION 25+30
WALL 2 LEFT OF -L- STATION 38+40
WALL 4 RIGHT OF -L- STATION 36+40
WALL 5 LEFT OF -L- STATION 45+20
WALL 7 RIGHT OF -L- STATION 44+40
WALL 8 LEFT OF -Y1- STATION 21+40
WALL 9 RIGHT OF -Y1- STATION 24+00
WALL 10 RIGHT OF -Y7RPC- STATION 14+80
WALL 17 RIGHT OF -LDFEB- STATION 160+00

RETAINING WALL INVENTORY

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3-5	SITE PLANS
6-8	WALL ENVELOPES
9	SOIL TEST RESULTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

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

PERSONNEL
N.D. MOHS
J.I. MILKOVITS, JR.
O.B. OTI
H.R. CONLEY
J.R. TURNAGE
J.R. MATULA
D.W. DIXON

INVESTIGATED BY N.D. MOHS
CHECKED BY N.T. ROBERSON
SUBMITTED BY N.T. ROBERSON
DATE JANUARY 2014

NORTH CAROLINA LICENSED SEAL 2124 GEOLOGIST NATHAN DANIEL MOHS
1/8/14

DRAWN BY: N.D. MOHS

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

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PROJECT: 34745.1.1
TIP: U-0071

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING # 10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
# 40	30 MX	50 MX	51 MN											
# 200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT / 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 (TONS/FT²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

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

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

HAMMER TYPE: [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B____
- [X] -N WD4
- [ ] -H____

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

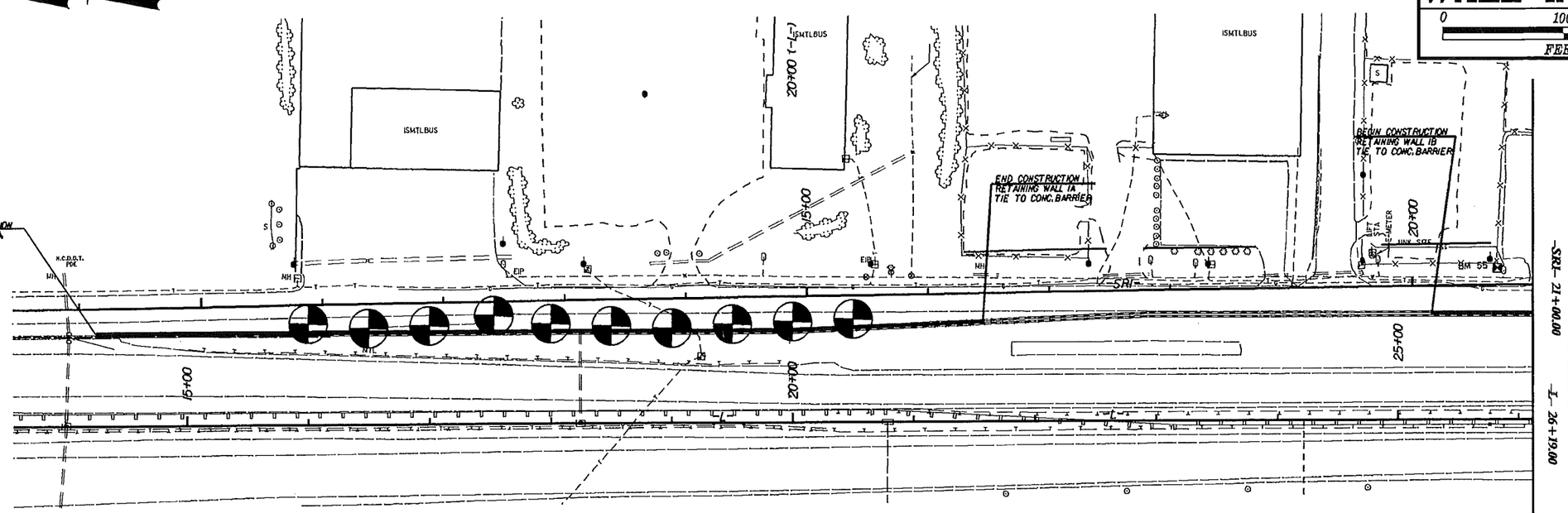
BENCH MARK: BL-107; N: 943300.46, E: 2173684.85 ELEV.=428.12'
BY243; N: 942937.84, E: 2173631.57 ELEV=450.71'
ELEVATION: FT.

NOTES:

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	3

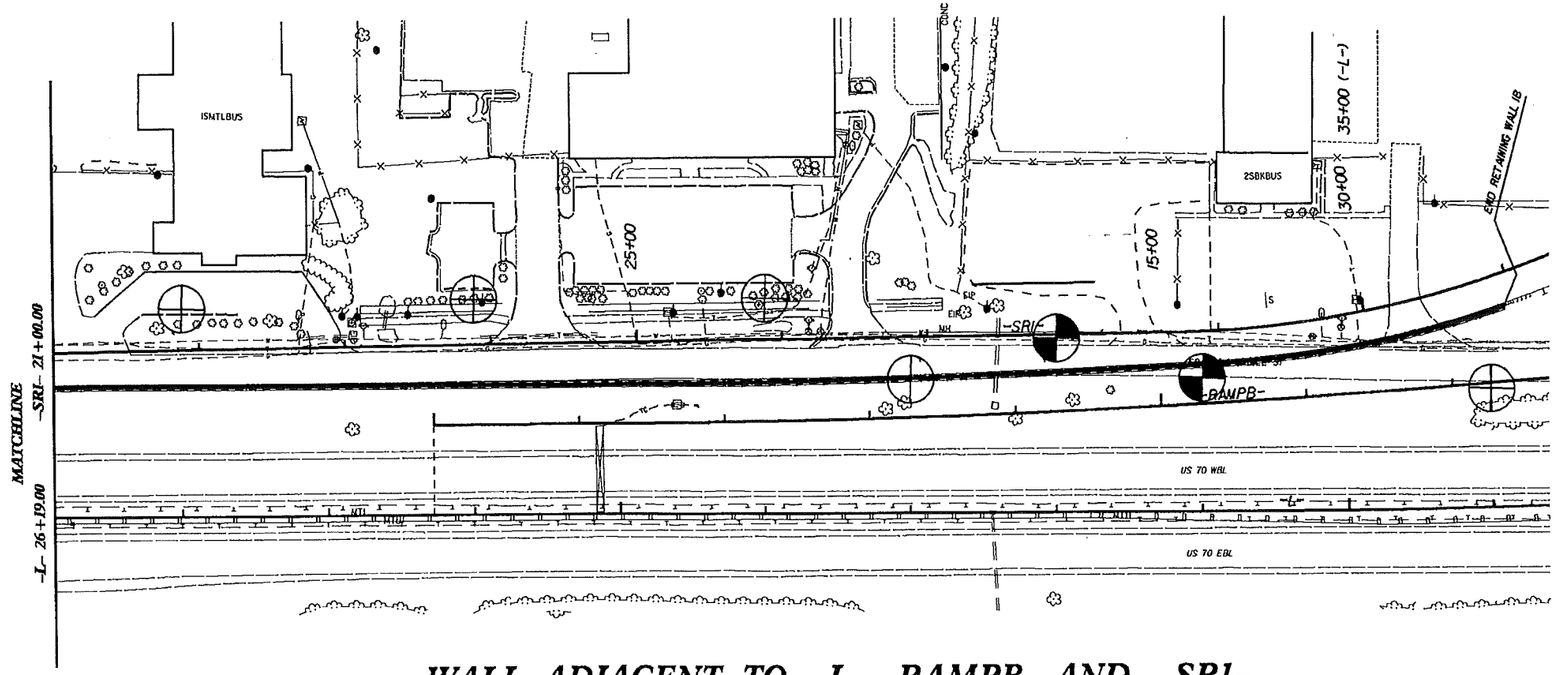
WALL 1A & 1B

0 100 200
FEET



WALL ADJACENT TO -L- AND -SR1-

WALL 1B



WALL ADJACENT TO -L-, -RAMPB-, AND -SR1-

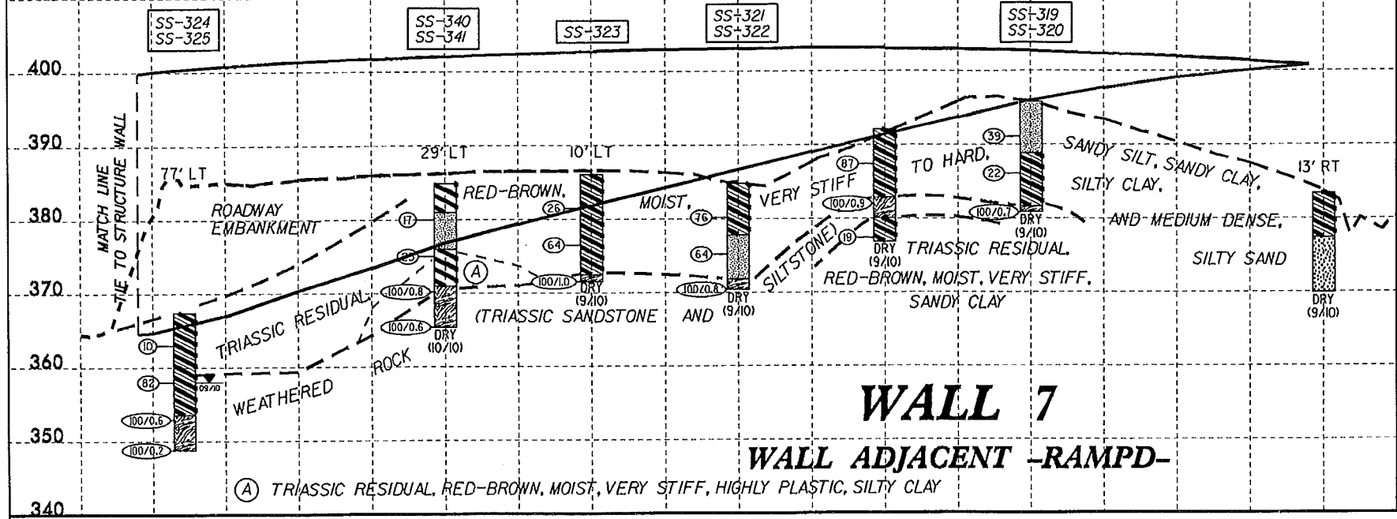
PROJECT REFERENCE NO.	SHEET NO.
34745.11 (U-0071)	8
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

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-324	77' LT	44+72	3.4-4.9	A-6(4)	29	11	9.9	36.5	23.2	30.4	100	96	61	-	-
SS-325	77' LT	44+72	8.4-9.9	A-6(6)	36	20	22.3	34.0	15.3	28.4	100	94	48	-	-
SS-340	29' LT	46+50	3.9-5.4	A-4(0)	31	6	26.9	42.1	18.7	12.3	100	93	37	-	-
SS-341	29' LT	46+50	8.9-10.4	A-7-5(49)	81	47	4.5	9.7	32.4	53.4	100	97	89	-	-
SS-323	10' LT	47+50	8.6-10.1	A-6(11)	36	14	6.5	19.6	47.7	26.3	100	99	80	-	-
SS-321	CL	48+50	3.6-5.1	A-6(6)	30	12	5.5	32.5	35.8	26.3	98	96	69	-	-
SS-322	CL	48+50	8.6-10.1	A-4(0)	33	8	9.2	58.4	19.3	13.1	100	99	38	-	-
SS-319	CL	50+50	3.7-5.2	A-4(7)	33	9	0.8	29.3	47.7	22.2	100	100	82	-	-
SS-320	CL	50+50	8.7-10.2	A-6(13)	38	16	3.0	16.2	48.5	32.3	98	98	83	-	-



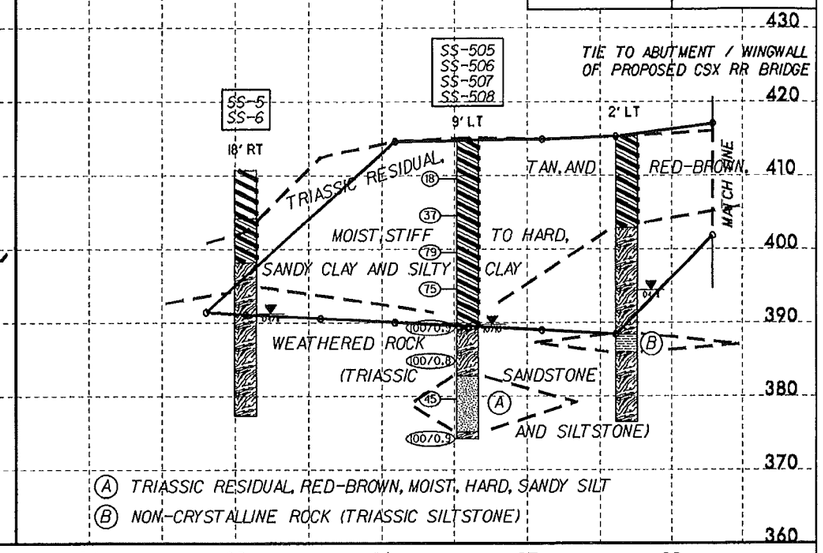
WALL 7

WALL ADJACENT -RAMPD-

(A) TRIASSIC RESIDUAL, RED-BROWN, MOIST, VERY STIFF, HIGHLY PLASTIC, SILTY CLAY

WALL 10

WALL ADJACENT -Y7RPC-



(A) TRIASSIC RESIDUAL, RED-BROWN, MOIST, HARD, SANDY SILT

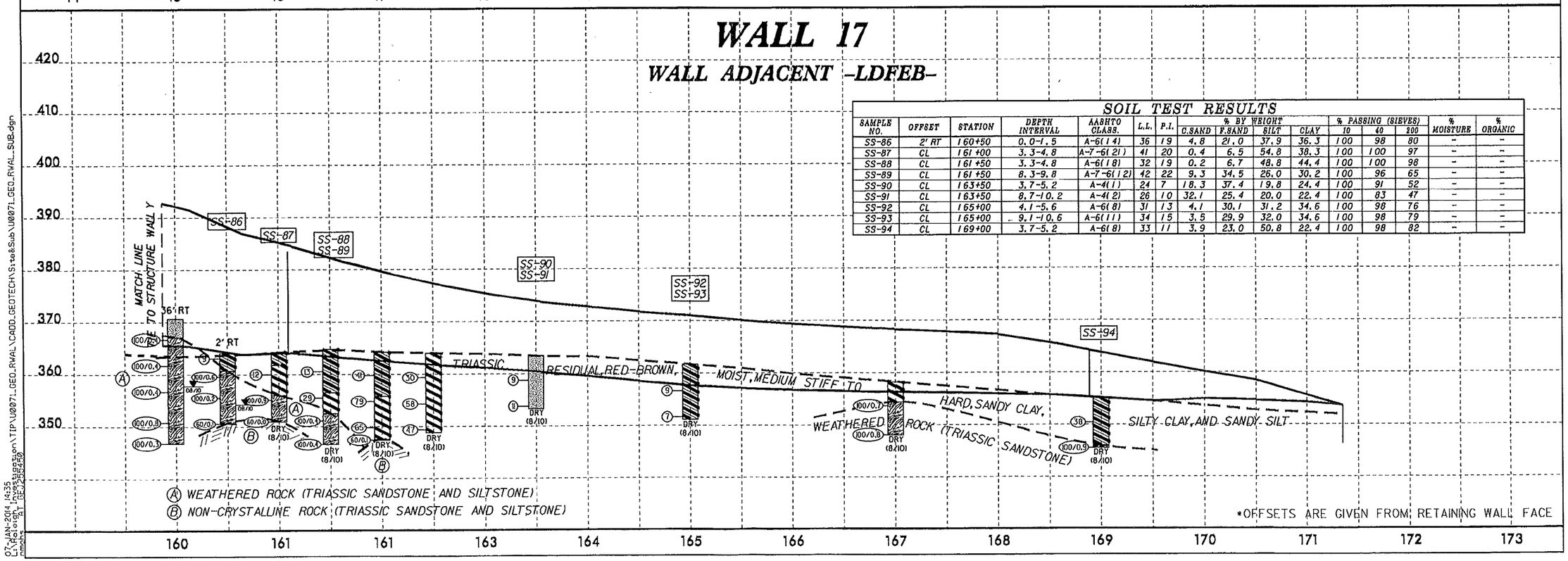
(B) NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)

WALL 17

WALL ADJACENT -LDFEB-

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-86	2' RT	160+50	0.0-1.5	A-6(14)	36	19	4.8	21.0	37.9	36.3	100	98	80	-	-
SS-87	CL	161+00	3.3-4.8	A-7-6(21)	41	20	0.4	6.5	54.8	38.3	100	100	97	-	-
SS-88	CL	161+50	3.3-4.8	A-6(18)	32	19	0.2	6.7	48.8	44.4	100	100	98	-	-
SS-89	CL	161+50	8.3-9.8	A-7-6(12)	42	22	9.3	34.5	26.0	30.2	100	96	65	-	-
SS-90	CL	163+50	3.7-5.2	A-4(1)	24	7	18.3	37.4	19.8	24.4	100	91	52	-	-
SS-91	CL	163+50	8.7-10.2	A-4(2)	26	10	32.1	25.4	20.0	22.4	100	83	47	-	-
SS-92	CL	165+00	4.1-5.6	A-6(8)	31	13	4.1	30.1	31.2	34.6	100	98	76	-	-
SS-93	CL	165+00	9.1-10.6	A-6(11)	34	15	3.5	29.9	32.0	34.6	100	98	79	-	-
SS-94	CL	169+00	3.7-5.2	A-6(8)	33	11	3.9	23.0	50.8	22.4	100	98	82	-	-



(A) WEATHERED ROCK (TRIASSIC SANDSTONE AND SILTSTONE)

(B) NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE AND SILTSTONE)

*OFFSETS ARE GIVEN FROM RETAINING WALL FACE

5/28/99

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WALL 2

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-500	29' RT	39+00	4.0-5.5	A-6(4)	28	11	21.4	24.1	19.4	35.1	99	86	60	-	-
SS-501	29' RT	39+00	9.0-10.5	A-4(0)	27	5	6.6	54.2	20.6	18.6	100	99	47	-	-
SS-502	29' RT	39+00	14.0-15.5	A-4(0)	31	7	39.2	27.4	14.8	18.6	100	79	37	-	-
SS-126	CL	40+80	3.9-5.4	A-6(9)	36	13	3.7	31.4	40.4	24.5	100	99	75	-	-
SS-127	CL	40+80	8.9-10.4	A-6(8)	32	11	1.8	30.8	49.0	18.4	100	99	79	-	-
SS-303	CL	41+50	3.5-5.0	A-6(6)	32	13	10.1	31.2	32.4	26.3	100	96	65	-	-
SS-304	CL	41+50	8.5-10.0	A-6(8)	30	13	4.3	29.1	42.3	24.3	100	99	74	-	-
SS-305	CL	42+50	3.6-5.1	A-2-4(0)	33	9	53.5	17.7	12.6	16.2	98	60	31	-	-
SS-306	CL	42+50	9.0-10.0	A-4(3)	26	6	1.8	34.6	47.4	16.2	100	99	78	-	-
SS-307	CL	32+85	3.5-5.0	A-6(11)	37	19	15.6	19.8	26.1	38.5	100	91	69	-	-

WALL 5

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-329	CL	46+00	3.3-4.8	A-6(8)	32	13	3.4	29.0	37.2	30.4	98	97	74	-	-
SS-330	CL	48+00	3.5-5.0	A-6(13)	36	15	3.5	17.7	48.0	30.8	100	98	89	-	-
SS-315	CL	50+58	3.4-4.9	A-4(0)	26	8	41.7	23.3	13.7	21.2	100	82	38	-	-
SS-316	1' RT	50+58	8.4-9.9	A-6(17)	40	18	2.2	11.9	55.6	30.3	100	99	91	-	-

WALL 9

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		
S-515	2' LT	24+00	1.0-2.0	A-6(6)	33	11	8.2	33.4	21.2	37.1	100	95	68	-	-
S-516	2' LT	26+00	1.0-2.0	A-2-4(0)	25	6	52.6	19.6	12.7	15.1	100	67	31	-	-

WALL 10

SOIL TEST RESULTS

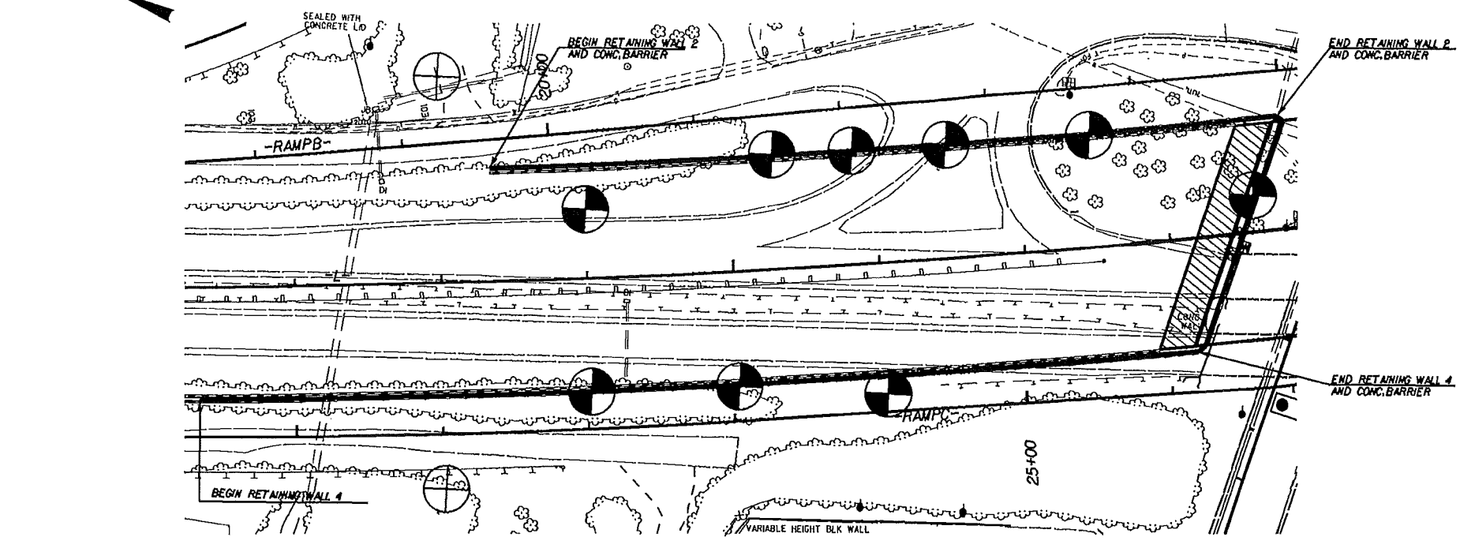
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-5	18' RT	15+07	3.2-4.7	A-7-6(16)	49	29	19.9	19.9	11.6	48.7	100	91	64	-	-
SS-6	18' RT	15+07	8.2-9.7	A-6(8)	35	11	0.8	25.6	45.2	28.4	100	100	76	-	-
SS-505	21' RT	16+59	4.1-5.6	A-6(6)	32	11	4.3	34.0	28.7	33.0	100	100	69	-	-
SS-506	21' RT	16+59	9.1-10.6	A-6(14)	36	16	0.8	19.2	40.8	39.2	100	100	87	-	-
SS-507	21' RT	16+59	19.1-20.6	A-6(15)	36	16	0.4	13.2	49.3	37.1	100	100	94	-	-
SS-508	21' RT	16+59	34.1-35.6	A-4(6)	30	10	8.5	25.6	39.2	26.8	100	97	73	-	-

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	4

WALLS 2, 4, 5, 7–9

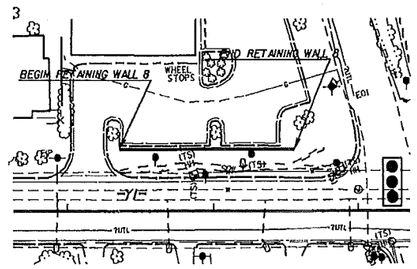
0 100 200
FEET

WALLS 2 & 4



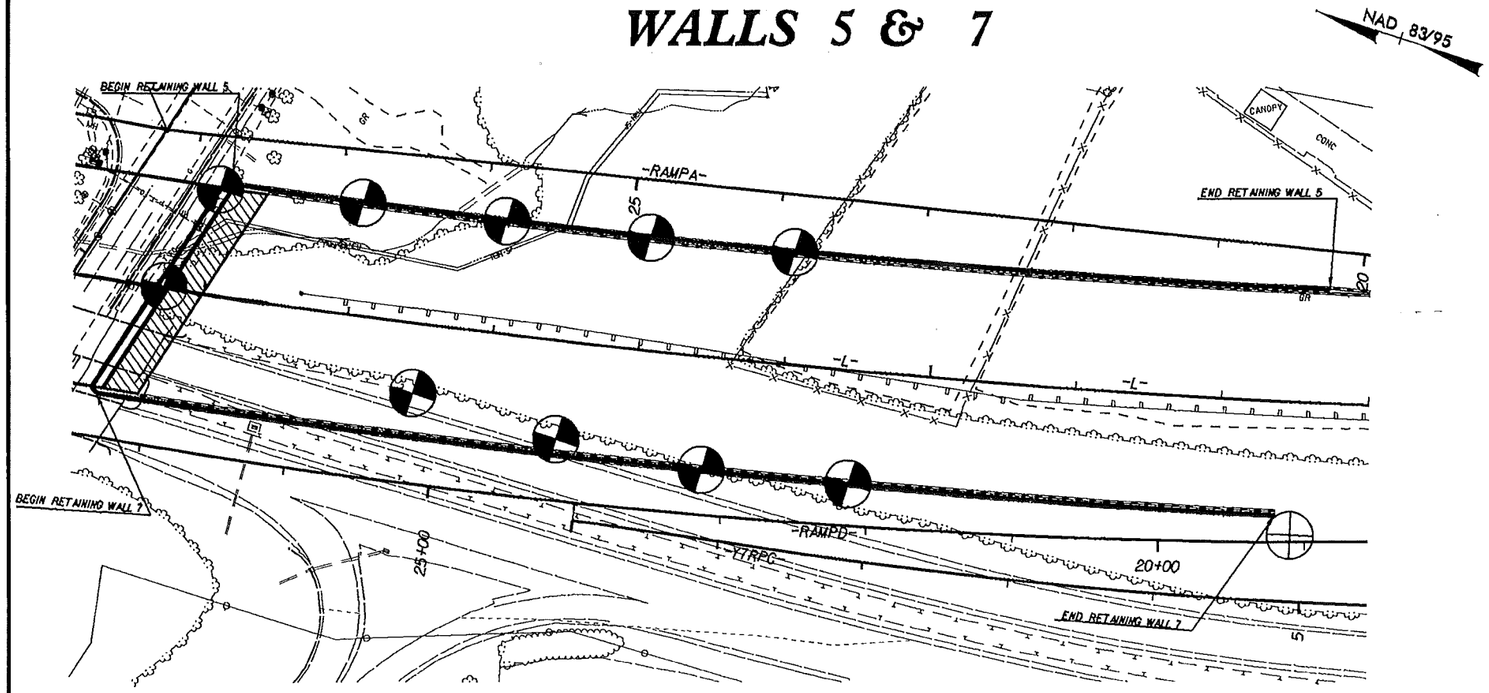
WALL 2 ADJACENT TO –RAMPB–
WALL 4 ADJACENT TO –RAMPC–

WALL 8



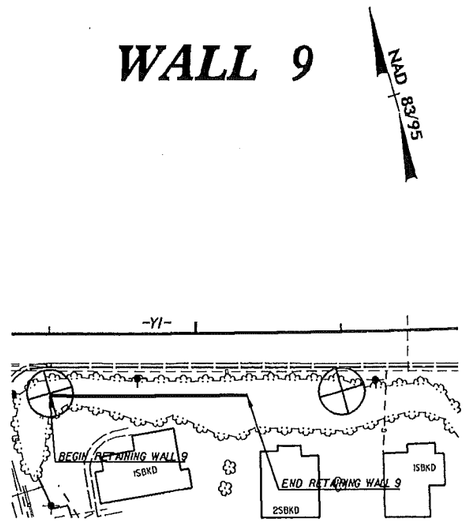
WALL 8 ADJACENT TO –Y1–

WALLS 5 & 7



WALL 5 ADJACENT TO –RAMPA–
WALL 7 ADJACENT TO –RAMPD–

WALL 9



WALL 9 ADJACENT TO –Y1–

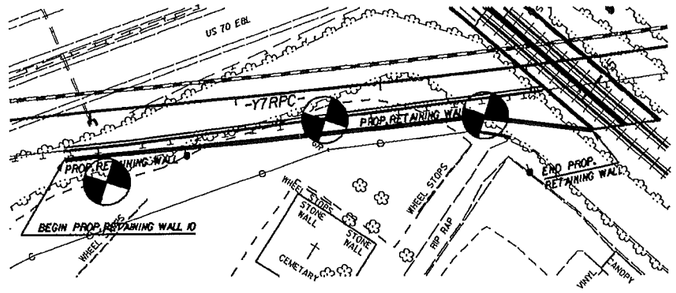
PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	5

WALLS 10 & 17

0 100 200
FEET

WALL 10

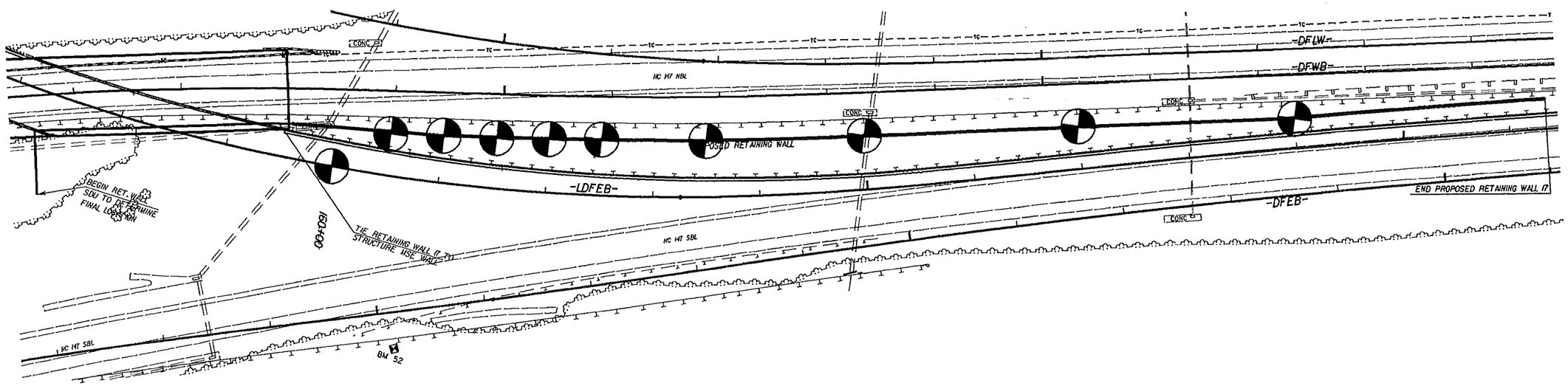
NAD 83/95



WALL 10 ADJACENT TO -Y7RPC-

WALL 17

NAD 83/95



WALL 17 ADJACENT TO -LDFEB-

PROJECT REFERENCE NO.	SHEET NO.
34745.11 (U-0071)	6
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

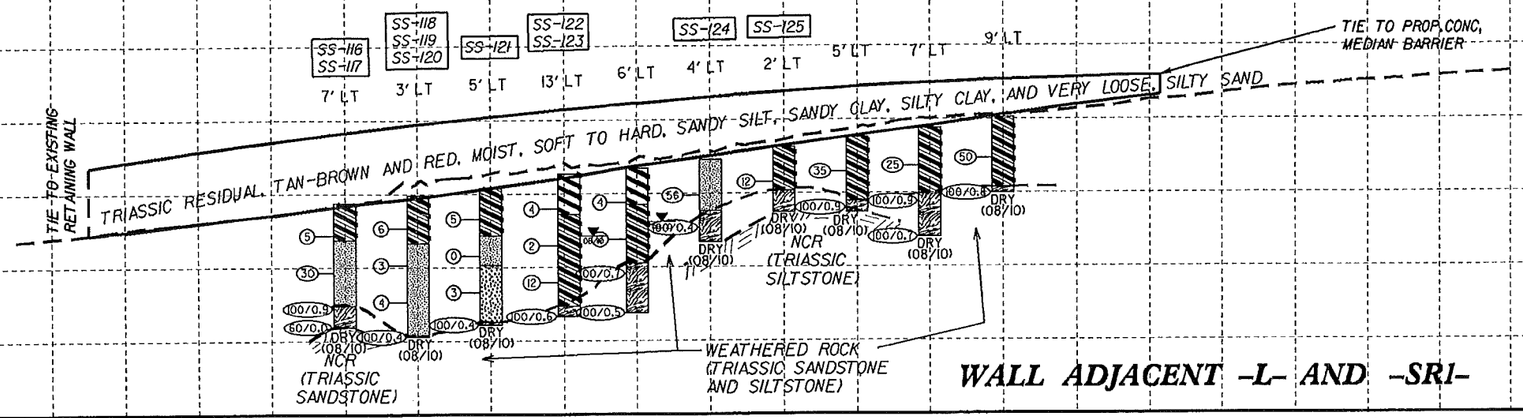
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

RETAINING WALL ENVELOPES

WALL 1A

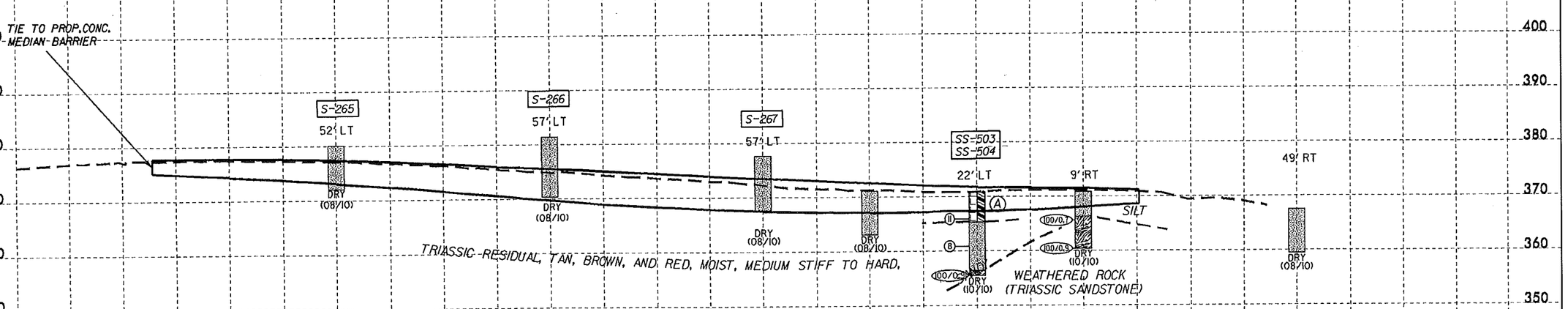
SOIL TEST RESULTS

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-116	7' LT	16+00	3.4-4.9	A-6(16)	39	22	6.6	20.5	25.1	47.7	99	96	78	-	-
SS-117	7' LT	16+00	8.4-9.9	A-4(6)	28	10	4.4	30.9	41.9	22.8	100	98	76	-	-
SS-118	3' LT	16+50	3.5-5.0	A-6(8)	32	15	9.8	28.6	35.1	26.5	96	91	68	-	-
SS-119	3' LT	16+50	8.5-10.0	A-4(0)	22	4	3.5	41.4	30.6	24.5	100	99	68	-	-
SS-120	3' LT	16+50	13.5-15.0	A-4(6)	27	10	2.9	32.7	38.0	26.5	100	99	76	-	-
SS-121	5' LT	17+00	13.2-14.7	A-2-4(0)	19	2	28.2	44.7	12.9	14.3	100	86	33	-	-
SS-122	13' LT	17+50	3.8-5.3	A-7-6(22)	46	27	4.1	21.8	27.1	46.9	100	98	81	-	-
SS-123	13' LT	17+50	8.8-10.3	A-6(9)	38	17	14.1	24.9	34.5	26.5	94	89	63	-	-
SS-124	4' LT	18+50	3.9-5.4	A-4(0)	24	5	24.8	44.0	19.0	12.2	100	91	37	-	-
SS-125	2' LT	19+00	3.8-5.3	A-6(8)	31	15	4.5	35.5	35.5	24.5	100	99	71	-	-



WALL ADJACENT -L- AND -SR1-

WALL 1B



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
S-265	52' LT	27+00	0.0-8.0	A-4(2)	28	7	18.3	27.0	38.2	16.6	98	88	62	-	-
S-266	57' LT	29+00	0.0-11.0	A-4(7)	31	9	2.3	24.3	52.7	20.7	100	100	86	-	-
S-267	57' LT	31+00	0.0-10.0	A-4(0)	30	6	27.0	36.7	19.7	16.6	100	90	40	-	-
SS-503	22' LT	33+00	3.9-5.4	A-6(7)	31	12	5.4	29.9	37.9	26.8	100	98	74	-	-
SS-504	22' LT	33+00	8.9-10.4	A-4(2)	25	7	10.5	39.6	23.1	26.8	98	93	60	-	-

(A) ROADWAY EMBANKMENT, TAN, RED, AND BROWN, MOIST, STIFF, SANDY CLAY

WALL ADJACENT -L-, -RAMPB-, AND -SR1-

*OFFSETS ARE GIVEN FROM RETAINING WALL FACE

7/2/99

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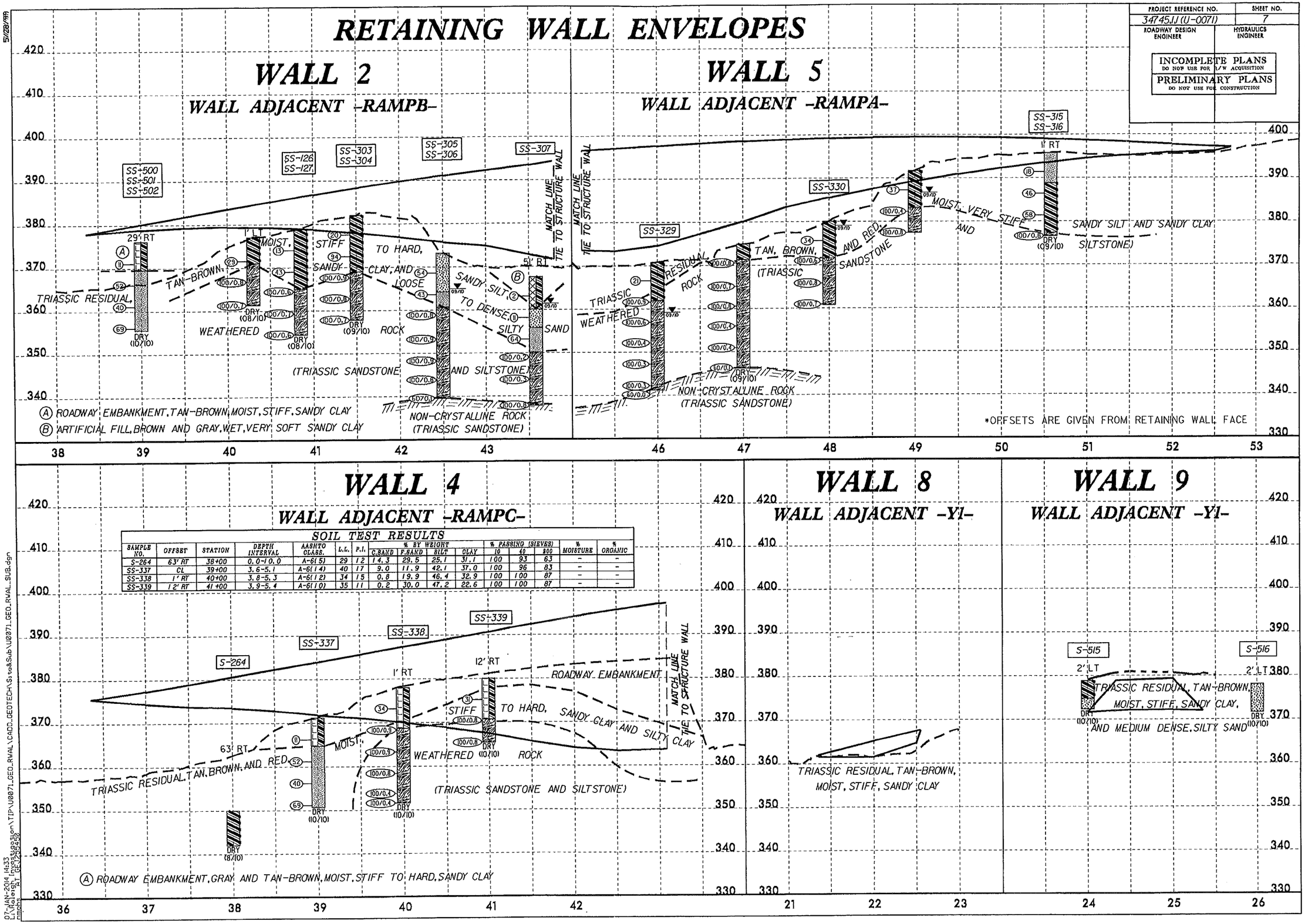
Lindsay, Stephanie
mmcbride GEOPAK

PROJECT REFERENCE NO.	SHEET NO.
34745.1.1 (U-0071)	7
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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

RETAINING WALL ENVELOPES



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
S-264	63' RT	38+00	0.0-10.0	A-6(5)	29	12	14.3	29.5	25.1	31.1	100	93	63	-	-
SS-337	CL	39+00	3.6-5.1	A-6(14)	40	17	9.0	11.9	42.1	37.0	100	96	83	-	-
SS-338	1' RT	40+00	3.8-5.3	A-6(12)	34	15	0.8	19.9	46.4	32.9	100	100	87	-	-
SS-339	12' RT	41+00	3.9-5.4	A-6(10)	35	11	0.2	30.0	47.2	22.6	100	100	87	-	-

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mmoore

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1 (U-0071)	1	19

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1 F.A. PROJ. U-0071

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM - EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION BRIDGE NO. 599 ON -LDFEB- & BRIDGE NO. 600 ON -DFLW- (EAST END CONNECTOR) OVER -Y15- (ANGIER AVE.) AND NSRR SWITCH YARD BETWEEN US 70 AND NC 147

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4-7	CROSS SECTIONS
8-18	BORE LOG REPORTS
19	SITE PHOTOGRAPHS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N.C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

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

PERSONNEL

E. HOWEY

M. BATTEN

B. KEANEY

D. TIGNOR

S. DAVIS

INVESTIGATED BY HDR, Inc.

CHECKED BY E. HOWEY

SUBMITTED BY HDR, Inc.

DATE November 12, 2012

NORTH CAROLINA LICENSED SEAL 671 GEOLOGIST ELIZABETH C. HOWEY

11/12/12 Elizabeth C. Howey

PROJECT: 34745.1.1

ID: U-0071

DRAWN BY: M. BATTEN

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

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PROJECT REFERENCE NO.	SHEET NO.
34745.1.1 (U-0071)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING #10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#40	30 MX	50 MX	51 MN											
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

GRAIN SIZE MM: 325 | 75 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY), MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

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
HA - HAND AUGER

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

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

ADVANCING TOOLS:
- [X] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [ ] TRICONE ____" STEEL TEETH
- [X] TRICONE 2-15/16" TUNG.-CARB.
- [ ] CORE BIT
- [X] 2-1/4" HSA

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

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

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION. AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

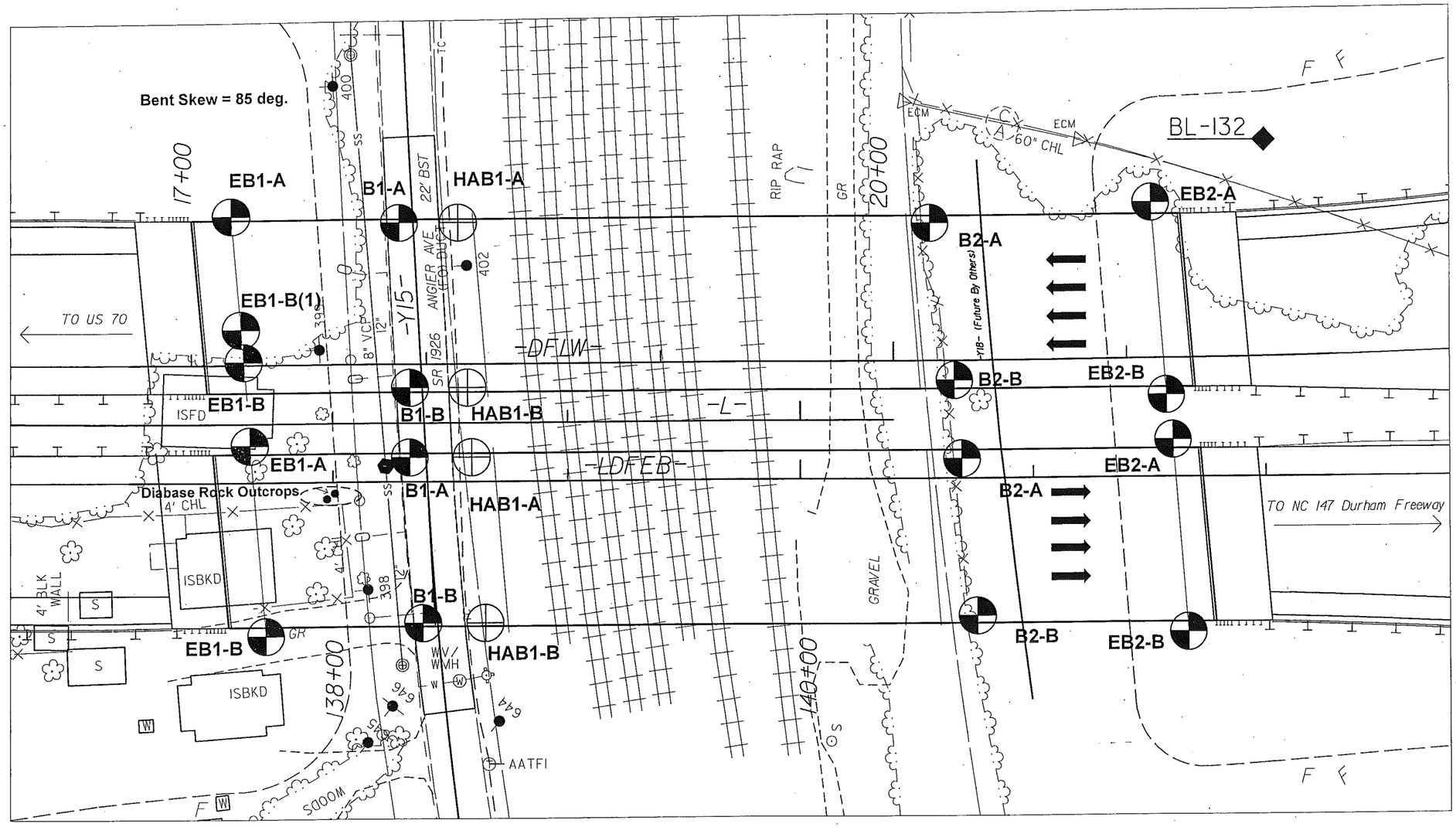
STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK: NCDOT BASELINE MARKER BL-132

ELEVATION: 400.61 FT.

NOTES:
ALSO USED NGS MONUMENT EZ0614, ELEV 395.83 FT



- Diabase Rock Outcrops

0 50 100
FEET

HDR

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

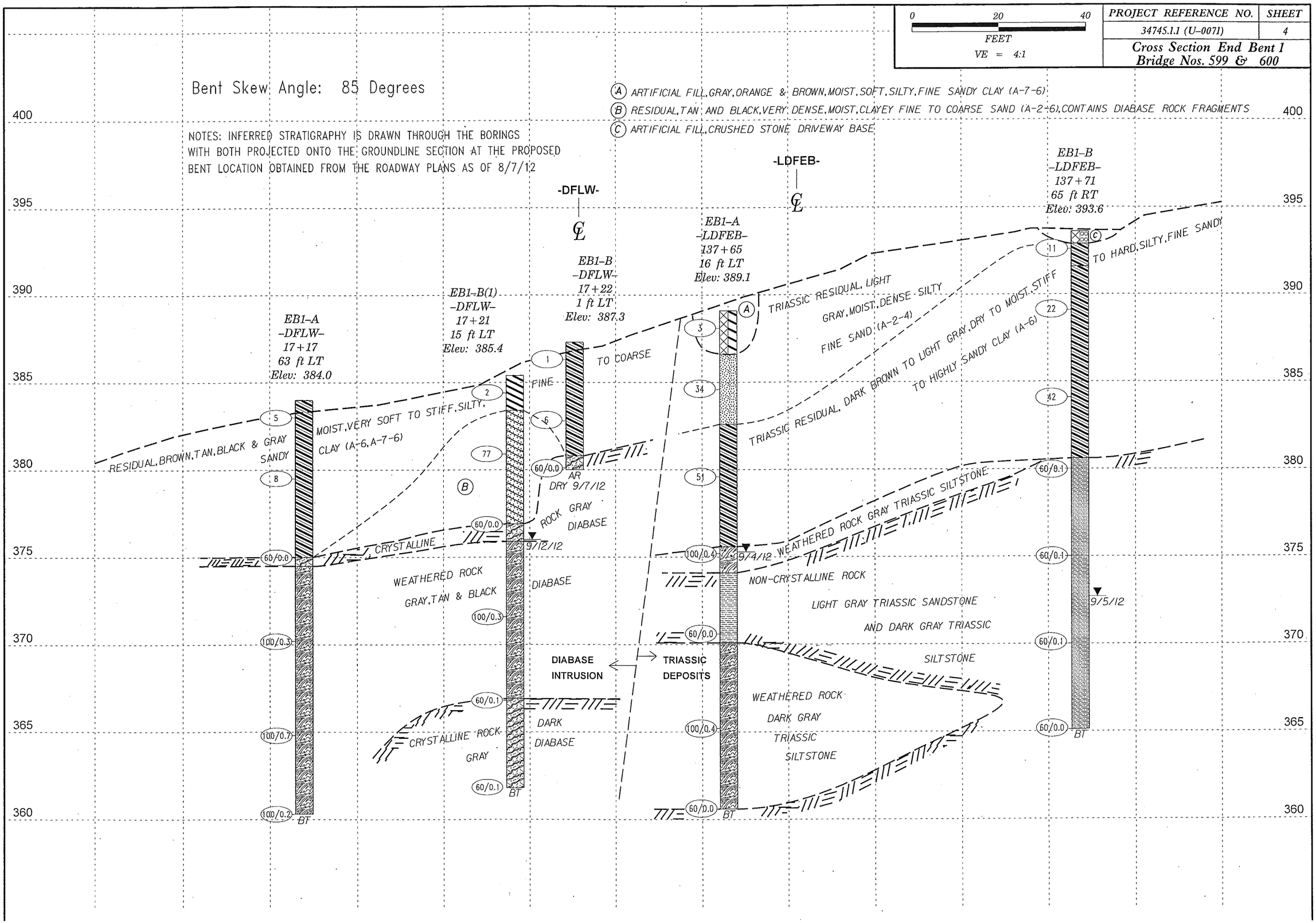
BORING LOCATION PLAN

PROJECT REFERENCE NO.	COUNTY: Durham			
WBS Element No. 34745.1.1	SITE DESCRIPTION: Bridge No. 600 on –DFLW– and Bridge No. 599 on –LDFEB– (East End Connector) over –Y15– (Angier Ave.) and NSRR between US 70 and NC 147			
TIP No.: U-0071	Drawn By:	M. Batten	9-24-12	FIGURE
	Checked By:	B. Howey	10-19-12	1

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	4

Cross Section End Bent 1
Bridge Nos. 599 & 600

0 20 40
FEET
VE = 4:1



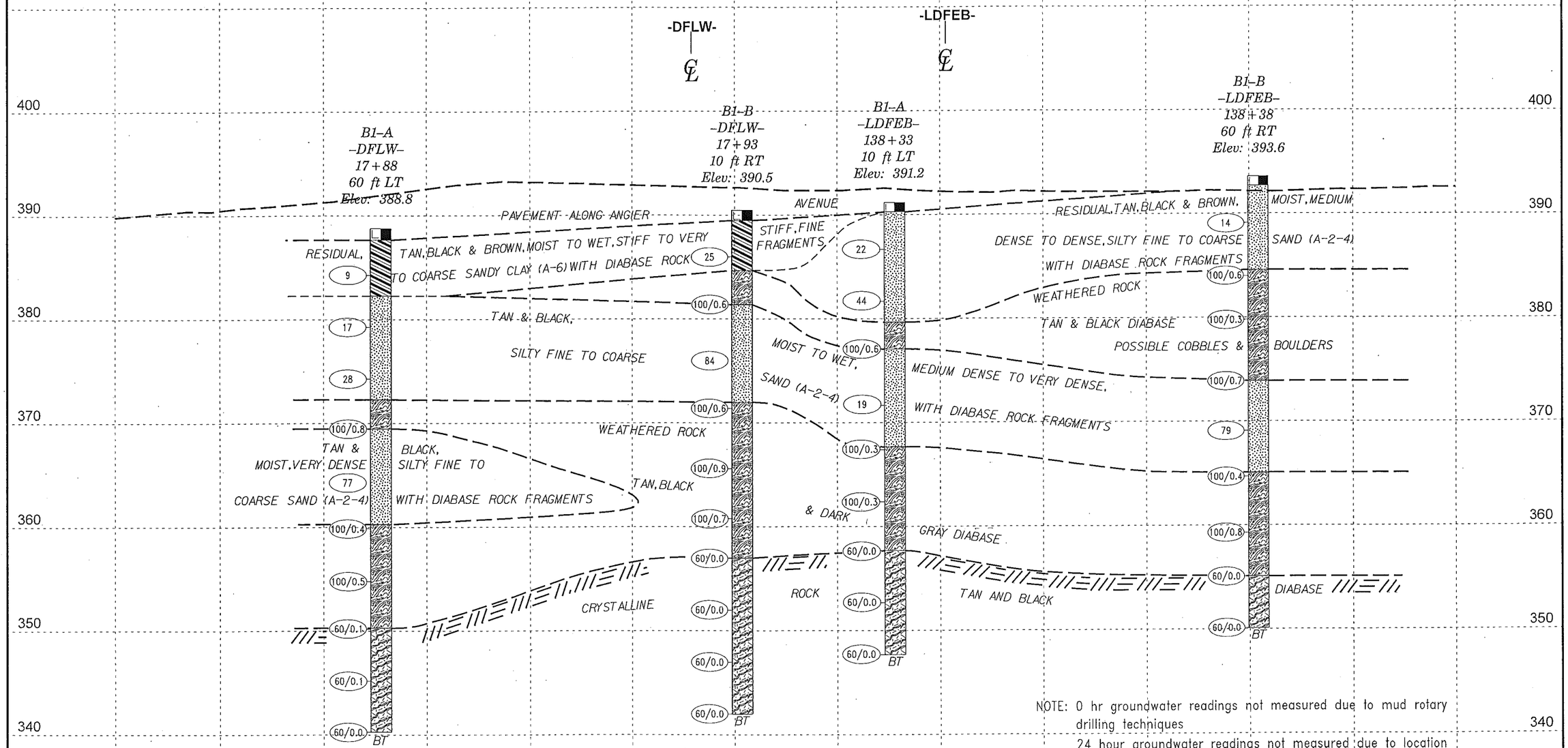
PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	5

Cross Section Bent 1
Bridge Nos. 599 & 600

0 20 40
FEET
VE = 2:1

Bent Skew Angle: 85 Degrees

NOTES: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE GROUNDLINE SECTION AT THE PROPOSED BENT LOCATION OBTAINED FROM THE ROADWAY PLANS AS OF 8/7/12



NOTE: 0 hr groundwater readings not measured due to mud rotary drilling techniques
24 hour groundwater readings not measured due to location in roadway and borings backfilled immediately after drilling

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	6

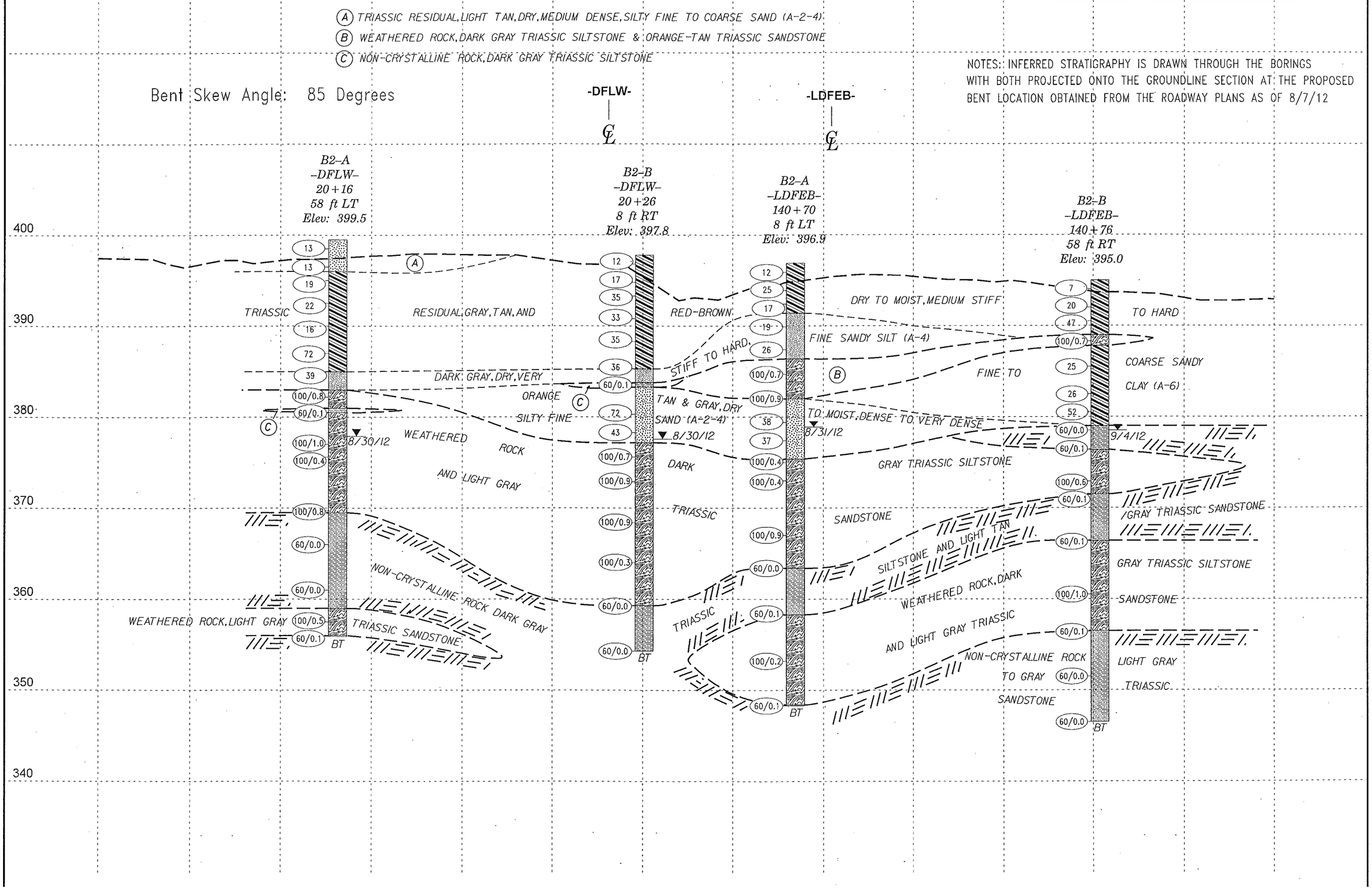
Cross Section Bent 2
Bridge Nos. 599 & 600

0 20 40
FEET
VE = 2:1

(A) TRIASSIC RESIDUAL, LIGHT TAN, DRY, MEDIUM DENSE, SILTY FINE TO COARSE SAND (A-2-4)
(B) WEATHERED ROCK, DARK GRAY TRIASSIC SILTSTONE & ORANGE-TAN TRIASSIC SANDSTONE
(C) NON-CRYSTALLINE ROCK, DARK GRAY TRIASSIC SILTSTONE

Bent Skew Angle: 85 Degrees

NOTES: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE GROUNDLINE SECTION AT THE PROPOSED BENT LOCATION OBTAINED FROM THE ROADWAY PLANS AS OF 8/7/12



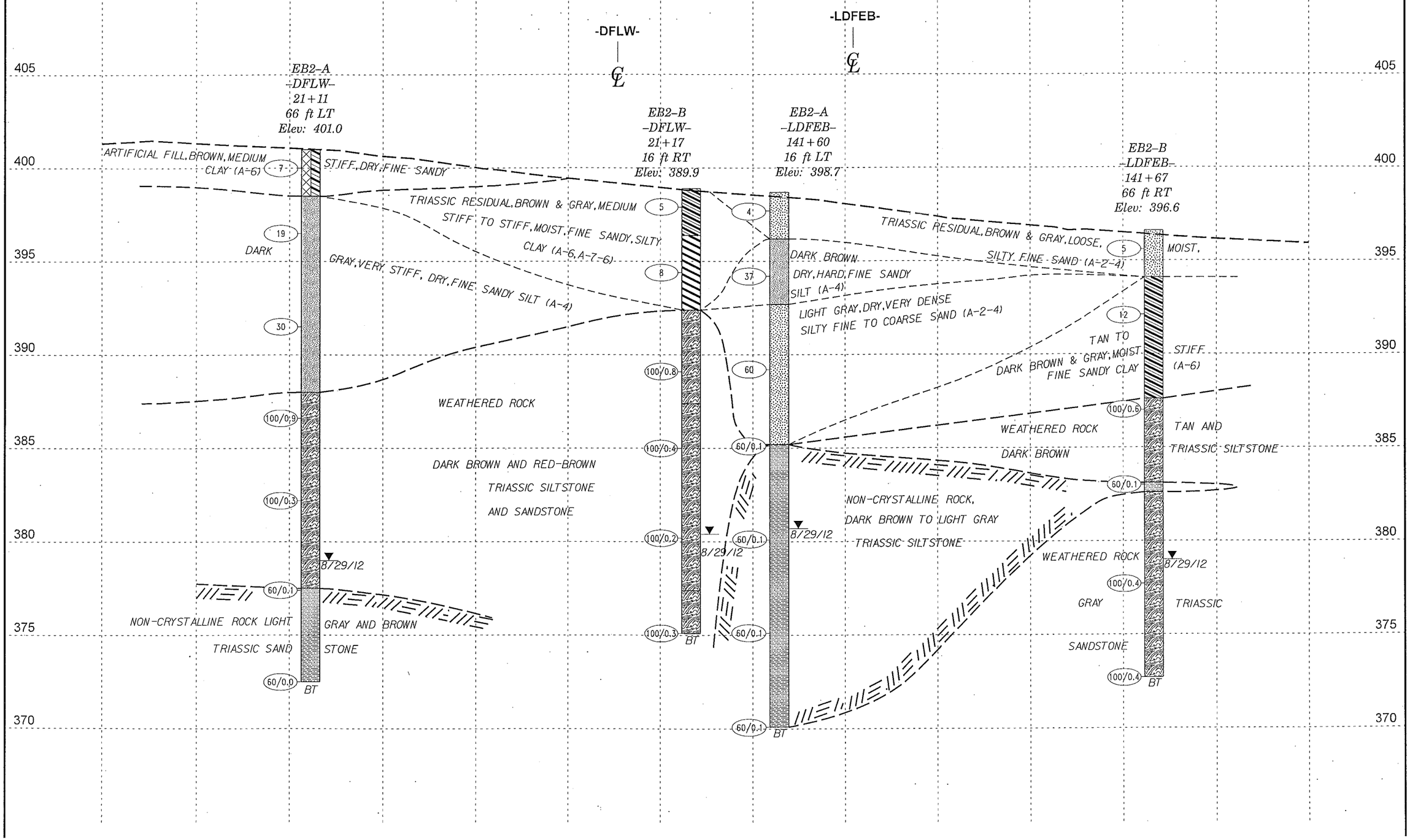
PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	7

Cross Section End Bent 2
Bridge Nos. 599 & 600

0 20 40
FEET
VE = 4:1

NOTES: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE GROUNDLINE SECTION AT THE PROPOSED BENT LOCATION OBTAINED FROM THE ROADWAY PLANS AS OF 8/7/12

Bent Skew Angle: 85 Degrees



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 600 -DFLW- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			GROUND WTR (ft)
BORING NO. EB1-A	STATION 17+17	OFFSET 63 ft LT	ALIGNMENT -DFLW-
COLLAR ELEV. 384.0 ft	TOTAL DEPTH 23.7 ft	NORTHING 807,730	EASTING 2,041,080
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		DRILL METHOD HSA 2-1/4" & Mud Rotary 2-15/16"	HAMMER TYPE Automatic
DRILLER Tignor, D.	START DATE 09/10/12	COMP. DATE 09/11/12	SURFACE WATER DEPTH N/A

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

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
385											
	384.0	0.0								384.0 GROUND SURFACE	0.0
			1	2	3	5		M		RESIDUAL Brown, tan, and black, fine to coarse sandy CLAY (A-6)	
380	380.5	3.5									
			3	4	4	8		M			
375	375.5	8.5								375.5	8.5
			40	60/0.0		60/0.0				375.0 CRYSTALLINE ROCK Gray to tan and black DIABASE	9.0
										WEATHERED ROCK Gray to tan and black DIABASE	
370	370.5	13.5									
			100/0.3			100/0.3					
365	365.5	18.5									
			34	66/0.2		100/0.7				0.3' thick clayey SAND (A-2-6) seam at 18.5'	
	360.5	23.5								360.3	23.7
			100/0.2			100/0.2				Boring Terminated at Elevation 360.3 ft in Weathered Rock (DIABASE)	

NOTES:

1) Concrete debris, trash, and dead trees scattered along ground surface.
2) Drill rig chatter at depths of 4.0' and 7.5' may be due to diabase cobbles/boulders.
3) Driller indicates harder drilling at a depth of 8.5'.
4) Switched to tricone bit at a depth of 9.5'.

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 600 -DFLW- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			GROUND WTR (ft)
BORING NO. EB1-B(1)	STATION 17+21	OFFSET 15 ft LT	ALIGNMENT -DFLW-
COLLAR ELEV. 385.4 ft	TOTAL DEPTH 23.6 ft	NORTHING 807,766	EASTING 2,041,047
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		DRILL METHOD Mud Rotary 2-15/16" Tricone	HAMMER TYPE Automatic
DRILLER Tignor, D.	START DATE 09/11/12	COMP. DATE 09/11/12	SURFACE WATER DEPTH N/A

GROUND WTR (ft)	
0 HR.	Dry
24 HR.	9.4

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
390										
385	385.4	0.0								385.4 GROUND SURFACE 0.0
			2	1	1	2		M		RESIDUAL
										383.4 Brown, silty, fine sandy highly plastic CLAY (A-7-6) 2.0
380	381.9	3.5								Tan and black, clayey fine to coarse SAND (A-2-6), contains Diabase rock fragments, boulder encountered at 2'
			25	49	28	77		M		
	376.9	8.5								376.9 8.5
375			60/0.0			60/0.0				375.9 CRYSTALLINE ROCK 9.5
										DIABASE
										WEATHERED ROCK Dark gray DIABASE
	371.9	13.5								
370			100/0.3			100/0.3				
	366.9	18.5								366.9 18.5
365			60/0.1			60/0.1				CRYSTALLINE ROCK Dark gray DIABASE
	361.9	23.5								361.8 23.6
			60/0.1			60/0.1				Boring Terminated with Standard Penetration Test Refusal at Elevation 361.8 ft in Crystalline Rock (DIABASE)

NOTES:

1) Offset boring due to shallow HSA refusal on possible boulder at EB1-B.
2) Driller indicates harder drilling at a depth of 2.0'.

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 600 -DFLW- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 17+22	**OFFSET** 1 ft LT	**ALIGNMENT** -DFLW- — **0 HR.** Dry
COLLAR ELEV. 387.3 ft	**TOTAL DEPTH** 7.3 ft	**NORTHING** 807,776	**EASTING** 2,041,037 — **24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		**DRILL METHOD** HSA 2-1/4"	**HAMMER TYPE** Automatic
DRILLER Tignor, D.	**START DATE** 09/06/12	**COMP. DATE** 09/06/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
390										
	387.3	0.0								387.3 GROUND SURFACE 0.0
			1	WOH	1	1.		M		**RESIDUAL** Brown gray to tan and gray, fine sandy CLAY (A-6)
385										
	383.8	3.5	2	2	4	6'		M		Roots encountered at 3.5'
										380.8 6.5
380	380.1	7.2	60/0.0			60/0.0				380.0 7.3 **CRYSTALLINE ROCK** Gray DIABASE, possible boulder

Boring Terminated by Auger Refusal at Elevation 380.0 ft in Crystalline Rock (DIABASE)

NOTES:

1) Driller indicates harder drilling at a depth of 6.5'.
2) Auger refusal at a depth of 7.3'. Moved to offset boring EB1-B(1).

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 600 -DFLW- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 17+88	**OFFSET** 60 ft LT	**ALIGNMENT** -DFLW- — **0 HR.** N/A
COLLAR ELEV. 388.8 ft	**TOTAL DEPTH** 48.5 ft	**NORTHING** 807,688	**EASTING** 2,041,022 — **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		**DRILL METHOD** Mud Rotary 2-15/16" Tricone	**HAMMER TYPE** Automatic
DRILLER Tignor, D.	**START DATE** 09/06/12	**COMP. DATE** 09/06/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
390										388.8 GROUND SURFACE	0.0
										387.7 5" Asphalt, 8" Concrete	1.1
385	385.3	3.5	3	4	5	9		M		**RESIDUAL** Tan and black, fine to coarse sandy CLAY (A-6), saprolitic	
										382.3	6.5
380	380.3	8.5	4	7	10	17		M		Tan and black silty fine to coarse SAND (A-2-4), with little clay, contains diabase rock fragments, saprolitic	
375	375.3	13.5	12	15	13	28		M			
										372.3	16.5
370	370.3	18.5	37	63/0.3		100/0.8				**WEATHERED ROCK** DIABASE boulder (no spoon recovery of boulder)	
										369.5	19.3
365	365.3	23.5	51	33	44	77		M		**RESIDUAL** Tan and black, silty fine to coarse SAND (A-2-4), with little clay, contains diabase rock fragments, saprolitic	
360	360.3	28.5	100/0.4			100/0.4				360.3 **WEATHERED ROCK** Tan and black DIABASE	28.5
355	355.3	33.5	100/0.5			100/0.5					
350	350.3	38.5	60/0.1			60/0.1				350.3 **CRYSTALLINE ROCK** Tan and black DIABASE	38.5
345	345.3	43.5	60/0.1			60/0.1					
	340.3	48.5	60/0.0			60/0.0				340.3 Boring Terminated with Standard Penetration Test Refusal at Elevation 340.3 ft in Crystalline Rock (DIABASE)	48.5

NOTES:

1) Driller indicates harder drilling and drill rig chatter at a depth of 16.5'.
2) Driller indicates consistently harder drilling from a depth of 38.5' to boring termination.
3) 0 hr groundwater table not measured due to mud rotary drilling techniques.
4) 24 hr groundwater table not measured due to location in roadway and boring backfilled immediately after drilling.

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 600 -DFLW- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 17+93	**OFFSET** 10 ft RT	**ALIGNMENT** -DFLW- — **0 HR.** N/A
COLLAR ELEV. 390.5 ft	**TOTAL DEPTH** 48.5 ft	**NORTHING** 807,740	**EASTING** 2,040,975 — **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		**DRILL METHOD** Mud Rotary 2-15/16" Tricone	**HAMMER TYPE** Automatic
DRILLER Tignor, D.	**START DATE** 09/07/12	**COMP. DATE** 09/07/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
395											
										390.5 GROUND SURFACE	0.0
390										389.5 5" Asphalt, 6.5" Concrete	1.0
	387.0	3.5	7	9	16	25		W		**RESIDUAL** Brown tan, fine to coarse sandy CLAY (A-6), contains diabase rock fragments	
385										384.7	5.8
	382.0	8.5	88	12/0.1		100/0.6				**WEATHERED ROCK** Tan and black DIABASE boulder	
380										381.4	9.1
	377.0	13.5	15	15	69	84		M		**RESIDUAL** Tan and black, silty fine to coarse SAND (A-2-4), with little clay, saprolitic	
375											
	372.0	18.5	90	10/0.1		100/0.6				372.0 **WEATHERED ROCK** Tan and black DIABASE	18.5
370											
	367.0	23.5	48	37	63/0.4	100/0.9					
365											
	362.0	28.5	22	46	54/0.2	100/0.7					
360											
	357.0	33.5	60/0.0			60/0.0				357.0 **CRYSTALLINE ROCK** DIABASE	33.5
355											
	352.0	38.5	60/0.0			60/0.0					
350											
	347.0	43.5	60/0.0			60/0.0					
345											
	342.0	48.5	60/0.0			60/0.0				342.0 Boring Terminated with Standard Penetration Test Refusal at Elevation 342.0 ft in Crystalline Rock (DIABASE)	48.5

NOTES:

1) Diabase boulder encountered at a depth of 5.8' and partially recovered in casing.
2) Driller indicates consistently harder drilling from a depth of 33.5' to boring termination.
3) 0 hr groundwater table not measured due to mud rotary drilling techniques.
4) 24 hr groundwater table not measured due to location in roadway and boring backfilled immediately after drilling.

NCDOT BORE DOUBLE U0071_GEO_BRDG0600_GINTBORINGLOGS.GPJ NC_DOT.GDT 11/12/12

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 600 -DFLW- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			GROUND WTR (ft)
BORING NO. HAB1-A	STATION 18+13	OFFSET 60 ft LT	ALIGNMENT -DFLW-
COLLAR ELEV. 388.2 ft	TOTAL DEPTH 2.0 ft	NORTHING 807,673	EASTING 2,041,003
DRILL RIG/HAMMER EFF./DATE NA		DRILL METHOD Hand Auger 3-1/4"	HAMMER TYPE NA
DRILLER N/A	START DATE 09/06/12	COMP. DATE 09/06/12	SURFACE WATER DEPTH N/A

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

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
390										388.2 GROUND SURFACE	0.0
										ARTIFICIAL FILL	
										386.2 Dark gray and tan, silty fine to coarse sandy highly plastic CLAY (A-7-6), contains gravel and trash, appears mixed with Diabase rock fragments	2.0
										Boring Terminated by Hand Auger Refusal at Elevation 386.2 ft on potential utility line	

NOTES:

1) Two other borings performed nearby and achieved hand auger refusal at the same elevation. Assumed utility line at this elevation.
2) Bent 1 borings were offset due to the location of the RR and overhead and underground utilities.
3) Hand auger borings were performed to determine if the actual bent location is in diabase material. Observations of soil cuttings indicate the diabase material will be encountered at the planned Bent 1 foundation locations.

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 600 -DFLW- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			GROUND WTR (ft)
BORING NO. HAB1-B	STATION 18+17	OFFSET 10 ft RT	ALIGNMENT -DFLW-
COLLAR ELEV. 390.2 ft	TOTAL DEPTH 5.0 ft	NORTHING 807,725	EASTING 2,040,956
DRILL RIG/HAMMER EFF./DATE NA		DRILL METHOD Hand Auger 3-1/4"	HAMMER TYPE NA
DRILLER N/A	START DATE 09/06/12	COMP. DATE 09/06/12	SURFACE WATER DEPTH N/A

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

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
395										
390										390.2 GROUND SURFACE 0.0
										ARTIFICIAL FILL
										388.2 Brown, silty, fine sandy highly plastic CLAY (A-7-6) 2.0
										387.2 3.0
										RESIDUAL
										385.2 Tan, brown, and black, fine to coarse sandy CLAY (A-6), likely Diabase dike, saprolitic 5.0
										Tan and black, highly sandy (fine to coarse) CLAY (A-6), saprolitic
										Boring Terminated at Elevation 385.2 ft in Residuum (DIABASE DIKE)

NOTES:

1) Bent 1 borings were offset due to the location of the RR and overhead and underground utilities.
2) Hand auger borings were performed to determine if the actual bent location is in diabase material. Observations of soil cuttings indicate the diabase material will be encountered at the planned Bent 1 foundation locations.

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)	
SITE DESCRIPTION Bridge No. 600 -DFLW- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147				GROUND WTR (ft)
BORING NO. B2-A	STATION 20+16	OFFSET 58 ft LT	ALIGNMENT -DFLW-	0 HR. N/A
COLLAR ELEV. 399.5 ft	TOTAL DEPTH 43.6 ft	NORTHING 807,547	EASTING 2,040,844	24 HR. 21.6
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		DRILL METHOD HSA 2-1/4"	HAMMER TYPE Automatic	
DRILLER Tignor, D.	START DATE 08/29/12	COMP. DATE 08/29/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
400										399.5 GROUND SURFACE	0.0
	399.5	0.0	3	5	8	13		D		TRIASSIC RESIDUAL Light tan, silty fine to coarse SAND (A-2-4)	
	397.5	2.0	11	7	6	13		D			
395	396.0	3.5	6	7	12	19		D		396.0 Light gray and tan with orange, fine sandy CLAY (A-6), saprolitic	3.5
	393.0	6.5	6	9	13	22		D			
390	391.0	8.5	6	7	9	16		D			
	388.0	11.5	7	30	42	72		D			
385	386.0	13.5	11	10	29	39		D		385.0	14.5
	383.0	16.5								383.0 Dark gray, fine sandy SILT (A-4)	16.5
	381.0	18.5	56	44/0.3		100/0.8				381.0 WEATHERED ROCK Dark gray TRIASSIC SILTSTONE	18.5
380			60/0.1			60/0.1				380.5 NON-CRYSTALLINE ROCK Dark gray TRIASSIC SILTSTONE	19.0
	378.0	21.5	28	72/0.5						WEATHERED ROCK Dark gray TRIASSIC SILTSTONE Possible soil seam from 21.5' to 22.0'	
375	376.0	23.5	100/0.4			100/1.0 100/0.4					
370	371.0	28.5	26	23	77/0.3	100/0.8				369.5 Possible soil seam from 28.5' to 29.5'	30.0
										NON-CRYSTALLINE ROCK Dark gray TRIASSIC SILTSTONE	
365	366.0	33.5	60/0.0			60/0.0					
360	361.0	38.5	60/0.0			60/0.0					
	358.0	41.5	90	10/0.0		100/0.5				359.0 WEATHERED ROCK Light gray TRIASSIC SANDSTONE	40.5
	356.0	43.5	60/0.1			60/0.1				356.0 / 355.9 NON-CRYSTALLINE ROCK Light gray TRIASSIC SANDSTONE	43.5 / 43.6

Boring Terminated with Standard Penetration Test Refusal at Elevation 355.9 ft in Non-Crystalline Rock (TRIASSIC SANDSTONE)

NOTES:

1) Strata break in split spoon at a depth of 14.5'.
2) Driller indicates harder drilling at a depth of 30.0'.

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)	
SITE DESCRIPTION Bridge No. 600 -DFLW- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147				GROUND WTR (ft)
BORING NO. B2-B	STATION 20+26	OFFSET 8 ft RT	ALIGNMENT -DFLW-	0 HR. N/A
COLLAR ELEV. 397.8 ft	TOTAL DEPTH 43.5 ft	NORTHING 807,593	EASTING 2,040,794	24 HR. 20.2
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		DRILL METHOD HSA 2-1/4"	HAMMER TYPE Automatic	
DRILLER Tignor, D.	START DATE 08/29/12	COMP. DATE 08/29/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
400										
	397.8	0.0	4	5	7	12		D		397.8 GROUND SURFACE 0.0
	395.8	2.0	7	8	9	17		D		TRIASSIC RESIDUAL Tan to light gray with orange, fine sandy CLAY (A-6) Root fragments encountered at 2.0'
395	394.3	3.5	8	16	19	35		D		
	391.8	6.0	9	14	19	33		D		
390	389.3	8.5	15	16	19	35		D		
	386.3	11.5	10	16	20	36		D		
385	384.3	13.5	36	60/0.1		60/0.1				385.3 12.5
										383.8 Dark gray, fine sandy SILT (A-4) 14.0
	381.3	16.5	19	36	36					383.3 NON-CRYSTALLINE ROCK Dark gray TRIASSIC SILTSTONE 14.5
380	379.3	18.5	29	25	18	72		D		TRIASSIC RESIDUAL Light tan-gray, silty fine SAND (A-2-4), with little clay
	376.3	21.5	36	64/0.2		43				377.2 Contains mica at 18.5' 20.6
375	374.3	23.5	25	55	45/0.4	100/0.7				WEATHERED ROCK Light tan gray TRIASSIC SANDSTONE
						100/0.9				
370	369.3	28.5	33	67/0.4		100/0.9				
365	364.3	33.5	100/0.3			100/0.3				
360	359.3	38.5	60/0.0			60/0.0				359.3 38.5
										NON-CRYSTALLINE ROCK Light tan gray TRIASSIC SANDSTONE
355	354.3	43.5	60/0.0			60/0.0				354.3 43.5

Boring Terminated with Standard Penetration Test Refusal at Elevation 354.3 ft in Non-Crystalline Rock (TRIASSIC SANDSTONE)

NOTES:

1) Strata break in split spoon at a depth of 12.5'.
2) Driller indicates harder drilling at a depth of 20.6'.

NCDOT BORE DOUBLE U0071_GEO_BRDG0600_GINTBORINGLOGS.GPJ NC_DOT.GDT 11/12/12

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 600 -DFLW- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			GROUND WTR (ft)
BORING NO. EB2-A	STATION 21+11	OFFSET 66 ft LT	ALIGNMENT -DFLW-
COLLAR ELEV. 401.0 ft	TOTAL DEPTH 28.5 ft	NORTHING 807,482	EASTING 2,040,775
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		DRILL METHOD HSA 2-1/4"	HAMMER TYPE Automatic
DRILLER Tignor, D.	START DATE 08/28/12	COMP. DATE 08/28/12	SURFACE WATER DEPTH N/A

GROUND WTR (ft)	
0 HR.	Dry
24 HR.	22.0

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
405											
	401.0	0.0								401.0 GROUND SURFACE	0.0
400			1	3	4	7		D		ARTIFICIAL FILL: Brown, fine sandy CLAY (A-6), contains root fragments	
	397.5	3.5								398.5	2.5
			6	8	11	19		D		TRIASSIC RESIDUAL: Dark gray, fine sandy SILT (A-4), with trace mica	
395											
	392.5	8.5									
			11	12	18	30		D			
390											
	387.5	13.5								388.0	13.0
			52	48/0.4		100/0.9				WEATHERED ROCK: Dark brown TRIASSIC SILTSTONE	
385											
	382.5	18.5									
			100/0.3			100/0.3					
380											
	377.5	23.5								377.5	23.5
			60/0.1			60/0.1				NON-CRYSTALLINE ROCK: Light gray and brown TRIASSIC SANDSTONE	
375											
	372.5	28.5								372.5	28.5
			60/0.0			60/0.0				Boring Terminated with Standard Penetration Test Refusal at Elevation 372.5 ft in Non-Crystalline Rock (TRIASSIC SANDSTONE)	

NOTES:

1) Tires, bricks, and lumber debris scattered along ground surface.
2) Driller indicates harder drilling at a depth of 13.0'.

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 600 -DFLW- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			GROUND WTR (ft)
BORING NO. EB2-B	STATION 21+17	OFFSET 16 ft RT	ALIGNMENT -DFLW-
COLLAR ELEV. 398.9 ft	TOTAL DEPTH 23.8 ft	NORTHING 807,541	EASTING 2,040,719
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		DRILL METHOD HSA 2-1/4"	HAMMER TYPE Automatic
DRILLER Tignor, D.	START DATE 08/28/12	COMP. DATE 08/28/12	SURFACE WATER DEPTH N/A

GROUND WTR (ft)	
0 HR.	Dry
24 HR.	18.5

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
400											
	398.9	0.0								398.9 GROUND SURFACE	0.0
			1	3	2	5		M		TRIASSIC RESIDUAL: Brown with orange, fine sandy CLAY (A-6)	
395	395.4	3.5								396.4	2.5
			2	3	5	8		M		Brown and gray, silty, fine sandy CLAY (A-7-6), with trace mica	
390	390.4	8.5								392.4	6.5
			13	27	73/0.3					WEATHERED ROCK: Red brown TRIASSIC SANDSTONE	
						100/0.6					
385	385.4	13.5								387.4	11.5
			100/0.4			100/0.4				Dark red brown TRIASSIC SILTSTONE	
380	380.4	18.5									
			100/0.2			100/0.2					
	375.4	23.5								377.4	21.5
			100/0.3			100/0.3				Gray TRIASSIC SANDSTONE	
										375.1	23.8
										Boring Terminated at Elevation 375.1 ft in Weathered Rock (TRIASSIC SANDSTONE)	

NOTES:

1) Driller indicates harder drilling at a depth of 6.5'.

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 599 -LDFEB- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 137+65	**OFFSET** 16 ft LT	**ALIGNMENT** -LDFEB-
COLLAR ELEV. 389.1 ft	**TOTAL DEPTH** 28.5 ft	**NORTHING** 807,802	**EASTING** 2,041,013
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		**DRILL METHOD** HSA 2-1/4"	**HAMMER TYPE** Automatic
DRILLER Tignor, D.	**START DATE** 08/31/12	**COMP. DATE** 08/31/12	**SURFACE WATER DEPTH** N/A

GROUND WTR (ft)	
0 HR.	Dry
24 HR.	13.8

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
390											
	389.1	0.0								389.1 GROUND SURFACE	0.0
			WOH	1	2	3		M		**ARTIFICIAL FILL** Gray, orange, and brown, silty, fine sandy CLAY (A-7-6)	2.5
385	385.6	3.5	14	13	21	34		M		**TRIASSIC RESIDUAL** Light gray, silty fine SAND (A-2-4), saprolitic	6.5
380	380.6	8.5	22	23	28	51		M		Light gray, highly sandy (fine to coarse) CLAY (A-6), saprolitic	
375	375.6	13.5	100/0.4			100/0.4				375.6 **WEATHERED ROCK** Dark gray TRIASSIC SILTSTONE	13.5
										374.1 **NON-CRYSTALLINE ROCK** Light gray TRIASSIC SANDSTONE	15.0
370	370.6	18.5	60/0.0			60/0.0				370.1 **WEATHERED ROCK** Dark gray TRIASSIC SILTSTONE	19.0
365	365.6	23.5	100/0.4			100/0.4					
	360.6	28.5	60/0.0			60/0.0				360.6 Boring Terminated with Standard Penetration Test Refusal at Elevation 360.6 ft on Non-Crystalline Rock (TRIASSIC SILTSTONE)	28.5

NOTES:

1) Driller indicates harder drilling at a depth of 15.0'.

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 599 -LDFEB- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 137+71	**OFFSET** 65 ft RT	**ALIGNMENT** -LDFEB-
COLLAR ELEV. 393.6 ft	**TOTAL DEPTH** 28.5 ft	**NORTHING** 807,861	**EASTING** 2,040,957
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		**DRILL METHOD** HSA 2-1/4"	**HAMMER TYPE** Automatic
DRILLER Tignor, D.	**START DATE** 09/04/12	**COMP. DATE** 09/04/12	**SURFACE WATER DEPTH** N/A

GROUND WTR (ft)	
0 HR.	Dry
24 HR.	20.9

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
395											
	393.6	0.0								393.6 GROUND SURFACE	0.0
			2	4	7	11		M		392.9 **ARTIFICIAL FILL** Crushed stone driveway base	0.7
390	390.1	3.5	4	11	11	22		D		391.6 **TRIASSIC RESIDUAL** Dark brown gray, silty, fine sandy CLAY (A-6)	2.0
385	385.1	8.5	7	7	35	42		D		Light gray, highly sandy (fine to coarse) CLAY (A-6), contains trace mica, saprolitic	
380	380.1	13.5	60/0.1			60/0.1				380.6 **NON-CRYSTALLINE ROCK** Dark gray TRIASSIC SILTSTONE	13.0
375	375.1	18.5	60/0.1			60/0.1					
370	370.1	23.5	60/0.1			60/0.1					
	365.1	28.5	60/0.0			60/0.0				365.1 Boring Terminated with Standard Penetration Test Refusal at Elevation 365.1 ft in Non-Crystalline Rock (TRIASSIC SILTSTONE)	28.5

NOTES:

1) Strata break in split spoon at a depth of 0.7'.
2) Driller indicates harder drilling at a depth of 13.0'.

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 599 -LDFEB- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			GROUND WTR (ft)
BORING NO. B1-A	STATION 138+33	OFFSET 10 ft LT	ALIGNMENT -LDFEB- / 0 HR. N/A
COLLAR ELEV. 391.2 ft	TOTAL DEPTH 43.5 ft	NORTHING 807,763	EASTING 2,040,957 / 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		DRILL METHOD Mud Rotary 2-15/16" Tricone	HAMMER TYPE Automatic
DRILLER Tignor, D.	START DATE 09/10/12	COMP. DATE 09/10/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
395											
										391.2 GROUND SURFACE	0.0
390										390.3 3.5" Asphalt, 7" Concrete	0.9
	387.7	3.5	7	10	12	22		M		RESIDUAL Tan and black, silty fine to coarse SAND (A-2-4), with little clay, saprolitic	
385											
	382.7	8.5	19	21	23	44		M		Diabase rock fragments encountered at 8.5'	
380										379.7	11.5
	377.7	13.5	77	23/0.1		100/0.6				WEATHERED ROCK Tan and black DIABASE, possible boulder 377.1	14.1
375										RESIDUAL Tan and black, silty fine to coarse SAND (A-2-4), contains diabase rock fragments with little clay	
	372.7	18.5	14	7	12	19		W			
370										367.7	23.5
	367.7	23.5	100/0.3			100/0.3				WEATHERED ROCK Tan and black to dark gray DIABASE	
365											
	362.7	28.5	100/0.3			100/0.3					
360											
	357.7	33.5	60/0.0			60/0.0				357.7 CRYSTALLINE ROCK DIABASE	33.5
355											
	352.7	38.5	60/0.0			60/0.0					
350											
	347.7	43.5	60/0.0			60/0.0				347.7 Boring Terminated with Standard Penetration Test Refusal at Elevation 347.7 ft in Crystalline Rock (DIABASE)	43.5

NOTES:

1) Drill rig chatter and harder drilling at a depth of 11.5' likely due to diabase cobbles/boulders.
2) Driller indicates harder drilling at a depth of 23.5'.
3) 0 hr groundwater table not measured due to mud rotary drilling techniques.
4) 24 hr groundwater table not measured due to location in roadway and boring backfilled immediately after drilling.

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 599 -LDFEB- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			GROUND WTR (ft)
BORING NO. B1-B	STATION 138+38	OFFSET 60 ft RT	ALIGNMENT -LDFEB- / 0 HR. N/A
COLLAR ELEV. 393.6 ft	TOTAL DEPTH 43.5 ft	NORTHING 807,815	EASTING 2,040,908 / 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		DRILL METHOD Mud Rotary 2-15/16" Tricone	HAMMER TYPE Automatic
DRILLER Tignor, D.	START DATE 09/05/12	COMP. DATE 09/05/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
395										
										393.6 GROUND SURFACE 0.0
										392.7 5.25" Asphalt, 6" Concrete 0.9
390	390.1	3.5	3	7	7	14		M		RESIDUAL Brown, tan, and black, silty fine SAND (A-2-4), with little clay, saprolitic, contains diabase rock fragments
385	385.1	8.5	8	34	66/0.1	100/0.6				384.6 9.0
380	380.1	13.5	100/0.3			100/0.3				WEATHERED ROCK Tan and black DIABASE, possible cobbles/boulders based on drill chatter and resistance
375	375.1	18.5	23	73	27/0.2	100/0.7				373.9 19.7
370	370.1	23.5	21	34	45	79		M		RESIDUAL Tan and black, silty fine to coarse SAND (A-2-4), with little clay, saprolitic
365	365.1	28.5	100/0.4			100/0.4				365.1 28.5 WEATHERED ROCK Tan and black DIABASE
360	360.1	33.5	45	55/0.3		100/0.8				
355	355.1	38.5	60/0.0			60/0.0				355.1 38.5 CRYSTALLINE ROCK Tan and black DIABASE
	350.1	43.5	60/0.0			60/0.0				350.1 43.5 Boring Terminated with Standard Penetration Test Refusal at Elevation 350.1 ft in Crystalline Rock (DIABASE)

NOTES:

1) Drill rig chatter at a depth of 10.0'.
2) Possible boulder at a depth of 15.0'.
3) Driller indicates harder drilling at a depth of 38.5'. Remained consistently hard to boring termination.
4) Boring terminated due to time constraints; road had to be reopened by 4PM.
5) 0 hr groundwater table not measured due to mud rotary drilling techniques.
6) 24 hr groundwater table not measured due to location in roadway and boring backfilled immediately after drilling.

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)	
SITE DESCRIPTION Bridge No. 599 -LDFEB- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147				GROUND WTR (ft)
BORING NO. HAB1-A	STATION 138+59	OFFSET 10 ft LT	ALIGNMENT -LDFEB-	0 HR. Dry
COLLAR ELEV. 391.4 ft	TOTAL DEPTH 3.5 ft	NORTHING 807,747	EASTING 2,040,936	24 HR. N/A
DRILL RIG/HAMMER EFF./DATE NA		DRILL METHOD Hand Auger 3-1/4"	HAMMER TYPE NA	
DRILLER N/A	START DATE 09/07/12	COMP. DATE 09/07/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
395											
										391.4 GROUND SURFACE	0.0
390										390.4 ARTIFICIAL FILL	1.0
										389.4 Brown, silty, fine sandy highly plastic CLAY (A-7-6)	2.0
										387.9 RESIDUAL	3.5
										Tan, fine to coarse sandy CLAY (A-6), likely Diabase dike, saprolitic	
										Tan and black, silty fine to coarse SAND (A-2-4), saprolitic	
										Boring Terminated at Elevation 387.9 ft in Residuum (DIABASE DIKE)	

NOTES:

1) Bent 1 borings were offset due to the location of the RR and overhead and underground utilities.
2) Hand auger borings were performed to determine if the actual bent location is in diabase material. Observations of soil cuttings indicate the diabase material will be encountered at the planned Bent 1 foundation locations.

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)	
SITE DESCRIPTION Bridge No. 599 -LDFEB- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147				GROUND WTR (ft)
BORING NO. HAB1-B	STATION 138+65	OFFSET 60 ft RT	ALIGNMENT -LDFEB-	0 HR. Dry
COLLAR ELEV. 392.5 ft	TOTAL DEPTH 3.0 ft	NORTHING 807,798	EASTING 2,040,888	24 HR. N/A
DRILL RIG/HAMMER EFF./DATE NA		DRILL METHOD Hand Auger 3-1/4"	HAMMER TYPE NA	
DRILLER N/A	START DATE 09/06/12	COMP. DATE 09/06/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
395										
										392.5 GROUND SURFACE 0.0
										391.5 RESIDUAL 1.0
390										Tan and black, fine to coarse sandy CLAY (A-6), contains rock fragments, likely Diabase dike, saprolitic
										389.5 3.0
										Tan and black, silty fine to coarse SAND (A-2-4), with little clay, contains diabase rock fragments, saprolitic
										Boring Terminated at Elevation 389.5 ft in Residuum (DIABASE DIKE)

NOTES:

1) Bent 1 borings were offset due to the location of the RR and overhead and underground utilities.
2) Hand auger borings were performed to determine if the actual bent location is in diabase material. Observations of soil cuttings indicate the diabase material will be encountered at the planned Bent 1 foundation locations.

NCDOT BORE DOUBLE U0071_GEO_BRDG0599_GINTBORINGLOGS.GPJ NC_DOT.GDT 11/9/12

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 599 -LDFEB- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			GROUND WTR (ft)
BORING NO. B2-A	STATION 140+70	OFFSET 8 ft LT	ALIGNMENT -LDFEB- / 0 HR. N/A
COLLAR ELEV. 396.9 ft	TOTAL DEPTH 48.6 ft	NORTHING 807,617	EASTING 2,040,771 / 24 HR. 18.0
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		DRILL METHOD HSA 2-1/4"	HAMMER TYPE Automatic
DRILLER Tignor, D.	START DATE 08/30/12	COMP. DATE 08/30/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
400											
	396.9	0.0								396.9 GROUND SURFACE	0.0
			5	6	6	12		D		**TRIASSIC RESIDUAL** Red brown and tan, fine sandy CLAY (A-6), contains root fragments at surface	
395	394.9	2.0	10	13	12	25		D			
	393.4	3.5	11	10	7	17		D			
	390.9	6.0	6	9	10	19		D			
390	388.4	8.5	7	10	16	26		D		391.4 Dark gray, fine sandy SILT (A-4), with little clay	5.5
385	385.4	11.5	62	38/0.2		100/0.7				386.4 **WEATHERED ROCK** Dark gray TRIASSIC SILTSTONE	10.5
	383.4	13.5	10	25	75/0.4	100/0.9				383.9 Orange tan TRIASSIC SANDSTONE	13.0
380	380.4	16.5	28	18	20	38				382.0 **TRIASSIC RESIDUAL** Orange-tan and gray, silty fine sand (A-2-4), with little clay, contains trace mica, saprolitic	14.9
	378.4	18.5	12	18	19	37		M			
375	375.4	21.5	100/0.4			100/0.4				375.4 **WEATHERED ROCK** Brown gray to gray TRIASSIC SANDSTONE	21.5
	373.4	23.5	100/0.4			100/0.4					
370	368.4	28.5	7	27	73/0.4	100/0.9					
365	363.4	33.5	60/0.0			60/0.0				363.4 **NON-CRYSTALLINE ROCK** Light gray TRIASSIC SANDSTONE	33.5
360	358.4	38.5	60/0.1			60/0.1				358.3 **WEATHERED ROCK** Dark gray TRIASSIC SILTSTONE	38.6
355	353.4	43.5	100/0.2			100/0.2					
350	348.4	48.5	60/0.1			60/0.1				348.4 / 348.3 **NON-CRYSTALLINE ROCK** TRIASSIC SILTSTONE	48.5 / 48.6

Boring Terminated with Standard Penetration Test Refusal at Elevation 348.3 ft in Non-Crystalline Rock (TRIASSIC SILTSTONE)

NOTES:

1) Driller indicates harder drilling at a depth of 10.5'.
2) Water level at 0hr affected by water used to flush out augers.

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 599 -LDFEB- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			GROUND WTR (ft)
BORING NO. B2-B	STATION 140+76	OFFSET 58 ft RT	ALIGNMENT -LDFEB- / 0 HR. N/A
COLLAR ELEV. 395.0 ft	TOTAL DEPTH 48.5 ft	NORTHING 807,665	EASTING 2,040,724 / 24 HR. 16.5
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		DRILL METHOD HSA 2-1/4"	HAMMER TYPE Automatic
DRILLER Tignor, D.	START DATE 08/30/12	COMP. DATE 08/31/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
395										395.0 GROUND SURFACE	0.0
	395.0	0.0	3	3	4	7		M		**TRIASSIC RESIDUAL** Red brown and gray to light tan, fine to coarse sandy CLAY (A-6)	
	393.0	2.0	8	10	10	20		D			
390	391.5	3.5	11	14	33	Root 47		D		Large root fragments encountered in spoon at 3.5', (N-value not representative of soil consistency)	
	388.5	6.5	77	23/0.2		100/0.7				389.0 **WEATHERED ROCK** Gray TRIASSIC SILTSTONE	6.0
385	386.5	8.5	10	12	13	25		D		387.8 **TRIASSIC RESIDUAL** Tan and light gray, fine sandy CLAY (A-6), saprolitic	7.2
	383.5	11.5	14	12	14	26		D			
380	381.5	13.5	11	12	40	52		D			
	378.5	16.5	60/0.0			60/0.0				379.0 **NON-CRYSTALLINE ROCK** Gray TRIASSIC SILTSTONE	16.0
375	376.5	18.5	60/0.1			60/0.1				376.4 **WEATHERED ROCK** Gray TRIASSIC SANDSTONE	18.6
	373.5	21.5	90	10/0.1		100/0.6					
370	371.5	23.5	60/0.1			60/0.1				371.5 **NON-CRYSTALLINE ROCK** Light gray TRIASSIC SANDSTONE	23.5
365	366.5	28.5	60/0.1			60/0.1				366.4 **WEATHERED ROCK** Light gray TRIASSIC SANDSTONE	28.6
360	361.5	33.5	44	56/0.5		100/1.0					
355	356.5	38.5	60/0.1			60/0.1				356.5 **NON-CRYSTALLINE ROCK** Light gray to gray TRIASSIC SANDSTONE	38.5
350	351.5	43.5	60/0.0			60/0.0					
	346.5	48.5	60/0.0			60/0.0				346.5	48.5

Boring Terminated with Standard Penetration Test Refusal at Elevation 346.5 ft in Non-Crystalline Rock (TRIASSIC SANDSTONE)

NOTES:

1) Driller indicates harder drilling at a depth of 6.0'.
2) Driller indicates harder drilling at a depth of 16.0'.

NCDOT BORE DOUBLE U0071_GEO_BRDG0599_GINTBORINGLOGS.GPJ NC_DOT.GDT 11/12/12

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 599 -LDFEB- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			GROUND WTR (ft)
BORING NO. EB2-A	STATION 141+60	OFFSET 16 ft LT	ALIGNMENT -LDFEB-
COLLAR ELEV. 398.7 ft	TOTAL DEPTH 28.6 ft	NORTHING 807,554	EASTING 2,040,705
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		DRILL METHOD HSA 2-1/4"	HAMMER TYPE Automatic
DRILLER Tignor, D.	START DATE 08/28/12	COMP. DATE 08/28/12	SURFACE WATER DEPTH N/A

GROUND WTR (ft)	
0 HR.	Dry
24 HR.	18.0

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
400											
	398.7	0.0								398.7 GROUND SURFACE	0.0
			2	3	1	4		M		**TRIASSIC RESIDUAL** Light gray, silty fine SAND (A-2-4), with little clay	
395	395.2	3.5	4	11	26	37		D		396.2	2.5
										Dark brown, micaceous, fine sandy SILT (A-4)	
										392.7	6.0
390	390.2	8.5	14	19	41	60		D		Light gray, silty fine to coarse SAND (A-2-4), with little clay, saprolitic	
385	385.2	13.5	60/0.1			60/0.1				385.2	13.5
										NON-CRYSTALLINE ROCK Dark brown to light gray, TRIASSIC SILTSTONE	
380	380.2	18.5	60/0.1			60/0.1					
375	375.2	23.5	60/0.1			60/0.1					
	370.2	28.5	60/0.1			60/0.1				370.1	28.6
										Boring Terminated with Standard Penetration Test Refusal at Elevation 370.1 ft in Non-Crystalline Rock (TRIASSIC SILTSTONE)	

NOTES:

1) Driller indicates harder drilling at a depth of 6.0'.

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 599 -LDFEB- (East End Connector) over -Y15- (Angier Ave.) and NSRR between US 70 and NC 147			GROUND WTR (ft)
BORING NO. EB2-B	STATION 141+67	OFFSET 66 ft RT	ALIGNMENT -LDFEB-
COLLAR ELEV. 396.6 ft	TOTAL DEPTH 23.9 ft	NORTHING 807,614	EASTING 2,040,649
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 76% 12/15/2011		DRILL METHOD HSA 2-1/4"	HAMMER TYPE Automatic
DRILLER Tignor, D.	START DATE 08/28/12	COMP. DATE 08/28/12	SURFACE WATER DEPTH N/A

GROUND WTR (ft)	
0 HR.	Dry
24 HR.	17.6

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
400										
	396.6	0.0								396.6 GROUND SURFACE 0.0
			1	3	2	5		M		**TRIASSIC RESIDUAL** Brown tan, silty fine SAND (A-2-4)
395	393.1	3.5	3	5	7	12		M		394.1 2.5
										Tan to dark brown and gray, micaceous, silty, fine sandy CLAY (A-6)
390	388.1	8.5	25	44	56/0.1	100/0.6				387.6 9.0
										WEATHERED ROCK Tan and dark brown TRIASSIC SILTSTONE
385	383.1	13.5	60/0.1			60/0.1				383.1 13.5
										382.6 **NON-CRYSTALLINE ROCK** Dark brown TRIASSIC SILTSTONE 14.0
380	378.1	18.5	100/0.4			100/0.4				**WEATHERED ROCK** Gray TRIASSIC SANDSTONE
375	373.1	23.5	100/0.4			100/0.4				372.7 23.9
										Boring Terminated at Elevation 372.7 ft in Weathered Rock (TRIASSIC SANDSTONE)

NOTES:

1) Driller indicates harder drilling at a depth of 9.3'.

NCDOT BORE DOUBLE U0071_GEO_BRDG0599_GINTBORINGLOGS.GPJ NC_DOT.GDT 11/12/12

Photo 1: -DFLW- Boring B1-A looking North toward –LDFEB-

Photo 3: -LDFEB- Boring EB2-A looking East

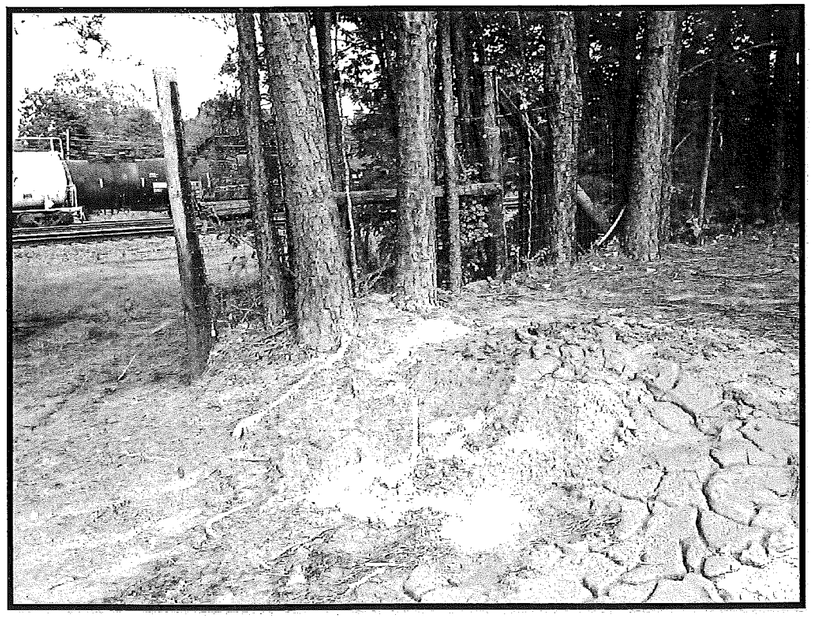


Photo 2: -LDFEB- Boring B2-B looking East

Photo 4: Diabase Rock outcropping near Boring EB1-A on –LDFEB- Alignment

HDR
ONE COMPANY | *Many Solutions*℠
Durham East End Connector Bridge Nos. 599 & 600 | U-0071 | Durham County

Site Photos

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1(U-0071)	1	13

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1(U-0071) F.A. PROJ. NHF-76-1(2)

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION STRUCTURE NO. 3 ON -Y7- (CARR ROAD) OVER EAST END CONNECTOR

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5-7	CROSS SECTIONS
8-12	BORE LOGS & CORE REPORT
13	CORE PHOTOGRAPH

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PERSONNEL

N.D. MOHS

SUMMIT

INVESTIGATED BY N.D. MOHS

CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE OCTOBER 2012

NORTH CAROLINA LICENSED SEAL 2124 GEOLOGIST NATHAN DANIEL MOHS

10/19/12

PROJECT: 34745.1.1

ID: U-0071

DRAWN BY: T.T. WALKER, N.D. MOHS

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

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PROJECT REFERENCE NO.	SHEET NO.
34745.1.1 (U-0071)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)								SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2					A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7					A-7-5 A-7-6			
SYMBOL															
% PASSING # 10	50 MX												GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
# 40	30 MX	50 MX	51 MN												
# 200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN		SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN				
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX				
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS					
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR					FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

ABBREVIATIONS

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

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

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

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

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

CORE SIZE:
- [ ] -B_____
- [X] -N 02
- [ ] -H_____

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS IN OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

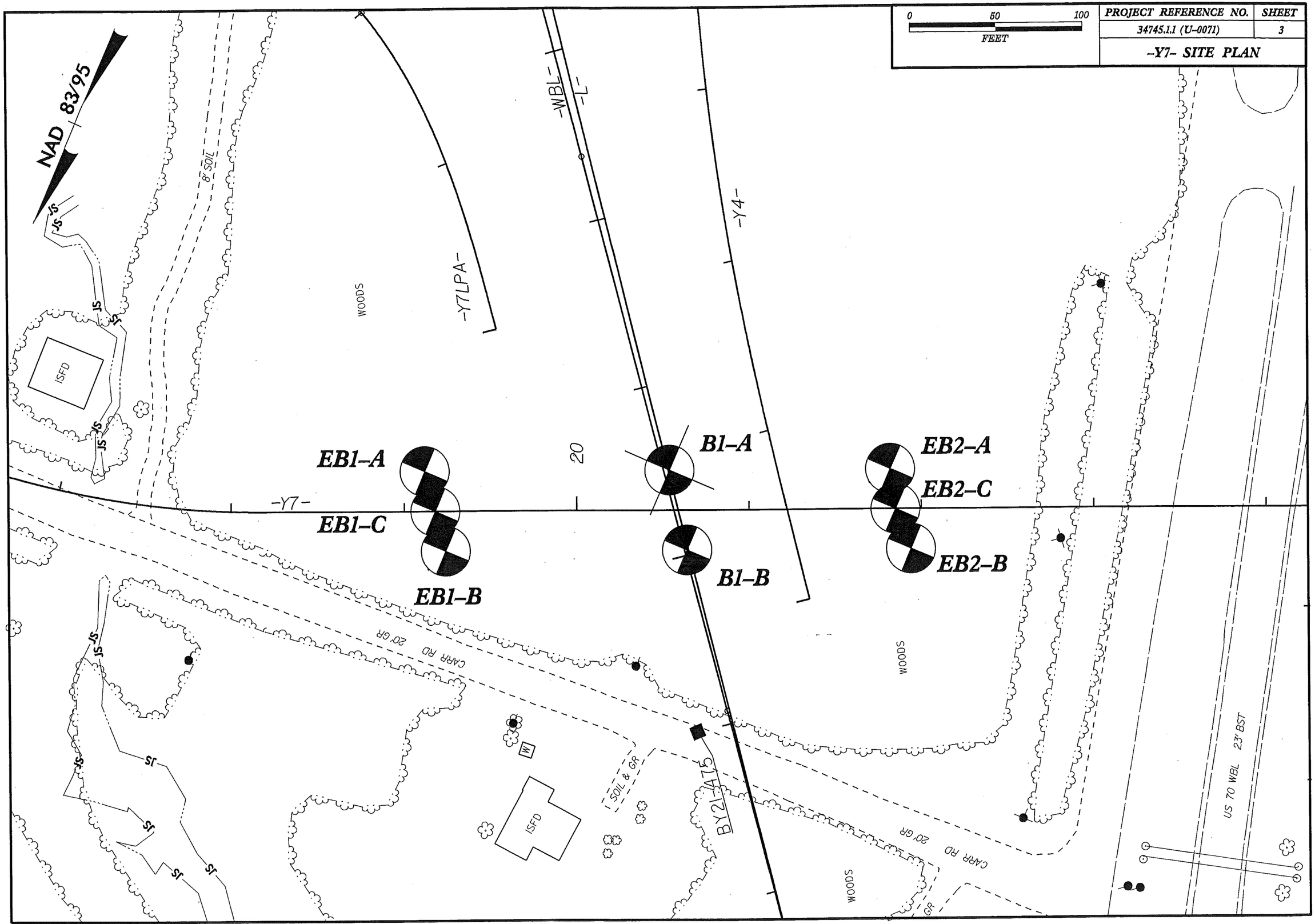
BENCH MARK: BY21-475, -BL- STATION 23+31.74

ELEVATION: 379.92 FT.

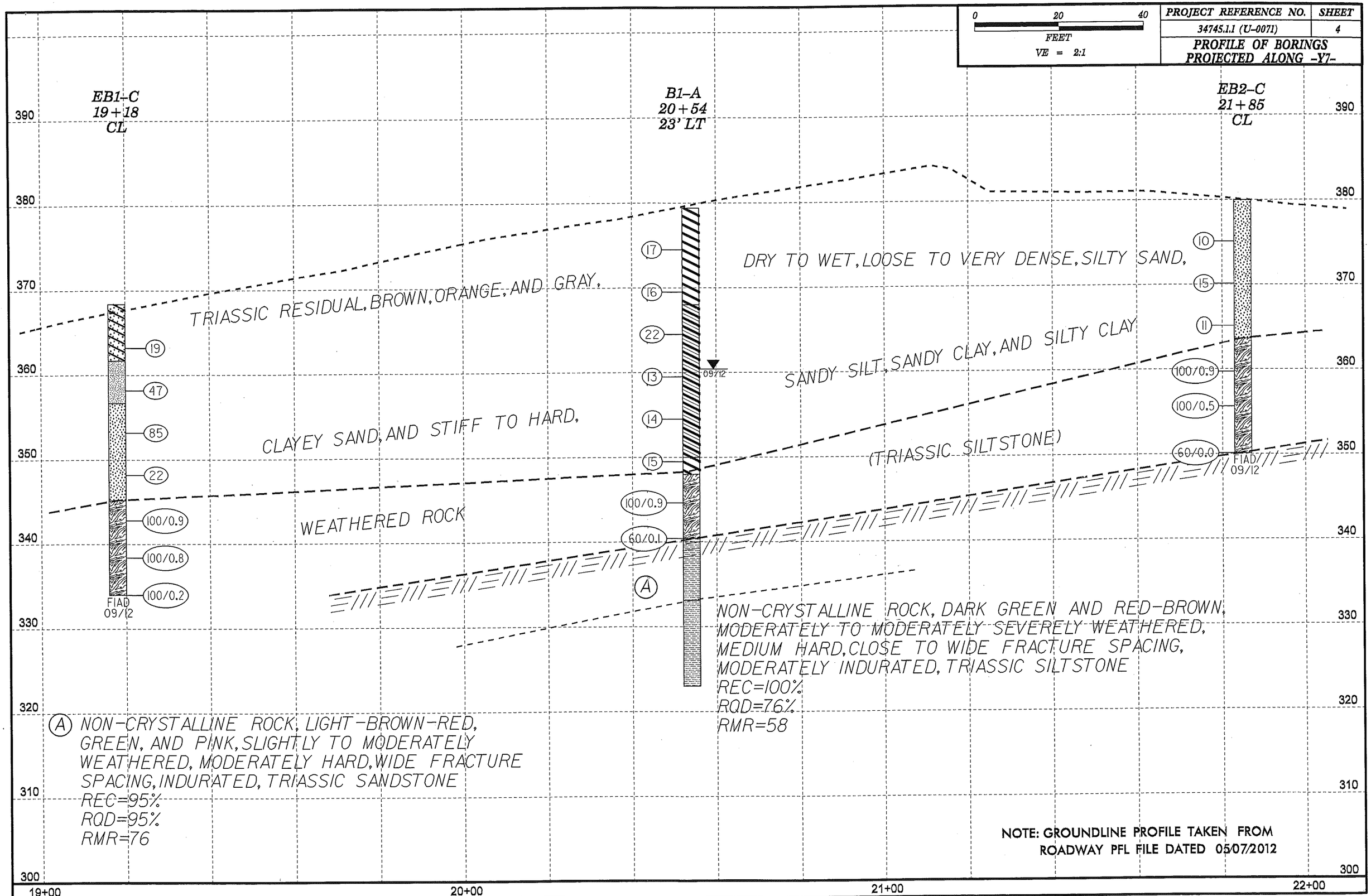
NOTES:

REVISED 09/23/09

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	3
-Y7- SITE PLAN	

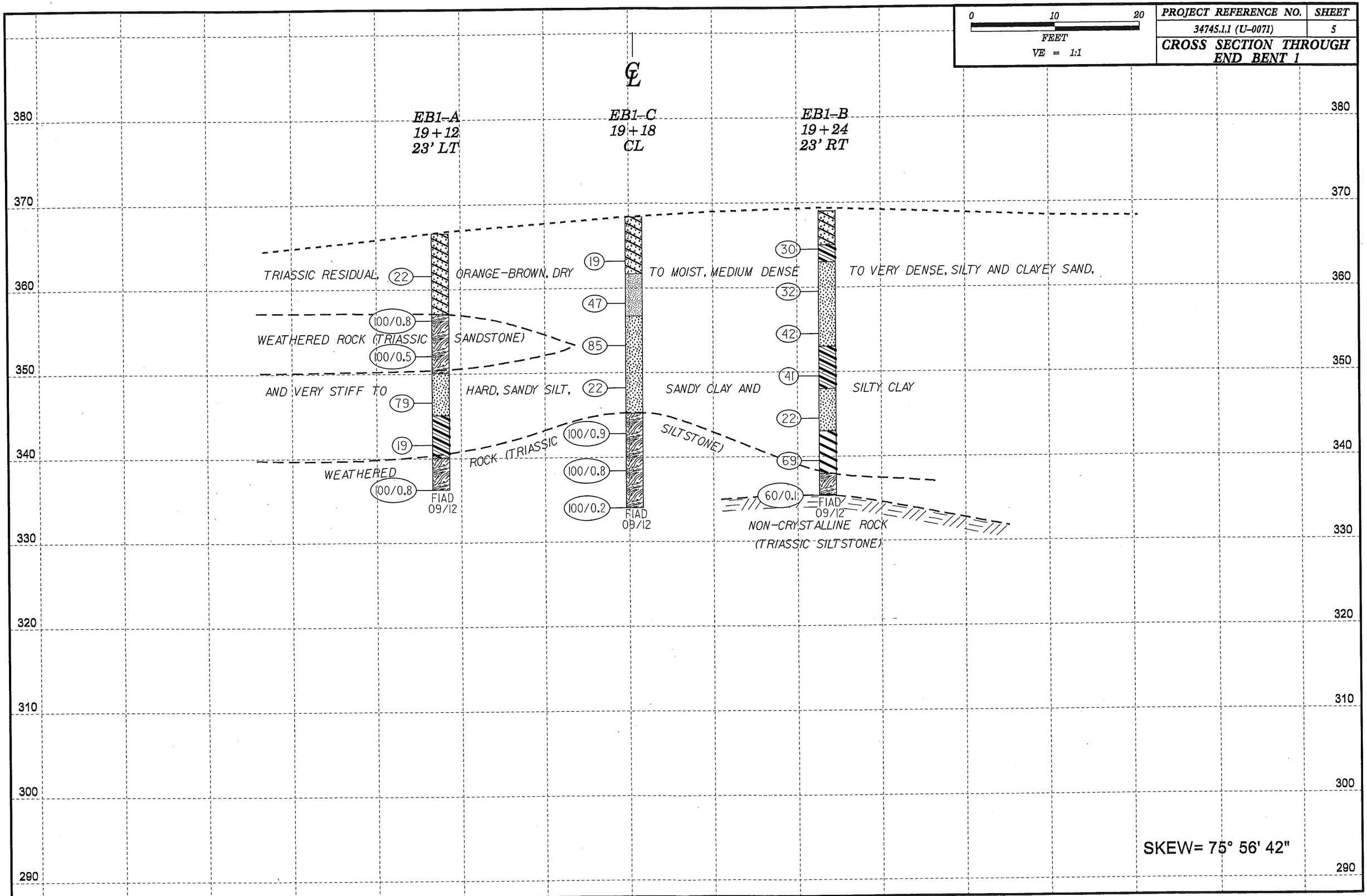


PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	4
PROFILE OF BORINGS PROJECTED ALONG -Y7-	

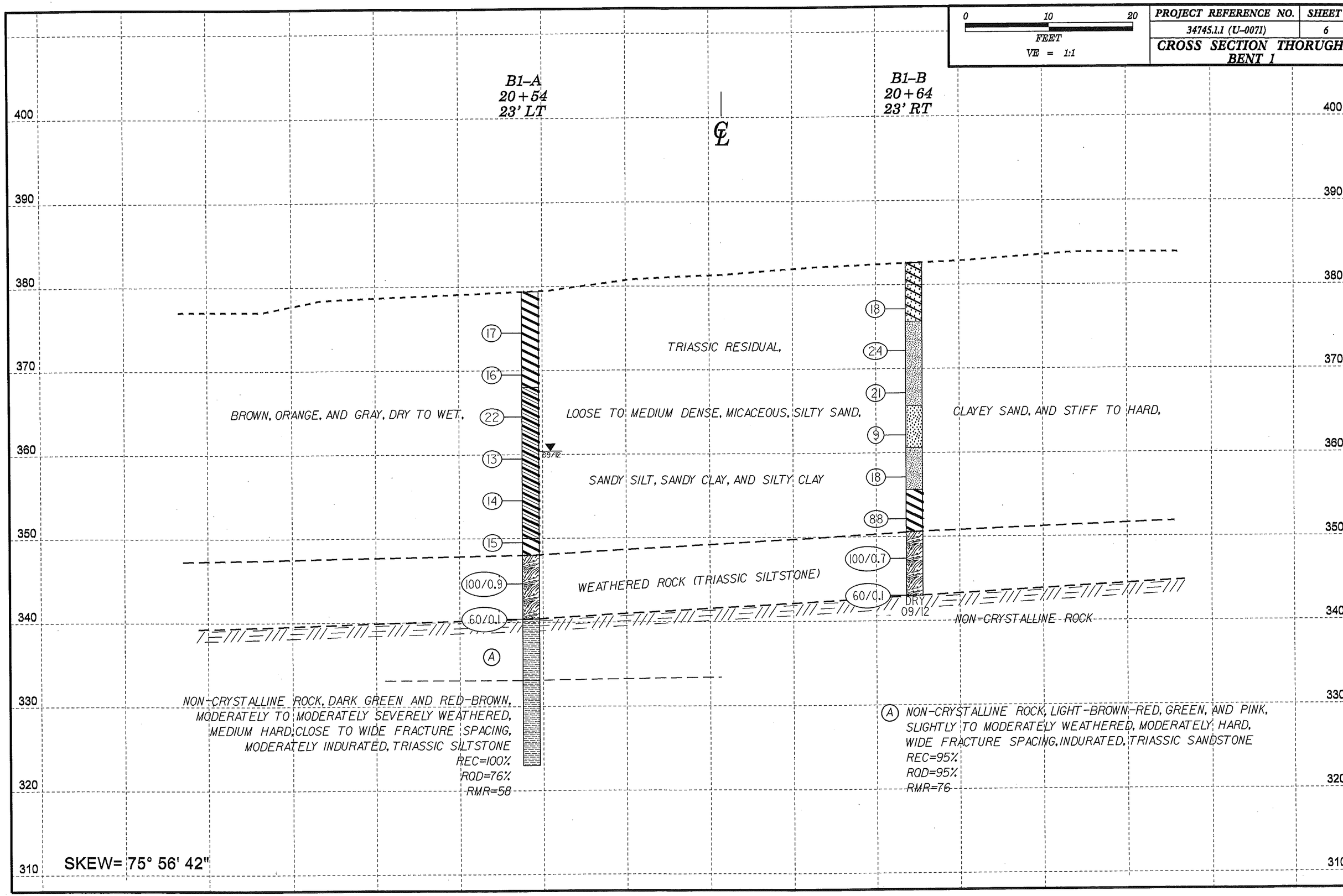


PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	5

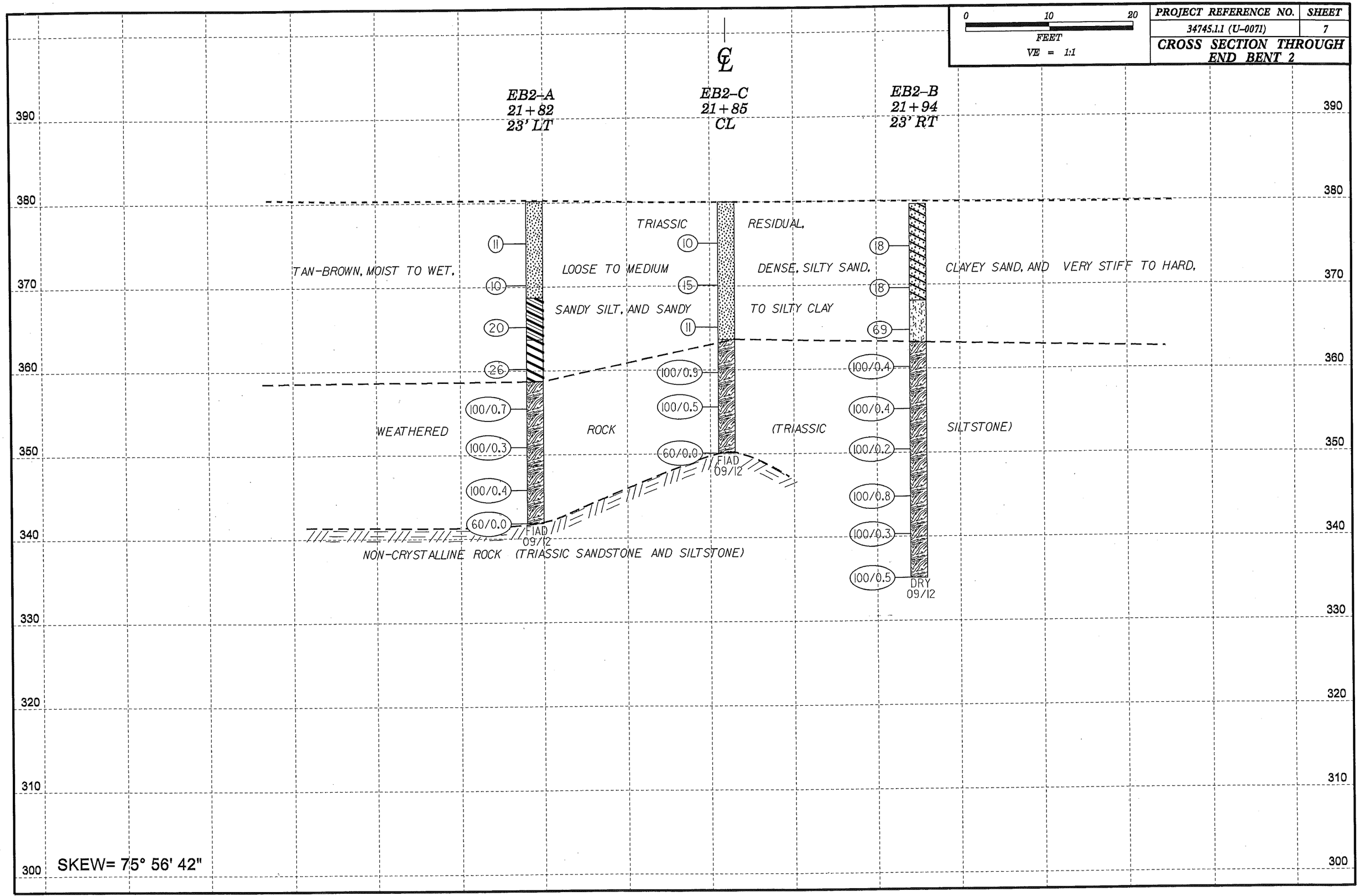
CROSS SECTION THROUGH END BENT 1



PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	6
CROSS SECTION THORUGH BENT 1	



PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	7
CROSS SECTION THROUGH END BENT 2	



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 3 ON -Y7- (CARR ROAD) OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. EB1-A	STATION 19+12	OFFSET 23 ft LT	ALIGNMENT -Y7- / 0 HR. Dry
COLLAR ELEV. 366.6 ft	TOTAL DEPTH 30.3 ft	NORTHING 812,062	EASTING 2,042,436 / 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/17/12	COMP. DATE 09/17/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
370											
										366.6 GROUND SURFACE	0.0
365										TRIASSIC RESIDUAL ORANGE-BROWN, CLAYEY SAND	
	362.6	4.0	6	9	13	22		D			
360											
	357.6	9.0	22	60	40/0.3	100/0.8				357.1 WEATHERED ROCK (TRIASSIC SANDSTONE)	9.5
355											
	352.6	14.0	100/0.5			100/0.5				350.1 TRIASSIC RESIDUAL TAN-BROWN, SILTY SAND	16.5
350											
	347.6	19.0	17	35	44	79		D			
345										345.1 RED-BROWN TO GREEN-GRAY, MICACEOUS, SANDY CLAY	21.5
	342.6	24.0	10	9	10	19		M			
340										340.1 WEATHERED ROCK (TRIASSIC SANDSTONE)	26.5
	337.6	29.0	25	49	51/0.3	100/0.8				336.3 Boring Terminated at Elevation 336.3 ft IN WEATHERED ROCK (TRIASSIC SILTSTONE)	30.3

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 3 ON -Y7- (CARR ROAD) OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. EB1-B	STATION 19+24	OFFSET 23 ft RT	ALIGNMENT -Y7- / 0 HR. Dry
COLLAR ELEV. 369.8 ft	TOTAL DEPTH 33.6 ft	NORTHING 812,099	EASTING 2,042,407 / 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/17/12	COMP. DATE 09/17/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
370										
										369.8 GROUND SURFACE 0.0
										TRIASSIC RESIDUAL ORANGE-BROWN, CLAYEY SAND
365	366.3	3.5	11	15	15	30		D		365.8 RED-BROWN AND GRAY, MICACEOUS, SANDY CLAY 4.0
360	361.3	8.5	17	17	15	32		D		363.8 ORANGE-BROWN, SILTY SAND WITH SOME MICA 6.0
355	356.3	13.5	16	19	23	42		D		353.8 BROWN AND GRAY, MICACEOUS, SANDY CLAY 16.0
350	351.3	18.5	13	22	19	41		M		348.8 BROWN, MICACEOUS, SILTY SAND 21.0
345	346.3	23.5	6	8	14	22		W		343.8 BROWN AND GRAY, SILTY CLAY 26.0
340	341.3	28.5	15	28	41	69		W		338.8 WEATHERED ROCK (TRIASSIC SILTSTONE) 31.0
	336.3	33.5	60/0.1			60/0.1				336.3 NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE) 33.5
										336.2 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 336.2 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE) 33.6

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 3 ON -Y7- (CARR ROAD) OVER EAST END CONNECTOR			**GROUND WTR (ft)**
BORING NO. EB1-C	**STATION** 19+18	**OFFSET** CL	**ALIGNMENT** -Y7- — **0 HR.** Dry
COLLAR ELEV. 368.4 ft	**TOTAL DEPTH** 34.4 ft	**NORTHING** 812,081	**EASTING** 2,042,422 — **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 10/09/12	**COMP. DATE** 10/09/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
370										368.4 GROUND SURFACE	0.0
365	364.2	4.2	8	10	9	19		M		**TRIASSIC RESIDUAL** ORANGE-BROWN, CLAYEY SAND WITH SOME MICA	361.7 / 6.7
360	359.2	9.2	16	21	26	47		M		LIGHT BROWN, SANDY SILT WITH MICA	356.7 / 11.7
355	354.2	14.2	12	33	52	85		M		LIGHT BROWN TO ORANGE-BROWN, SILTY SAND WITH MICA	345.2 / 23.2
350	349.2	19.2	7	9	13	22		M			
345	344.2	24.2	29	50	50/0.4	100/0.9				**WEATHERED ROCK** (TRIASSIC SILTSTONE)	334.0 / 34.4
340	339.2	29.2	64	36/0.3		100/0.8					
335	334.2	34.2	100/0.2			100/0.2				Boring Terminated at Elevation 334.0 ft IN WEATHERED ROCK (TRIASSIC SILTSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 3 ON -Y7- (CARR ROAD) OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. B1-A	STATION 20+54	OFFSET 23 ft LT	ALIGNMENT -Y7- — 0 HR. N/A
COLLAR ELEV. 379.4 ft	TOTAL DEPTH 56.4 ft	NORTHING 812,005	EASTING 2,042,306 — 24 HR. 19.0
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD NW Casing w/ Core	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/13/12	COMP. DATE 09/14/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
380										379.4 GROUND SURFACE	0.0
375	375.5	3.9	6	8	9	17		M		**TRIASSIC RESIDUAL** RED-ORANGE AND GRAY, SILTY CLAY	
370	370.5	8.9	4	7	9	16		M		368.0 ORANGE AND BROWN, SANDY CLAY	11.4
365	365.5	13.9	7	10	12	22		M			
360	360.5	18.9	4	6	7	13		W			
355	355.5	23.9	5	7	7	14		W			
350	350.5	28.9	3	5	10	15		M		350.0 DARK RED-BROWN AND GRAY, SILTY CLAY	29.4
345	345.5	33.9	39	61/0.4		100/0.9				348.0 **WEATHERED ROCK** (TRIASSIC SILTSTONE)	31.4
340	340.5	38.9	60/0.1			60/0.1	RS-1			340.5 **NON-CRYSTALLINE ROCK** LIGHT-BROWN-RED, GREEN, AND LIGHT PINK, SLIGHTLY TO MODERATELY WEATHERED, MODERATELY HARD, WIDE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=95% RQD=95% RMR=76	38.9
335										333.1 RED-BROWN AND DARK GREEN, SLIGHTLY TO MODERATELY SEVERELY WEATHERED, MEDIUM HARD, CLOSE TO WIDE FRACTURE SPACING, MODERATELY INDURATED, TRIASSIC SILTSTONE REC=100% RQD=76% RMR=58	46.3
330										323.0 Boring Terminated at Elevation 323.0 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	56.4
325											

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 3 ON -Y7- (CARR ROAD) OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. B1-A	STATION 20+54	OFFSET 23 ft LT	ALIGNMENT -Y7- — 0 HR. N/A
COLLAR ELEV. 379.4 ft	TOTAL DEPTH 56.4 ft	NORTHING 812,005	EASTING 2,042,306 — 24 HR. 19.0
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD NW Casing w/ Core	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/13/12	COMP. DATE 09/14/12	SURFACE WATER DEPTH N/A
CORE SIZE NQ2	TOTAL RUN 17.4 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
340.4											Begin Coring @ 39.0 ft	
	340.4	39.0	2.4	1:30/1.0 1:32/1.0	(2.4) 100%	(2.4) 100%					**NON-CRYSTALLINE ROCK** LIGHT-BROWN-RED, GREEN, AND LIGHT PINK, SLIGHTLY TO MODERATELY WEATHERED, MODERATELY HARD, WIDE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=95% RQD=95% RMR=76 *(continued)*	
	338.0	41.4	5.0	0:35/0.4 1:57/1.0 1:45/1.0 1:56/1.0 2:10/1.0 2:30/1.0	(4.6) 92%	(4.5) 90%	RS-1					
	333.0	46.4	5.0	3:00/1.0 2:07/1.0 2:13/1.0 2:56/1.0 7:38/1.0	(5.0) 100%	(4.4) 88%		(10.1) 100%	(7.7) 76%		333.1 RED-BROWN AND DARK GREEN, SLIGHTLY TO MODERATELY SEVERELY WEATHERED, MEDIUM HARD, CLOSE TO WIDE FRACTURE SPACING, MODERATELY INDURATED, TRIASSIC SILTSTONE REC=100% RQD=76% RMR=58	46.3
	328.0	51.4	5.0	4:16/1.0 2:31/1.0 2:34/1.0 2:07/1.0 2:22/1.0	(5.0) 100%	(3.3) 66%						
	323.0	56.4									323.0 Boring Terminated at Elevation 323.0 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	56.4

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 3 ON -Y7- (CARR ROAD) OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. B1-B	STATION 20+64	OFFSET 23 ft RT	ALIGNMENT -Y7- — 0 HR. Dry
COLLAR ELEV. 382.6 ft	TOTAL DEPTH 39.6 ft	NORTHING 812,044	EASTING 2,042,278 — 24 HR. Dry
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/14/12	COMP. DATE 09/14/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
385											
										382.6 GROUND SURFACE	0.0
380										TRIASSIC RESIDUAL TAN-BROWN, CLAYEY SAND WITH TRACE MICA	
	378.1	4.5	5	8	10	18		D		375.6	7.0
375										LIGHT GRAY, MICACEOUS, SANDY SILT	
	373.1	9.5	8	11	13	24		M			
370											
	368.1	14.5	6	8	13	21		M		365.6	17.0
365										LIGHT GRAY, MICACEOUS SILT SAND	
	363.1	19.5	4	3	6	9		M		360.6	22.0
360										GRAY, MICACEOUS, SANDY SILT	
	358.1	24.5	7	7	11	18		W		355.6	27.0
355										GRAY AND RED-BROWN, MICACEOUS, SILTY CLAY	
	353.1	29.5	18	30	58	88		M		350.6	32.0
350										WEATHERED ROCK (TRIASSIC SILTSTONE)	
	348.1	34.5	60	40/0.2		100/0.7					
345											
	343.1	39.5	60/0.1			60/0.1				343.0	39.6
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 343.0 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 3 ON -Y7- (CARR ROAD) OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. EB2-A	STATION 21+82	OFFSET 23 ft LT	ALIGNMENT -Y7- — 0 HR. Dry
COLLAR ELEV. 380.2 ft	TOTAL DEPTH 38.4 ft	NORTHING 811,955	EASTING 2,042,188 — 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/12/12	COMP. DATE 09/13/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
385										
380										380.2 GROUND SURFACE 0.0
										TRIASSIC RESIDUAL LIGHT TAN-BROWN, SILTY SAND WITH SOME MICA
	376.2	4.0	5	5	6	11		M		
375										
	371.2	9.0	4	5	5	10		M		368.7 11.5
370										BROWN, MICACEOUS, SANDY CLAY
	366.2	14.0	4	8	12	20		W		363.7 16.5
365										BROWN AND GRAY, MICACEOUS, SILTY CLAY
	361.2	19.0	7	9	17	26		W		358.7 21.5
360										WEATHERED ROCK (TRIASSIC SILTSTONE)
	356.2	24.0	66	34/0.2		100/0.7				
355										
	351.2	29.0	100/0.3			100/0.3				348.7 31.5
350										(TRIASSIC SILTSTONE)
	346.2	34.0	100/0.4			100/0.4				
345										
	341.8	38.4	60/0.0			60/0.0				341.8 38.4
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 341.8 ft ON NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 3 ON -Y7- (CARR ROAD) OVER EAST END CONNECTOR			**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 21+94	**OFFSET** 23 ft RT	**ALIGNMENT** -Y7- — **0 HR.** 41.5
COLLAR ELEV. 379.6 ft	**TOTAL DEPTH** 44.5 ft	**NORTHING** 811,992	**EASTING** 2,042,159 — **24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 09/12/12	**COMP. DATE** 09/12/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
380										379.6 GROUND SURFACE	0.0
375	375.6	4.0	5	8	10	18		M		TRIASSIC RESIDUAL LIGHT BROWN, MICACEOUS, CLAYEY SAND	
370	370.6	9.0	8	9	9	18		M			
365	365.6	14.0	10	20	49	69		M		368.1 BROWN, MICACEOUS, CLAYEY SILT	11.5
360	360.6	19.0	100/0.4			100/0.4				363.1 WEATHERED ROCK (TRIASSIC SILTSTONE)	16.5
355	355.6	24.0	100/0.4			100/0.4					
350	350.6	29.0	100/0.2			100/0.2					
345	345.6	34.0	50	50/0.3		100/0.8					
340	340.6	39.0	100/0.3			100/0.3					
	335.6	44.0	100/0.5			100/0.5				335.1 Boring Terminated at Elevation 335.1 ft IN WEATHERED ROCK (TRIASSIC SILTSTONE)	44.5

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 3 ON -Y7- (CARR ROAD) OVER EAST END CONNECTOR			**GROUND WTR (ft)**
BORING NO. EB2-C	**STATION** 21+85	**OFFSET** CL	**ALIGNMENT** -Y7- — **0 HR.** Dry
COLLAR ELEV. 380.0 ft	**TOTAL DEPTH** 29.9 ft	**NORTHING** 811,975	**EASTING** 2,042,177 — **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 10/09/12	**COMP. DATE** 10/09/12	**SURFACE WATER DEPTH** N/A

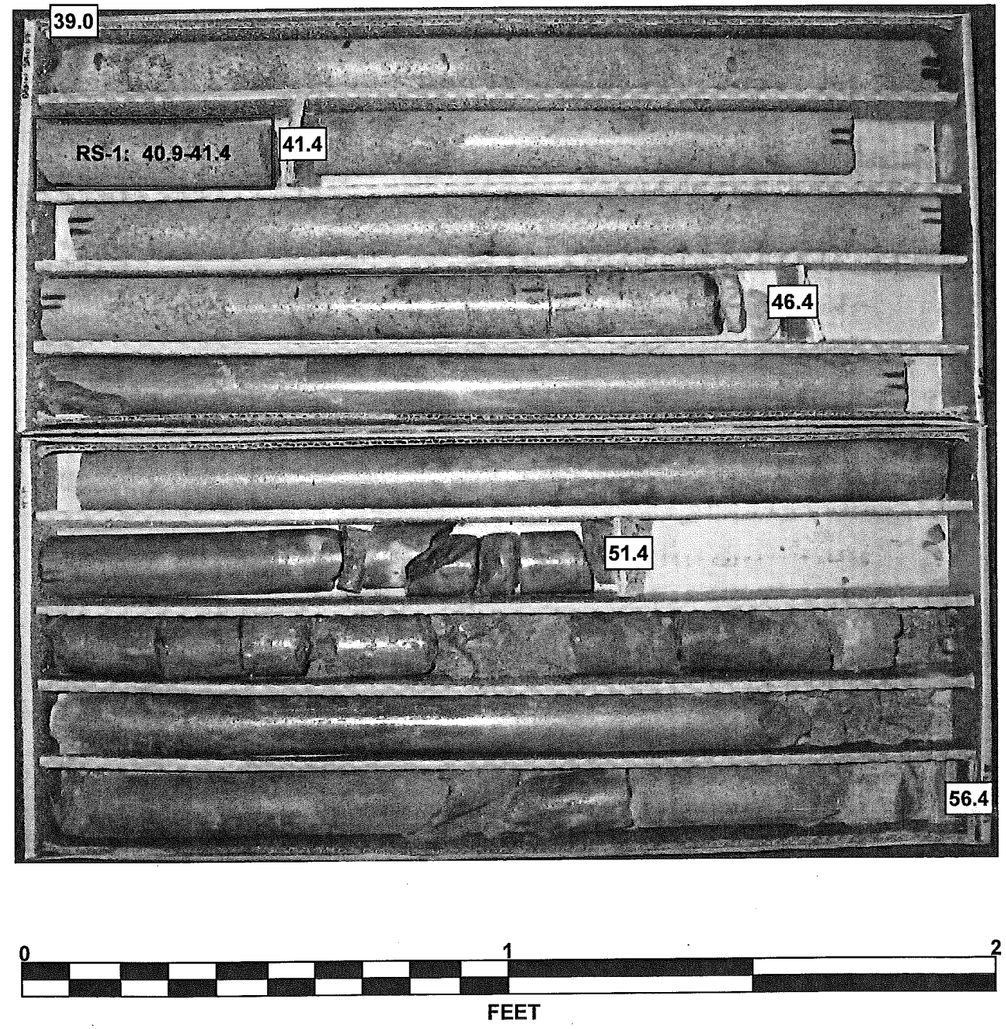
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
380										380.0 GROUND SURFACE 0.0
375	376.1	3.9	6	6	4	10		M		TRIASSIC RESIDUAL LIGHT TAN-BROWN AND WHITE, MICACEOUS, SILTY SAND
370	371.1	8.9	7	8	7	15		M		
365	366.1	13.9	7	5	6	11		M		363.6 16.4
360	361.1	18.9	14	26	74/0.4	100/0.9				WEATHERED ROCK (TRIASSIC SILTSTONE)
355	356.1	23.9	75	25/0.0		100/0.5				
	351.1	28.9	27	35	60/0.0	60/0.0				350.1 29.9 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 350.1 ft ON NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)

NCDOT BORE DOUBLE U0071_GEO_BH_Y7.GPJ NC_DOT.GDT 10/17/12

CORE PHOTOGRAPH

B1-A

BOXES 1 & 2: 39.0-56.4 FEET



STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1 (U-0071)	1	9

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1 (U-0071) F.A. PROJ. NHF-76-1(2)

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION STRUCTURE NO. 4 ON -Y4- OVER EAST END CONNECTOR

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5, 6	CROSS SECTIONS
7-9	BORE LOGS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

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

PERSONNEL

N.D. MOHS

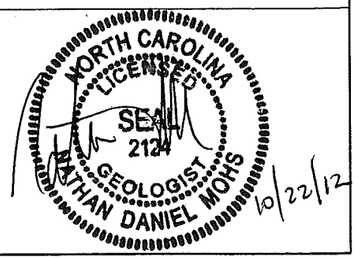
SUMMIT

INVESTIGATED BY N.D. MOHS

CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE OCTOBER 2012



PROJECT: 34745.1.1

ID: U-0071

DRAWN BY: W.D. FIELDS, N.D. MOHS

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

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PROJECT REFERENCE NO.	SHEET NO.
34745.1.1 (U-0071)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING # 10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
# 40	30 MX	50 MX	51 MN											
# 200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				18 MX	18 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.75	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 | 76 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO PODRLY 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
- 25/026 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT / DPT DMT / VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

ABBREVIATIONS

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

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [X] CME-450
- [ ] _____

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

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

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

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (REC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

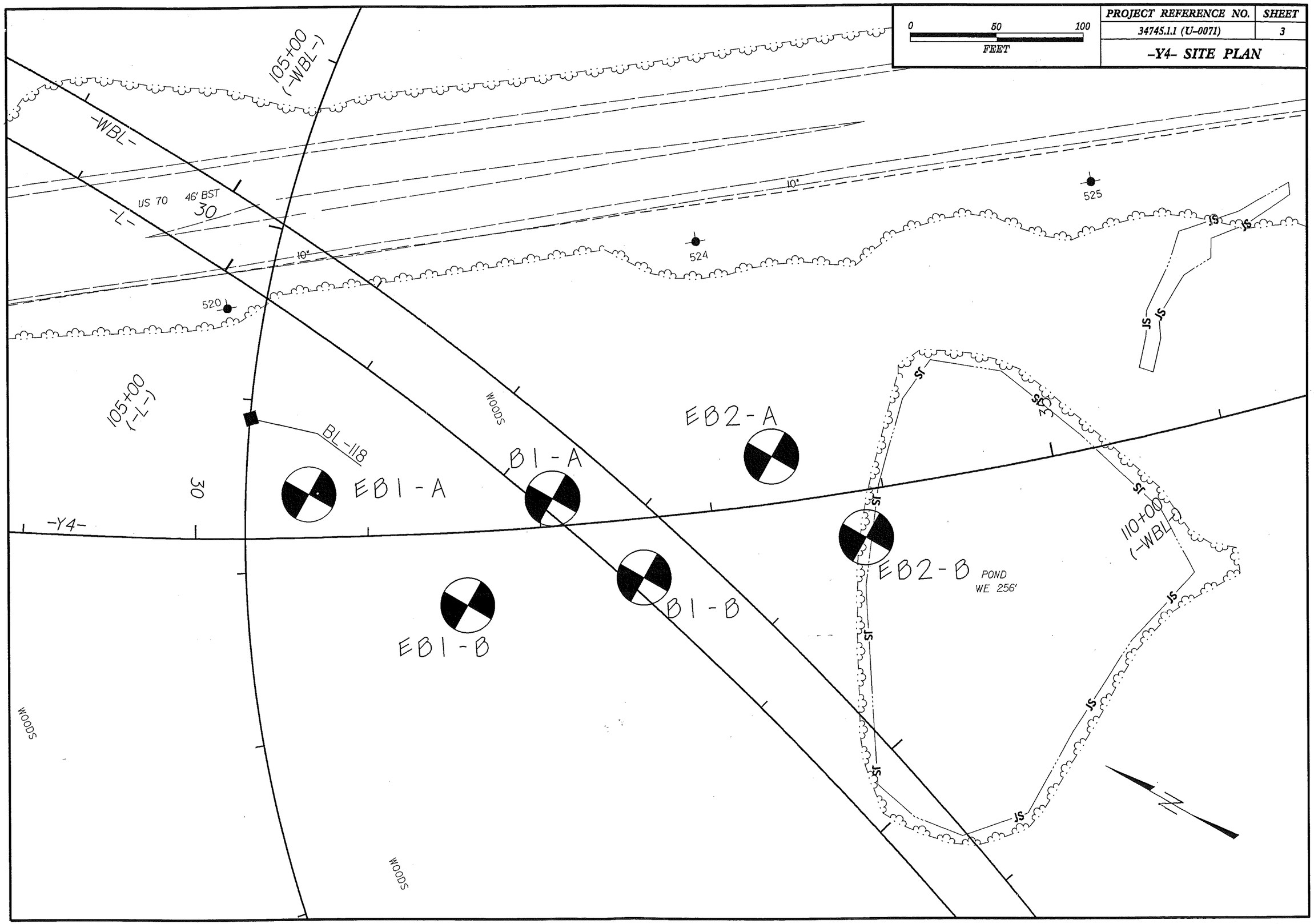
TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BL-118: -BL- STATION 105+29.98

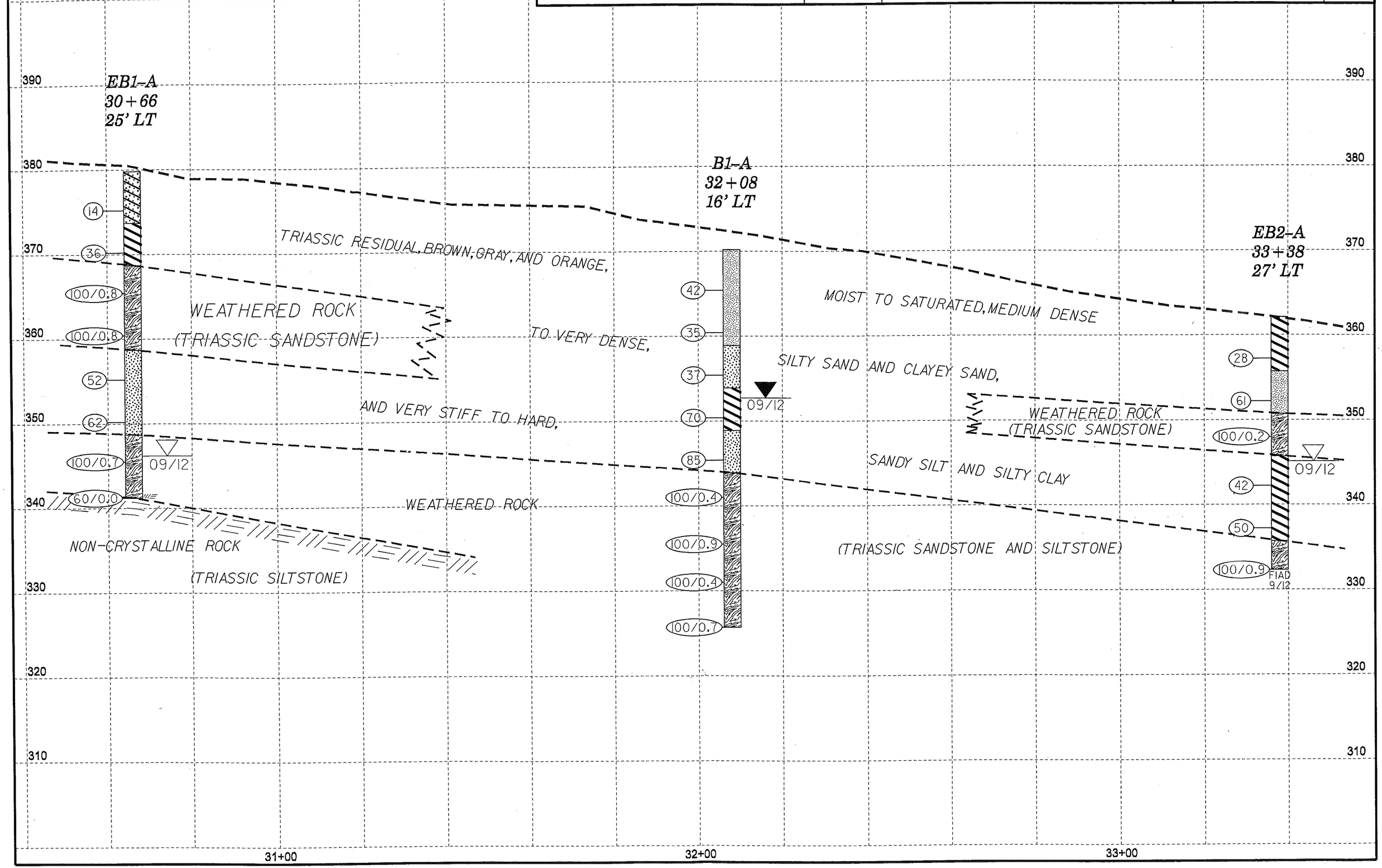
ELEVATION: 378.68 FT.

NOTES:

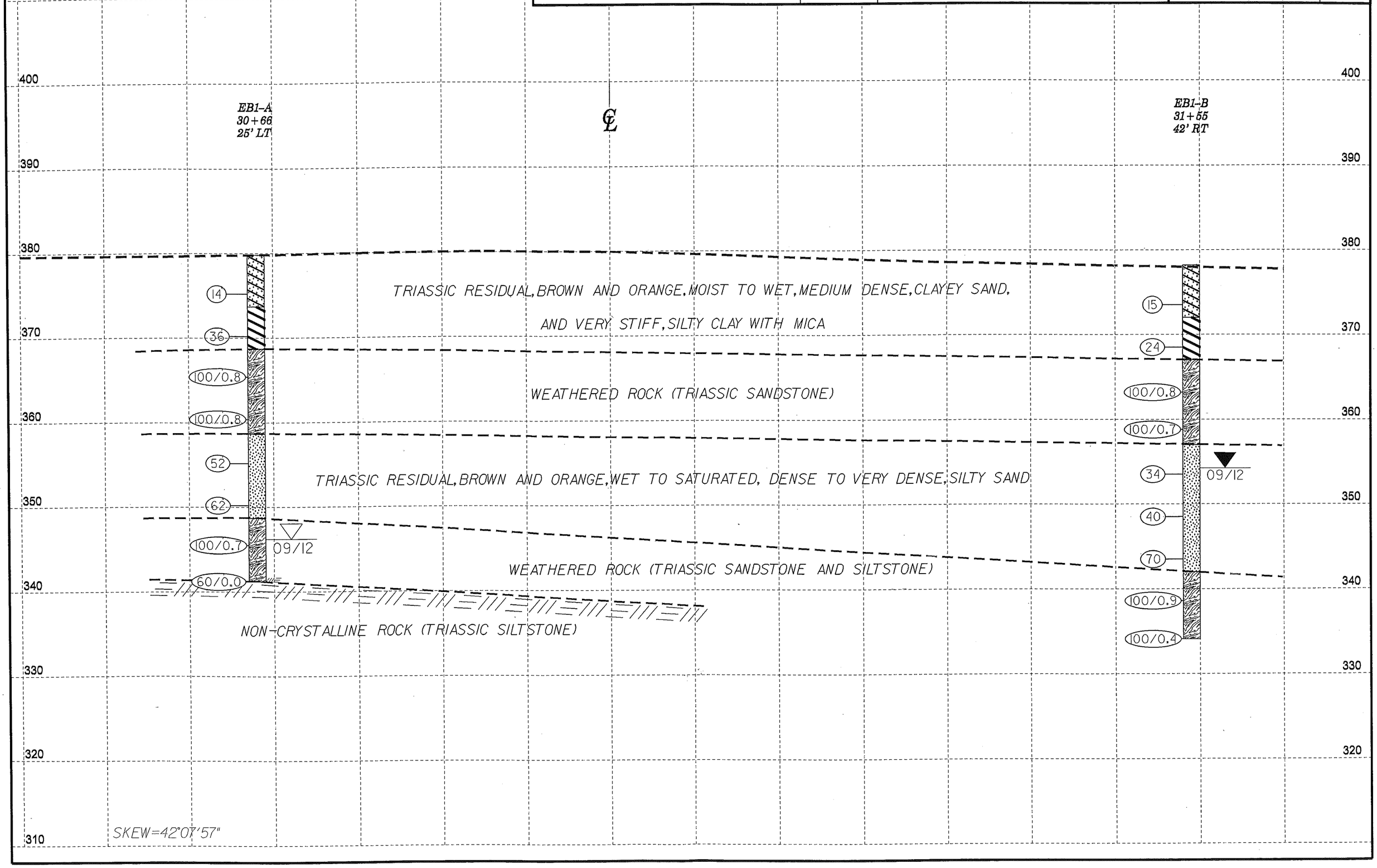
PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	3
-Y4- SITE PLAN	

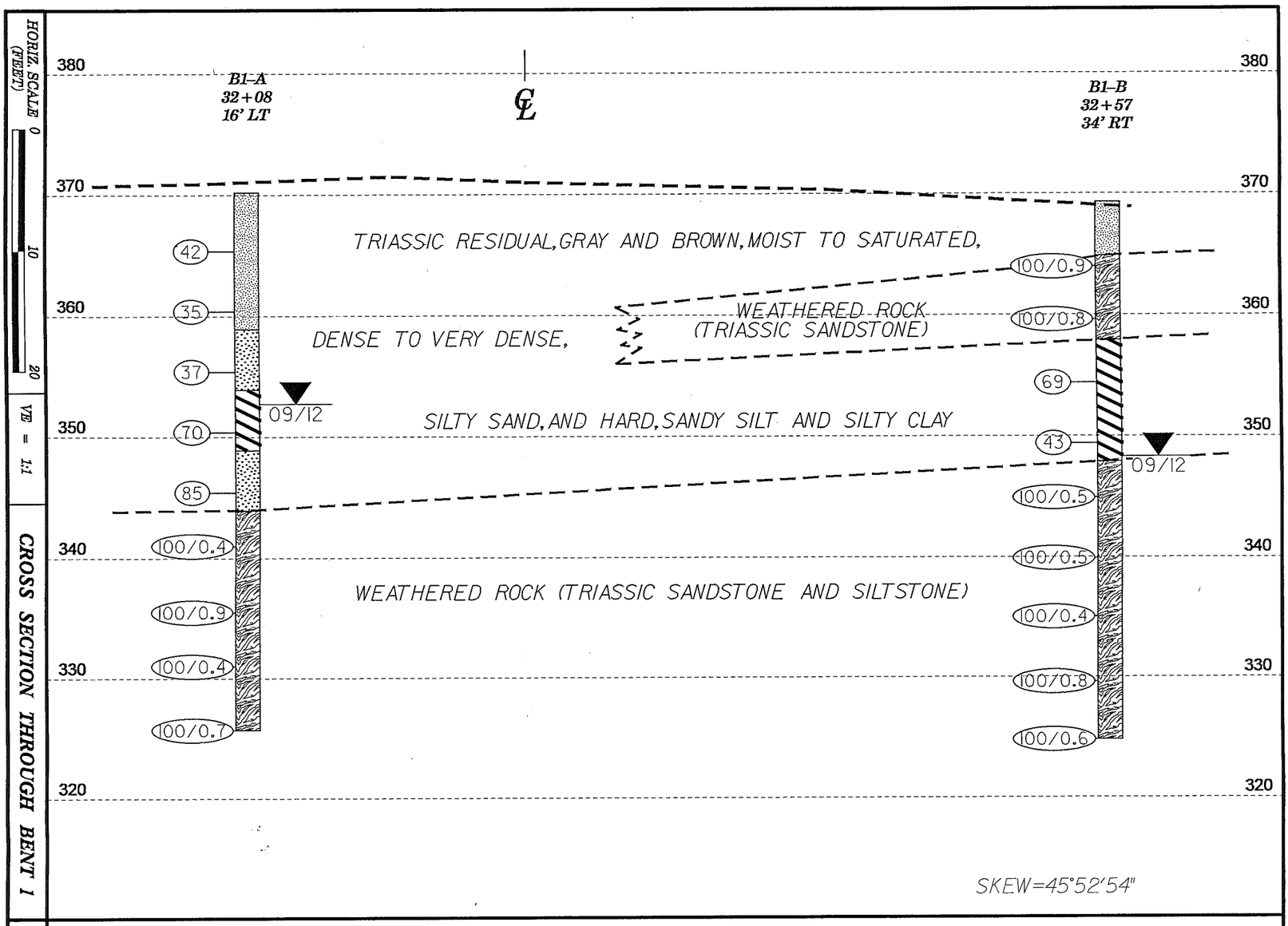


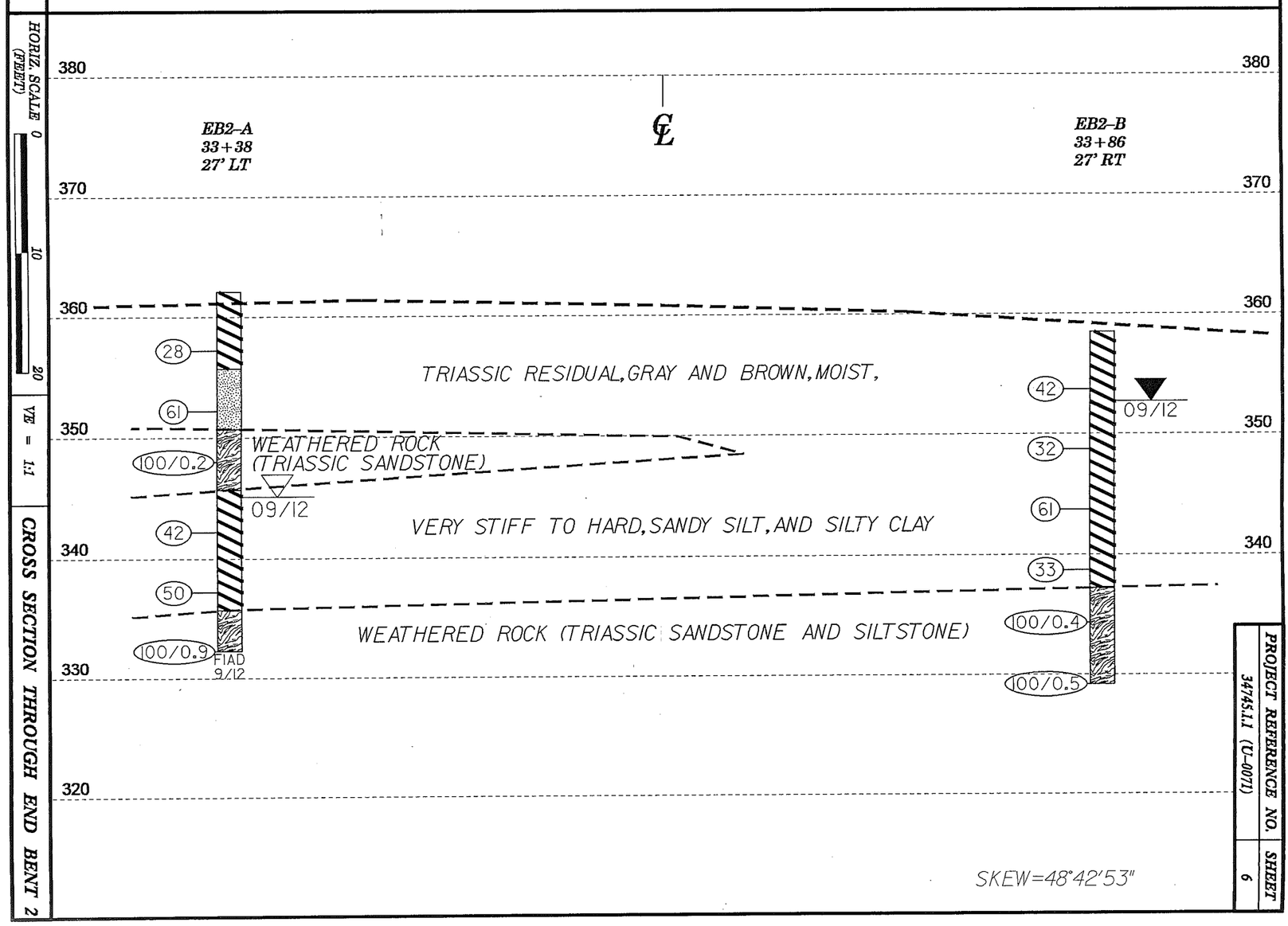
HORIZ. SCALE (FEET) 0 20 40	VE = 2:1	PROFILE OF BORINGS ALONG -Y4-	PROJECT REFERENCE NO. 34745.1.1 (U-0071)	SHEET 4



HORIZ. SCALE (FEET) 0 10 20	VE = 1:1	CROSS SECTION THROUGH END BENT 1	PROJECT REFERENCE NO.	SHEET
			34745.1.1 (U-0071)	5







PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	6

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist	
SITE DESCRIPTION STRUCTURE NO. 4 ON -Y4- OVER EAST END CONNECTOR				GROUND WTR (ft)
BORING NO. EB1-A	STATION 30+66	OFFSET 25 ft LT	ALIGNMENT -Y4-	0 HR. 33.6
COLLAR ELEV. 379.8 ft	TOTAL DEPTH 38.6 ft	NORTHING 810,135	EASTING 2,042,915	24 HR. N/A
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Contract Driller	START DATE 09/20/12	COMP. DATE 09/20/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
380										379.8 GROUND SURFACE	0.0
										TRIASSIC RESIDUAL BROWN TO ORANGE-BROWN, MICACEOUS, CLAYEY SAND	
375	376.2	3.6	4	6	8	14		W		373.7	6.1
										BROWN AND GRAY, SILTY CLAY	
370	371.2	8.6	8	14	22	36		W		368.7	11.1
										WEATHERED ROCK (TRIASSIC SANDSTONE)	
365	366.2	13.6	15	85/0.3		100/0.8					
360	361.2	18.6	40	60/0.3		100/0.6				358.7	21.1
										TRIASSIC RESIDUAL LIGHT BROWN TO TAN-BROWN, SILTY SAND WITH SOME MICA	
355	356.2	23.6	15	24	28	52		W			
350	351.2	28.6	45	30	32	62		W		348.7	31.1
										WEATHERED ROCK (TRIASSIC SILTSTONE)	
345	346.2	33.6	42	58/0.2		100/0.7					
	341.2	38.6	60/0.0			60/0.0				341.2	38.6
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 341.2 ft ON NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist	
SITE DESCRIPTION STRUCTURE NO. 4 ON -Y4- OVER EAST END CONNECTOR				GROUND WTR (ft)
BORING NO. EB1-B	STATION 31+55	OFFSET 42 ft RT	ALIGNMENT -Y4-	0 HR. 25.0
COLLAR ELEV. 378.2 ft	TOTAL DEPTH 44.1 ft	NORTHING 810,024	EASTING 2,042,904	24 HR. 24.0
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Contract Driller	START DATE 09/26/12	COMP. DATE 09/26/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
380										378.2 GROUND SURFACE 0.0
										TRIASSIC RESIDUAL ORANGE-BROWN, CLAYEY SAND WITH SOME MICA
375	374.5	3.7	6	7	8	15		M		372.0 6.2
										BROWN AND GRAY, SILTY CLAY WITH TRACE FINE SAND AND MICA
370	369.5	8.7	9	11	13	24		M		367.0 11.2
										WEATHERED ROCK (TRIASSIC SANDSTONE)
365	364.5	13.7	16	40	60/0.3	100/0.8				
360	359.5	18.7	39	61/0.2		100/0.7				357.0 21.2
										TRIASSIC RESIDUAL TAN, BROWN AND ORANGE, SILTY SAND WITH SOME MICA
355	354.5	23.7	11	13	21	34		Sat.		
350	349.5	28.7	17	19	21	40		Sat.		
345	344.5	33.7	13	27	43	70		Sat.		342.0 36.2
										WEATHERED ROCK (TRIASSIC SANDSTONE)
340	339.5	38.7	37	63/0.4		100/0.9				
335	334.5	43.7	100/0.4			100/0.4				334.1 44.1
										Boring Terminated at Elevation 334.1 ft IN WEATHERED ROCK (TRIASSIC SANDSTONE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist	
SITE DESCRIPTION STRUCTURE NO. 4 ON -Y4- OVER EAST END CONNECTOR				GROUND WTR (ft)
BORING NO. B1-A	STATION 32+08	OFFSET 16 ft LT	ALIGNMENT -Y4-	0 HR. 19.0
COLLAR ELEV. 370.2 ft	TOTAL DEPTH 44.5 ft	NORTHING 810,012	EASTING 2,042,982	24 HR. 17.5
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Contract Driller	START DATE 09/26/12	COMP. DATE 09/26/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
370.2										GROUND SURFACE	0.0
	366.4	3.8	10	15	27	42		M		TRIASSIC RESIDUAL LIGHT GRAY, SANDY SILT WITH SOME MICA	
	361.4	8.8	6	15	20	35		M			
358.9											11.3
	356.4	13.8	11	15	22	37		M		LIGHT GRAY TO LIGHT BROWN, SILTY SAND WITH MICA	
353.9											16.3
	351.4	18.8	19	30	40	70		M		GRAY AND BROWN, SILTY CLAY WITH TRACE SAND AND MICA	
348.9											21.3
	346.4	23.8	22	38	47	85		Sat.		LIGHT GRAY TO LIGHT BROWN, SILTY SAND WITH MICA AND TRACE CLAY	
343.9											26.3
	341.4	28.8	100/0.4			100/0.4				WEATHERED ROCK (TRIASSIC SANDSTONE)	
	336.4	33.8	47	53/0.4		100/0.9					
	331.4	38.8	100/0.4			100/0.4					
325.7											44.5
	326.4	43.8	65	35/0.2		100/0.7				Boring Terminated at Elevation 325.7 ft IN WEATHERED ROCK (TRIASSIC SANDSTONE)	

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist	
SITE DESCRIPTION STRUCTURE NO. 4 ON -Y4- OVER EAST END CONNECTOR				GROUND WTR (ft)
BORING NO. B1-B	STATION 32+57	OFFSET 34 ft RT	ALIGNMENT -Y4-	0 HR. 20.0
COLLAR ELEV. 369.3 ft	TOTAL DEPTH 44.5 ft	NORTHING 809,943	EASTING 2,042,969	24 HR. 21.0
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Contract Driller	START DATE 09/27/12	COMP. DATE 09/27/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
369.3										GROUND SURFACE	0.0
	365.4	3.9	22	50	50/0.4					TRIASSIC RESIDUAL LIGHT GRAY, SANDY SILT	
364.9											4.4
	360.4	8.9	27	73/0.3		100/0.9				WEATHERED ROCK (TRIASSIC SANDSTONE)	
	355.4	13.9	21	27	42	100/0.8					
357.9											11.4
	350.4	18.9	10	19	24	69		M		TRIASSIC RESIDUAL BROWN AND GRAY, SILTY CLAY WITH SOME SAND AND MICA	
	345.4	23.9	100/0.5			43		M			
347.9											21.4
	340.4	28.9	90	10/0.0		100/0.5				WEATHERED ROCK (TRIASSIC SANDSTONE AND SILTSTONE)	
	335.4	33.9	100/0.4			100/0.5					
	330.4	38.9	43	57/0.3		100/0.4					
	325.4	43.9	75	25/0.1		100/0.8					
324.8						100/0.6				Boring Terminated at Elevation 324.8 ft IN WEATHERED ROCK (TRIASSIC SILTSTONE)	44.5

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist	
SITE DESCRIPTION STRUCTURE NO. 4 ON -Y4- OVER EAST END CONNECTOR				GROUND WTR (ft)
BORING NO. EB2-A	STATION 33+38	OFFSET 27 ft LT	ALIGNMENT -Y4-	0 HR. 17.0
COLLAR ELEV. 362.1 ft	TOTAL DEPTH 29.8 ft	NORTHING 809,913	EASTING 2,043,066	24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Contract Driller	START DATE 09/28/12	COMP. DATE 09/28/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
365											
										362.1 GROUND SURFACE	0.0
360										TRIASSIC RESIDUAL BROWN AND GRAY, SILTY CLAY WITH TRACE SAND	
	358.2	3.9	10	13	15	28		M			
355										355.7 GRAY, MICACEOUS, SANDY SILT	6.4
	353.2	8.9	13	19	42	61		M			
350										350.7 WEATHERED ROCK (TRIASSIC SANDSTONE)	11.4
	348.2	13.9	100/0.2			100/0.2					
345										345.7 TRIASSIC RESIDUAL BROWN AND GRAY, SILTY CLAY WITH TRACE SAND	16.4
	343.2	18.9	16	20	22	42		M			
340											
	338.2	23.9	17	23	27	50		M			
335										335.7 WEATHERED ROCK (TRIASSIC SILTSTONE)	26.4
	333.2	28.9	21	79/0.4		100/0.9				332.3 Boring Terminated at Elevation 332.3 ft IN WEATHERED ROCK (TRIASSIC SILTSTONE)	29.8

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist	
SITE DESCRIPTION STRUCTURE NO. 4 ON -Y4- OVER EAST END CONNECTOR				GROUND WTR (ft)
BORING NO. EB2-B	STATION 33+86	OFFSET 27 ft RT	ALIGNMENT -Y4-	0 HR. Dry
COLLAR ELEV. 358.5 ft	TOTAL DEPTH 29.3 ft	NORTHING 809,842	EASTING 2,043,053	24 HR. 5.8
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Contract Driller	START DATE 09/27/12	COMP. DATE 09/27/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
360										
										358.5 GROUND SURFACE 0.0
355	354.7	3.8	11	15	27	42		M		TRIASSIC RESIDUAL BROWN AND GRAY, SILTY CLAY WITH SOME FINE SAND AND MICA
350	349.7	8.8	11	14	18	32		M		
345	344.7	13.8	14	26	35	61		M		
340	339.7	18.8	17	13	20	33		M		337.2 WEATHERED ROCK (TRIASSIC SILTSTONE AND SANDSTONE) 21.3
335	334.7	23.8	100/0.4			100/0.4				
330	329.7	28.8	100/0.5			100/0.5				329.2 Boring Terminated at Elevation 329.2 ft IN WEATHERED ROCK (TRIASSIC SANDSTONE) 29.3

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1(U-0071)	1	21

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1(U-0071) F.A. PROJ. NHF-76-1(2)

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5-9	CROSS SECTIONS
10-18	BORE LOGS
19	ROCK CORE TEST RESULTS
20-21	CORE PHOTOGRAPHS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

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

PERSONNEL

N.D. MOHS

SUMMIT

J.I. MILKOVITS, JR.

H.R. CONLEY

J.R. MATULA

H.R. FROATS

INVESTIGATED BY N.D. MOHS

CHECKED BY N.D. MOHS

SUBMITTED BY N.T. ROBERSON

DATE FEBRUARY 2013

NORTH CAROLINA LICENSED SEAL 2124 GEOLOGIST JONATHAN DANIEL MOHS

2/8/13

PROJECT: 34745.1.1

ID: U-0071

DRAWN BY: T.T. WALKER, N.D. MOHS

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

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PROJECT REFERENCE NO.	SHEET NO.
34745.1.1 (U-0071)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING # 10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
# 40	30 MX	50 MX	51 MN											
# 200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

ABBREVIATIONS

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

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [X] CME-450
- [ ] _____

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

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

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

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

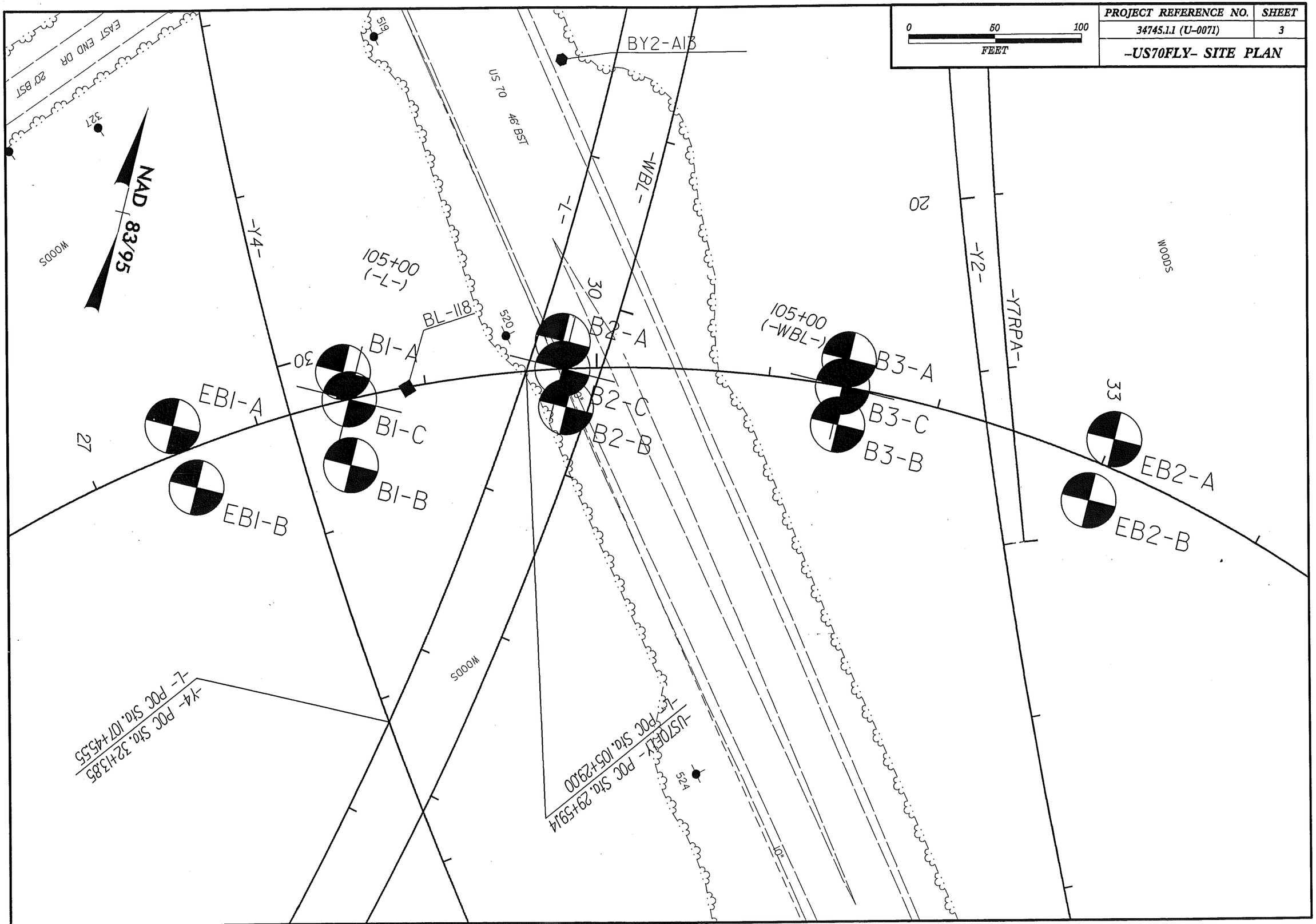
TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BL-118, -BL- STATION 105+29.98, ELEVATION 378.68 FEET
BY2-A13, -BL- STATION 103+21.37, ELEVATION 371.65 FEET

ELEVATION: FT.

NOTES:

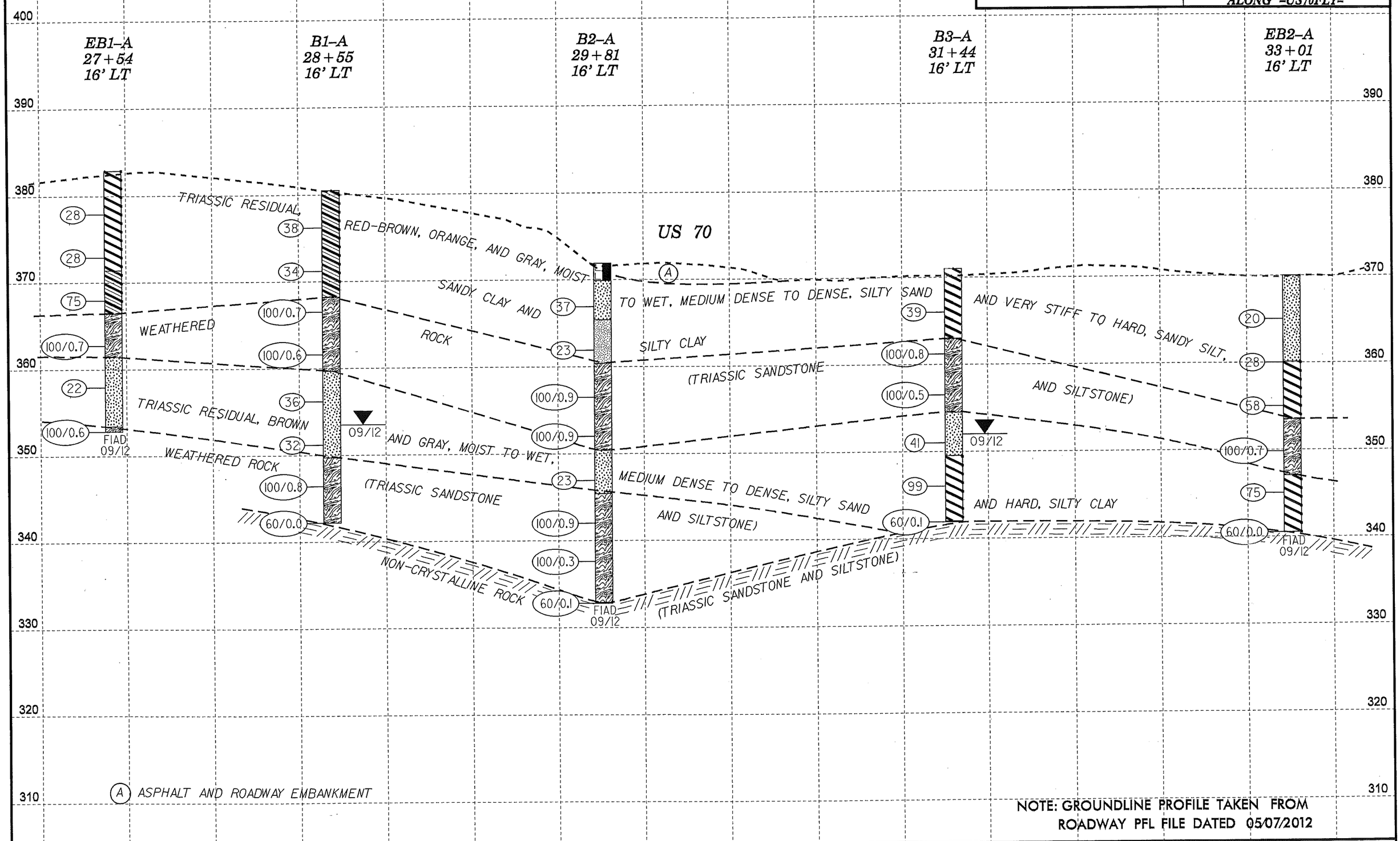
PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	3
-US70FLY- SITE PLAN	



PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	4

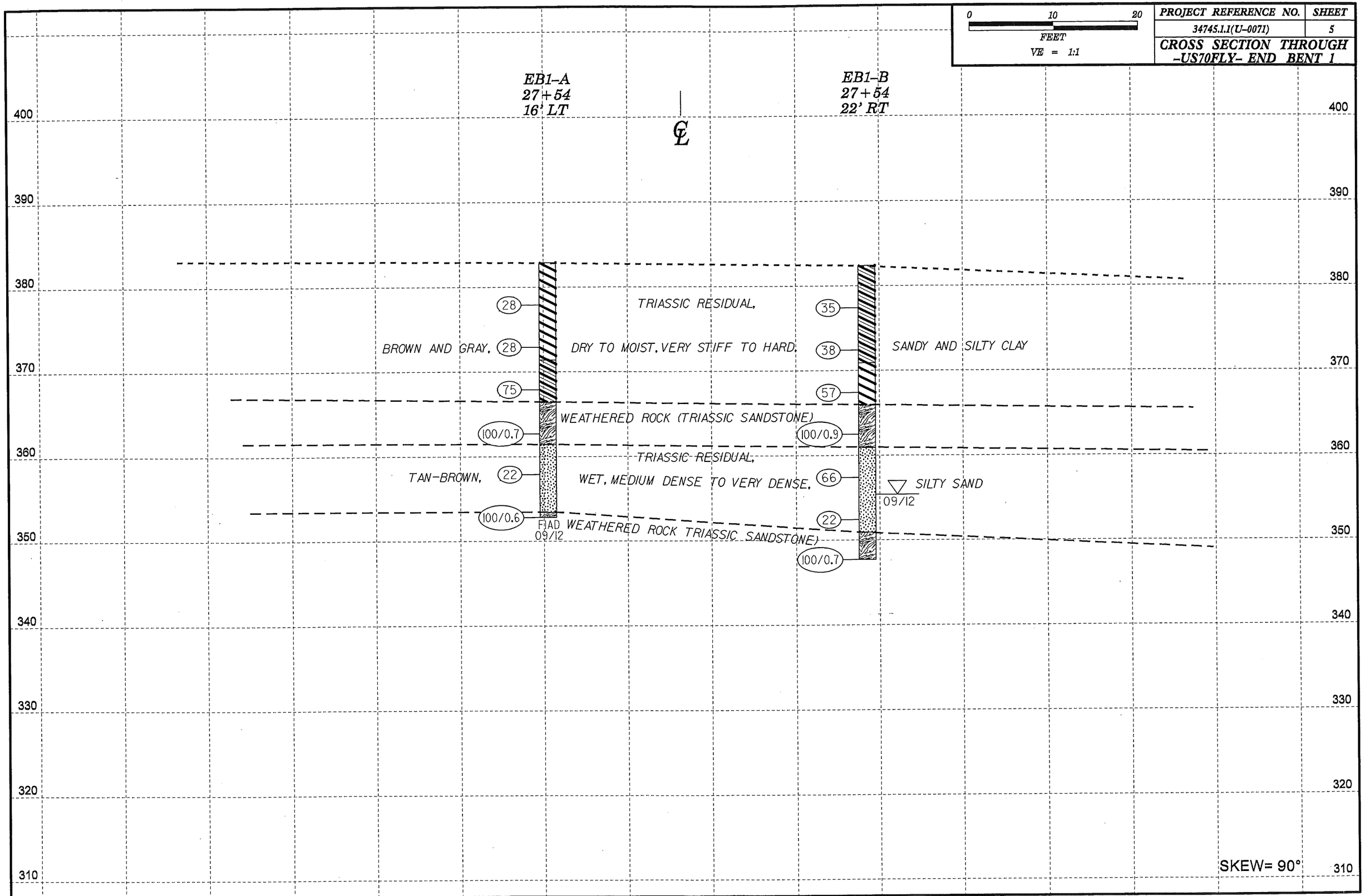
PROFILE BROINGS PROJECTED ALONG -US70FLY-

0 40 80
FEET
VE = 4:1



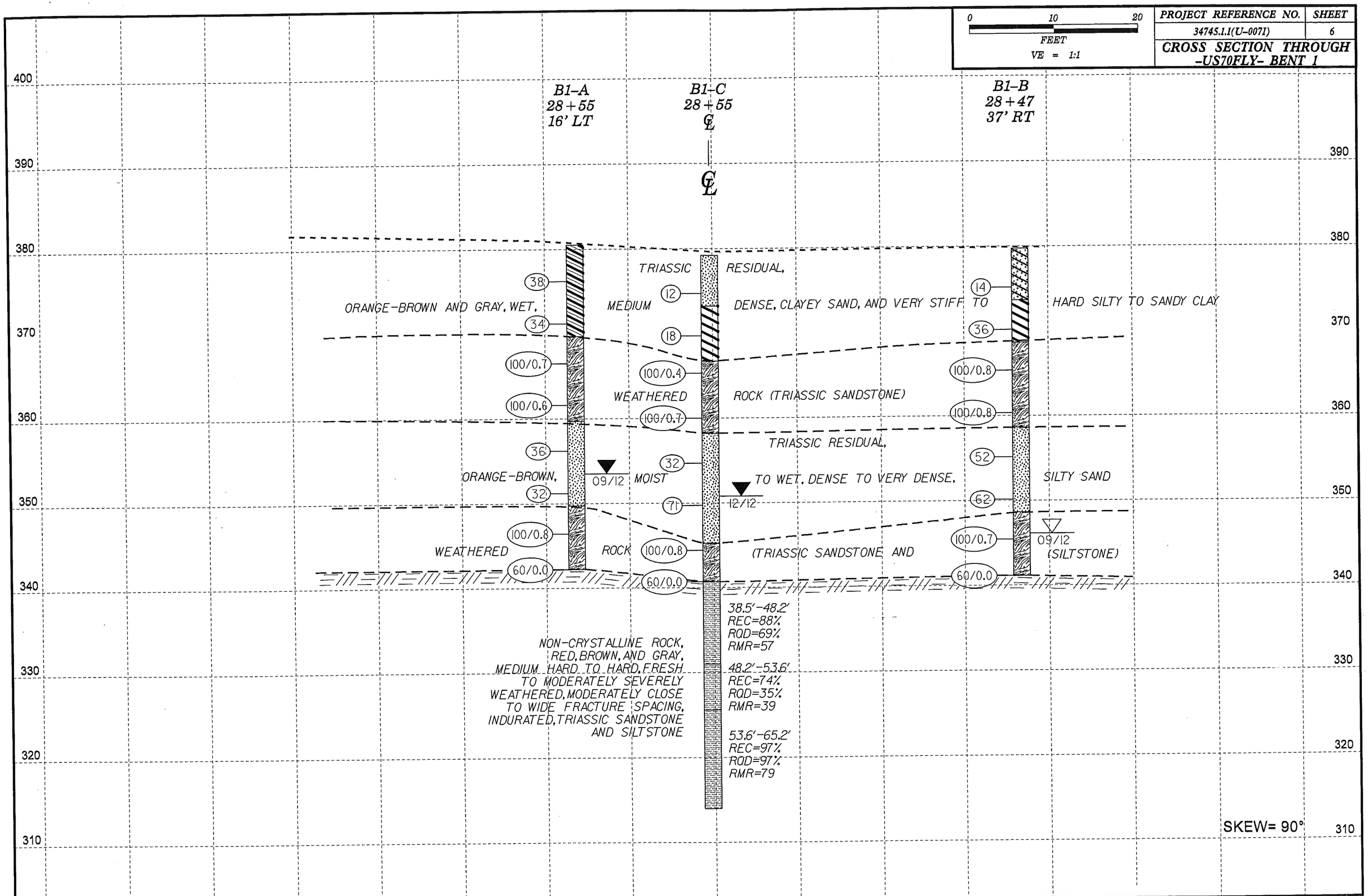
NOTE: GROUNDLINE PROFILE TAKEN FROM ROADWAY PFL FILE DATED 05/07/2012

PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	5
CROSS SECTION THROUGH -US70FLY- END BENT 1	



PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	6

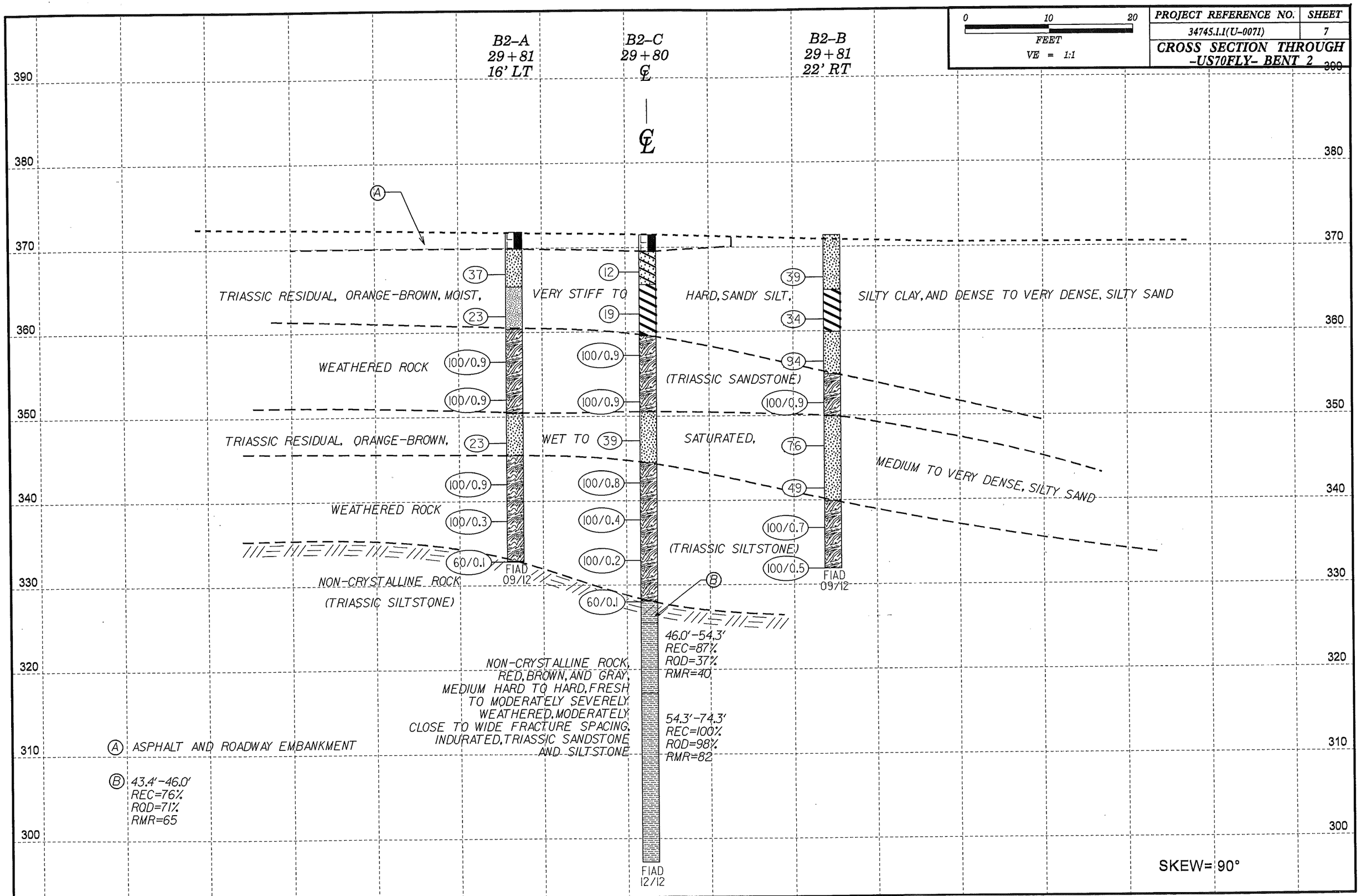
CROSS SECTION THROUGH -US70FLY- BENT 1



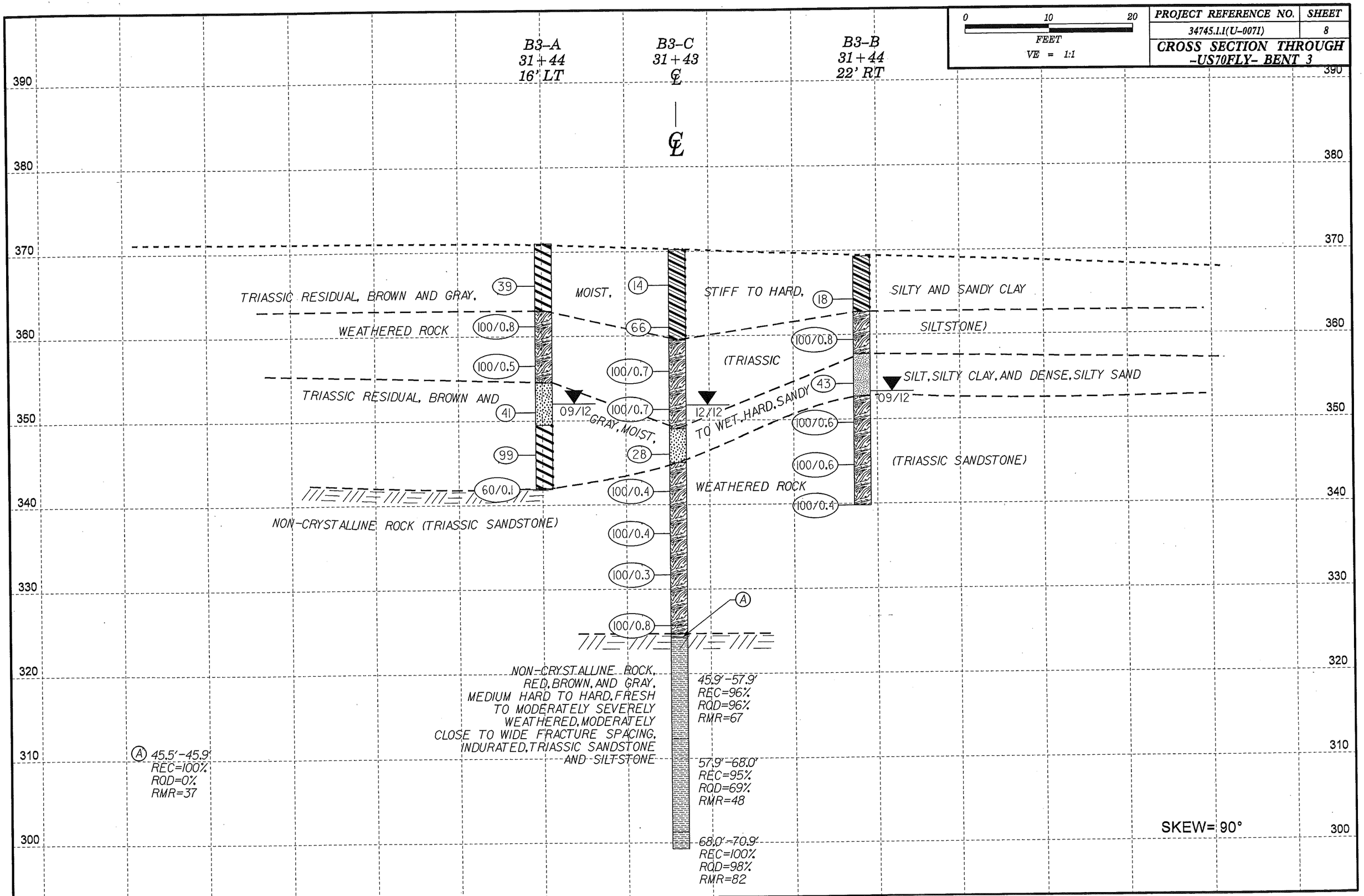
PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	7

CROSS SECTION THROUGH -US70FLY- BENT 2

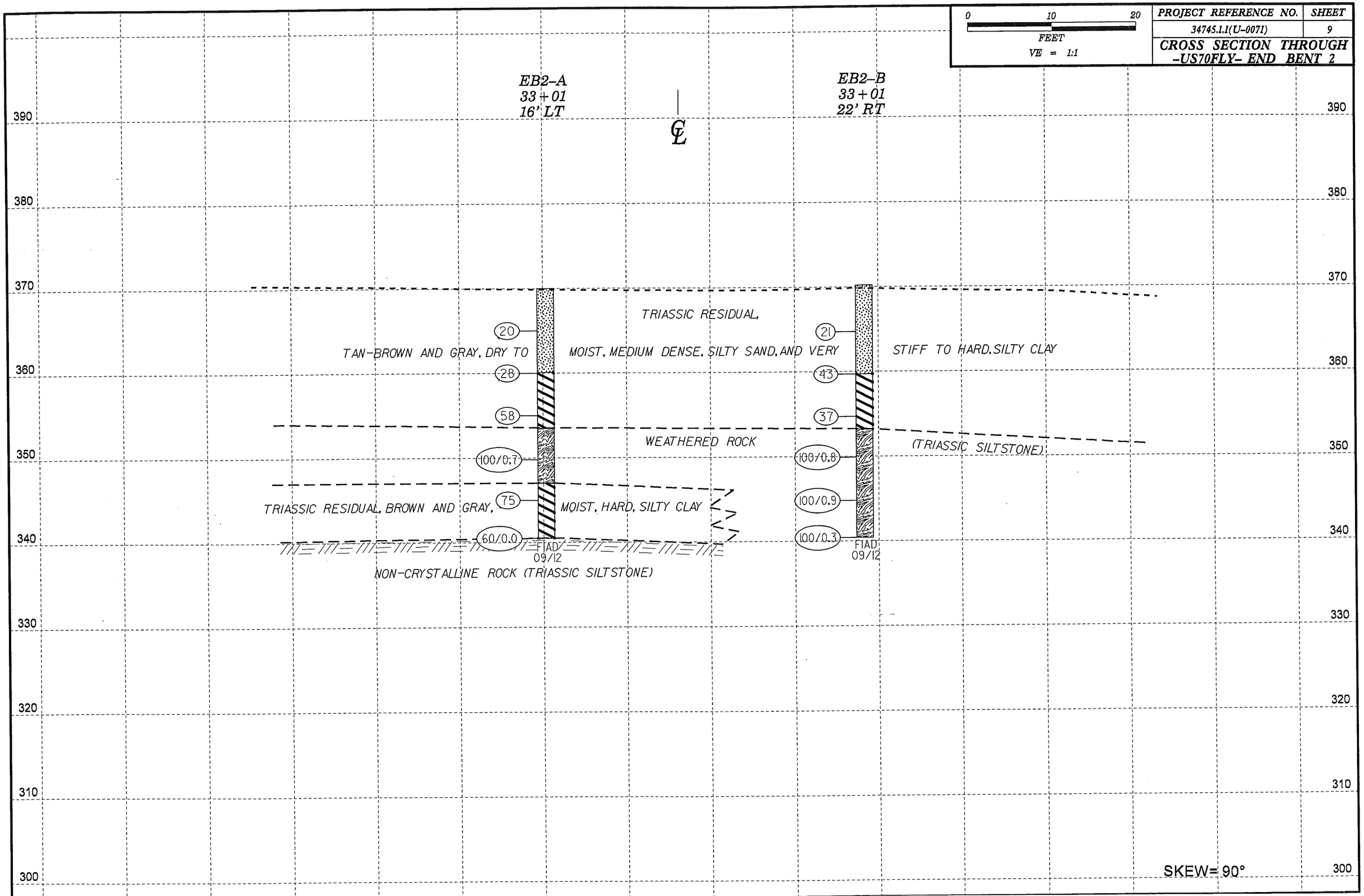
0 10 20
FEET
VE = 1:1



PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	8
CROSS SECTION THROUGH -US70FLY- BENT 3	



PROJECT REFERENCE NO.	SHEET
34745.1.1(U-0071)	9
CROSS SECTION THROUGH -US70FLY- END BENT 2	



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. EB1-A	STATION 27+54	OFFSET 16 ft LT	ALIGNMENT -US70FLY- — 0 HR. Dry
COLLAR ELEV. 382.9 ft	TOTAL DEPTH 30.1 ft	NORTHING 810,133	EASTING 2,042,810 — 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/20/12	COMP. DATE 09/20/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
385										382.9 GROUND SURFACE 0.0
380	378.9	4.0	6	10	18	28		D		**TRIASSIC RESIDUAL** BROWN AND GRAY, SILTY CLAY WITH TRACE MICA
375	373.9	9.0	11	12	16	28		D		371.4 11.5
370	368.9	14.0	19	31	44	75		M		PURPLE AND GRAY, SANDY CLAY WITH SOME MICA 366.4 16.5
365	363.9	19.0	35	60	40/0.2	100/0.7				**WEATHERED ROCK** (TRIASSIC SANDSTONE) 361.4 21.5
360	358.9	24.0	7	9	13	22		W		**TRIASSIC RESIDUAL** LIGHT TAN-BROWN, SILTY SAND WITH SOME MICA 353.4 29.5
355	353.9	29.0	18	67	33/0.1	100/0.6				352.8 30.1 **WEATHERED ROCK** (TRIASSIC SANDSTONE) Boring Terminated at Elevation 352.8 ft in WEATHERED ROCK (TRIASSIC SANDSTONE)

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. EB1-B	STATION 27+54	OFFSET 22 ft RT	ALIGNMENT -US70FLY- — 0 HR. 27.0
COLLAR ELEV. 382.4 ft	TOTAL DEPTH 34.7 ft	NORTHING 810,102	EASTING 2,042,832 — 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/20/12	COMP. DATE 09/20/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
385										382.4 GROUND SURFACE 0.0
380	378.4	4.0	6	11	24	35		M		**TRIASSIC RESIDUAL** GRAY AND ORANGE-BROWN, SANDY CLAY WITH SOME MICA
375	373.4	9.0	13	16	22	38		M		370.9 11.5
370	368.4	14.0	10	22	35	57		M		BROWN AND GRAY, SILTY CLAY WITH TRACE SAND 365.9 16.5
365	363.4	19.0	30	70/0.4		100/0.9				**WEATHERED ROCK** (TRIASSIC SANDSTONE) 360.9 21.5
360	358.4	24.0	23	36	30	66		W		**TRIASSIC RESIDUAL** TAN-BROWN, SILTY SAND WITH SOME MICA
355	353.4	29.0	4	10	12	22		W		350.9 31.5
350	348.4	34.0	45	55/0.2		100/0.7				**WEATHERED ROCK** (TRIASSIC SANDSTONE) 347.7 34.7 Boring Terminated at Elevation 347.7 ft in WEATHERED ROCK (TRIASSIC SANDSTONE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. B1-A	STATION 28+55	OFFSET 16 ft LT	ALIGNMENT -US70FLY- / 0 HR. Dry
COLLAR ELEV. 380.5 ft	TOTAL DEPTH 38.3 ft	NORTHING 810,186	EASTING 2,042,898 / 24 HR. 27.0
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/19/12	COMP. DATE 09/19/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
385										
380										380.5 GROUND SURFACE 0.0
										TRIASSIC RESIDUAL ORANGE-BROWN AND GRAY, SANDY CLAY
	377.2	3.3	8	16	22	38		W		
375										
	372.2	8.3	8	13	21	34		W		
370										368.2 12.3
										WEATHERED ROCK (TRIASSIC SANDSTONE)
	367.2	13.3	44	56/0.2		100/0.7				
365										
	362.2	18.3	70	30/0.1		100/0.6				
360										359.7 20.8
										TRIASSIC RESIDUAL ORANGE-BROWN, SILTY SAND WITH SOME MICA
	357.2	23.3	14	18	18	36		M		
355										
	352.2	28.3	20	18	14	32		M		
350										349.7 30.8
										WEATHERED ROCK (TRIASSIC SANDSTONE)
	347.2	33.3	45	55/0.3		100/0.8				
345										342.2 38.3
	342.2	38.3	60/0.0			60/0.0				Boring Terminated with Standard Penetration Test Refusal at Elevation 342.2 ft on NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. B1-B	STATION 28+47	OFFSET 37 ft RT	ALIGNMENT -US70FLY- / 0 HR. 33.6
COLLAR ELEV. 379.8 ft	TOTAL DEPTH 38.6 ft	NORTHING 810,136	EASTING 2,042,916 / 24 HR. N/A
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/20/12	COMP. DATE 09/20/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
380										379.8 GROUND SURFACE 0.0
										TRIASSIC RESIDUAL BROWN TO ORANGE-BROWN, MICACEOUS, CLAYEY SAND
375	376.2	3.6	4	6	8	14		W		373.7 6.1
										BROWN AND GRAY, SILTY CLAY
370	371.2	8.6	8	14	22	36		W		368.7 11.1
										WEATHERED ROCK (TRIASSIC SANDSTONE)
365	366.2	13.6	15	85//0.3		100/0.8				
360	361.2	18.6	40	60/0.3		100/0.8				358.7 21.1
										TRIASSIC RESIDUAL LIGHT BROWN TO TAN-BROWN, SILTY SAND WITH SOME MICA
355	356.2	23.6	15	24	28	52		W		
350	351.2	28.6	45	30	32	62		W		348.7 31.1
										WEATHERED ROCK (TRIASSIC SILTSTONE)
345	346.2	33.6	42	58/0.2		100/0.7				341.2 38.6
	341.2	38.6	60/0.0			60/0.0				Boring Terminated with Standard Penetration Test Refusal at Elevation 341.2 ft on NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. B1-C	STATION 28+55	OFFSET CL	ALIGNMENT -US70FLY- — 0 HR. N/A
COLLAR ELEV. 379.2 ft	TOTAL DEPTH 65.2 ft	NORTHING 810,172	EASTING 2,042,906 — 24 HR. 28.4
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 12/10/12	COMP. DATE 12/11/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
380										379.2 GROUND SURFACE	0.0
375	375.7	3.5	4	5	7	12		W		TRIASSIC RESIDUAL TAN-BROWN, SILTY SAND	
370	370.7	8.5	5	7	11	18		W		373.2 RED, TAN, AND BROWN, SILTY CLAY	6.0
365	365.7	13.5	100/0.4			100/0.4				366.7 WEATHERED ROCK (TRIASSIC SANDSTONE)	12.5
360	360.7	18.5	68	32/0.2		100/0.7				358.2 TRIASSIC RESIDUAL TAN-BROWN, SILTY SAND	21.0
355	355.7	23.5	12	14	18	32		W			
350	350.7	28.5	7	39	32	71		W			
345	345.7	33.5	11	45	55/0.3	100/0.8				345.2 WEATHERED ROCK (TRIASSIC SANDSTONE)	34.0
340	340.7	38.5	60/0.0			60/0.0	RS-1			340.7 NON-CRYSTALLINE ROCK TAN-BROWN, MEDIUM HARD TO HARD, MODERATELY TO SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=88% RQD=69% RMR=57	38.5
335							RS-2				
							RS-3			331.0 RED-BROWN, MEDIUM HARD, MODERATELY SEVERELY TO MODERATELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, TRIASSIC SILTSTONE REC=74% RQD=35% RMR=39	48.2
330							RS-4				
325							RS-5			325.6 GRAY AND TAN, HARD, FRESH TO SLIGHTLY WEATHERED, MODERATELY CLOSE TO WIDE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=97% RQD=97% RMR=79	53.6
320							RS-6				
315										314.0 Boring Terminated at Elevation 314.0 ft in NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	65.2

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. B1-C	STATION 28+55	OFFSET CL	ALIGNMENT -US70FLY- — 0 HR. N/A
COLLAR ELEV. 379.2 ft	TOTAL DEPTH 65.2 ft	NORTHING 810,172	EASTING 2,042,906 — 24 HR. 28.4
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 12/10/12	COMP. DATE 12/11/12	SURFACE WATER DEPTH N/A
CORE SIZE NXWL	TOTAL RUN 26.7 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
340.7											Begin Coring @ 38.5 ft	
340	340.7	38.5	1.7	N=60/0.0	(1.5) 88%	(1.0) 59%	RS-1	(9.4) 97%	(6.7) 69%		340.7 NON-CRYSTALLINE ROCK TAN-BROWN, MEDIUM HARD TO HARD, MODERATELY TO SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=88% RQD=69% RMR=57	38.5
	339.0	40.2	5.0	1:20/1.0 :41/0.7 1:22/1.0 :37/1.0 1:01/1.0 1:20/1.0 :57/1.0	(4.9) 98%	(3.8) 76%						
335	334.0	45.2					RS-2					
			5.0	1:02/1.0 1:09/1.0 1:33/1.0 2:08/1.0 1:59/1.0	(4.0) 80%	(1.9) 38%	RS-3				331.0 RED-BROWN, MEDIUM HARD, MODERATELY SEVERELY TO MODERATELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, TRIASSIC SILTSTONE REC=74% RQD=35% RMR=39	48.2
330	329.0	50.2					RS-4	(4.0) 74%	(1.9) 35%			
			5.0	1:25/1.0 1:06/1.0 1:11/1.0 :57/1.0 :49/1.0	(4.6) 92%	(3.5) 70%						
325	324.0	55.2					RS-5	(11.2) 97%	(11.2) 97%		325.6 GRAY AND TAN, HARD, FRESH TO SLIGHTLY WEATHERED, MODERATELY CLOSE TO WIDE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=97% RQD=97% RMR=79	53.6
			5.0	1:49/1.0 :57/1.0 :49/1.0 :55/1.0 :54/1.0	(5.0) 100%	(5.0) 100%						
320	319.0	60.2					RS-6					
			5.0	:40/1.0 :32/1.0 :35/1.0 1:30/1.0 1:39/1.0	(4.6) 92%	(4.6) 92%						
315	314.0	65.2									314.0 Boring Terminated at Elevation 314.0 ft in NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	65.2

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. B2-A	STATION 29+81	OFFSET 16 ft LT	ALIGNMENT -US70FLY- / 0 HR. 19.0
COLLAR ELEV. 371.9 ft	TOTAL DEPTH 39.1 ft	NORTHING 810,234	EASTING 2,043,018 / 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/24/12	COMP. DATE 09/24/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
371.9										GROUND SURFACE	0.0
369.9										ROADWAY EMBANKMENT PAVEMENT WITH GRAVEL AND SAND	2.0
	367.9	4.0	12	18	19	37		M		TRIASSIC RESIDUAL ORANGE-BROWN, SILTY SAND WITH SOME MICA	
365.4											6.5
	362.9	9.0	5	7	16	23		M		BROWN TO ORANGE-BROWN, SANDY SILT	
360.4											11.5
	357.9	14.0	24	36	64/0.4	100/0.9				WEATHERED ROCK (TRIASSIC SANDSTONE)	
	352.9	19.0	40	60/0.4		100/0.9					
350.4											21.5
	347.9	24.0	9	10	13	23		Sat.		TRIASSIC RESIDUAL ORANGE-BROWN TO TAN-BROWN, SILTY SAND WITH SOME MICA	
345.4											26.5
	342.9	29.0	20	80/0.4		100/0.9				WEATHERED ROCK (TRIASSIC SILTSTONE)	
	337.9	34.0	100/0.3			100/0.3					
332.9		39.0	60/0.1			60/0.1					
332.8										NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	39.1

Boring Terminated with Standard Penetration Test Refusal at Elevation 332.8 ft in NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. B2-B	STATION 29+81	OFFSET 22 ft RT	ALIGNMENT -US70FLY- / 0 HR. 18.0
COLLAR ELEV. 371.4 ft	TOTAL DEPTH 39.5 ft	NORTHING 810,198	EASTING 2,043,029 / 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/24/12	COMP. DATE 09/24/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
371.4										GROUND SURFACE	0.0
	367.4	4.0	13	17	22	39		M		TRIASSIC RESIDUAL ORANGE-BROWN AND LIGHT GRAY, SILTY SAND WITH SOME MICA	
364.9											6.5
	362.4	9.0	8	14	20	34		M		BROWN AND GRAY, SILTY CLAY	
359.9											11.5
	357.4	14.0	32	42	52	94		M		TAN-BROWN, SILTY SAND WITH SOME MICA	
354.9											16.5
	352.4	19.0	44	56/0.4		100/0.9				WEATHERED ROCK (TRIASSIC SANDSTONE)	
349.9											21.5
	347.4	24.0	30	36	40	76		W		TRIASSIC RESIDUAL ORANGE-BROWN TO TAN-BROWN, SILTY SAND WITH SOME MICA	
339.9											31.5
	342.4	29.0	14	25	24	49		Sat.		WEATHERED ROCK (TRIASSIC SILTSTONE)	
	337.4	34.0	26	74/0.2		100/0.7					
331.9		39.0	100/0.5			100/0.5					39.5

Boring Terminated at Elevation 331.9 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)

NCDOT BORE DOUBLE U0071_GEO_BH_US70FLY.GPJ NC_DOT.GDT 1/18/13

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. B2-C	STATION 29+80	OFFSET CL	ALIGNMENT -US70FLY- / 0 HR. N/A
COLLAR ELEV. 371.5 ft	TOTAL DEPTH 74.3 ft	NORTHING 810,219	EASTING 2,043,021 / 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 92% 07/12/2011		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 12/06/12	COMP. DATE 12/06/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
375											
370										371.5 GROUND SURFACE	0.0
										ROADWAY EMBANKMENT ASPHALT & ABC	
	368.1	3.4	3	4	8	12				369.5 TRIASSIC RESIDUAL TAN-BROWN, CLAYEY SAND	2.0
365								W		365.6 RED-BROWN, SILTY CLAY	5.9
	363.1	8.4	7	7	12	19					
360								M		359.5 WEATHERED ROCK (TRIASSIC SANDSTONE)	12.0
	358.1	13.4	27	73/0.4		100/0.9					
355											
	353.1	18.4	23	67	33/0.4	100/0.9				350.5 TRIASSIC RESIDUAL TAN-BROWN, SILTY SAND	21.0
350											
	348.1	23.4	14	19	20	39		W		344.5 WEATHERED ROCK (TRIASSIC SANDSTONE AND SILTSTONE)	27.0
345											
	343.1	28.4	11	40	60/0.3	100/0.8					
340											
	338.1	33.4	100/0.4			100/0.4					
335											
	333.1	38.4	100/0.2			100/0.2					
330											
	328.1	43.4	60/0.1			60/0.1				328.1 NON-CRYSTALLINE ROCK GRAY, TAN, AND BROWN, HARD, FRESH TO SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=76% RQD=71% RMR=65	43.4
325							RS-7 RS-8 RS-9			325.5 RED-BROWN, MEDIUM HARD TO HARD, MODERATELY SEVERELY TO MODERATELY WEATHERED, CLOSE TO VERY CLOSE FRACTURE SPACING, TRIASSIC SILTSTONE REC=87% RQD=37% RMR=40	46.0
320											
315							RS-10 RS-11 RS-12			317.2 GRAY AND TAN, HARD TO VERY HARD, FRESH, CLOSE TO WIDE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=100% RQD=98% RMR=82	54.3
310							RS-13				
305							RS-14				
300							RS-15			297.2 Boring Terminated at Elevation 297.2 ft in NON-CRYSTALLINE ROCK (TRIASSIC	74.3

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. B2-C	STATION 29+80	OFFSET CL	ALIGNMENT -US70FLY- / 0 HR. N/A
COLLAR ELEV. 371.5 ft	TOTAL DEPTH 74.3 ft	NORTHING 810,219	EASTING 2,043,021 / 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 92% 07/12/2011		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 12/06/12	COMP. DATE 12/06/12	SURFACE WATER DEPTH N/A
CORE SIZE NXWL	TOTAL RUN 30.9 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
328.1											Begin Coring @ 43.4 ft	
	328.1	43.4	1.9	:36/1.0 N=60/0.1	(1.9) 100%	(1.7) 89%		(2.6) 100%	(2.4) 92%		328.1 NON-CRYSTALLINE ROCK GRAY, TAN, AND BROWN, HARD, FRESH TO SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=76% RQD=71% RMR=65	43.4
325	326.2	45.3	5.0	:36/1.0 :47/0.9	(3.9) 78%	(2.5) 50%	RS-7 RS-8 RS-9	(7.2) 87%	(3.1) 37%		325.5 RED-BROWN, MEDIUM HARD TO HARD, MODERATELY SEVERELY TO MODERATELY WEATHERED, CLOSE TO VERY CLOSE FRACTURE SPACING, TRIASSIC SILTSTONE REC=87% RQD=37% RMR=40	46.0
320	321.2	50.3	5.0	1:13/1.0 1:21/1.0 1:10/1.0 1:13/1.0 1:14/1.0	(5.0) 100%	(2.2) 44%	RS-10 RS-11					
315	316.2	55.3	5.0	1:23/1.0 1:24/1.0 :59/1.0 :47/1.0 :49/1.0 :29/1.0 :34/1.0	(5.0) 100%	(5.0) 100%	RS-12	(20.0) 100%	(19.5) 98%		317.2 GRAY AND TAN, HARD TO VERY HARD, FRESH, CLOSE TO WIDE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=100% RQD=98% RMR=82	54.3
310	311.2	60.3	5.0	:37/1.0 :38/1.0 :39/1.0 :39/1.0 :39/1.0 :31/1.0 :35/1.0 :35/1.0	(5.0) 100%	5.0' UNFRACTURED STICK (5.0) 100% 5.0' UNFRACTURED STICK	RS-13					
305	306.2	65.3	5.0	:33/1.0 :32/1.0 :53/1.0 :42/1.0 :52/1.0	(5.0) 100%	(4.5) 90%	RS-14					
300	301.2	70.3	4.0	:37/1.0 :43/1.0 :38/1.0 :43/1.0	(4.0) 100%	(4.0) 100% 4.0' UNFRACTURED STICK	RS-15				297.2 Boring Terminated at Elevation 297.2 ft in NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	74.3
	297.2	74.3									.TIN FILE ELEVATION	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. B3-A	STATION 31+44	OFFSET 16 ft LT	ALIGNMENT -US70FLY- / 0 HR. 24.0
COLLAR ELEV. 371.0 ft	TOTAL DEPTH 29.1 ft	NORTHING 810,264	EASTING 2,043,181 / 24 HR. 19.0
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/19/12	COMP. DATE 09/19/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
										371.0 GROUND SURFACE	0.0
	367.0	4.0	8	13	26	39		M		TRIASSIC RESIDUAL BROWN AND GRAY, SILTY CLAY	
	362.0	9.0	47	53/0.3		100/0.8				363.0 WEATHERED ROCK (TRIASSIC SILTSTONE)	8.0
	357.0	14.0	70	30/0.0		100/0.5				354.5	16.5
	352.0	19.0	28	20	21	41		W		TRIASSIC RESIDUAL LIGHT TAN-BROWN, SILTY SAND WITH SOME MICA	
	347.0	24.0	19	35	64	99		M		349.5 BROWN AND GRAY, SILTY CLAY	21.5
	342.0	29.0	60/0.1			60/0.1				342.0 / 341.9 NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	29.0 / 29.1

Boring Terminated with Standard Penetration Test Refusal at Elevation 341.9 ft in NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. B3-B	STATION 31+44	OFFSET 22 ft RT	ALIGNMENT -US70FLY- / 0 HR. 24.1
COLLAR ELEV. 369.3 ft	TOTAL DEPTH 29.5 ft	NORTHING 810,226	EASTING 2,043,184 / 24 HR. 16.0
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/19/12	COMP. DATE 09/19/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										369.3 GROUND SURFACE 0.0
	365.2	4.1	7	10	8	18		M		TRIASSIC RESIDUAL ORANGE-BROWN AND GRAY, SANDY CLAY
	360.2	9.1	33	67/0.3		100/0.8				362.7 WEATHERED ROCK (TRIASSIC SILTSTONE) 6.6
	355.2	14.1	16	21	22	43		M		357.7 TRIASSIC RESIDUAL BROWN AND GRAY, SANDY SILT WITH SOME CLAY 11.6
	350.2	19.1	80	20/0.1		100/0.6				352.7 WEATHERED ROCK (TRIASSIC SILTSTONE) 16.6
	345.2	24.1	78	22/0.1		100/0.6				
	340.2	29.1	100/0.4			100/0.4				339.8 29.5

Boring Terminated at Elevation 339.8 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)

NCDOT BORE DOUBLE U0071_GEO_BH_US70FLY.GPJ NC_DOT.GDT 1/23/13

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Milkovits, J. I.
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			**GROUND WTR (ft)**
BORING NO. B3-C	**STATION** 31+43	**OFFSET** CL	**ALIGNMENT** -US70FLY- — **0 HR.** N/A
COLLAR ELEV. 370.2 ft	**TOTAL DEPTH** 70.9 ft	**NORTHING** 810,248	**EASTING** 2,043,181 — **24 HR.** 18.4
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 92% 07/12/2011		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Conley, H. R.	**START DATE** 12/04/12	**COMP. DATE** 12/05/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
375											
370										370.2 GROUND SURFACE	0.0
										TRIASSIC RESIDUAL RED, BROWN, AND GRAY, SANDY CLAY	
365	367.0	3.2	8	7	7	14		M			
360	362.0	8.2	13	21	45	66		M		359.5	10.7
										WEATHERED ROCK (TRIASSIC SILTSTONE)	
355	357.0	13.2	39	56	44/0.2	100/0.7					
350	352.0	18.2	42	58/0.2		100/0.7				349.0	21.2
										TRIASSIC RESIDUAL BROWN-GRAY, SILTY SAND	
345	347.0	23.2	18	12	16	28		W		345.0	25.2
										WEATHERED ROCK (TRIASSIC SILTSTONE)	
340	342.0	28.2	100/0.4			100/0.4					
335	337.0	33.2	100/0.4			100/0.4					
330	332.0	38.2	100/0.3			100/0.3					
325	327.0	43.2	30	47	53/0.3	100/0.8				325.7	44.5
										324.7 **WEATHERED ROCK** (TRIASSIC SILTSTONE)	45.5
										324.3 **NON-CRYSTALLINE ROCK** BROWN AND GRAY, MEDIUM HARD, MODERATELY WEATHERED, CLOSE FRACTURE SPACING, TRIASSIC SILTSTONE REC=100% RQD=0% RMR=37	45.9
320							RS-16				
							RS-17				
315							RS-18				
							RS-19			312.3 BROWN AND GRAY, HARD, FRESH TO SLIGHTLY WEATHERED, MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=96% RQD=96% RMR=67	57.9
310							RS-20				
							RS-21				
305							RS-22			RED-BROWN, MEDIUM HARD TO HARD, MODERATELY SEVERELY TO MODERATELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, TRIASSIC SILTSTONE REC=95% RQD=69% RMR=48	
							RS-24			301.3	68.9
300							RS-25			299.3 BROWN AND GRAY, HARD, FRESH TO SLIGHTLY WEATHERED, MODERATELY CLOSE FRACTURE SPACING,	70.9

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Milkovits, J. I.
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			**GROUND WTR (ft)**
BORING NO. B3-C	**STATION** 31+43	**OFFSET** CL	**ALIGNMENT** -US70FLY- — **0 HR.** N/A
COLLAR ELEV. 370.2 ft	**TOTAL DEPTH** 70.9 ft	**NORTHING** 810,248	**EASTING** 2,043,181 — **24 HR.** 18.4
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 92% 07/12/2011		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Conley, H. R.	**START DATE** 12/04/12	**COMP. DATE** 12/05/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
295						Match Line				INDURATED, TRIASSIC SANDSTONE REC=100% RQD=98% RMR=82

Boring Terminated at Elevation 299.3 ft in NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)

NCDOT BORE DOUBLE U0071_GEO_BH_US70FLY.GPJ NC_DOT.GDT 2/8/13

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Milkovits, J. I.
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			**GROUND WTR (ft)**
BORING NO. B3-C	**STATION** 31+43	**OFFSET** CL	**ALIGNMENT** -US70FLY- — **0 HR.** N/A
COLLAR ELEV. 370.2 ft	**TOTAL DEPTH** 70.9 ft	**NORTHING** 810,248	**EASTING** 2,043,181 — **24 HR.** 18.4
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 92% 07/12/2011		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Conley, H. R.	**START DATE** 12/04/12	**COMP. DATE** 12/05/12	**SURFACE WATER DEPTH** N/A
CORE SIZE NWXL	**TOTAL RUN** 26.4 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG
325.7										
325	325.7	44.5	1.4	:16/0.4	(0.7)	(0.0)		(0.3)	N/A	
	324.3	45.9		1:16/1.0	50%	0%		30%	(0.0)	
			5.0	1:11/1.0	(4.7)	(4.7)	RS-16	(0.4)	0%	
				:28/1.0	94%	94%		100%	(11.5)	
				:26/1.0					96%	
320				:25/1.0			RS-17	(11.5)		
	319.3	50.9		:23/1.0				96%		
			5.0	:51/1.0	(4.8)	(4.8)				
				:25/1.0	96%	96%				
				:23/1.0						
				:23/1.0			RS-18			
315				:22/1.0						
	314.3	55.9								
			5.0	:30/1.0	(5.0)	(4.4)				
				:43/1.0	100%	88%	RS-19			
				1:17/1.0				(10.5)	(7.6)	
				:58/1.0			RS-20	95%	69%	
310				1:01/1.0						
	309.3	60.9					RS-21			
			5.0	1:33/1.0	(4.5)	(3.7)				
				1:13/1.0	90%	74%				
				2:16/1.0			RS-22			
				2:03/1.0						
305				:35/1.0						
	304.3	65.9								
			5.0	1:15/1.0	(5.0)	(3.5)	RS-24			
				:55/1.0	100%	70%				
				1:05/1.0						
				:39/1.0				(2.0)	(2.0)	
300				:48/1.0				100%	100%	
	299.3	70.9					RS-25		98%	

ELEV. (ft)	DESCRIPTION AND REMARKS	DEPTH (ft)
	Begin Coring @ 44.5 ft	
325.7	**WEATHERED ROCK** (TRIASSIC SILTSTONE)	44.5
324.7		45.5
324.3	**NON-CRYSTALLINE ROCK** BROWN AND GRAY, MEDIUM HARD, MODERATELY WEATHERED, CLOSE FRACTURE SPACING, TRIASSIC SILTSTONE REC=100% RQD=0% RMR=37	45.9
	BROWN AND GRAY, HARD, FRESH TO SLIGHTLY WEATHERED, MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=96% RQD=96% RMR=67	
312.3		57.9
	RED-BROWN, MEDIUM HARD TO HARD, MODERATELY SEVERELY TO MODERATELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, TRIASSIC SILTSTONE REC=95% RQD=69% RMR=48	
301.3		68.9
299.3	BROWN AND GRAY, HARD, FRESH TO SLIGHTLY WEATHERED, MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=100% RQD=98% RMR=82	70.9
	Boring Terminated at Elevation 299.3 ft in NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. EB2-A	STATION 33+01	OFFSET 16 ft LT	ALIGNMENT -US70FLY- — 0 HR. Dry
COLLAR ELEV. 370.0 ft	TOTAL DEPTH 29.0 ft	NORTHING 810,256	EASTING 2,043,341 — 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/18/12	COMP. DATE 09/18/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
370										370.0 GROUND SURFACE	0.0
365	366.0	4.0	8	9	11	20, 28		D		TRIASSIC RESIDUAL LIGHT TAN-BROWN, SILTY SAND WITH SOME MICA	
360	361.0	9.0	5	12	16	58		M		360.1 GRAY AND BROWN, SILTY CLAY	9.9
355	356.0	14.0	9	19	39			M		353.5 WEATHERED ROCK (TRIASSIC SILTSTONE)	16.5
350	351.0	19.0	45	55/0.2		100/0.7				347.0 TRIASSIC RESIDUAL BROWN AND GRAY, SILTY CLAY WITH TRACE MICA	23.0
345	346.0	24.0	21	40	35	75		M		341.0 Boring Terminated with Standard Penetration Test Refusal at Elevation 341.0 ft on NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	29.0
	341.0	29.0	60/0.0			60/0.0					

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 5 ON -US70FLY- OVER EAST END CONNECTOR			GROUND WTR (ft)
BORING NO. EB2-B	STATION 33+01	OFFSET 22 ft RT	ALIGNMENT -US70FLY- — 0 HR. Dry
COLLAR ELEV. 370.2 ft	TOTAL DEPTH 29.8 ft	NORTHING 810,218	EASTING 2,043,335 — 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 09/19/12	COMP. DATE 09/19/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
375											
370										370.2 GROUND SURFACE	0.0
365	365.7	4.5	8	10	11	21		M		TRIASSIC RESIDUAL TAN-BROWN TO ORANGE-BROWN, SILTY SAND WITH SOME MICA	
360	360.7	9.5	13	21	22	43		M		359.7 BROWN AND GRAY, SILTY CLAY	10.5
355	355.7	14.5	14	21	16	37		M		353.2 WEATHERED ROCK (TRIASSIC SILTSTONE)	17.0
350	350.7	19.5	16	84/0.3		100/0.8					
345	345.7	24.5	34	66/0.4		100/0.9					
	340.7	29.5	100/0.3			100/0.3				340.4 Boring Terminated at Elevation 340.4 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)	29.8

ROCK CORE TEST RESULTS

SAMPLE NO.	BORING	OFFSET	STATION	DEPTH INTERVAL	H/D RATIO	UNIT WT lbs/ft3	Ultimate lbf	Ultimate ksi	Ultimate (corrected) ksi	Sec. Mod. @ 40% Mpsi
RS-1	B1-C	28+55	CL	39.5-39.9	1.97	139.3	9500	3.54	3.53	0.257
RS-2	B1-C	28+55	CL	43.7-44.2	2.00	140.2	10310	3.96	3.96	0.1597
RS-3	B1-C	28+55	CL	46.7-47.3	2.00	145.9	14250	5.34	5.34	0.284
RS-4	B1-C	28+55	CL	49.7-50.6	SAMPLE BROKE AT LAB/NOT TESTED					
RS-5	B1-C	28+55	CL	54.7-55.2	2.00	155.2	22100	8.2	8.21	1.176
RS-6	B1-C	28+55	CL	59.7-60.2	2.00	151.9	26800	9.94	9.94	0.944
RS-7	B2-C	29+80	CL	45.3-45.7	2.00	148	20300	7.49	7.49	1.176
RS-12	B2-C	29+80	CL	55.8-56.3	1.96	145.3	11780	4.3	4.29	0.46
RS-13	B2-C	29+80	CL	59.8-60.3	1.75	158.7	22900	8.44	8.28	1.821
RS-14	B2-C	29+80	CL	64.8-65.3	1.92	150	17080	6.29	6.26	1
RS-15	B2-C	29+80	CL	70.3-71.0	1.99	146.1	17940	6.61	6.61	0.968
RS-16	B3-C	31+43	CL	47.0-47.5	2.00	152.6	9100	3.31	3.31	0.0976
RS-17	B3-C	31+43	CL	49.5-50.1	1.98	156.7	18390	6.71	6.7	0.459
RS-18	B3-C	31+43	CL	53.7-54.3	2.00	145.4	11700	4.25	4.25	0.623
RS-19	B3-C	31+43	CL	56.5-57.1	1.99	149.4	21600	7.81	7.82	1.178
RS-22	B3-C	31+43	CL	63.0-63.7	SAMPLE TOO SOFT TO TEST					
RS-24	B3-C	31+43	CL	66.2-66.8	SAMPLE TOO SOFT TO TEST					
RS-25	B3-C	31+43	CL	70.2-70.9	1.99	151.9	14260	5.15	5.15	0.274

*THESE SAMPLES TESTED BY THE SOILS LAB

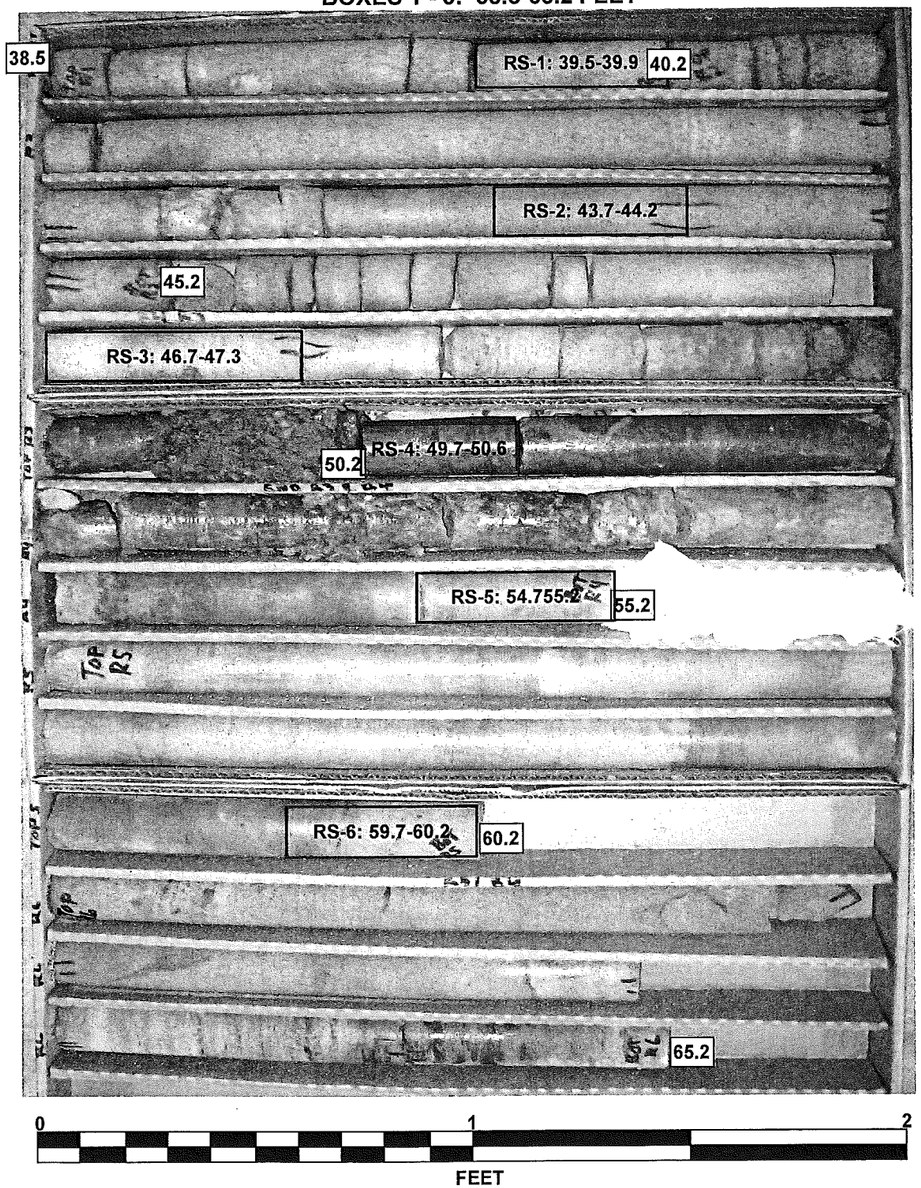
ROCK CORE TEST RESULTS

SAMPLE NO.	BORING	OFFSET	STATION	DEPTH INTERVAL	H/D RATIO	DRY DENSITY (pcf)	WEIGHT (g)	VOID RATIO	UNCONFINED STRENGTH (psi)
RS-8	B2-C	29+80	CL	46.1-46.9	1.96	162.0	402.0	0.02	1990
RS-9	B2-C	29+80	CL	47.3-47.7	1.95	160.1	401.0	0.03	980
RS-10	B2-C	29+80	CL	52.3-52.7	1.73	160.1	362.0	0.03	1037
RS-11	B2-C	29+80	CL	53.0-53.4	1.53	156.3	319.0	0.06	626
RS-20	B3-C	31+43	CL	58.8-59.4	1.93	153.9	389.0	0.08	1095
RS-21	B3-C	31+43	CL	60.2-60.9	1.91	155.6	390.0	0.06	860

CORE PHOTOGRAPHS

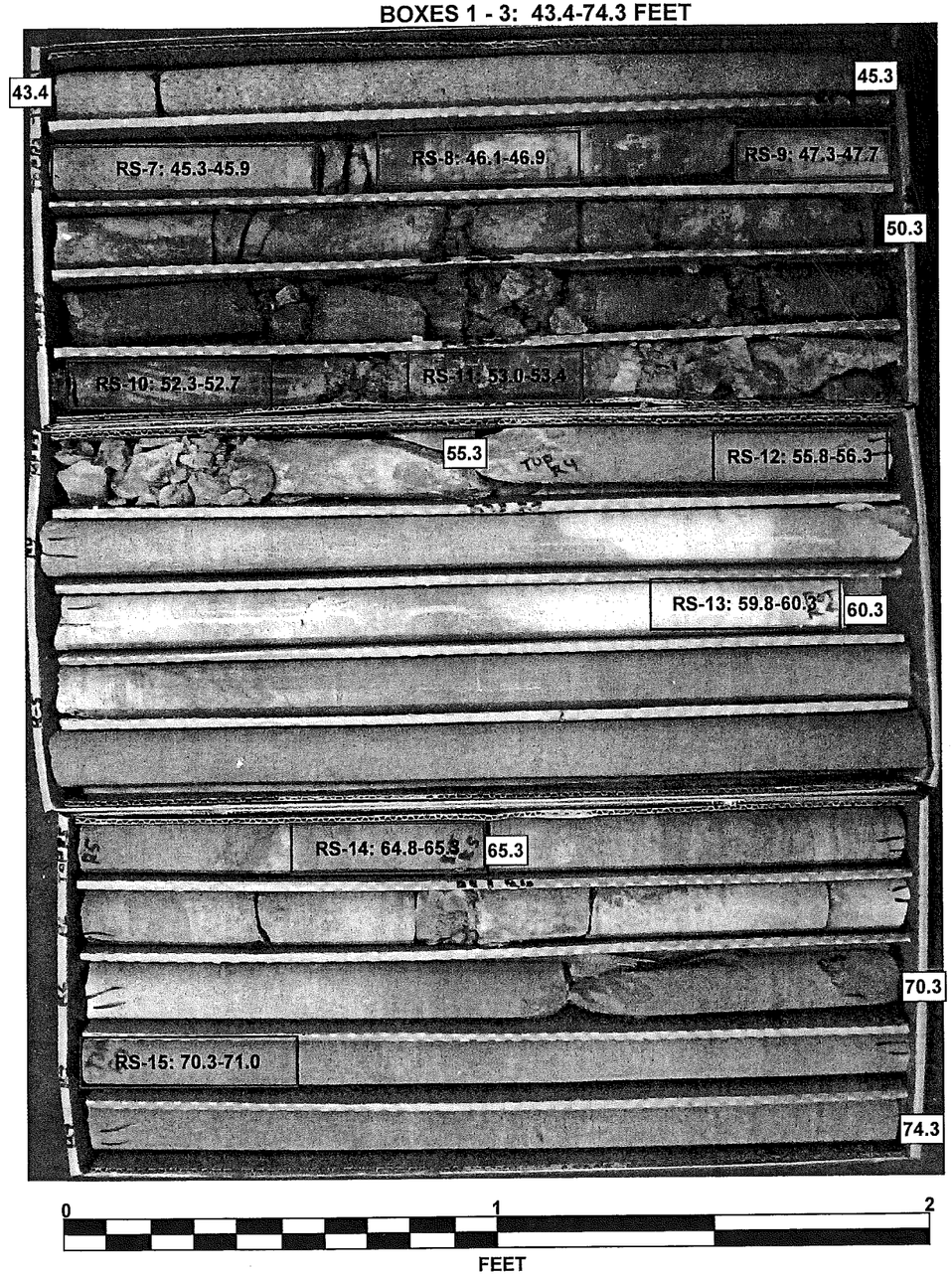
B1-C

BOXES 1 - 3: 38.5-65.2 FEET



B2-C

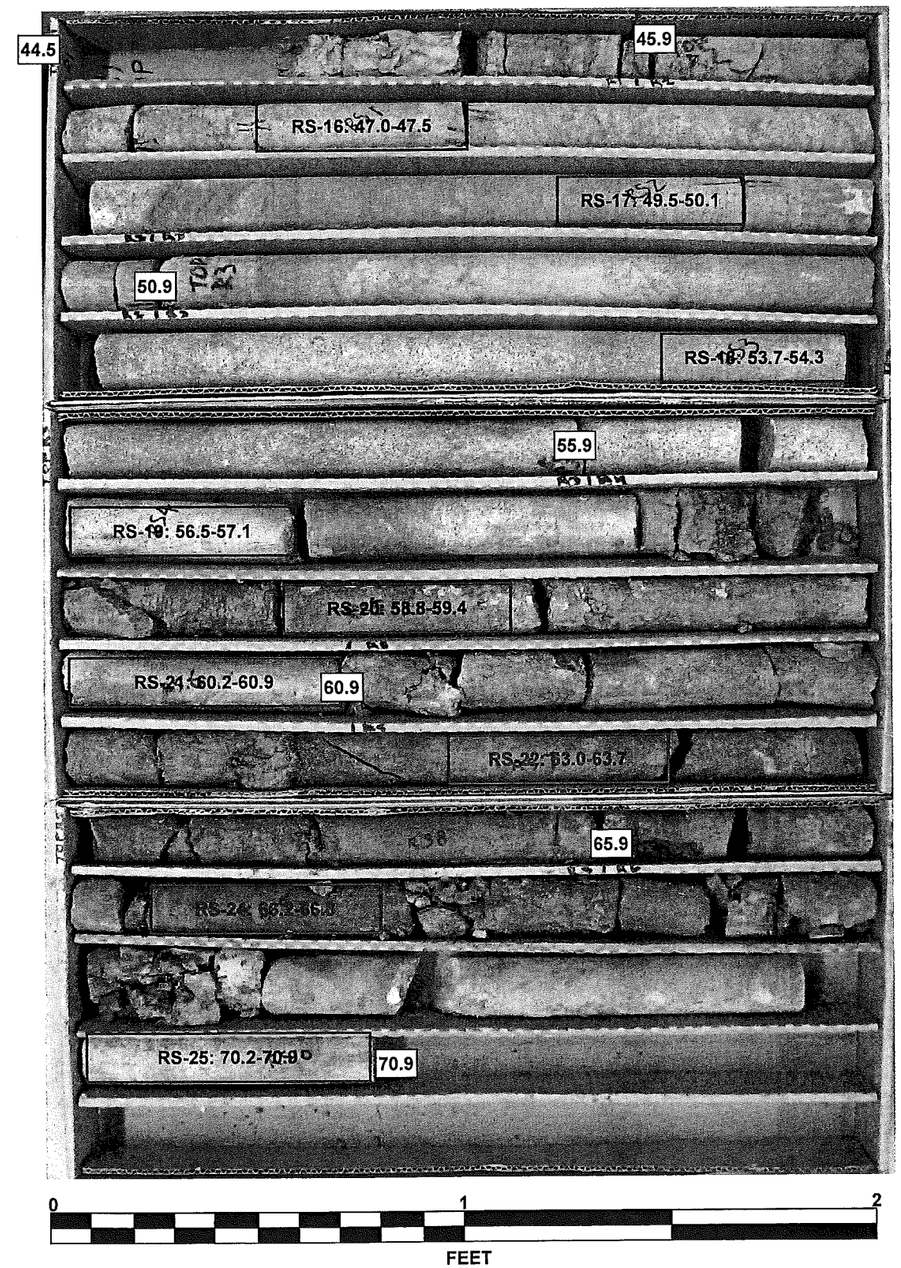
BOXES 1 - 3: 43.4-74.3 FEET



CORE PHOTOGRAPHS

B3-C

BOXES 1 - 3: 44.5-70.9 FEET



STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1 (U-0071)	1	18

PROJECT: 34745.1.1

ID: U-0071

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1 (U-0071) F.A. PROJ. NHF-76-1(2)

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5, 6	CROSS SECTIONS
7-15	BORE LOG & CORE REPORTS
16, 17	CORE PHOTOGRAPHS
18	ROCK CORE TEST RESULTS

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CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE MARCH 2013

NORTH CAROLINA LICENSED SEAL 2124 GEOLOGIST NATHAN DANIEL MOHS

3/28/13

DRAWN BY: T.T. WALKER

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PROJECT REFERENCE NO.	SHEET NO.
34745.1.1 (U-0071)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

VERY STIFF, GRAY, 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 / PLASTIC INDEX	6 MX		NP	40 MX / 18 MX	41 MN / 18 MX	40 MX / 11 MN	41 MN / 11 MN	40 MX / 18 MX	41 MN / 18 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 (TONS/FT^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/026 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

ABBREVIATIONS

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

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

EQUIPMENT USED ON SUBJECT PROJECT

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

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

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

CORE SIZE:
- [ ] -B_____
- [X] -N WC3
- [ ] -H_____

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

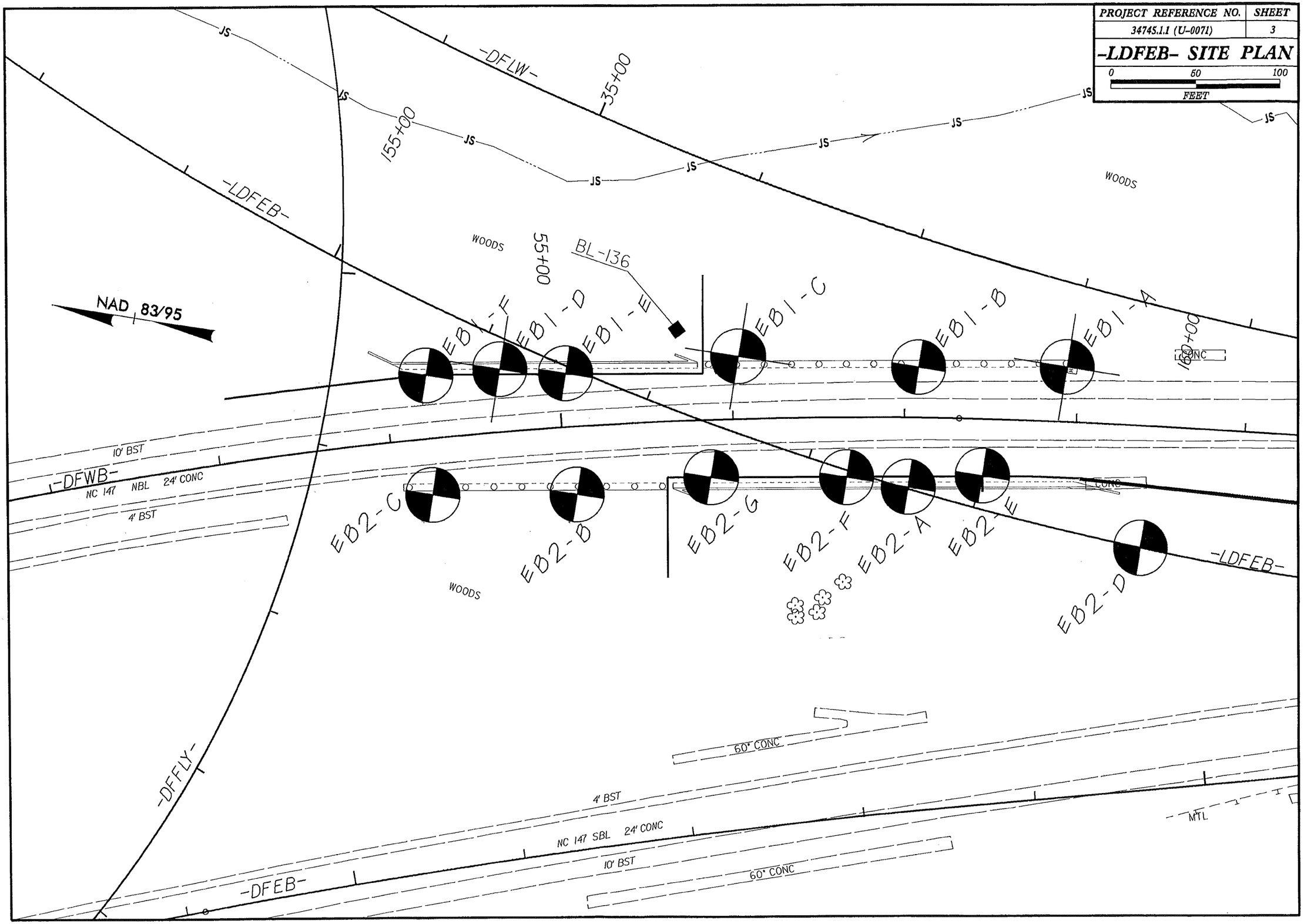
STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK: BL-136: -BL- STA. 159+24.24

ELEVATION: 375.24 FT.

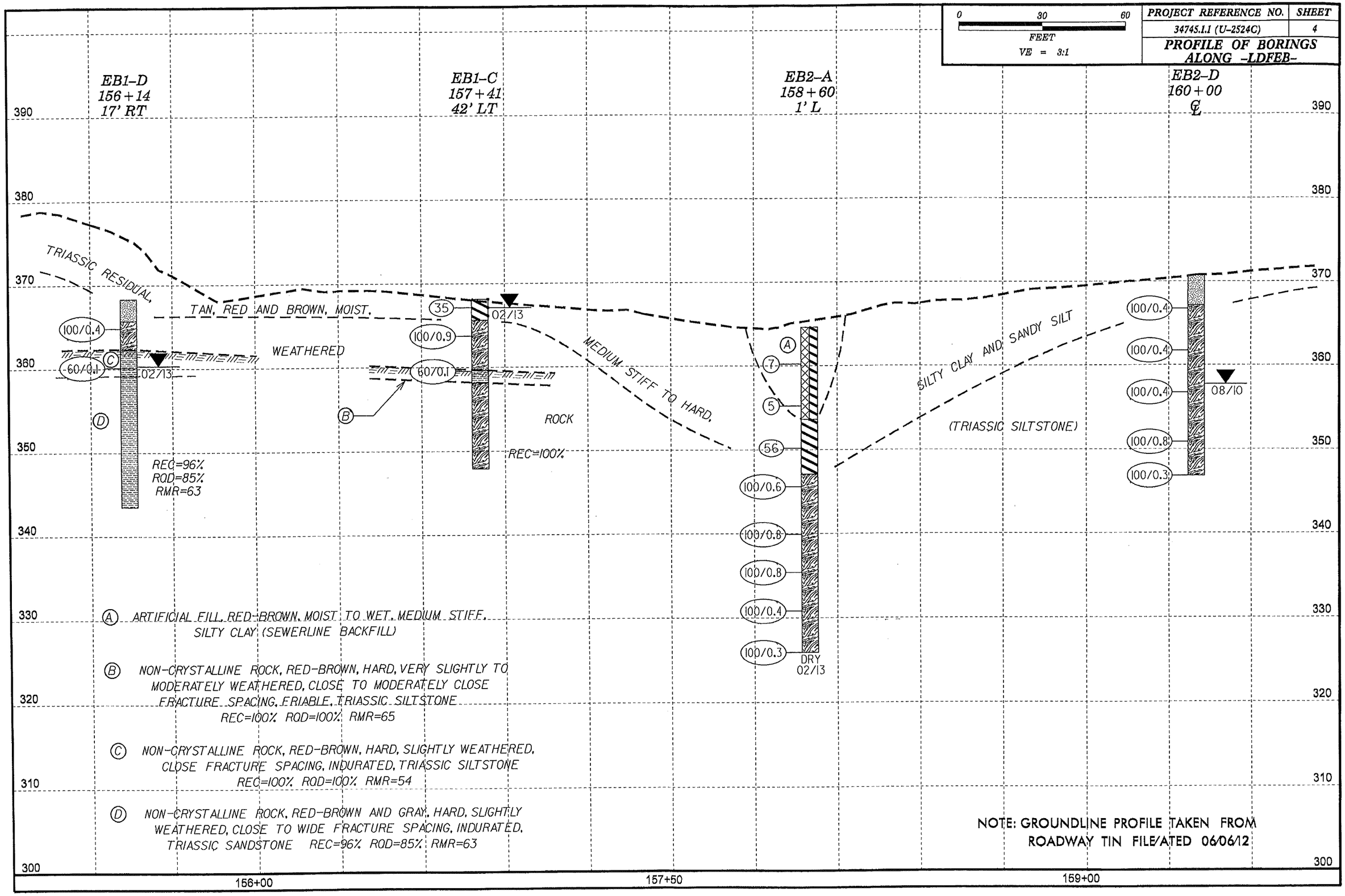
NOTES:


PROJECT REFERENCE NO.
SHEET
34745.1.1 (U-0071)
3
-LDFEB- SITE PLAN
0
50
100
FEET
-DFLW-
35+00
155+00
JS
-LDFEB-
WOODS
55+00
BL-136
NAD 83/95
EB1-F
EB1-D
EB1-E
EB1-C
EB1-B
EB1-A
160+00
CONC
10' BST
-DFWB-
NC 147 NBL 24' CONC
4' BST
EB2-C
EB2-B
EB2-G
EB2-F
EB2-A
EB2-E
EB2-D
-LDFEB-
-DFFLY-
60" CONC
4' BST
NC 147 SBL 24' CONC
10' BST
-DFEB-
MTL

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-2524C)	4

PROFILE OF BORINGS ALONG -LDFEB-

0 30 60
FEET
VE = 3:1



(A) ARTIFICIAL FILL, RED-BROWN, MOIST TO WET, MEDIUM STIFF, SILTY CLAY (SEWERLINE BACKFILL)

(B) NON-CRYSTALLINE ROCK, RED-BROWN, HARD, VERY SLIGHTLY TO MODERATELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, FRIABLE, TRIASSIC SILTSTONE
REC=100% RQD=100% RMR=65

(C) NON-CRYSTALLINE ROCK, RED-BROWN, HARD, SLIGHTLY WEATHERED, CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE
REC=100% RQD=100% RMR=54

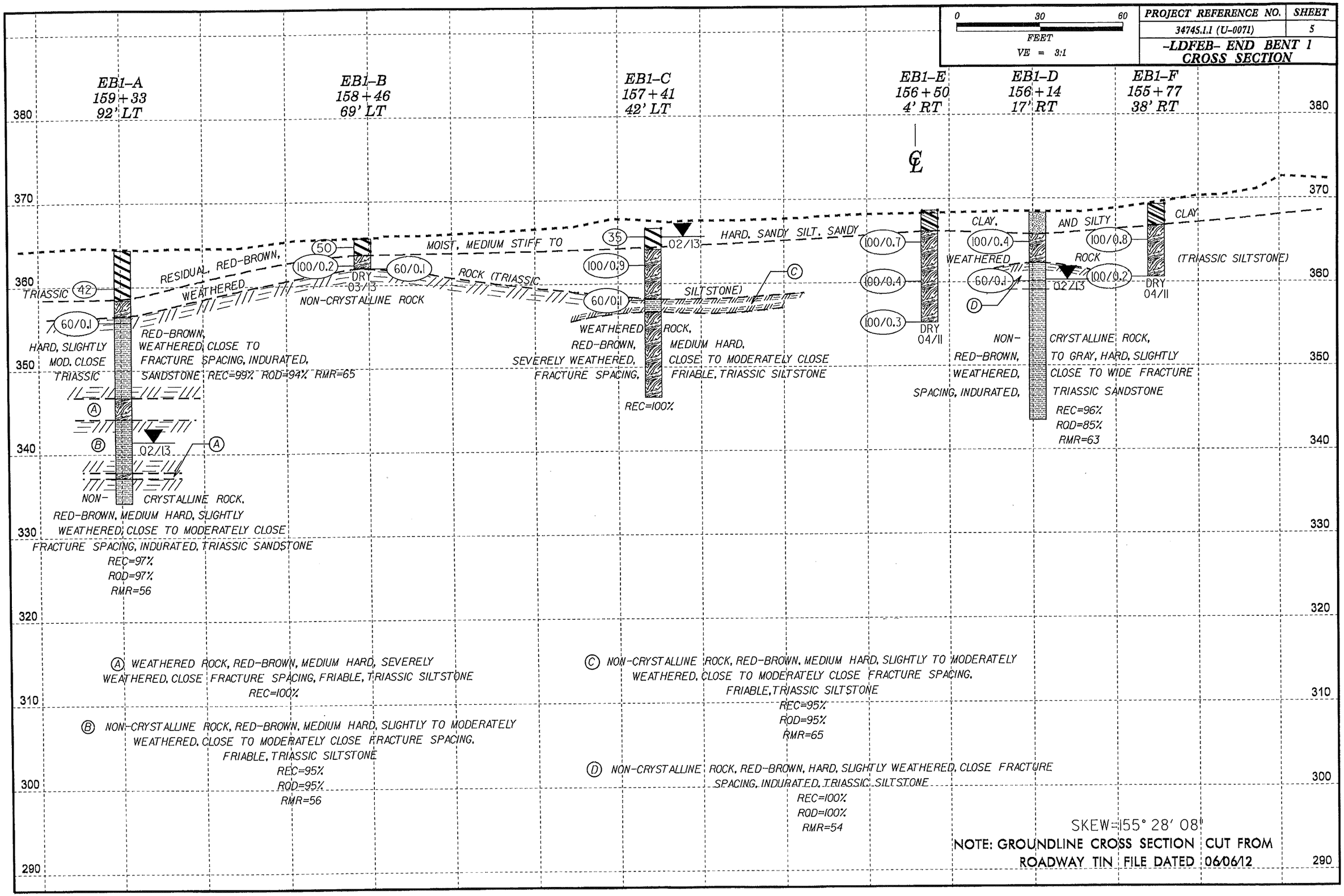
(D) NON-CRYSTALLINE ROCK, RED-BROWN AND GRAY, HARD, SLIGHTLY WEATHERED, CLOSE TO WIDE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=96% RQD=85% RMR=63

NOTE: GROUNDLINE PROFILE TAKEN FROM ROADWAY TIN FILE/ATED 06/06/12

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	5

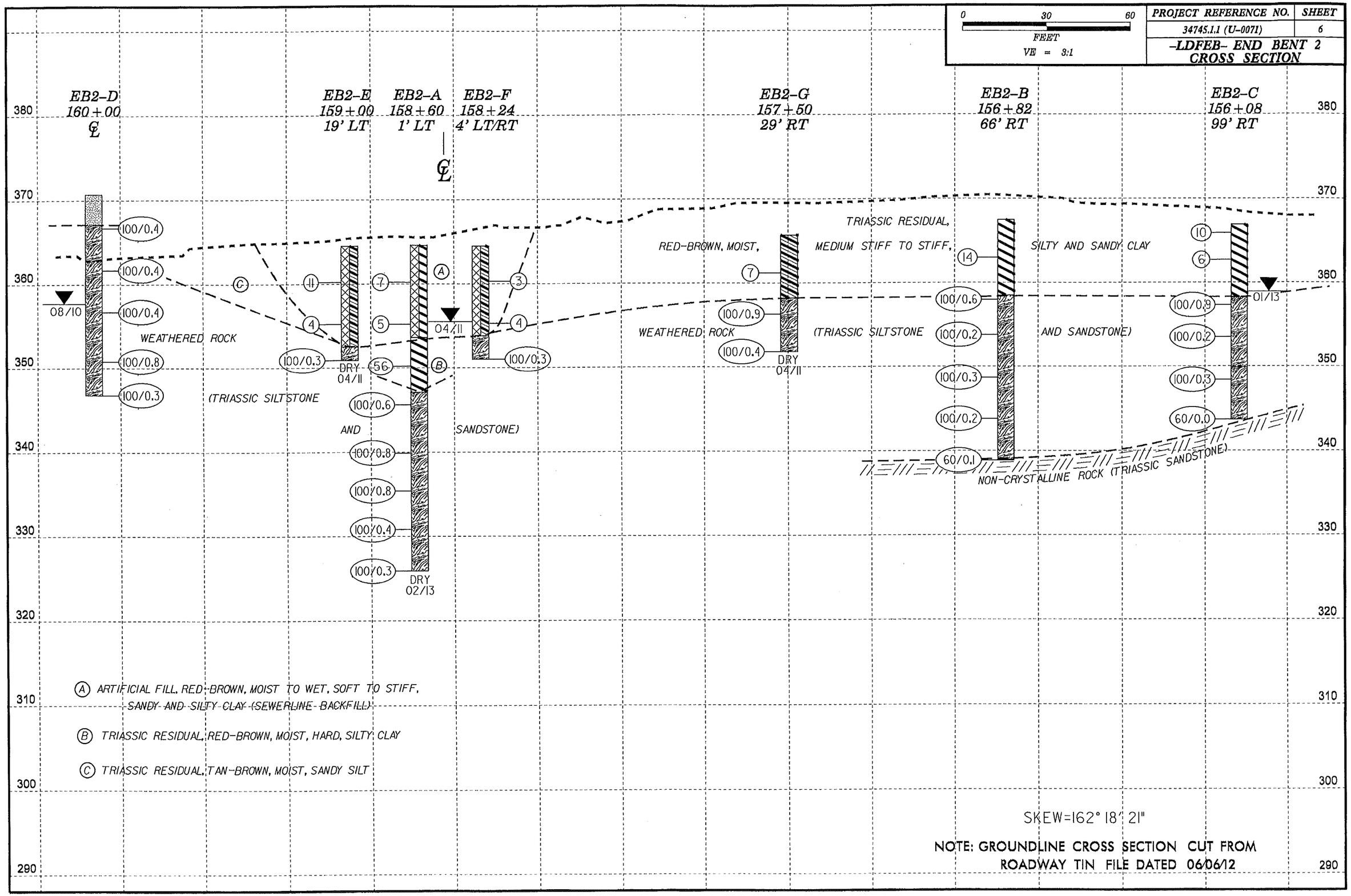
-LDFEB- END BENT 1
CROSS SECTION

0 30 60
FEET
VE = 3:1



PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	6

-LDFEB- END BENT 2
CROSS SECTION



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147			GROUND WTR (ft)
BORING NO. EB1-A	STATION 159+33	OFFSET 92 ft LT	ALIGNMENT -LDFEB-
COLLAR ELEV. 364.4 ft	TOTAL DEPTH 30.3 ft	NORTHING 806,106	EASTING 2,039,877
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 02/21/13	COMP. DATE 02/21/13	SURFACE WATER DEPTH N/A

GROUND WTR (ft): 0 HR. N/A; 24 HR. 23.0

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
365										364.4 GROUND SURFACE	0.0
										TRIASSIC RESIDUAL RED-BROWN, SILTY CLAY	
360	360.8	3.6	16	17	25	42				358.4	6.0
										WEATHERED ROCK (TRIASSIC SILTSTONE) 356.4	8.0
355	355.8	8.6	60/0.1			60/0.1				355.7 **NON-CRYSTALLINE ROCK** (TRIASSIC SILTSTONE)	8.7
350							RS-7			RED-BROWN, HARD, SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=99% RQD=94% RMR=65 346.7	17.7
345										**WEATHERED ROCK** RED-BROWN, MEDIUM HARD, SEVERELY WEATHERED, CLOSE FRACTURE SPACING, FRIABLE, TRIASSIC SILTSTONE REC=100% 344.1	20.3
340							RS-8 RS-9			**NON-CRYSTALLINE ROCK** RED-BROWN, MEDIUM HARD, SLIGHTLY TO MODERATELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, FRIABLE, TRIASSIC SILTSTONE REC=95% RQD=95% RMR=56 337.8	26.6
335										337.1 334.1	27.3 30.3
										WEATHERED ROCK RED-BROWN, MEDIUM HARD, SEVERELY WEATHERED, CLOSE FRACTURE SPACING, FRIABLE, TRIASSIC SILTSTONE REC=100%	
										NON-CRYSTALLINE ROCK RED-BROWN, MEDIUM HARD, SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE REC=97% RQD=97% RMR=56	
										Boring Terminated at Elevation 334.1 ft IN WEATHERED ROCK (TRIASSIC SILTSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147			GROUND WTR (ft)
BORING NO. EB1-A	STATION 159+33	OFFSET 92 ft LT	ALIGNMENT -LDFEB-
COLLAR ELEV. 364.4 ft	TOTAL DEPTH 30.3 ft	NORTHING 806,106	EASTING 2,039,877
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 02/21/13	COMP. DATE 02/21/13	SURFACE WATER DEPTH N/A
CORE SIZE NWC3	TOTAL RUN 21.6 ft		

GROUND WTR (ft): 0 HR. N/A; 24 HR. 23.0

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
355.7											Begin Coring @ 8.7 ft	
355	355.7	8.7	1.6	0:56/0.6 2:00/1.0	(1.6) 100%	(1.3) 81%		(8.9) 99%	(8.5) 94%		355.7 RED-BROWN, HARD, SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=99% RQD=94% RMR=65	8.7
350	354.1 349.1	10.3 15.3	5.0	1:14/1.0 0:42/1.0 0:44/1.0 0:47/1.0 0:53/1.0	(4.9) 98%	(4.9) 98%	RS-7					
345			5.0	1:00/1.0 0:57/1.0 1:55/1.0 1:27/1.0 2:17/1.0	(4.7) 94%	(2.4) 48%		(2.6) 100%	N/A		346.7 **WEATHERED ROCK** RED-BROWN, MEDIUM HARD, SEVERELY WEATHERED, CLOSE FRACTURE SPACING, FRIABLE, TRIASSIC SILTSTONE REC=100% 344.1	17.7 20.3
340	344.1 339.1	20.3 25.3	5.0	2:01/1.0 1:15/1.0 0:57/1.0 1:02/1.0 0:58/1.0	(4.9) 98%	(4.7) 94%	RS-8 RS-9	(6.0) 95%	(6.0) 95%		**NON-CRYSTALLINE ROCK** RED-BROWN, MEDIUM HARD, SLIGHTLY TO MODERATELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, FRIABLE, TRIASSIC SILTSTONE REC=95% RQD=95% RMR=56 337.8	26.6
335	334.1	30.3	5.0	2:21/1.0 1:06/1.0 0:52/1.0 0:59/1.0 1:07/1.0	(5.0) 100%	(4.4) 88%		(0.6) 86% (2.9) 97%	N/A (2.9) 97%		337.1 334.1	27.3 30.3
											WEATHERED ROCK RED-BROWN, MEDIUM HARD, SEVERELY WEATHERED, CLOSE FRACTURE SPACING, FRIABLE, TRIASSIC SILTSTONE REC=100%	
											NON-CRYSTALLINE ROCK RED-BROWN, MEDIUM HARD, SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE REC=97% RQD=97% RMR=56	
											Boring Terminated at Elevation 334.1 ft IN WEATHERED ROCK (TRIASSIC SILTSTONE)	

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147			**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 158+46	**OFFSET** 69 ft LT	**ALIGNMENT** -LDFEB- — **0 HR.** Dry
COLLAR ELEV. 365.6 ft	**TOTAL DEPTH** 3.6 ft	**NORTHING** 806,191	**EASTING** 2,039,863 — **24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Conley, H. R.	**START DATE** 01/24/13	**COMP. DATE** 01/24/13	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
370											
365	365.6	0.0	6	10	40	50				365.6 GROUND SURFACE	0.0
										TRIASSIC RESIDUAL RED-BROWN, SILTY CLAY	2.0
	362.6	3.0								**WEATHERED ROCK** (TRIASSIC SILTSTONE)	3.5
	362.1	3.5	100/0.2			100/0.2 60/0.1				**NON-CRYSTALLINE ROCK** (TRIASSIC SILTSTONE)	3.6
			60/0.1							Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 362.0 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147			GROUND WTR (ft)
BORING NO. EB1-C	STATION 157+41	OFFSET 42 ft LT	ALIGNMENT -LDFEB- — 0 HR. N/A
COLLAR ELEV. 366.6 ft	TOTAL DEPTH 20.2 ft	NORTHING 806,296	EASTING 2,039,853 — 24 HR. 1.0
DRILL RIG/HAMMER EFF./DATE RF00074 CME-55 91% 12/18/2012		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 02/22/13	COMP. DATE 02/22/13	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
370											
	366.6	0.0	4	16	19	35		M		366.6 GROUND SURFACE	0.0
365										**TRIASSIC RESIDUAL** RED-BROWN, SILTY CLAY	
	364.1	2.5								364.1	2.5
	363.1	3.5	22	78/0.4		100/0.9				**WEATHERED ROCK** (TRIASSIC SILTSTONE)	
360											
	358.1	8.5	60/0.1			60/0.1				358.1	8.5
							RS-4			358.6 **NON-CRYSTALLINE ROCK** RED-BROWN, HARD, VERY SLIGHTLY TO MODERATELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, FRIABLE, TRIASSIC SILTSTONE REC=100% RQD=100% RMR=65	10.0
355							RS-5				
350											
							RS-6			346.4 **WEATHERED ROCK** RED-BROWN, MEDIUM HARD, SEVERELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, FRIABLE, TRIASSIC SILTSTONE REC=100%	20.2
										Boring Terminated at Elevation 346.4 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147			GROUND WTR (ft)
BORING NO. EB1-C	STATION 157+41	OFFSET 42 ft LT	ALIGNMENT -LDFEB- — 0 HR. N/A
COLLAR ELEV. 366.6 ft	TOTAL DEPTH 20.2 ft	NORTHING 806,296	EASTING 2,039,853 — 24 HR. 1.0
DRILL RIG/HAMMER EFF./DATE RF00074 CME-55 91% 12/18/2012		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 02/22/13	COMP. DATE 02/22/13	SURFACE WATER DEPTH N/A
CORE SIZE NWC3	TOTAL RUN 11.6 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
358											Begin Coring @ 8.6 ft	
	358.0 356.4	8.6 10.2	1.6	:55/0.6 1:55/1.0	(1.6) 100%	(1.6) 100%	RS-4	(10.2) 100%	N/A		356.6 **NON-CRYSTALLINE ROCK** RED-BROWN, HARD, VERY SLIGHTLY TO MODERATELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, FRIABLE, TRIASSIC SILTSTONE REC=100% RQD=100% RMR=65 *(continued)*	10.0
355			5.0	2:02/1.0 1:01/1.0 :45/1.0 1:15/1.0 N/A/1.0	(5.0) 100%	(5.0) 100%	RS-5					
	351.4	15.2										
350			5.0	1:35/1.0 :46/1.0 :49/1.0 :52/1.0 :51/1.0	(5.0) 100%	(5.0) 100%						
	346.4	20.2					RS-6				346.4 **WEATHERED ROCK** RED-BROWN, MEDIUM HARD, SEVERELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, FRIABLE, TRIASSIC SILTSTONE REC=100%	20.2
											Boring Terminated at Elevation 346.4 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147			GROUND WTR (ft)
BORING NO. EB1-D	STATION 156+14	OFFSET 17 ft RT	ALIGNMENT -LDFEB- — 0 HR. N/A
COLLAR ELEV. 368.3 ft	TOTAL DEPTH 24.8 ft	NORTHING 806,432	EASTING 2,039,824 — 24 HR. 8.0
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 02/20/13	COMP. DATE 02/20/13	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
370										368.3 GROUND SURFACE	0.0
										TRIASSIC RESIDUAL RED-BROWN, SANDY SILT	
365	365.2	3.1	100/0.4			100/0.4				365.7	2.6
										WEATHERED ROCK (TRIASSIC SILTSTONE)	
										362.3	6.0
										NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	
360	360.2	8.1	60/0.1			60/0.1				360.1	8.2
										359.1 RED-BROWN, HARD, SLIGHTLY WEATHERED, CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE REC=100% RQD=100% RMR=54	9.2
355							RS-1				
							RS-2			RED-BROWN TO GRAY, HARD, SLIGHTLY WEATHERED, CLOSE TO WIDE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=96% RQD=85% RMR=63	
350											
345							RS-3				
										343.5	24.8
										Boring Terminated at Elevation 343.5 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147			GROUND WTR (ft)
BORING NO. EB1-D	STATION 156+14	OFFSET 17 ft RT	ALIGNMENT -LDFEB- — 0 HR. N/A
COLLAR ELEV. 368.3 ft	TOTAL DEPTH 24.8 ft	NORTHING 806,432	EASTING 2,039,824 — 24 HR. 8.0
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 02/20/13	COMP. DATE 02/20/13	SURFACE WATER DEPTH N/A
CORE SIZE NWC3	TOTAL RUN 16.6 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
360.01											Begin Coring @ 8.2 ft	
	360.1	8.2	1.6	1:40/0.6	(1.4)	(1.4)		(1.0)	(1.0)		360.1 RED-BROWN, HARD, SLIGHTLY WEATHERED, CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE REC=100% RQD=100% RMR=54	8.2
	358.5	9.8		0:57/1.0	88%	88%	RS-1	100%	100%		359.1	9.2
355			5.0	2:08/1.0	(5.0)	(4.8)		(15.0)	(13.3)		RED-BROWN TO GRAY, HARD, SLIGHTLY WEATHERED, CLOSE TO WIDE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=96% RQD=85% RMR=63	
				0:49/1.0	100%	96%		96%	85%			
				0:40/1.0								
				0:42/1.0								
	353.5	14.8		1:19/1.0			RS-2					
			5.0	0:42/1.0	(4.6)	(3.2)						
				0:55/1.0	92%	64%						
350				0:41/1.0								
				0:46/1.0								
	348.5	19.8		0:36/1.0								
			5.0	1:00/1.0	(5.0)	(4.9)						
				1:11/1.0	100%	98%						
345				0:57/1.0			RS-3					
				0:49/1.0								
	343.5	24.8		0:33/1.0							343.5	24.8
											Boring Terminated at Elevation 343.5 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	

NCDOT BORE DOUBLE U0071_GEO_LDFEB_BH.GPJ NC_DOT.GDT 3/21/13

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147			GROUND WTR (ft)
BORING NO. EB1-E	STATION 156+50	OFFSET 4 ft RT	ALIGNMENT -LDFEB-
COLLAR ELEV. 368.6 ft	TOTAL DEPTH 13.4 ft	NORTHING 806,394	EASTING 2,039,828
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 00% 00/00/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 04/13/11	COMP. DATE 04/13/11	SURFACE WATER DEPTH N/A

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

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
370											
										368.6 GROUND SURFACE	0.0
										TRIASSIC RESIDUAL RED-BROWN, SANDY CLAY	
							S-43	M		366.1	2.5
365	365.5	3.1	26	74/0.2		100/0.7				WEATHERED ROCK (TRIASSIC SILTSTONE)	
360	360.5	8.1	100/0.4			100/0.4					
	355.5	13.1	00/03.3			100/0.3				355.2	13.4
										Boring Terminated at Elevation 355.2 ft IN WEATHERED ROCK (TRIASSIC SILTSTONE) .TIN FILE ELEVATION	

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147			GROUND WTR (ft)
BORING NO. EB1-F	STATION 155+77	OFFSET 38 ft RT	ALIGNMENT -LDFEB-
COLLAR ELEV. 369.3 ft	TOTAL DEPTH 8.7 ft	NORTHING 806,474	EASTING 2,039,814
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 00% 00/00/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 04/13/11	COMP. DATE 04/13/11	SURFACE WATER DEPTH N/A

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

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
370										
										369.3 GROUND SURFACE 0.0
										TRIASSIC RESIDUAL RED-BROWN, SANDY CLAY
										366.8 2.5
365	365.8	3.5	24	76/0.3		100/0.8				WEATHERED ROCK (TRIASSIC SILTSTONE)
	360.8	8.5	100/0.2			100/0.2				360.6 8.7
										Boring Terminated at Elevation 360.6 ft IN WEATHERED ROCK (TRIASSIC SILTSTONE) .TIN FILE ELEVATION

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147			GROUND WTR (ft)
BORING NO. EB2-A	STATION 158+60	OFFSET 1 ft LT	ALIGNMENT -LDFEB- / 0 HR. N/A
COLLAR ELEV. 364.6 ft	TOTAL DEPTH 38.7 ft	NORTHING 806,187	EASTING 2,039,794 / 24 HR. Dry
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD NW Casing w/ SPT	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 02/06/13	COMP. DATE 02/06/13	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
365										364.6 GROUND SURFACE	0.0
										ARTIFICIAL FILL RED-BROWN, SILTY CLAY	
360	361.2	3.4	3	3	4	7		M			
355	356.2	8.4	2	3	2	5		M		353.6	11.0
										TRIASSIC RESIDUAL RED-BROWN, SILTY CLAY	
350	351.2	13.4	10	15	41	56		M			
345	346.2	18.4	44	56/0.1		100/0.6				347.1	17.5
										WEATHERED ROCK (TRIASSIC SILTSTONE)	
340	341.2	23.4	20	18	82/0.3	100/0.8					
335	336.2	28.4	33	67/0.3		100/0.8					
330	331.2	33.4	100/0.4			100/0.4					
	326.2	38.4	10/0.3			100/0.3				325.9	38.7
										Boring Terminated at Elevation 325.9 ft IN WEATHERED ROCK (TRIASSIC SILTSTONE)	

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147			GROUND WTR (ft)
BORING NO. EB2-B	STATION 156+82	OFFSET 66 ft RT	ALIGNMENT -LDFEB- / 0 HR. N/A
COLLAR ELEV. 366.4 ft	TOTAL DEPTH 28.6 ft	NORTHING 806,377	EASTING 2,039,760 / 24 HR. 17.0
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD NW Casing w/ SPT	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 02/14/13	COMP. DATE 02/14/13	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
370										366.4 GROUND SURFACE 0.0
										TRIASSIC RESIDUAL RED-BROWN, SILTY CLAY
365	362.9	3.5	4	7	7	14		M		
360	357.9	8.5	6	70	30/0.1	100/0.6				357.4 9.0
										WEATHERED ROCK (TRIASSIC SILTSTONE)
355	352.9	13.5	100/0.2			100/0.2				
350	347.9	18.5	100/0.3			100/0.3				
345	342.9	23.5	100/0.2			100/0.2				
340	337.9	28.5	60/0.1			60/0.1				337.9 28.5 / 337.8 28.6
										NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 337.8 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)

NCDOT BORE DOUBLE U0071_GEO_LDFEB_BH.GPJ NC_DOT.GDT 3/21/13

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.	
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147				GROUND WTR (ft)
BORING NO. EB2-C	STATION 156+08	OFFSET 99 ft RT	ALIGNMENT -LDFEB-	0 HR. 8.0
COLLAR ELEV. 366.9 ft	TOTAL DEPTH 23.2 ft	NORTHING 806,460	EASTING 2,039,747	24 HR. 8.0
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 01/28/13	COMP. DATE 01/28/13	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
370											
	366.9	0.0								366.9 GROUND SURFACE	0.0
365			4	4	6	10		M		TRIASSIC RESIDUAL RED-BROWN, SILTY CLAY	
	363.7	3.2	2	3	3	6		M			
360											
	358.7	8.2	2	6	94/0.4	100/0.9				358.2 WEATHERED ROCK (TRIASSIC SILTSTONE)	8.7
355											
	353.7	13.2	100/0.2			100/0.2					
350										349.9 WEATHERED ROCK (TRIASSIC SANDSTONE)	17.0
	348.7	18.2	100/0.3			100/0.3					
345											
	343.7	23.2	60/0.0			60/0.0				343.7 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 343.7 ft ON NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	23.2

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.	
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147				GROUND WTR (ft)
BORING NO. EB2-D	STATION 160+00	OFFSET CL	ALIGNMENT -LDFEB-	0 HR. Dry
COLLAR ELEV. 370.7 ft	TOTAL DEPTH 23.9 ft	NORTHING 806,047	EASTING 2,039,781	24 HR. 13.0
DRILL RIG/HAMMER EFF./DATE RFO0067 CME-550X 77% 03/15/2010		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 08/03/10	COMP. DATE 08/03/10	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
375											
										370.7 GROUND SURFACE	0.0
370										TRIASSIC RESIDUAL TAN, BROWN, SANDY SILT	
	367.1	3.6	100/0.4			100/0.4				367.1	3.6
365										WEATHERED ROCK (TRIASSIC SANDSTONE)	
	362.1	8.6	100/0.4			100/0.4					
360											
	357.1	13.6	100/0.4			100/0.4					
355											
	352.1	18.6	18	33	67/0.3	100/0.8					
350											
	347.1	23.6	100/0.3			100/0.3				346.8 Boring Terminated at Elevation 346.8 ft IN WEATHERED ROCK (TRIASSIC SANDSTONE)	23.9

.TIN FILE ELEVATION

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147			GROUND WTR (ft)
BORING NO. EB2-E	STATION 159+00	OFFSET 19 ft LT	ALIGNMENT -LDFEB- — 0 HR. Dry
COLLAR ELEV. 364.5 ft	TOTAL DEPTH 13.6 ft	NORTHING 806,145	EASTING 2,039,807 — 24 HR. Dry
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 00% 00/00/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 04/13/11	COMP. DATE 04/13/11	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
365										364.5 GROUND SURFACE	0.0
										ARTIFICIAL FILL RED-BROWN, SANDY CLAY	
360	361.2	3.3	3	5	6	11		M			
355	356.2	8.3	1	1	3	4		W			
	351.2	13.3	100/0.3			100/0.3				352.5 WEATHERED ROCK (TRIASSIC SILTSTONE)	12.0
										350.9 Boring Terminated at Elevation 350.9 ft IN WEATHERED ROCK (TRIASSIC SILTSTONE)	13.6
										.TIN FILE ELEVATION	

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147			GROUND WTR (ft)
BORING NO. EB2-F	STATION 158+24	OFFSET 4 ft RT	ALIGNMENT -LDFEB- — 0 HR. 9.0
COLLAR ELEV. 364.5 ft	TOTAL DEPTH 13.5 ft	NORTHING 806,223	EASTING 2,039,794 — 24 HR. 9.0
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 00% 00/00/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 04/13/11	COMP. DATE 04/13/11	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
365										364.5 GROUND SURFACE	0.0
										ARTIFICIAL FILL RED-BROWN, SANDY CLAY	
360	361.3	3.2	4	1	2	3		M			
355	356.3	8.2	WOH	1	3	4	SS-44	W			
										353.8	10.7
	351.3	13.2	100/0.3			100/0.3				351.0 WEATHERED ROCK (TRIASSIC SILTSTONE)	13.5
										Boring Terminated at Elevation 351.0 ft IN WEATHERED ROCK (TRIASSIC SILTSTONE)	
										.TIN FILE ELEVATION	

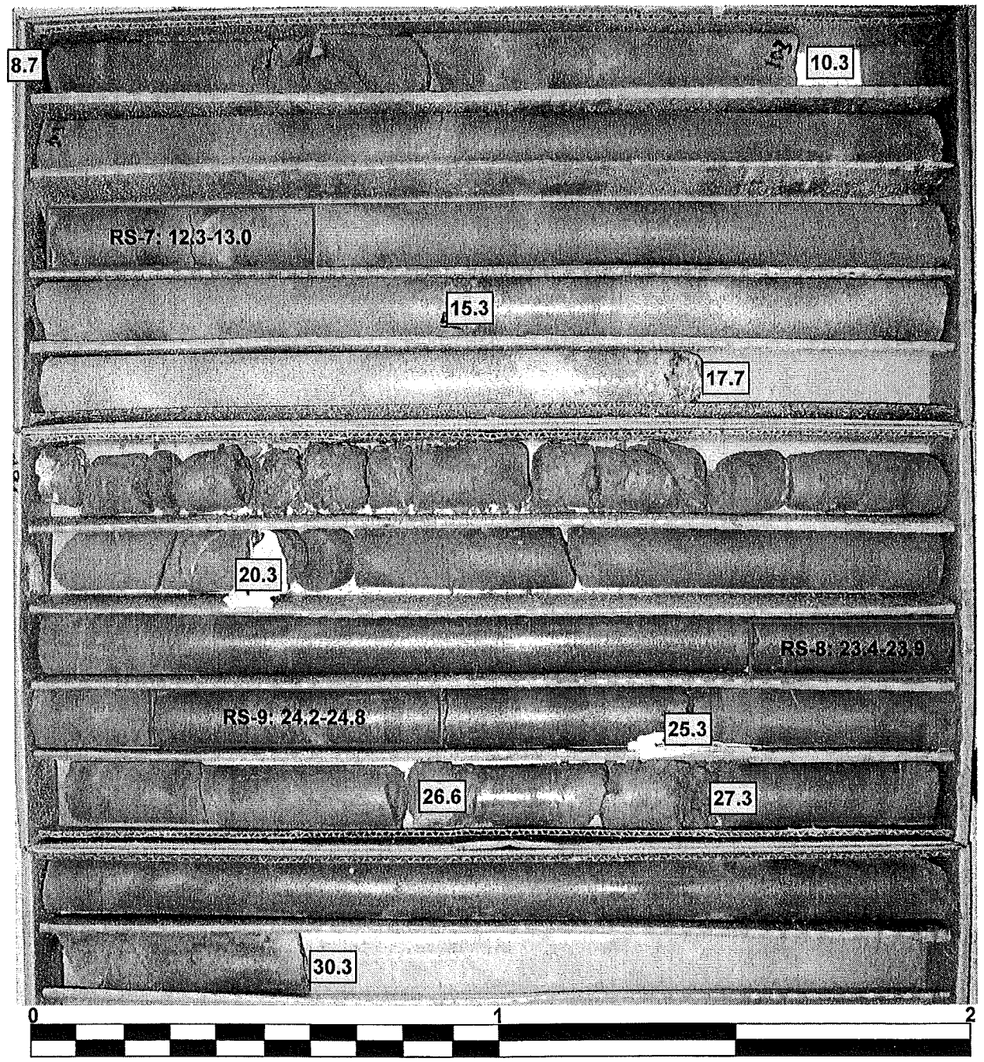
WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Mohs, N. D.
SITE DESCRIPTION STRUCTURE NO. 10 ON -LDFEB- (EAST END CONNECTOR) OVER NC 147			**GROUND WTR (ft)**
BORING NO. EB2-G	**STATION** 157+50	**OFFSET** 29 ft RT	**ALIGNMENT** -LDFEB- — **0 HR.** Dry
COLLAR ELEV. 365.7 ft	**TOTAL DEPTH** 13.9 ft	**NORTHING** 806,301	**EASTING** 2,039,782 — **24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 00% 00/00/2011		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Conley, H. R.	**START DATE** 04/13/11	**COMP. DATE** 04/13/11	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
370											
365										365.7 GROUND SURFACE	0.0
	362.2	3.5	2	5	2	7		M		**TRIASSIC RESIDUAL** RED-BROWN, SANDY CLAY	
360										358.2	7.5
	357.2	8.5	8	92/0.4		100/0.9				**WEATHERED ROCK** (TRIASSIC SILTSTONE)	
355										351.8	13.9
	352.2	13.5	100/0.4			100/0.4				Boring Terminated at Elevation 351.8 ft IN WEATHERED ROCK (TRIASSIC SILTSTONE)	
										.TIN FILE ELEVATION	

CORE PHOTOGRAPHS

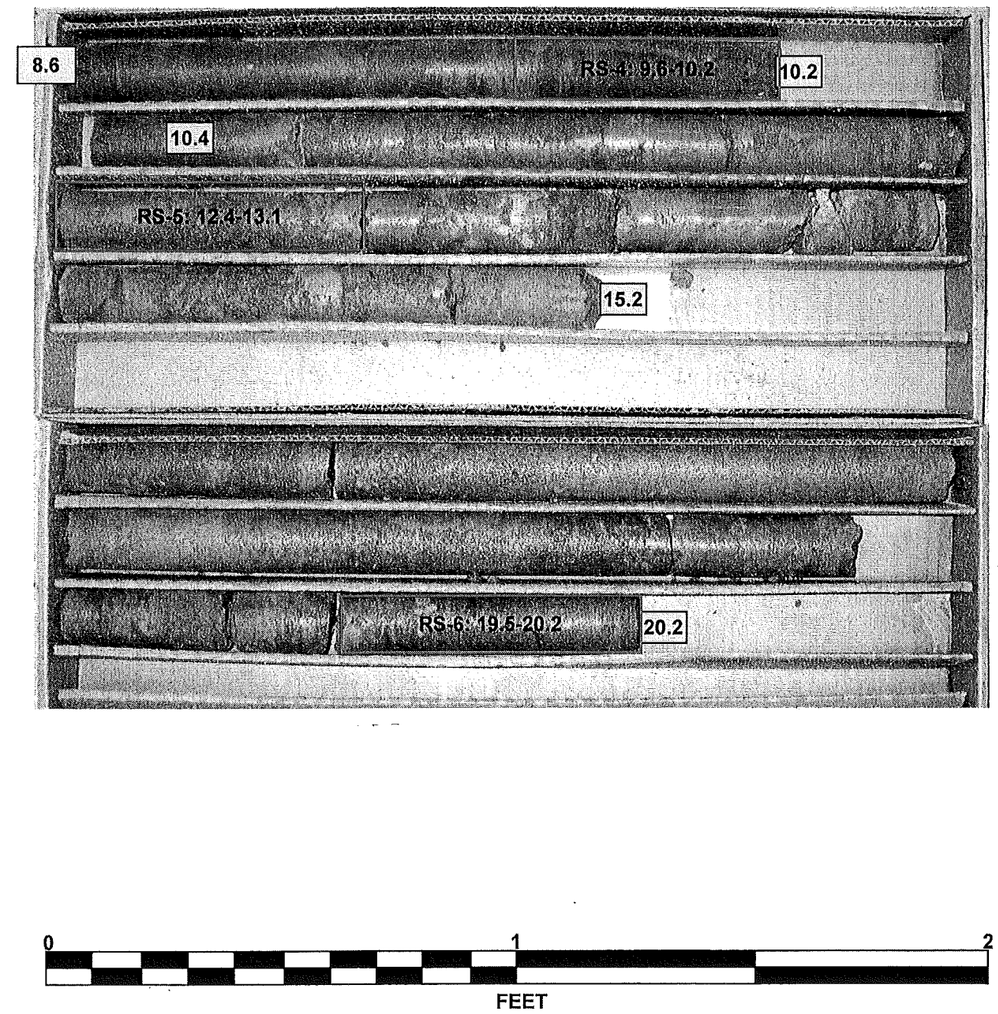
EB1-A

BOXES 1 - 3: 8.7 -30.3 FEET



EB1-C

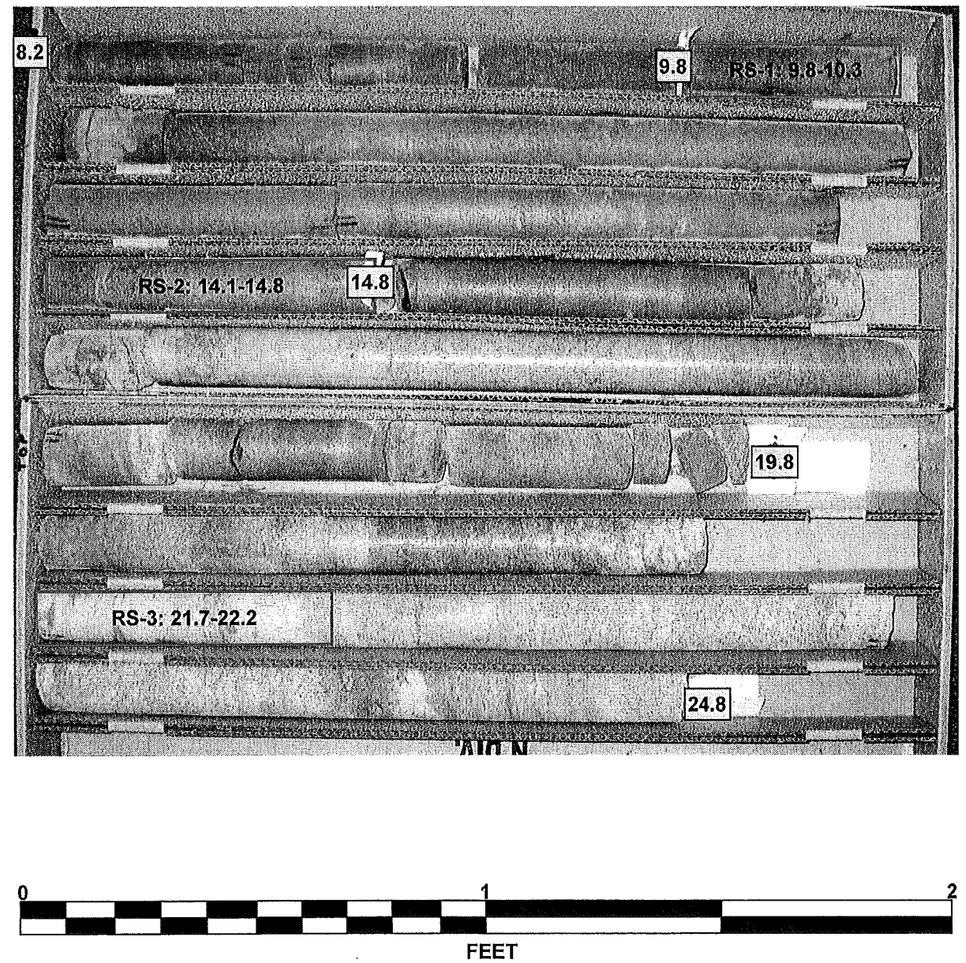
BOXES 1 & 2: 8.6 - 20.2 FEET



CORE PHOTOGRAPHS

EB1-D

BOXES 1 & 2 8.2 - 24.8 FEET



ROCK CORE TEST RESULTS

SAMPLE NO.	BORING	OFFSET	STATION	DEPTH INTERVAL	H/D RATIO	UNIT WT lbs/ft3	Ultimate lbf	Ultimate ksi	Ultimate (corrected) ksi	Sec. Mod. @ 40% Mpsi
RS-1	EB1-D	17' RT	156+14	9.8-10.3	1.91	156.3	9740	3.97	3.95	0.1738
RS-2	EB1-D	17' RT	156+14	14.1-14.8	1.988	156.1	14240	5.31	5.31	0.204
RS-3	EB1-D	17' RT	156+14	21.7-22.2	1.988	150.8	22800	8.57	8.56	0.897
RS-4	EB1-C	42' LT	157+41	9.6-10.2	1.979	156.8	13530	5.08	5.08	0.216
RS-5	EB1-C	42' LT	157+41	12.4-13.1	1.984	154.6	8630	3.19	3.19	0.0834
RS-6	EB1-C	42' LT	157+41	19.5-20.2	1.99	158.6	16540	6.15	6.14	0.254
RS-7	EB1-A	92' LT	159+33	12.3-13.0	2.00	153.4	27800	10.28	10.28	2.31
RS-8	EB1-A	92' LT	159+33	23.4-23.9	1.971	155.7	13500	5.04	5.03	0.346
RS-9	EB1-A	92' LT	159+33	24.2-24.8	1.904	161.2	23500	8.69	8.64	1.187

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1 (U-0071)	1	8

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1 (U-0071) F.A. PROJ. NHF-76-1(2)

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION STRUCTURE NO. 12 ON -DFWB- (NC 147 NORTH) OVER -Y16- (ELLIS ROAD)

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5-7	BORE LOGS & CORE REPORT
8	CORE PHOTOGRAPH

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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PERSONNEL

N.D. MOHS

SUMMIT

INVESTIGATED BY N.D. MOHS

CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE OCTOBER 2012

NORTH CAROLINA LICENSED SEAL 024 GEOLOGIST NATHAN DANIEL MOHS

10/24/12

DRAWN BY: W.D. FIELDS

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PROJECT: 34745.1.1

ID: U-0071

PROJECT REFERENCE NO.	SHEET NO.
34745.1.1 (U-0071)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING #10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#40	30 MX	50 MX	51 MN											
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

ABBREVIATIONS

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

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [X] CME-450
- [ ] _____

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [X] -N 02
- [ ] -H_____

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

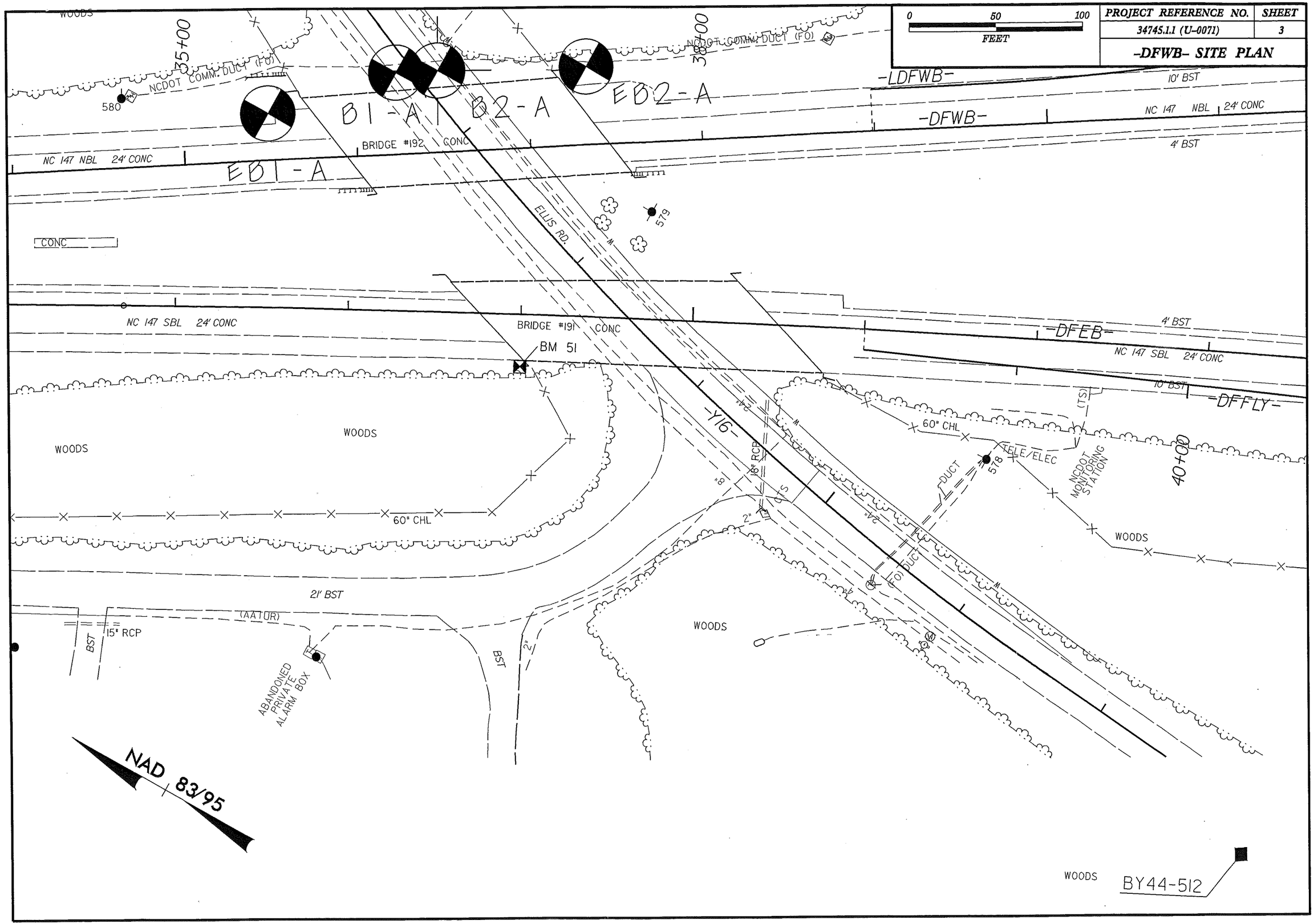
BENCH MARK: BM#51: -BY41- STATION 50+48, 75' RT, ELEVATION 424.46 FEET
BY44-512: -BY44- STATION 22+10.85, ELEVATION 415.17 FEET
ELEVATION: FT.

NOTES:

REVISED 09/23/09

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	3

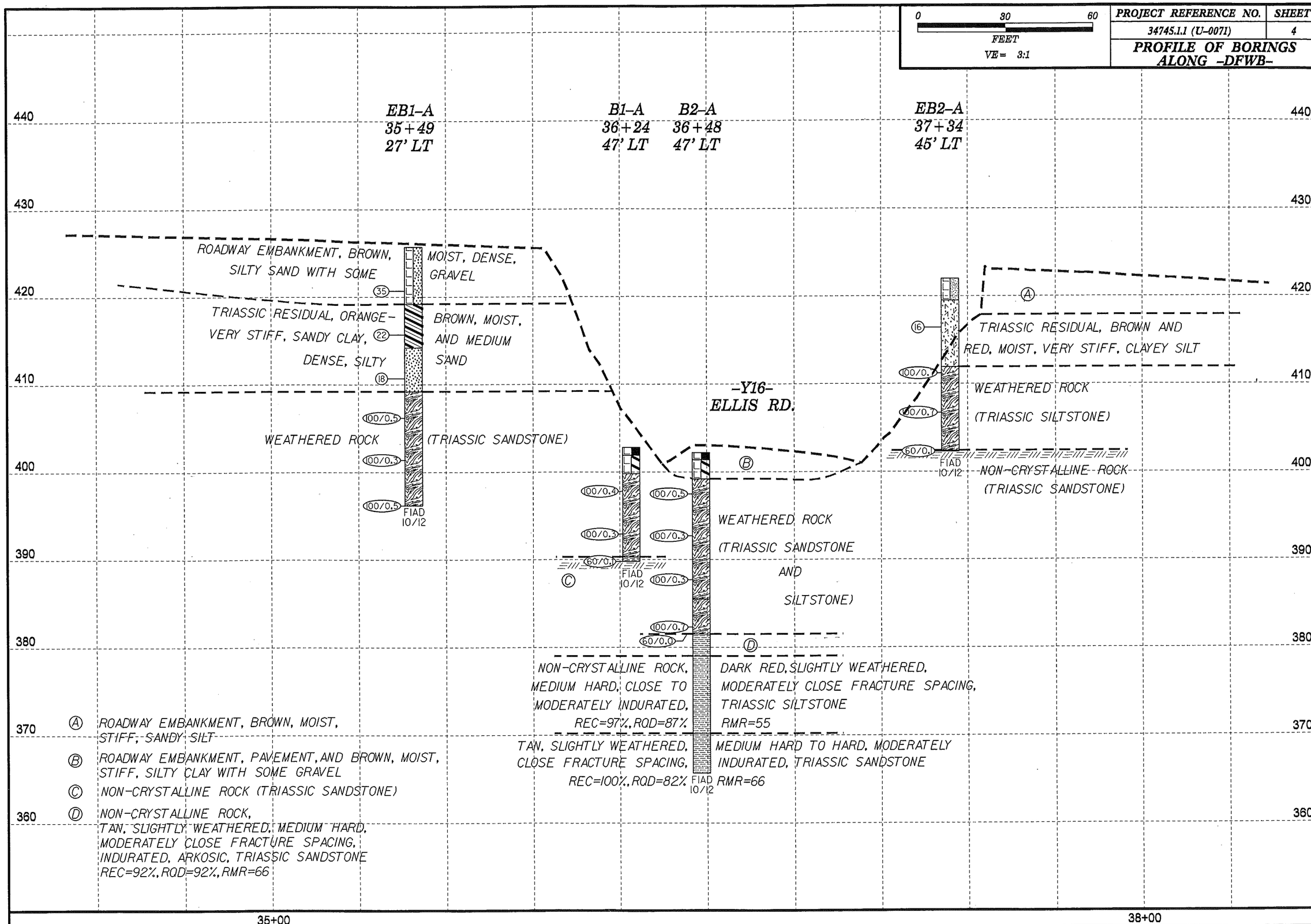
-DFWB- SITE PLAN



PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	4

PROFILE OF BORINGS ALONG -DFWB-

0 30 60
FEET
VE= 3:1



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 12 ON -DFWB- (NC 147 NORTH) OVER -Y16- (ELLIS ROAD)			**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 35+49	**OFFSET** 27 ft LT	**ALIGNMENT** -DFWB- — **0 HR.** Dry
COLLAR ELEV. 425.7 ft	**TOTAL DEPTH** 29.5 ft	**NORTHING** 808,124	**EASTING** 2,038,919 — **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 10/04/12	**COMP. DATE** 10/04/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
425.7										GROUND SURFACE	0.0
										ROADWAY EMBANKMENT LIGHT TAN-BROWN TO BROWN, SILTY SAND WITH SOME CLAY AND GRAVEL	
419.2										**TRIASSIC RESIDUAL** ORANGE-BROWN, SANDY CLAY	6.5
414.2										ORANGE-BROWN, SILTY SAND	11.5
409.2										**WEATHERED ROCK** (TRIASSIC SANDSTONE)	16.5
396.2										Boring Terminated at Elevation 396.2 ft IN WEATHERED ROCK (TRIASSIC SANDSTONE)	29.5

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 12 ON -DFWB- (NC 147 NORTH) OVER -Y16- (ELLIS ROAD)			**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 36+24	**OFFSET** 47 ft LT	**ALIGNMENT** -DFWB- — **0 HR.** Dry
COLLAR ELEV. 402.8 ft	**TOTAL DEPTH** 13.0 ft	**NORTHING** 808,071	**EASTING** 2,038,975 — **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 08/03/12	**COMP. DATE** 08/03/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
402.8										GROUND SURFACE	0.0
401.9										**ROADWAY EMBANKMENT** PAVEMENT AND GRAVEL	0.9
399.8										BROWN, SILTY CLAY WITH SOME SAND AND GRAVEL	3.0
										WEATHERED ROCK (TRIASSIC SANDSTONE)	
390.3											12.5
389.8										**NON-CRYSTALLINE ROCK** (TRIASSIC SANDSTONE)	13.0
										Boring Terminated at Elevation 389.8 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 12 ON -DFWB- (NC 147 NORTH) OVER -Y16- (ELLIS ROAD)			GROUND WTR (ft)
BORING NO. B2-A	STATION 36+48	OFFSET 47 ft LT	ALIGNMENT -DFWB- — 0 HR. N/A
COLLAR ELEV. 402.2 ft	TOTAL DEPTH 36.5 ft	NORTHING 808,051	EASTING 2,038,988 — 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 10/03/12	COMP. DATE 10/03/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
405											
										402.2 GROUND SURFACE	0.0
										401.4 ROADWAY EMBANKMENT PAVEMENT AND GRAVEL	0.8
400										399.2 BROWN, SILTY CLAY WITH SOME SAND AND GRAVEL	3.0
	398.0	4.2	100/0.5			100/0.5				WEATHERED ROCK (TRIASSIC SANDSTONE AND SILTSTONE)	
395											
	393.0	9.2	100/0.3			100/0.3					
390											
	388.0	14.2	100/0.3			100/0.3					
385											
	383.0	19.2	25	75/0.2		100/0.7					
	381.5	20.7	60/0.0			60/0.0				381.5 NON-CRYSTALLINE ROCK	20.7
380										379.0 TAN, SLIGHTLY WEATHERED, MEDIUM HARD, MODERATELY CLOSE FRACTURE SPACING, INDURATED, ARKOSIC, TRIASSIC SANDSTONE REC=92% RQD=92% RMR=66	23.2
375							RS-1				
370										370.2 DARK RED, SLIGHTLY WEATHERED, MEDIUM HARD, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, MODERATELY INDURATED, TRIASSIC SILTSTONE REC=97% RQD=87% RMR=55	32.0
										365.7 TAN, SLIGHTLY WEATHERED, MEDIUM HARD TO HARD, MODERATELY CLOSE FRACTURE SPACING, INDURATED, ARKOSIC, TRIASSIC SANDSTONE REC=100% RQD=82% RMR=66	36.5
										Boring Terminated at Elevation 365.7 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 12 ON -DFWB- (NC 147 NORTH) OVER -Y16- (ELLIS ROAD)			GROUND WTR (ft)
BORING NO. B2-A	STATION 36+48	OFFSET 47 ft LT	ALIGNMENT -DFWB- — 0 HR. N/A
COLLAR ELEV. 402.2 ft	TOTAL DEPTH 36.5 ft	NORTHING 808,051	EASTING 2,038,988 — 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 10/03/12	COMP. DATE 10/03/12	SURFACE WATER DEPTH N/A
CORE SIZE NQ2	TOTAL RUN 15.8 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
381.5											Begin Coring @ 20.7 ft	
380	381.5	20.7	0.8	N=60/0.0	(0.6)	(0.6)		(2.3)	(2.3)		381.5 NON-CRYSTALLINE ROCK	20.7
	380.7	21.5	5.0	1:25/0.8	75%	75%		92%	92%		379.0 TAN, SLIGHTLY WEATHERED, MEDIUM HARD, MODERATELY CLOSE FRACTURE SPACING, INDURATED, ARKOSIC, TRIASSIC SANDSTONE REC=92% RQD=92% RMR=66	23.2
				1:22/1.0 1:40/1.0 2:05/1.0 1:59/1.0 2:24/1.0	(5.0) 100%	(4.3) 86%		(8.5) 97%	(7.8) 89%			
375	375.7	26.5	5.0	1:05/1.0 1:34/1.0 1:43/1.0 1:09/1.0 1:20/1.0	(5.0) 100%	(5.0) 100%	RS-1				DARK RED, SLIGHTLY WEATHERED, MEDIUM HARD, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, MODERATELY INDURATED, TRIASSIC SILTSTONE REC=97% RQD=87% RMR=55	
370	370.7	31.5	5.0	1:19/1.0 1:21/1.0 1:23/1.0 1:20/1.0 1:22/1.0	(5.0) 100%	(4.3) 86%		(4.5) 100%	(3.7) 82%		370.2 TAN, SLIGHTLY WEATHERED, MEDIUM HARD TO HARD, MODERATELY CLOSE FRACTURE SPACING, INDURATED, ARKOSIC, TRIASSIC SANDSTONE REC=100% RQD=82% RMR=66	32.0
	365.7	36.5									365.7 Boring Terminated at Elevation 365.7 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	36.5

NCDOT BORE DOUBLE U0071_GEO_BRDG_DFWB.GPJ NC_DOT.GDT 10/22/12

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 12 ON -DFWB- (NC 147 NORTH) OVER -Y16- (ELLIS ROAD)			**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 37+34	**OFFSET** 45 ft LT	**ALIGNMENT** -DFWB- — **0 HR.** Dry
COLLAR ELEV. 422.0 ft	**TOTAL DEPTH** 19.7 ft	**NORTHING** 807,977	**EASTING** 2,039,032 — **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 10/05/12	**COMP. DATE** 10/05/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
425										
										422.0 GROUND SURFACE 0.0
420										419.5 **ROADWAY EMBANKMENT** BROWN TO RED-BROWN, SANDY SILT 2.5
	417.4	4.6	4	8	8	16		M		**TRIASSIC RESIDUAL** TAN-BROWN AND RED-BROWN, CLAYEY SILT
415										
	412.4	9.6	27	48	52/0.2	100/0.7				411.9 10.1 **WEATHERED ROCK** (TRIASSIC SILTSTONE)
410										
	407.4	14.6	60	40/0.2		100/0.7				
405										
	402.4	19.6	60/0.1			60/0.1				402.4 19.6 402.3 19.7 **NON-CRYSTALLINE ROCK** (TRIASSIC SANDSTONE) Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 402.3 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)

CORE PHOTOGRAPH

B2-A

BOXES 1 & 2: 20.7-36.5 FEET

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1 (U-0071)	1	8

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1 (U-0071) F.A. PROJ. NHF-76-1(2)

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION STRUCTURE NO. 13 ON -DFEB- (NC 147 SOUTH) OVER -Y16- (ELLIS ROAD)

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5-7	BORE LOGS & CORE REPORT
8	CORE PHOTOGRAPH

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

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

PERSONNEL
N.D. MOHS
SUMMIT

INVESTIGATED BY N.D. MOHS
CHECKED BY N.T. ROBERSON
SUBMITTED BY N.T. ROBERSON
DATE OCTOBER 2012

NORTH CAROLINA LICENSED SEAL 2124 GEOLOGIST NATHAN DANIEL MOHS
10/22/12

PROJECT: 34745.1.1
ID: U-0071

DRAWN BY: N.D. MOHS

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

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PROJECT REFERENCE NO.	SHEET NO.
34745.1.1 (U-0071)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING # 10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
# 40	30 MX	50 MX	51 MN											
# 200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/026 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT / DPT DHT / VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

ABBREVIATIONS

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

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [X] CME-450
- [ ] _____

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

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

CORE SIZE:
- [ ] -B_____
- [X] -N 02
- [ ] -H_____

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

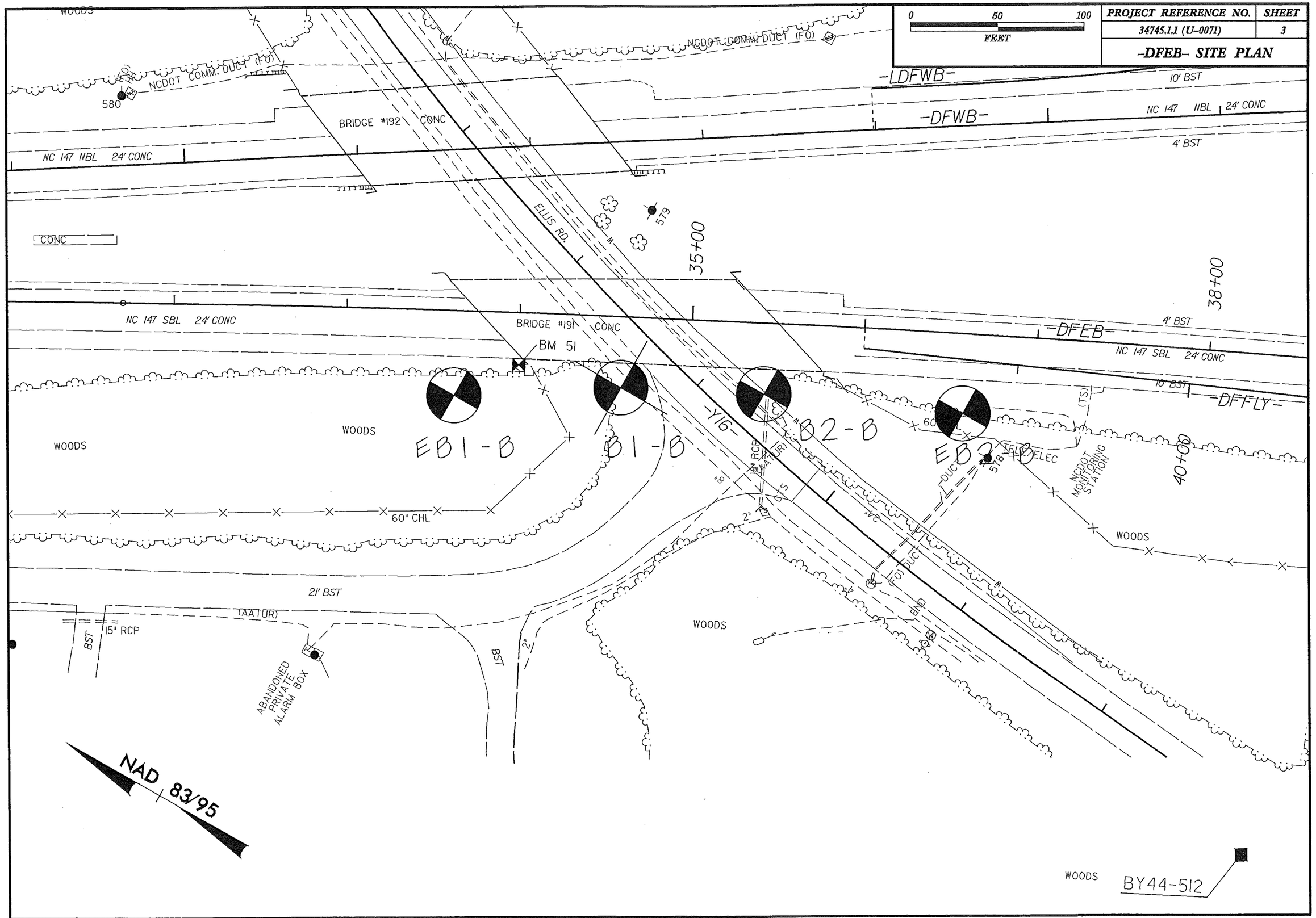
BENCH MARK: BM#51: -BY41- STATION 50+48, 75' RT, ELEVATION 424.46 FEET
BY44-512: -BY44- STATION 22+10.85, ELEVATION 415.17 FEET
ELEVATION: FT.

NOTES:

REVISED 09/23/09

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	3

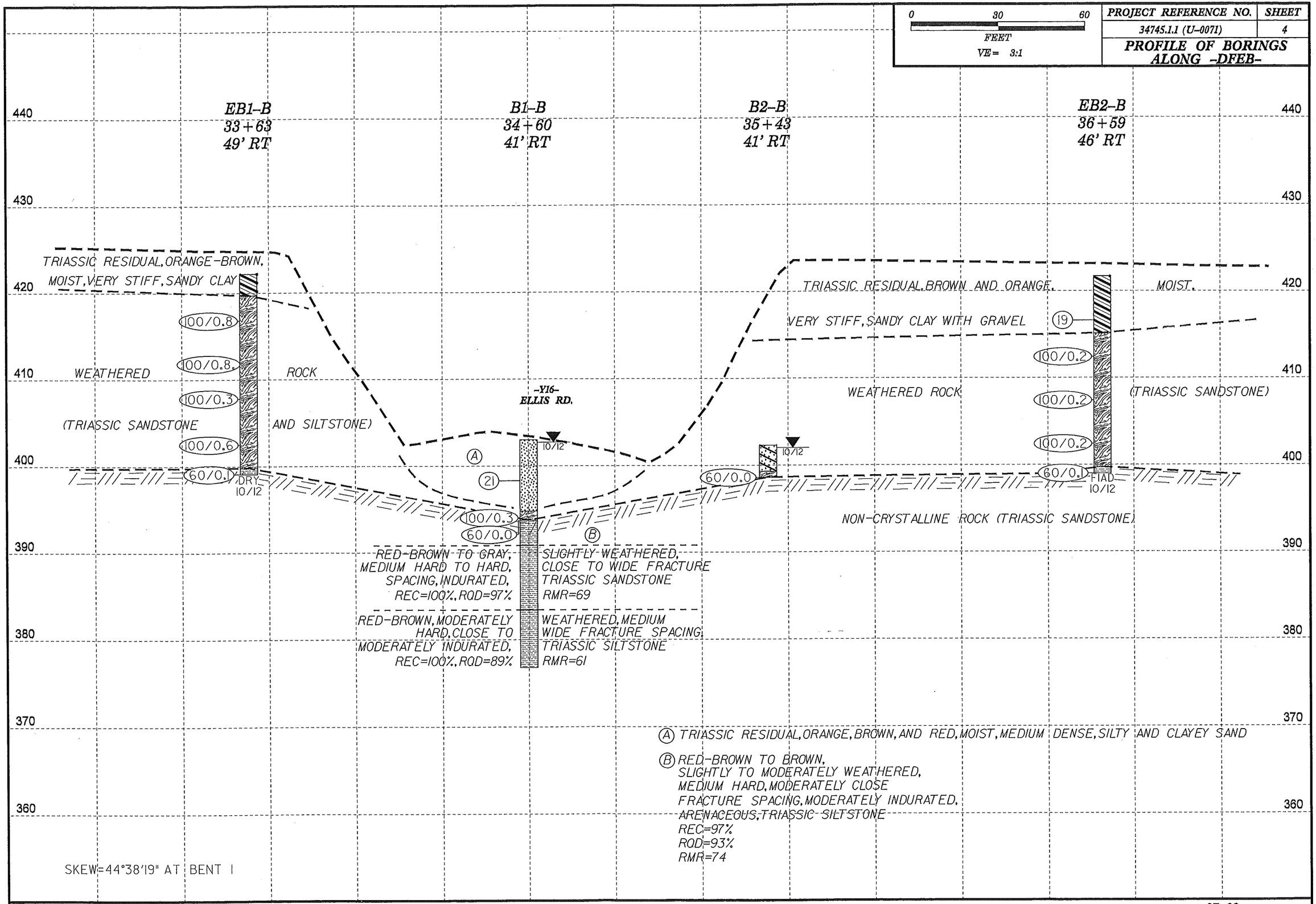
-DFEB- SITE PLAN



PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	4

PROFILE OF BORINGS ALONG -DFEB-

0 30 60
FEET
VE= 3:1



WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 13 ON -DFEB- (NC 147 SOUTH) OVER -Y16- (ELLIS ROAD)			**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 33+63	**OFFSET** 49 ft RT	**ALIGNMENT** -DFEB- — **0 HR.** Dry
COLLAR ELEV. 422.2 ft	**TOTAL DEPTH** 23.1 ft	**NORTHING** 807,950	**EASTING** 2,038,829 — **24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 10/04/12	**COMP. DATE** 10/04/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
425										
										422.2 GROUND SURFACE 0.0
420										419.7 **TRIASSIC RESIDUAL** ORANGE-BROWN, SANDY CLAY 2.5
	418.1	4.1	42	43	57/0.3	100/0.8				**WEATHERED ROCK** (TRIASSIC SANDSTONE AND SILTSTONE)
415										
	413.1	9.1	27	43	57/0.3	100/0.8				
410										
	408.1	14.1	100/0.3			100/0.3				
405										
	403.1	19.1	100/0.6			100/0.6				
400										399.8 22.4
	399.2	23.0	60/0.1			60/0.1				399.1 23.1 **NON-CRYSTALLINE ROCK** (TRIASSIC SILTSTONE)
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 399.1 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 13 ON -DFEB- (NC 147 SOUTH) OVER -Y16- (ELLIS ROAD)			GROUND WTR (ft)
BORING NO. B1-B	STATION 34+60	OFFSET 41 ft RT	ALIGNMENT -DFEB-	0 HR. N/A
COLLAR ELEV. 403.0 ft	TOTAL DEPTH 26.2 ft	NORTHING 807,867	EASTING 2,038,880	24 HR. 0.3
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 10/01/12	COMP. DATE 10/01/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
405											
										403.0 GROUND SURFACE	0.0
400	399.3	3.7	21	13	8	21		M		TRIASSIC RESIDUAL ORANGE-BROWN, CLAYEY, SILTY SAND	
395	394.3	8.7								394.8	8.2
	393.7	9.3	100/.03			100/0.3				393.7 WEATHERED ROCK (TRIASSIC SILTSTONE)	9.3
			60/0.0			60/0.0					
390							RS-1			390.8 NON-CRYSTALLINE ROCK RED-BROWN TO BROWN, SLIGHT TO MODERATE WEATHERING, MEDIUM HARD, MODERATELY CLOSE FRACTURE SPACING, MODERATELY INDURATED, ARENACEOUS, TRIASSIC SILTSTONE REC=97% RQD=93% RMR=74	12.2
385										383.4 RED-BROWN TO GRAY, SLIGHTLY WEATHERED, MEDIUM HARD TO HARD, CLOSE TO WIDE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=100% RQD=97% RMR=69	19.6
380							RS-2			376.8 RED-BROWN, MODERATELY WEATHERED, MEDIUM HARD, CLOSE TO WIDE FRACTURE SPACING, MODERATELY INDURATED, TRIASSIC SILTSTONE REC=100% RQD=89% RMR=61	26.2

Boring Terminated at Elevation 376.8 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 13 ON -DFEB- (NC 147 SOUTH) OVER -Y16- (ELLIS ROAD)			GROUND WTR (ft)
BORING NO. B1-B	STATION 34+60	OFFSET 41 ft RT	ALIGNMENT -DFEB-	0 HR. N/A
COLLAR ELEV. 403.0 ft	TOTAL DEPTH 26.2 ft	NORTHING 807,867	EASTING 2,038,880	24 HR. 0.3
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 10/01/12	COMP. DATE 10/01/12	SURFACE WATER DEPTH N/A
CORE SIZE NQ2	TOTAL RUN 16.9 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
393.7											Begin Coring @ 9.3 ft	
	393.7	9.3	1.9	N=60/0.0	(1.8)	(1.8)		(2.8)	(2.7)		393.7 NON-CRYSTALLINE ROCK RED-BROWN TO BROWN, SLIGHT TO MODERATE WEATHERING, MEDIUM HARD, MODERATELY CLOSE FRACTURE SPACING, MODERATELY INDURATED, ARENACEOUS, TRIASSIC SILTSTONE REC=97% RQD=93% RMR=74	9.3
	391.8	11.2		1:14/1.0	95%	95%		97%	93%			
			5.0	1:15/0.9								
390				2:01/1.0	(4.9)	(4.8)	RS-1	(7.4)	(7.2)		390.8	12.2
				1:40/1.0	98%	96%		100%	97%			
				2:02/1.0								
				2:09/1.0								
	386.8	16.2		1:41/1.0								
			5.0	2:16/1.0	(5.0)	(4.1)					RED-BROWN TO GRAY, SLIGHTLY WEATHERED, MEDIUM HARD TO HARD, CLOSE TO WIDE FRACTURE SPACING, INDURATED, TRIASSIC SANDSTONE REC=100% RQD=97% RMR=69	
385				1:53/1.0	100%	82%						
				1:55/1.0								
				2:42/1.0				(6.6)	(5.9)		383.4	19.6
	381.8	21.2		3:52/1.0				100%	89%			
			5.0	3:12/1.0	(5.0)	(5.0)						
380				2:45/1.0	100%	100%	RS-2					
				2:19/1.0								
				1:30/1.0								
	376.8	26.2		2:28/1.0							376.8 RED-BROWN, MODERATELY WEATHERED, MEDIUM HARD, CLOSE TO WIDE FRACTURE SPACING, MODERATELY INDURATED, TRIASSIC SILTSTONE REC=100% RQD=89% RMR=61	26.2

Boring Terminated at Elevation 376.8 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist	
SITE DESCRIPTION STRUCTURE NO. 13 ON -DFEB- (NC 147 SOUTH) OVER -Y16- (ELLIS ROAD)				GROUND WTR (ft)
BORING NO. B2-B	STATION 35+43	OFFSET 41 ft RT	ALIGNMENT -DFEB-	0 HR. 0.8
COLLAR ELEV. 402.3 ft	TOTAL DEPTH 3.7 ft	NORTHING 807,794	EASTING 2,038,918	24 HR. 0.3
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Contract Driller	START DATE 10/02/12	COMP. DATE 10/02/12	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
405											
										402.3 GROUND SURFACE	0.0
400										TRIASSIC RESIDUAL ORANGE-BROWN TO RED-BROWN, CLAYEY SAND	
										399.3	3.0
	398.6	3.7	60/0.0			60/0.0				398.6 WEATHERED ROCK (TRIASSIC SANDSTONE)	3.7

Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 398.6 ft ON NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist	
SITE DESCRIPTION STRUCTURE NO. 13 ON -DFEB- (NC 147 SOUTH) OVER -Y16- (ELLIS ROAD)				GROUND WTR (ft)
BORING NO. EB2-B	STATION 36+59	OFFSET 46 ft RT	ALIGNMENT -DFEB-	0 HR. Dry
COLLAR ELEV. 421.7 ft	TOTAL DEPTH 22.7 ft	NORTHING 807,688	EASTING 2,038,965	24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Contract Driller	START DATE 10/04/12	COMP. DATE 10/04/12	SURFACE WATER DEPTH N/A	

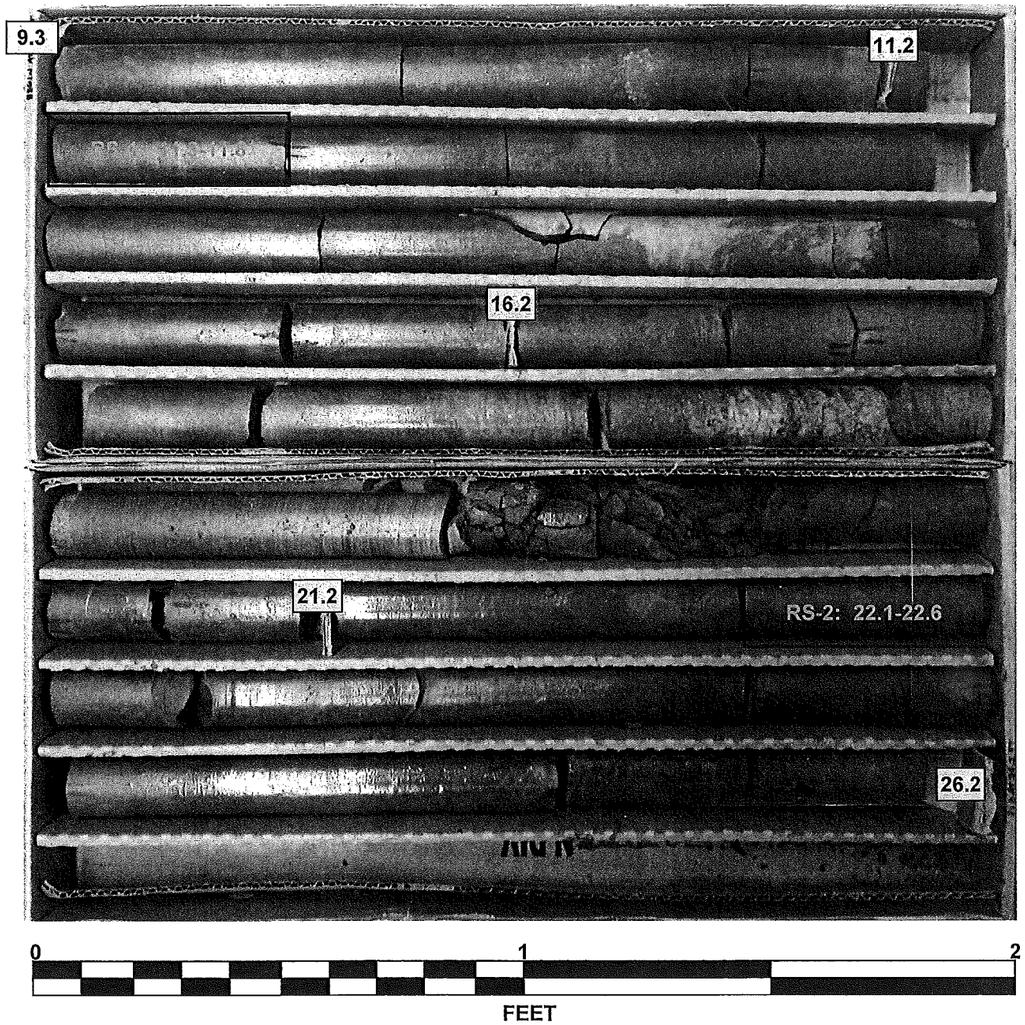
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
425										
										421.7 GROUND SURFACE 0.0
420										ROADWAY EMBANKMENT DARK BROWN TO ORANGE-BROWN, SANDY CLAY WITH TRACE GRAVEL
	417.6	4.1	6	10	9	19		M		415.1 6.6
415										WEATHERED ROCK (TRIASSIC SANDSTONE)
	412.6	9.1	100/0.2			100/0.2				
410										
	407.6	14.1	100/0.2			100/0.2				
405										
	402.6	19.1	100/0.2			100/0.2				
400										
	399.1	22.6	60/0.1			60/0.1				399.1 22.6
										399.0 NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE) 22.7

Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 399.0 ft IN NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)

CORE PHOTOGRAPH

B1-B

BOXES 1 & 2: 9.3-26.2 FEET



STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1 (U-0071)	1	8

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1 (U-0071) F.A. PROJ. NHF-76-1(2)

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION STRUCTURE NO. 13 ON -DFEB- (NC 147 SOUTH) OVER -Y16- (ELLIS ROAD)

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5-7	BORE LOGS & CORE REPORT
8	CORE PHOTOGRAPH

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

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

PERSONNEL

N.D. MOHS

SUMMIT

INVESTIGATED BY N.D. MOHS

CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE OCTOBER 2012

NORTH CAROLINA LICENSED SEAL 2124 GEOLOGIST NATHAN DANIEL MOHS

10/22/12

PROJECT: 34745.1.1 ID: U-0071

DRAWN BY: N.D. MOHS

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

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1 (U-0071)	1	14

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1 (U-0071) F.A. PROJ. NHF-76-1(2)

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION STRUCTURE NO. 14 ON -DFWB- (NC 147 NORTH) OVER CSX RAILROAD

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5-7	CROSS SECTIONS
8-12	BORE LOGS & CORE REPORT
13	CORE PHOTOGRAPH
14	ROCK CORE TEST RESULTS

CAUTION NOTICE

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PERSONNEL

URS

SUMMIT

INVESTIGATED BY N.D. MOHS

CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE DECEMBER 2013

NORTH CAROLINA LICENSED SEAL 2124 GEOLOGIST NATHAN DANIEL MOHS

12/10/13

PROJECT: 34745.1.1

ID: U-0071

DRAWN BY: N.D. MOHS

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

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PROJECT REFERENCE NO.	SHEET NO.
34745.1.1 (U-0071)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING # 10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
# 40	30 MX	50 MX	51 MN											
# 200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT / PLASTIC INDEX	6 MX		NP	40 MX / 18 MX	41 MN / 18 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 (TONS/FT^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

ABBREVIATIONS

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

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [X] CME-450
- [ ] _____

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

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

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

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (REC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

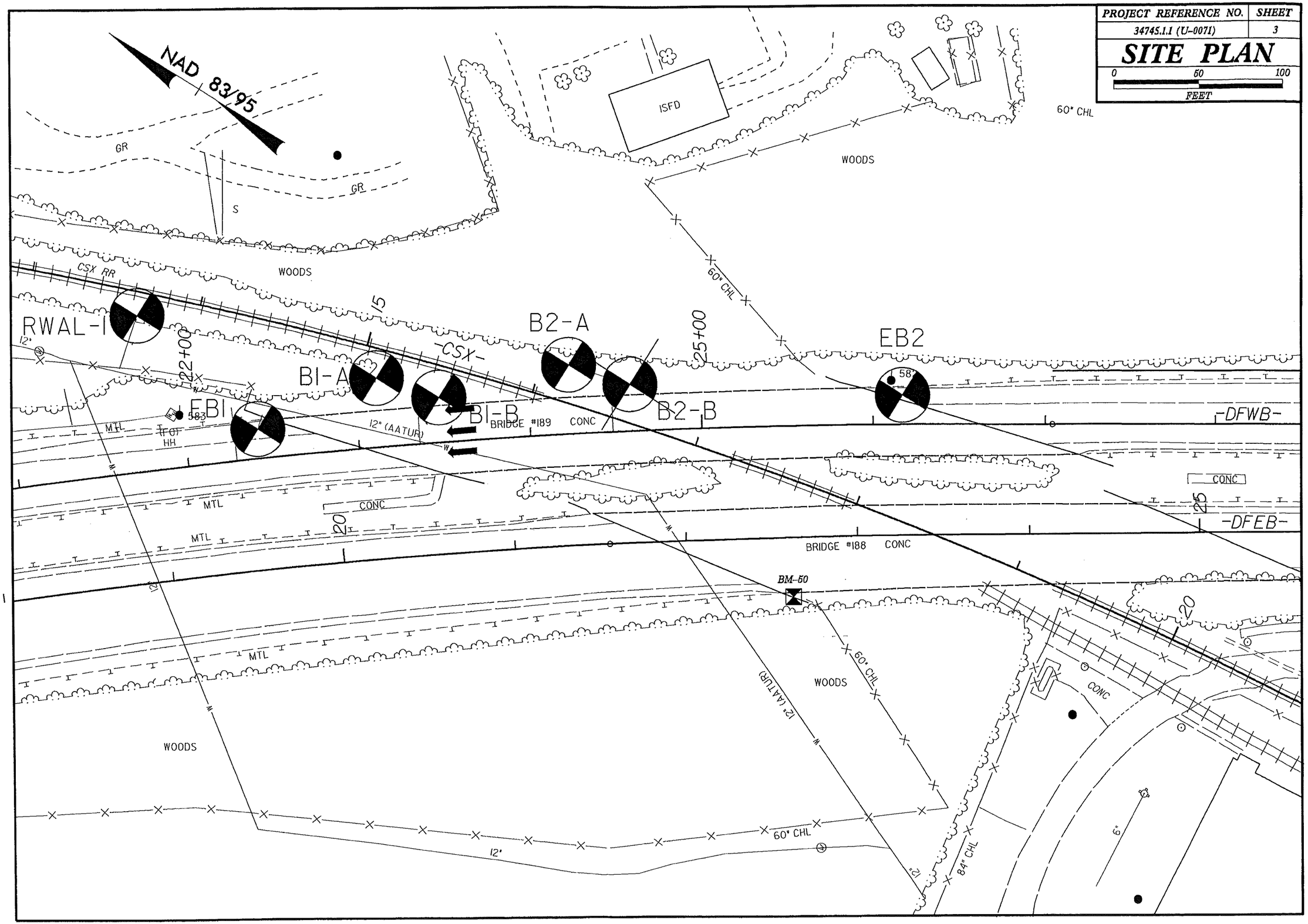
BENCH MARK: BM-50: CHISELED "X" ON SE CORNER OF BRIDGE
N: 2038283 E: 801901
ELEVATION: 416.16 FT.

NOTES:

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	3

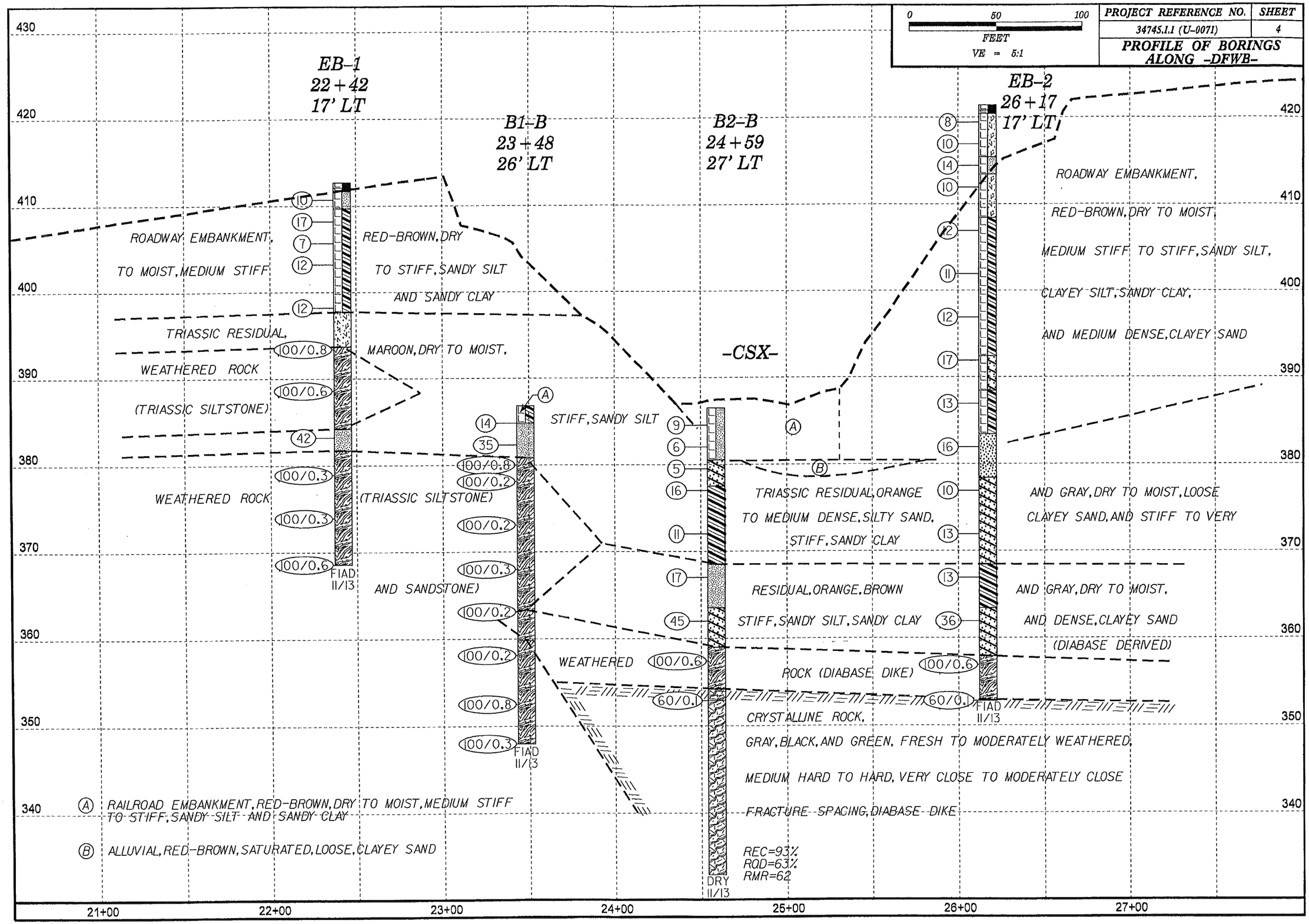
SITE PLAN

0 60 100
FEET



PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	4

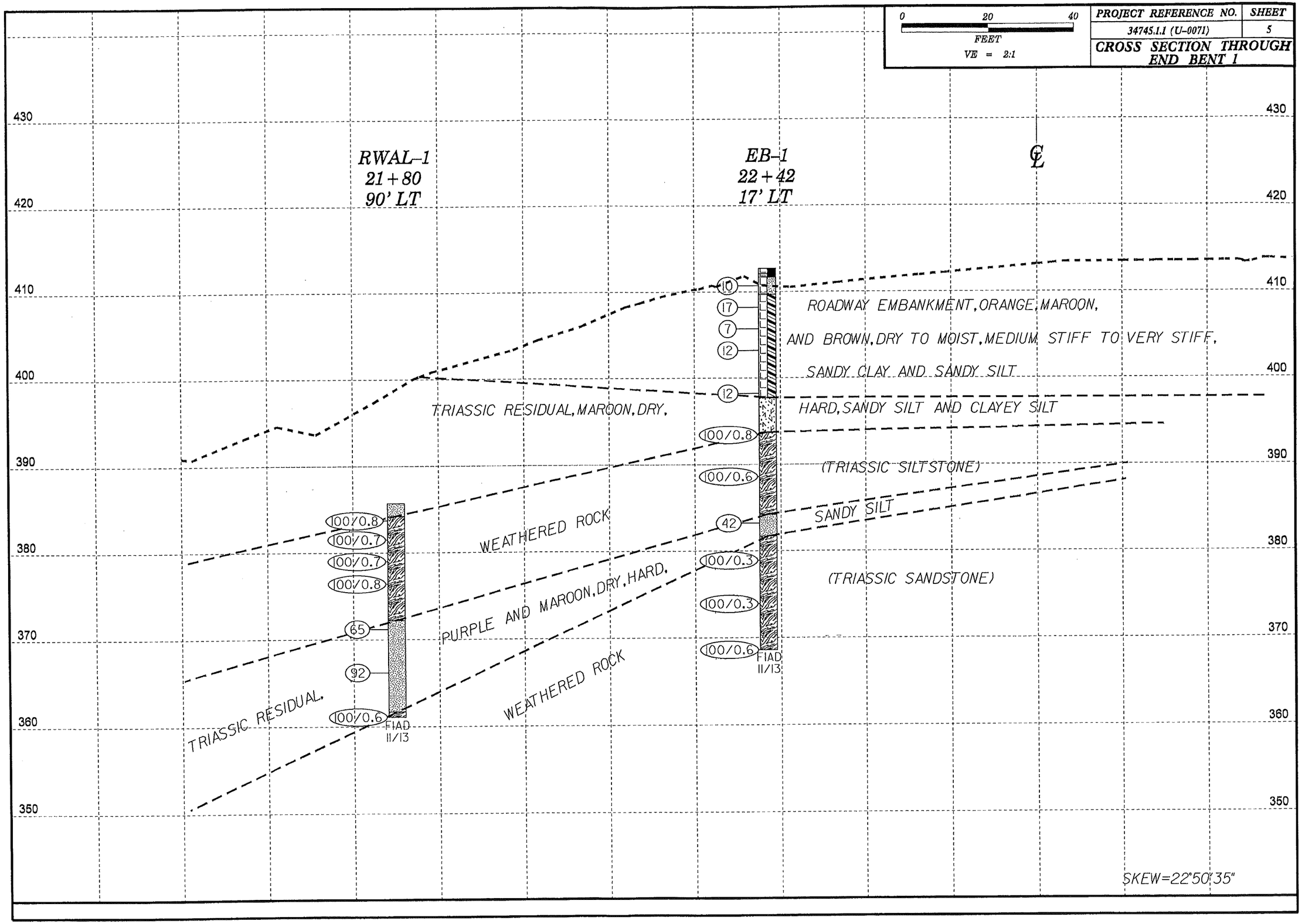
PROFILE OF BORINGS ALONG -DFWB-



(A) RAILROAD EMBANKMENT, RED-BROWN, DRY TO MOIST, MEDIUM STIFF TO STIFF, SANDY SILT AND SANDY CLAY

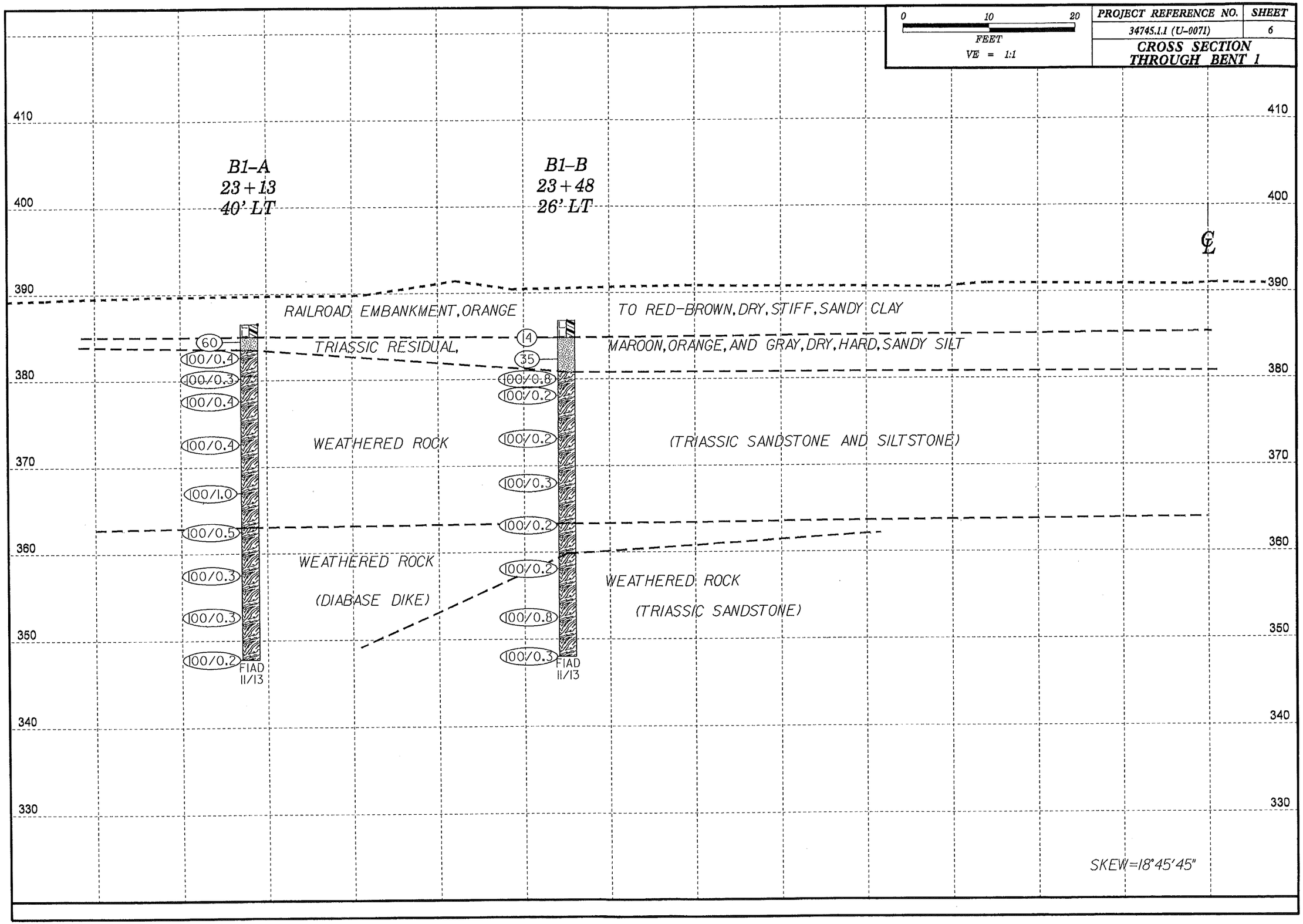
(B) ALLUVIAL, RED-BROWN, SATURATED, LOOSE, CLAYEY SAND

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	5
CROSS SECTION THROUGH END BENT 1	



PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	6

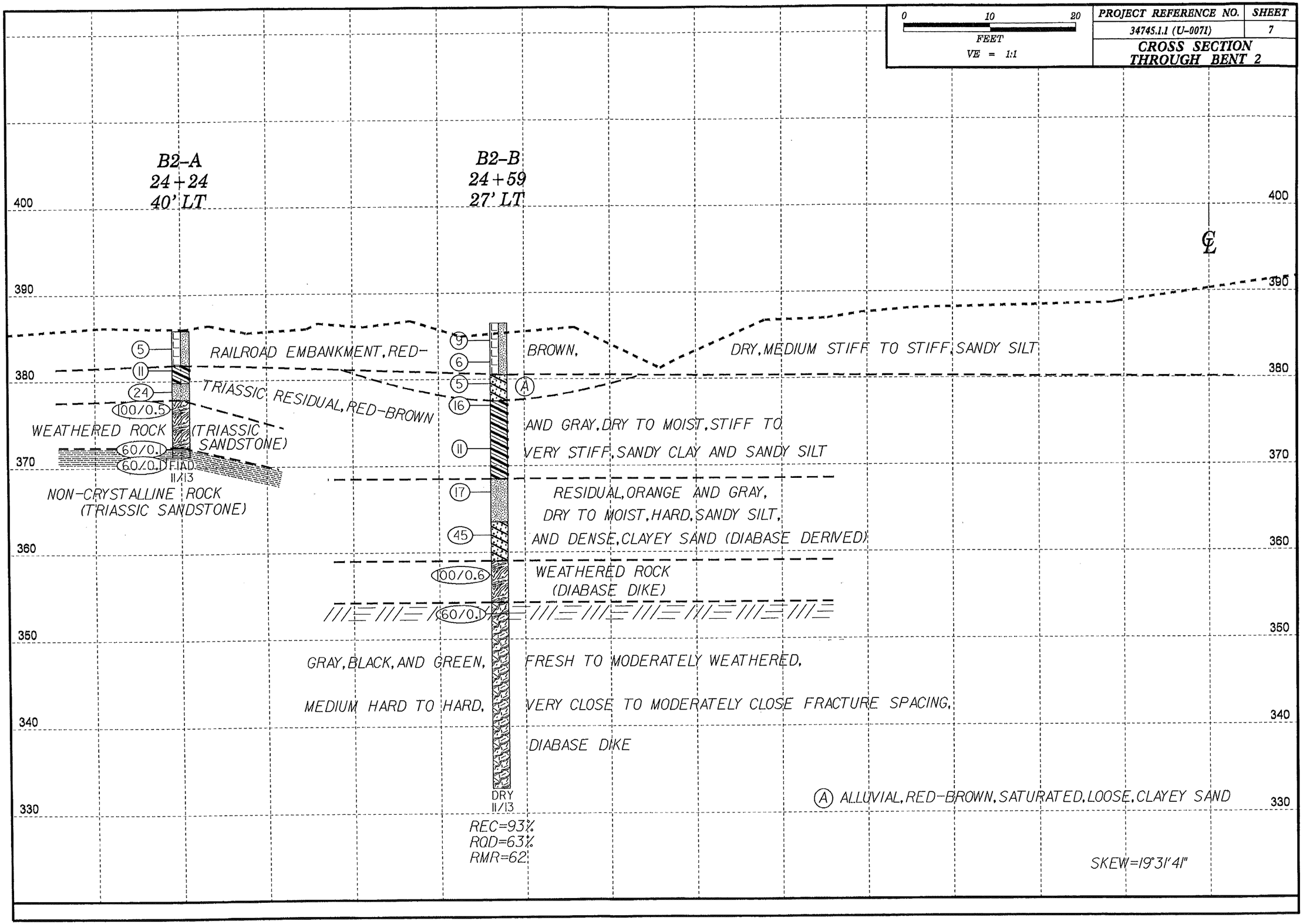
CROSS SECTION THROUGH BENT 1



PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	7

CROSS SECTION THROUGH BENT 2

0 10 20
FEET
VE = 1:1



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 14 ON -DFWB- (NC 147 NORTH) OVER CSX RAILROAD			GROUND WTR (ft)
BORING NO. EB-1	STATION 22+42	OFFSET 17 ft LT	ALIGNMENT -DFWB-
COLLAR ELEV. 412.7 ft	TOTAL DEPTH 44.1 ft	NORTHING 809,217	EASTING 2,038,200
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 85% 08/15/2013		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 11/18/13	COMP. DATE 11/18/13	SURFACE WATER DEPTH N/A

GROUND WTR (ft): 0 HR. Dry; 24 HR. FIAD

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
415										
	411.7	1.0								412.7 / 0.0 GROUND SURFACE; 412.1 / 0.6 ROADWAY EMBANKMENT; 411.7 / 1.0 ASPHALT
410			2	5	5	10		D		409.7 / 3.0 ABC; MAROON AND ORANGE, SANDY SILT
	409.2	3.5	5	9	8	17		M		ORANGE AND BROWN, SANDY CLAY
	406.7	6.0	3	2	5	7		M		
405	404.2	8.5	3	4	8	12		M		
400	399.2	13.5	3	5	7	12		M		397.7 / 15.0 TRIASSIC RESIDUAL MAROON, CLAYEY SILT
395	394.2	18.5	16	55	45/0.3	100/0.8				393.7 / 19.0 WEATHERED ROCK (TRIASSIC SILTSTONE)
390	389.2	23.5	75	25/0.1		100/0.6				
385	384.2	28.5	16	18	24	42		D		384.2 / 28.5 TRIASSIC RESIDUAL MAROON, SANDY SILT; 381.7 / 31.0 WEATHERED ROCK (TRIASSIC SILTSTONE)
380	379.2	33.5	100/0.3			100/0.3				
375	374.2	38.5	100/0.3			100/0.3				
370	369.2	43.5	70	30/0.1		100/0.6				368.6 / 44.1 Boring Terminated at Elevation 368.6 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 14 ON -DFWB- (NC 147 NORTH) OVER CSX RAILROAD			GROUND WTR (ft)
BORING NO. RWAL-1	STATION 21+80	OFFSET 90 ft LT	ALIGNMENT -DFWB-
COLLAR ELEV. 385.7 ft	TOTAL DEPTH 24.6 ft	NORTHING 809,312	EASTING 2,038,218
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 85% 08/15/2013		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 11/17/13	COMP. DATE 11/17/13	SURFACE WATER DEPTH N/A

GROUND WTR (ft): 0 HR. Dry; 24 HR. FIAD

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
390										
385	384.7	1.0	37	54	46/0.3					385.7 / 0.0 GROUND SURFACE
	382.2	3.5	48	52/0.2		100/0.8		D		384.2 / 1.5 RESIDUAL MAROON, SANDY SILT; WEATHERED ROCK (TRIASSIC SILTSTONE)
380	379.7	6.0	59	41/0.2		100/0.7				
	377.2	8.5	32	68/0.3		100/0.7				
375						100/0.8				
370	372.2	13.5	45	22	43	85		D		372.2 / 13.5 RESIDUAL GRAY, PURPLE AND ORANGE, SANDY SILT
365	367.2	18.5	25	20	72	92		D		
	362.2	23.5	23	66	44/0.1	100/0.6				361.7 / 24.0 WEATHERED ROCK (TRIASSIC SILTSTONE); 361.1 / 24.6 Boring Terminated at Elevation 361.1 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 14 ON -DFWB- (NC 147 NORTH) OVER CSX RAILROAD			GROUND WTR (ft)
BORING NO. B1-A	STATION 23+13	OFFSET 40 ft LT	ALIGNMENT -DFWB-
COLLAR ELEV. 386.5 ft	TOTAL DEPTH 38.7 ft	NORTHING 809,174	EASTING 2,038,261
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 85% 08/15/2013		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 11/16/13	COMP. DATE 11/16/13	SURFACE WATER DEPTH N/A

GROUND WTR (ft): 0 HR. Dry; 24 HR. FIAD

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
386.5										GROUND SURFACE	0.0
385	385.5	1.0	8	27	33	60		D		ROADWAY EMBANKMENT ORANGE-BROWN, SANDY CLAY (RAILROAD EMBANKMENT) 385.0	1.5
	383.0	3.5	100/0.4			100/0.4				TRIASSIC RESIDUAL MAROON, SANDY SILT 383.5	3.0
380	380.5	6.0	100/0.3			100/0.3				WEATHERED ROCK (TRIASSIC SANDSTONE) 380.5	6.0
	378.0	8.5	100/0.4			100/0.4				(TRIASSIC SILTSTONE)	
375	373.0	13.5	100/0.4			100/0.4					
370	368.0	18.5	19	81/0.5		100/1.0					
365	363.0	23.5	100/0.5			100/0.5				363.0 (DIABASE DIKE)	23.5
360	358.0	28.5	100/0.3			100/0.3					
355	353.0	33.5	100/0.3			100/0.3					
350	348.0	38.5	100/0.2			100/0.2				347.8 Boring Terminated at Elevation 347.8 ft in WEATHERED ROCK (DIABASE)	38.7

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 14 ON -DFWB- (NC 147 NORTH) OVER CSX RAILROAD			GROUND WTR (ft)
BORING NO. B1-B	STATION 23+48	OFFSET 26 ft LT	ALIGNMENT -DFWB-
COLLAR ELEV. 386.8 ft	TOTAL DEPTH 38.8 ft	NORTHING 809,137	EASTING 2,038,271
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 85% 08/15/2013		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 11/16/13	COMP. DATE 11/16/13	SURFACE WATER DEPTH N/A

GROUND WTR (ft): 0 HR. Dry; 24 HR. FIAD

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
386.8										GROUND SURFACE 0.0
385	385.8	1.0	2	3	11	14 35		D		ROADWAY EMBANKMENT RED-BROWN, SANDY CLAY (RAILROAD EMBANKMENT) 384.8 2.0
	383.3	3.5	12	12	23			D		TRIASSIC RESIDUAL ORANGE AND GRAY, SANDY SILT 380.8 6.0
380	380.8	6.0	31	69/0.3		100/0.8				WEATHERED ROCK (TRIASSIC SILTSTONE)
	378.3	8.5	100/0.2			100/0.2				
375	373.3	13.5	100/0.2			100/0.2				
370	368.3	18.5	100/0.3			100/0.3				
365	363.3	23.5	100/0.2			100/0.2				363.3 (DIABASE DIKE) 23.5
360	358.3	28.5	100/0.2			100/0.2				359.8 (TRIASSIC SANDSTONE) 27.0
355	353.3	33.5	44	56/0.3		100/0.8				
350	348.3	38.5	100/0.3			100/0.3				348.0 Boring Terminated at Elevation 348.0 ft in WEATHERED ROCK (TRIASSIC SANDSTONE) 38.8

NCDOT BORE DOUBLE U0071_GEO_DFWB_CSX_BH.GPJ NC_DOT.GDT 12/4/13

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 14 ON -DFWB- (NC 147 NORTH) OVER CSX RAILROAD			**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 24+24	**OFFSET** 40 ft LT	**ALIGNMENT** -DFWB- — **0 HR.** Dry
COLLAR ELEV. 385.8 ft	**TOTAL DEPTH** 14.6 ft	**NORTHING** 809,083	**EASTING** 2,038,327 — **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 85% 08/15/2013		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 11/18/13	**COMP. DATE** 11/18/13	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
390											
										385.8 GROUND SURFACE	0.0
385	384.8	1.0								**ROADWAY EMBANKMENT** RED-BROWN AND ORANGE, SANDY SILT (RAILROAD EMBANKMENT)	
			2	2	3	5		D			
	382.3	3.5								381.8	4.0
			2	4	7	11		D		**TRIASSIC RESIDUAL** RED, BROWN, AND GRAY, SANDY CLAY	
380	379.8	6.0								379.8	6.0
			3	6	18	24		D		ORANGE AND GRAY, SANDY SILT	
	377.3	8.5								377.8	8.0
			100/0.5			100/0.5				**WEATHERED ROCK** (TRIASSIC SANDSTONE)	
375											
	372.3	13.5								372.3	13.5
	371.3	14.5	60/0.1			60/0.1				371.2 **NON-CRYSTALLINE ROCK** TRIASSIC SANDSTONE)	14.6
			60/0.1			60/0.1				Boring Terminated with Standard Penetration Test Refusal at Elevation 371.2 ft in NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 14 ON -DFWB- (NC 147 NORTH) OVER CSX RAILROAD			GROUND WTR (ft)
BORING NO. B2-B	STATION 24+59	OFFSET 27 ft LT	ALIGNMENT -DFWB- / 0 HR. Dry
COLLAR ELEV. 386.5 ft	TOTAL DEPTH 53.6 ft	NORTHING 809,047	EASTING 2,038,336 / 24 HR. Dry
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 85% 08/15/2013		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 11/14/13	COMP. DATE 11/15/13	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
390											
										386.5 GROUND SURFACE	0.0
385	385.5	1.0	3	4	5	9		D		ROADWAY EMBANKMENT RED-BROWN AND ORANGE, SANDY SILT WITH RIP RAP COBBLES (RAILROAD EMBANKMENT)	
	383.0	3.5	2	3	3	6		D			
380	380.5	6.0	2	3	2	5		Sat.		380.5 ALLUVIAL RED-BROWN, CLAYEY SAND	6.0
	378.0	8.5	3	6	10	16		M		377.5 TRIASSIC RESIDUAL ORANGE AND GRAY, SANDY CLAY	9.0
375											
	373.0	13.5	6	5	6	11		M			
370										368.5 RESIDUAL ORANGE AND GRAY, SANDY SILT (DIABASE DERIVED)	18.0
	368.0	18.5	8	6	11	17		D			
365										363.5 ORANGE-BROWN, CLAYEY SAND (DIABASE DERIVED)	23.0
	363.0	23.5	22	19	26	45		M			
360										359.0 WEATHERED ROCK (DIABASE DIKE)	27.5
	358.0	28.5	57	43/0.1		100/0.6					
355										354.2 CRYSTALLINE ROCK (DIABASE DIKE)	32.3
	353.0	33.5	60/0.1			60/0.1				352.9 GRAY, BLACK, AND GREEN, FRESH TO MODERATELY WEATHERED, MEDIUM HARD TO HARD, VERY CLOSE TO MODERATELY CLOSE FRACTURE SPACING, DIABASE DIKE REC=93% RQD=63% RMR=62	33.6
350							RS-1 RS-2 RS-3				
345							RS-4				
340							RS-5				
335										332.9 Boring Terminated at Elevation 332.9 ft in CRYSTALLINE ROCK (DIABASE)	53.6

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 14 ON -DFWB- (NC 147 NORTH) OVER CSX RAILROAD			GROUND WTR (ft)
BORING NO. B2-B	STATION 24+59	OFFSET 27 ft LT	ALIGNMENT -DFWB- / 0 HR. Dry
COLLAR ELEV. 386.5 ft	TOTAL DEPTH 53.6 ft	NORTHING 809,047	EASTING 2,038,336 / 24 HR. Dry
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 85% 08/15/2013		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 11/14/13	COMP. DATE 11/15/13	SURFACE WATER DEPTH N/A
CORE SIZE NQ	TOTAL RUN 20.0 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
352.9											Begin Coring @ 33.6 ft	
	352.9	33.6	2.5	1:29/1.0 3:21/1.0 1:37/0.5	(2.1) 84%	(0.0) 0%		(18.5) 93%	(12.5) 63%		352.9 GRAY, BLACK, AND GREEN, FRESH TO MODERATELY WEATHERED, MEDIUM HARD TO HARD, VERY CLOSE TO MODERATELY CLOSE FRACTURE SPACING, DIABASE DIKE REC=93% RQD=63% RMR=62	33.6
350	350.4	36.1	5.0	0:48/1.0 1:21/1.0 1:54/1.0 3:10/1.0 4:44/1.0	(4.0) 80%	(2.8) 56%	RS-1 RS-2 RS-3					
345	345.4	41.1	4.8	1:34/1.0 2:00/1.0 1:40/1.0 1:35/1.0 1:38/0.8	(4.7) 98%	(3.5) 73%	RS-4 RS-5					
340	340.6	45.9	5.0	1:39/1.0 1:19/1.0 1:28/1.0 1:32/1.0 1:35/1.0	(5.0) 100%	(3.6) 72%						
335	335.6	50.9	2.7	1:49/1.0 1:23/1.0 1:02/0.7	(2.7) 100%	(2.6) 96%						
	332.9	53.6									332.9 Boring Terminated at Elevation 332.9 ft in CRYSTALLINE ROCK (DIABASE)	53.6

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Contract Geologist
SITE DESCRIPTION STRUCTURE NO. 14 ON -DFWB- (NC 147 NORTH) OVER CSX RAILROAD			**GROUND WTR (ft)**
BORING NO. EB-2	**STATION** 26+17	**OFFSET** 17 ft LT	**ALIGNMENT** -DFWB- — **0 HR.** Dry
COLLAR ELEV. 421.4 ft	**TOTAL DEPTH** 68.6 ft	**NORTHING** 808,909	**EASTING** 2,038,415 — **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 85% 08/15/2013		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 11/13/13	**COMP. DATE** 11/13/13	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
425										
										421.4 GROUND SURFACE 0.0
										420.8 ASPHALT 0.6
420	420.4	1.0	3	4	4	8		D		420.4 ABC 1.0
	417.9	3.5	2	5	5	10		D		ROADWAY EMBANKMENT RED-BROWN, CLAYEY SILT
415	415.4	6.0	4	6	8	14		D		415.4 RED-BROWN AND GRAY, SANDY SILT 6.0
	412.9	8.5	3	4	6	10		D		413.4 RED-BROWN, CLAYEY SILT 8.0
410										
	407.9	13.5	2	5	7	12		D		408.4 RED-BROWN AND GRAY, SANDY CLAY 13.0
405										
	402.9	18.5	2	4	7	11		D		
400										
	397.9	23.5	2	5	7	12		M		
395										
	392.9	28.5	5	6	11	17		D		392.4 ORANGE-BROWN AND GRAY, CLAYEY SAND 29.0
390										
	387.9	33.5	3	6	7	13		D		388.4 RED-BROWN AND GRAY, SANDY CLAY 33.0
385										
	382.9	38.5	3	7	9	16		D		383.4 TRIASSIC RESIDUAL GRAY, SILTY SAND 38.0
380										
	377.9	43.5	4	4	6	10		M		378.4 GRAY, CLAYEY SAND 43.0
375										
	372.9	48.5	3	5	8	13		W		
370										
	367.9	53.5	3	6	7	13		W		368.4 DARK GRAY, SANDY CLAY 53.0
365										
	362.9	58.5	10	16	20	36		W		363.4 RESIDUAL ORANGE-BROWN, CLAYEY SAND (DIABASE DERIVED) 58.0
360										
	357.9	63.5	69	31/0.1		100/0.6				357.9 WEATHERED ROCK (DIABASE DIKE) 63.5
355										
	352.9	68.5	60/0.1			60/0.1				352.9 68.5
										352.8 CRYSTALLINE ROCK (DIABASE DIKE) 68.6

Boring Terminated with Standard Penetration Test Refusal at Elevation 352.8 ft in CRYSTALLINE ROCK (DIABASE)

CORE PHOTOGRAPH

B2-B

BOXES 1 & 2: 33.6 - 53.6 FEET

ROCK TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	H/D RATIO	UNIT WT lbs/ft3	Ultimate lbf	Ultimate ksi	Ultimate (corrected) ksi	Sec. Mod. @ 40% Mpsi
RS-1	27' LT	24+59	36.2-36.8	1.97	179.0	36800	13.4	13.4	11.2
RS-2	27' LT	24+59	36.8-37.4	1.83	178.4	28000	10.2	10.1	10.6
RS-3	27' LT	24+59	37.8-38.3	1.96	176.6	37800	13.8	13.7	10.8
RS-4	27' LT	24+59	41.1-41.6	1.96	180.0	20600	7.6	7.6	7.1
RS-5	27' LT	24+59	44.2-44.7	1.76	166.4	19540	7.1	7.0	1.3

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	34745.1.1 (U-0071)	1	23

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34745.1.1 (U-0071) F.A. PROJ. NHF-76-1(2)

COUNTY DURHAM

PROJECT DESCRIPTION DURHAM EAST END CONNECTOR FROM NC 147 (BUCK DEAN FREEWAY) TO NORTH OF NC 98

SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147

PROJECT: U-0071

ID: 34745.1.1

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4, 5	PROFILE
6-9	CROSS SECTIONS
10-20	BORE LOG & CORE REPORTS
21, 22	CORE PHOTOGRAPHS
23	ROCK CORE TEST RESULTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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DATE MARCH 2013

NORTH CAROLINA LICENSED SEAL 2724 GEOLOGIST NATHAN DANIEL MOHS

3/28/13

DRAWN BY: T.T. WALKER, N.D. MOHS

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PROJECT REFERENCE NO.	SHEET NO.
34745.1.1 (U-0071)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING #10	50 MX		50 MX	51 MN								GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#40	30 MX		25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN		
#200	15 MX													
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS
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
- 25/026 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

ABBREVIATIONS

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

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

EQUIPMENT USED ON SUBJECT PROJECT

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

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

HAMMER TYPE:
[X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [X] -N WC3
- [ ] -H_____

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION. AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCK(S).

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK: BL-134: -BL- STA. 151+73.22, ELEV=403.06 FT.
BL-136: -BL- STA. 159+24.24, ELEV=375.24 FT.
BY41-306: BY41 STA. 66+09.56, ELEV=399.17 FT. ELEVATION: FT.

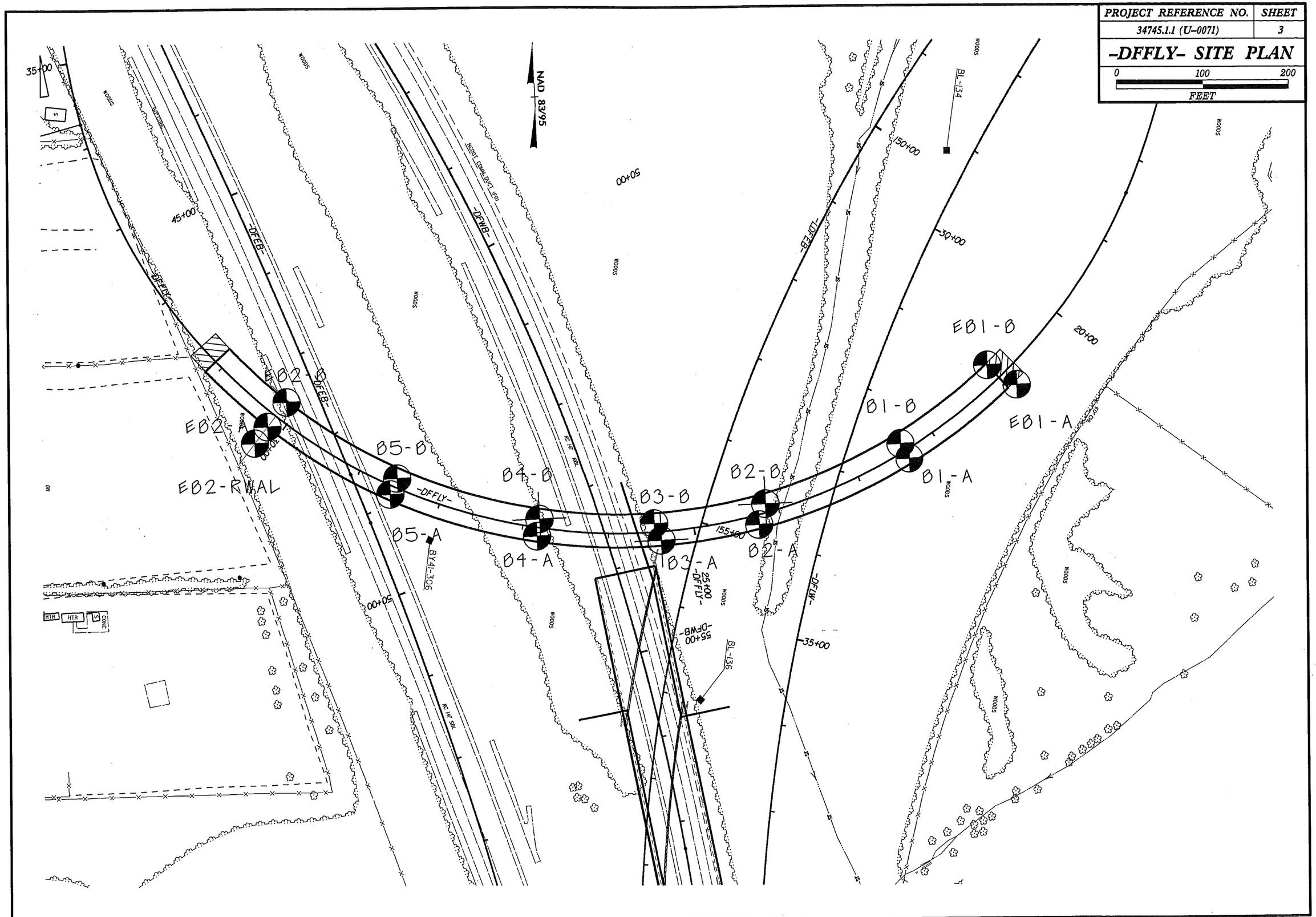
NOTES:

REVISED 09/23/09

PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	3

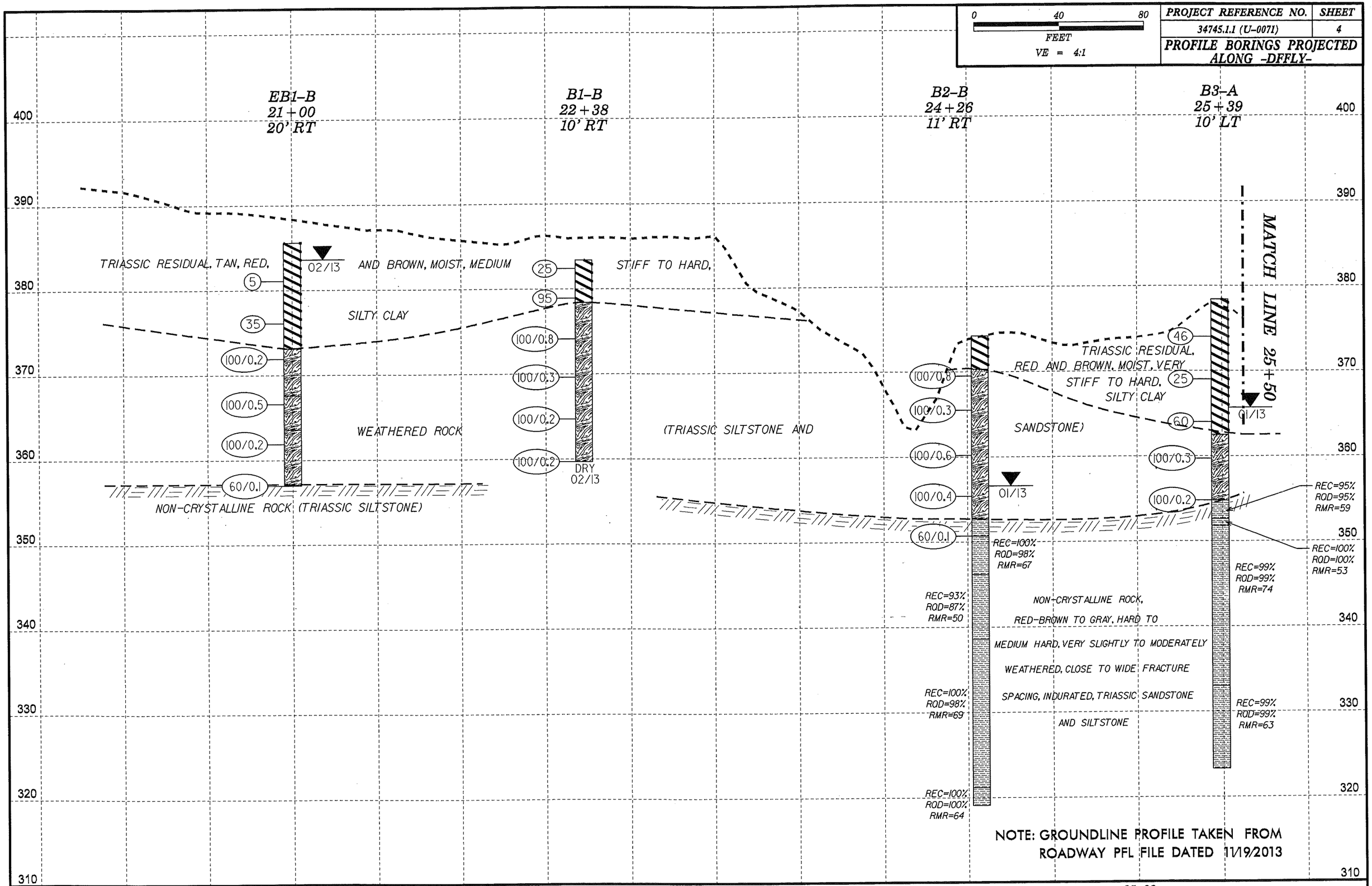
-DFFLY- SITE PLAN

0 100 200
FEET



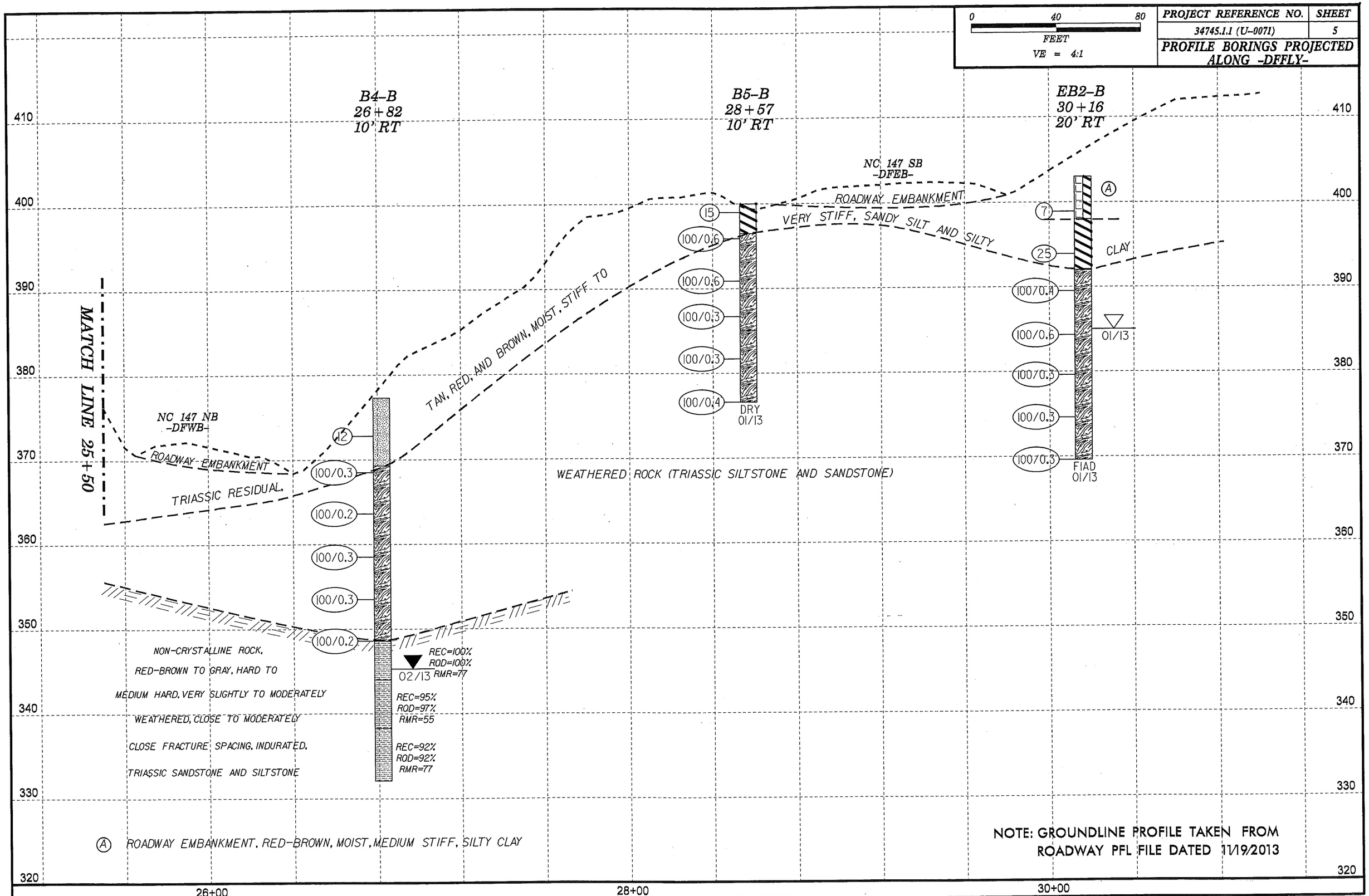
PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	4

PROFILE BORINGS PROJECTED ALONG -DFFLY-



NOTE: GROUNDLINE PROFILE TAKEN FROM ROADWAY PFL FILE DATED 11/19/2013

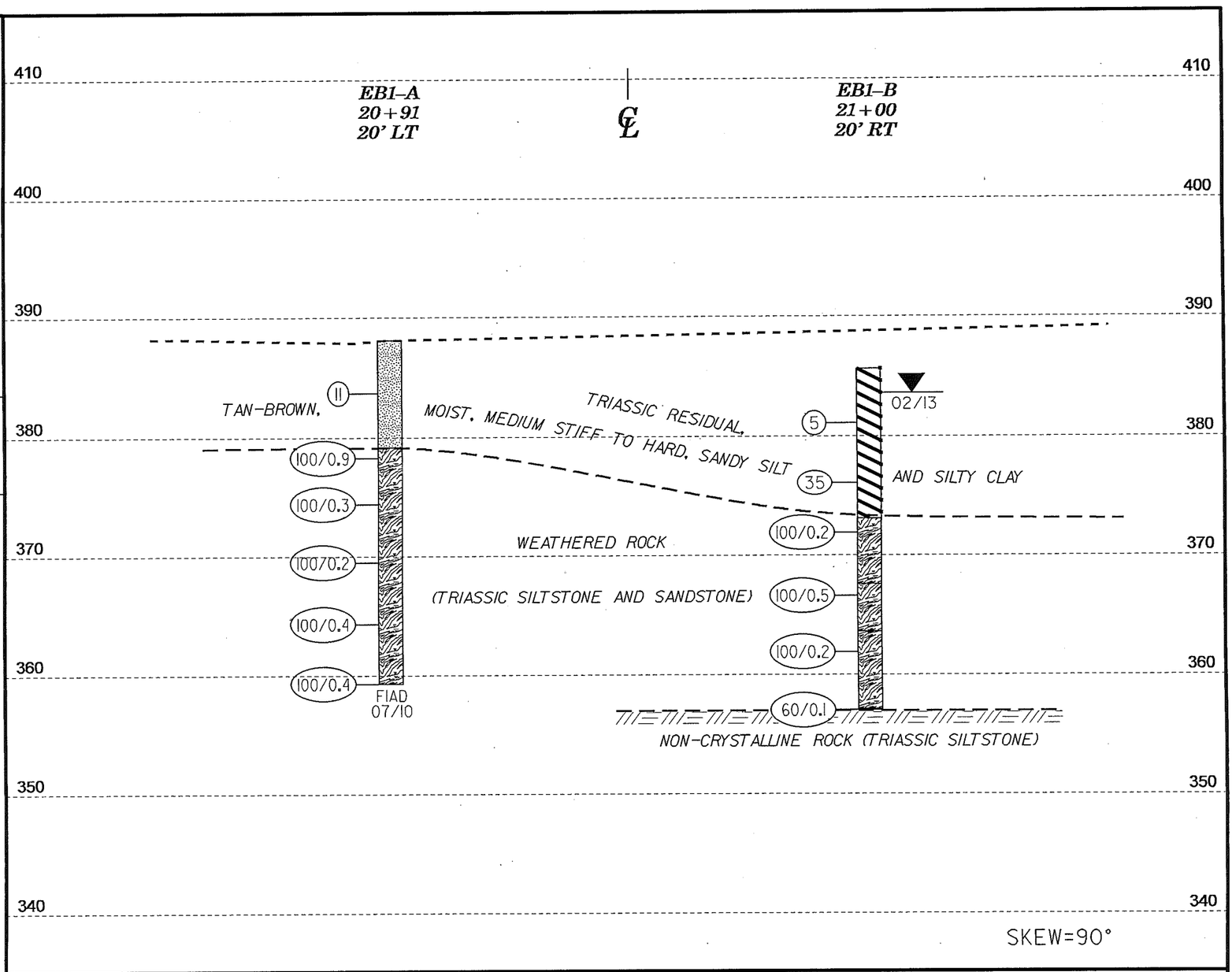
PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	5
PROFILE BORINGS PROJECTED ALONG -DFFLY-	



HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

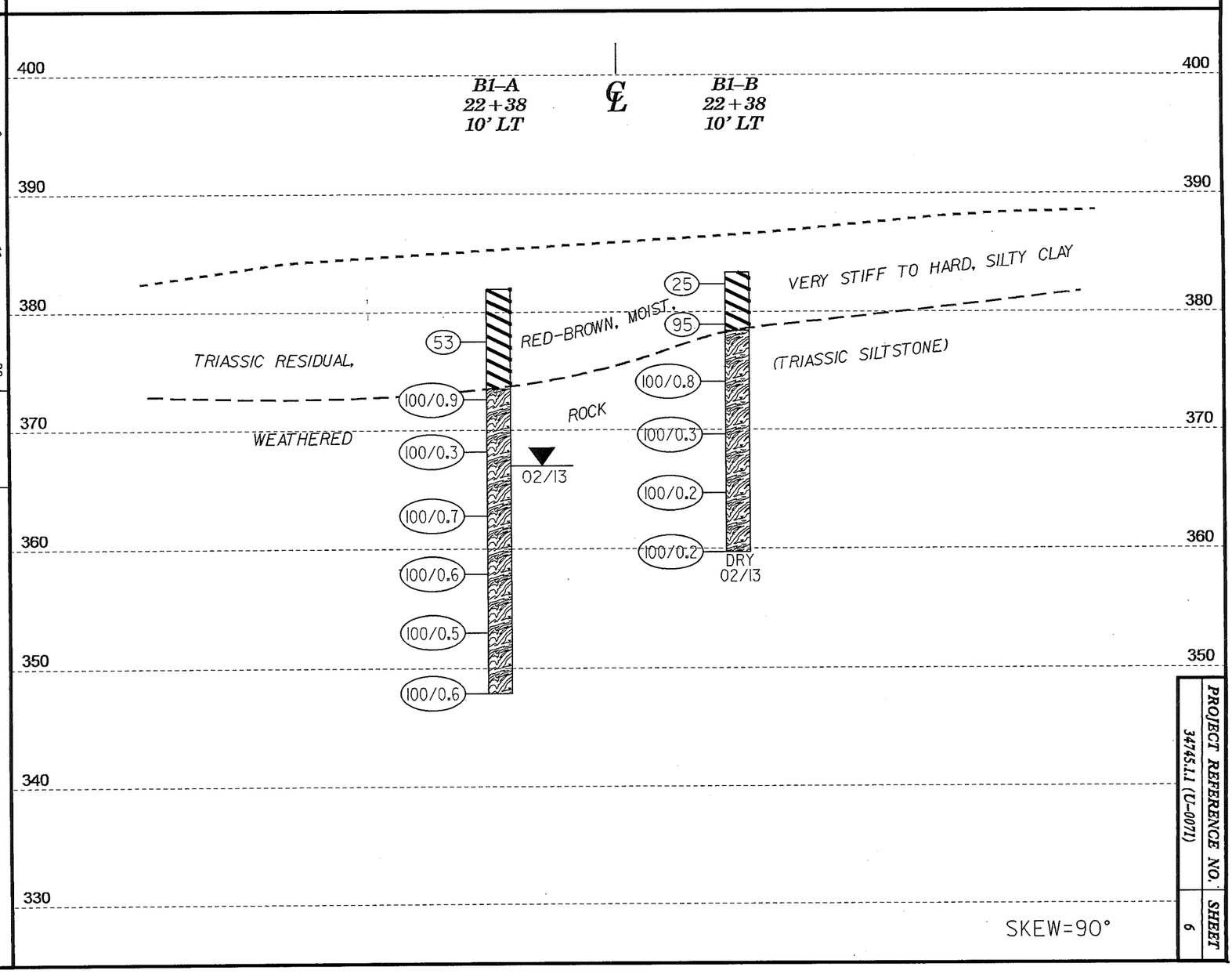
CROSS SECTION THROUGH END BENT 1



HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

CROSS SECTION THROUGH BENT 1

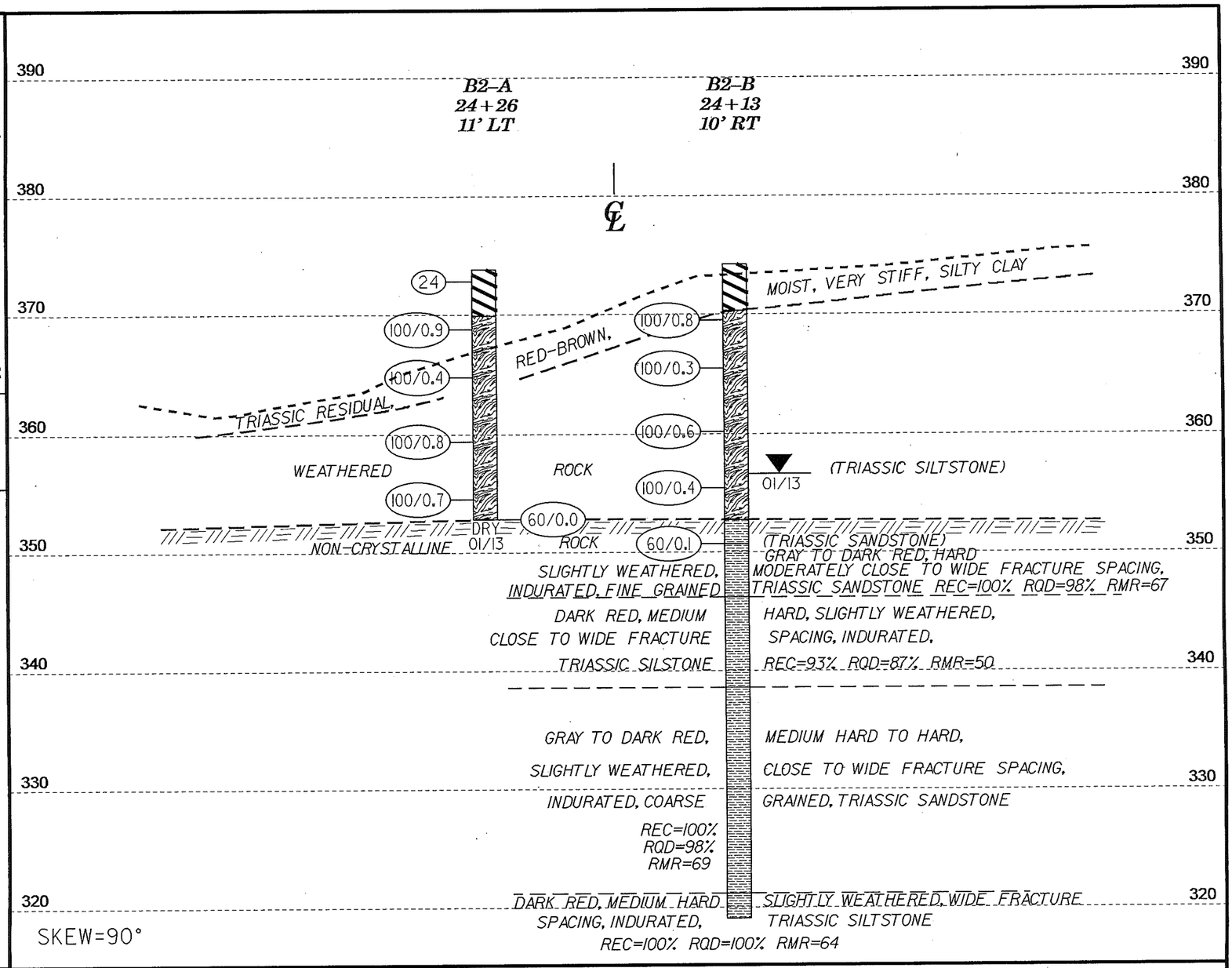


PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	6

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

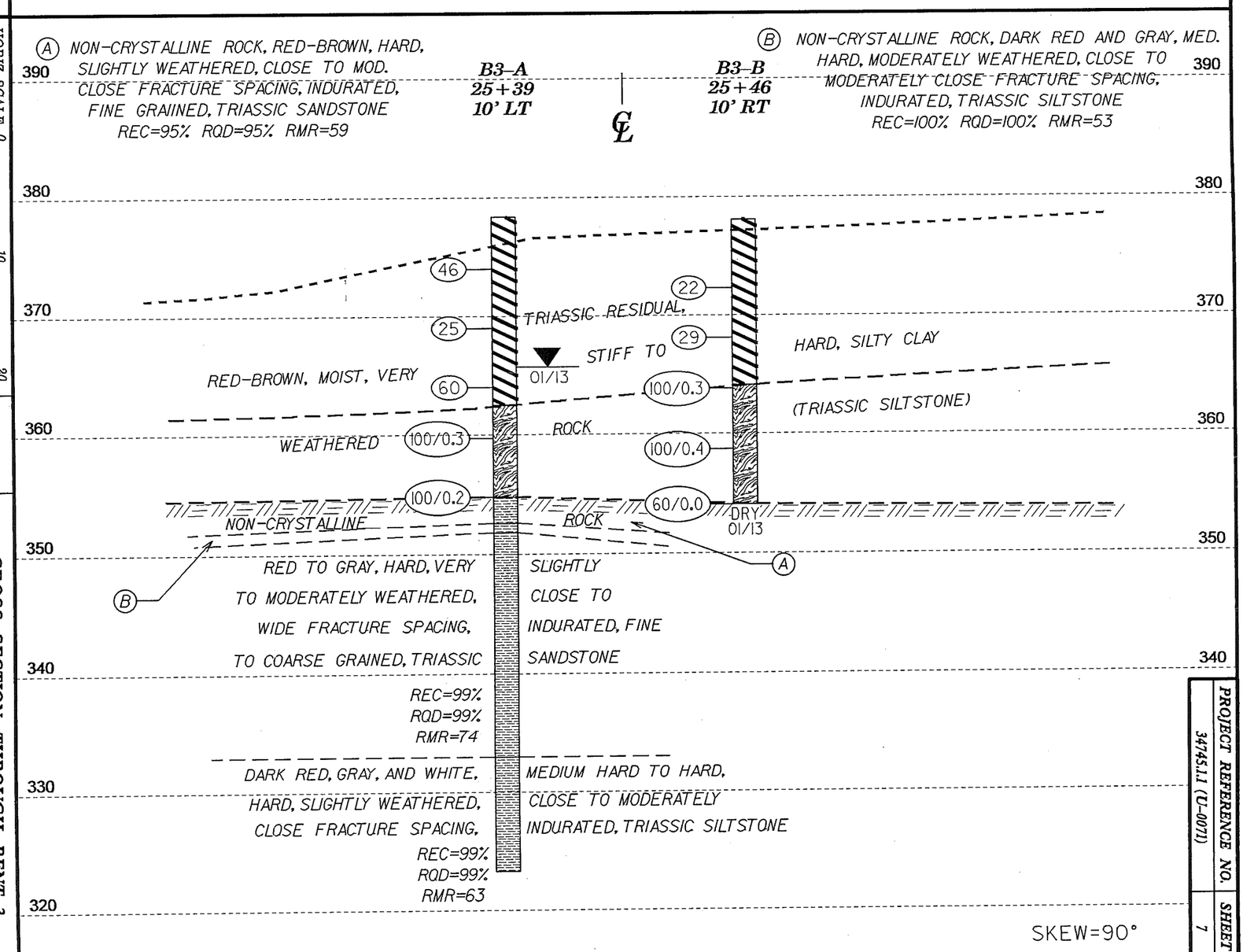
CROSS SECTION THROUGH BENT 2



HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

CROSS SECTION THROUGH BENT 3

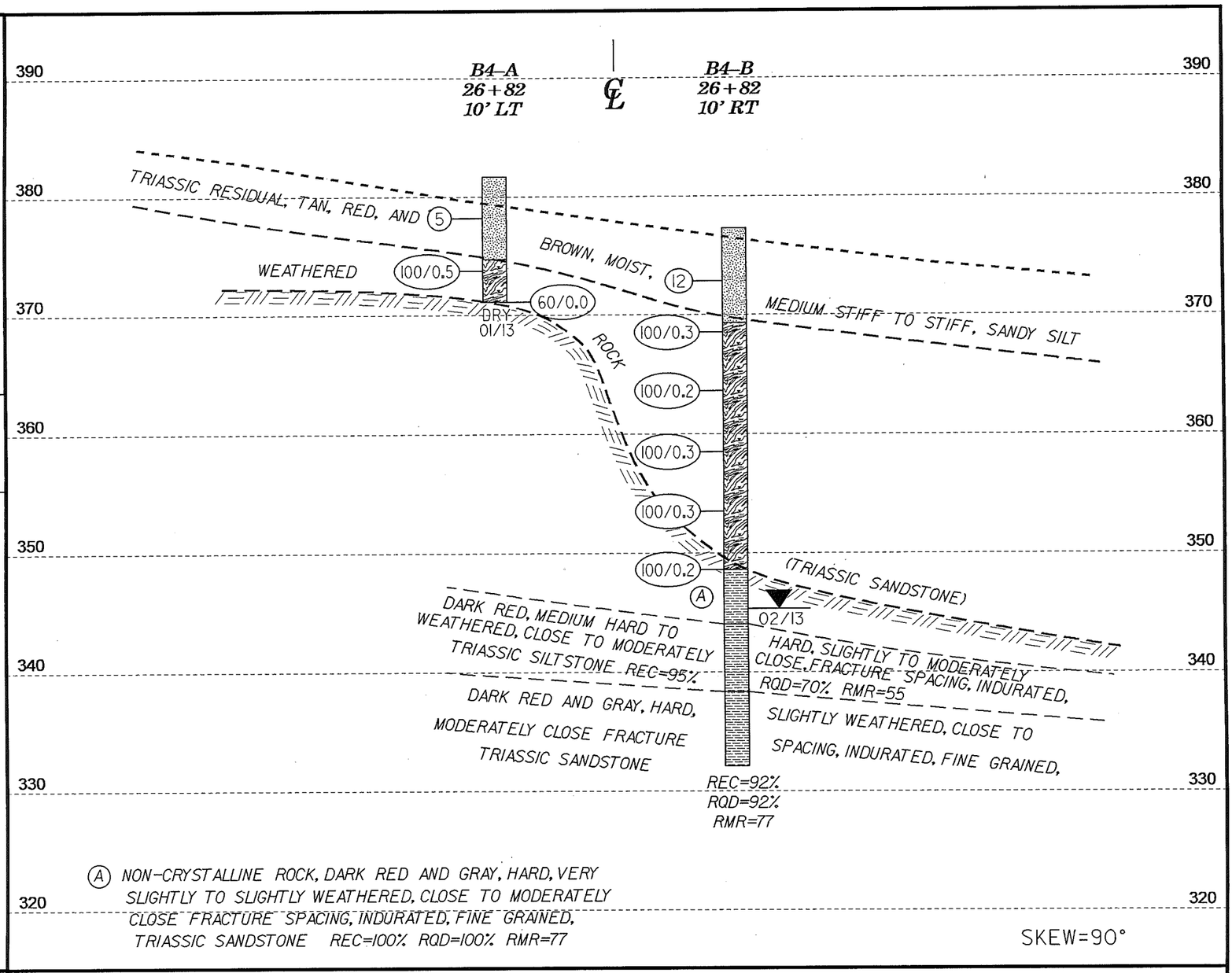


PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	7

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

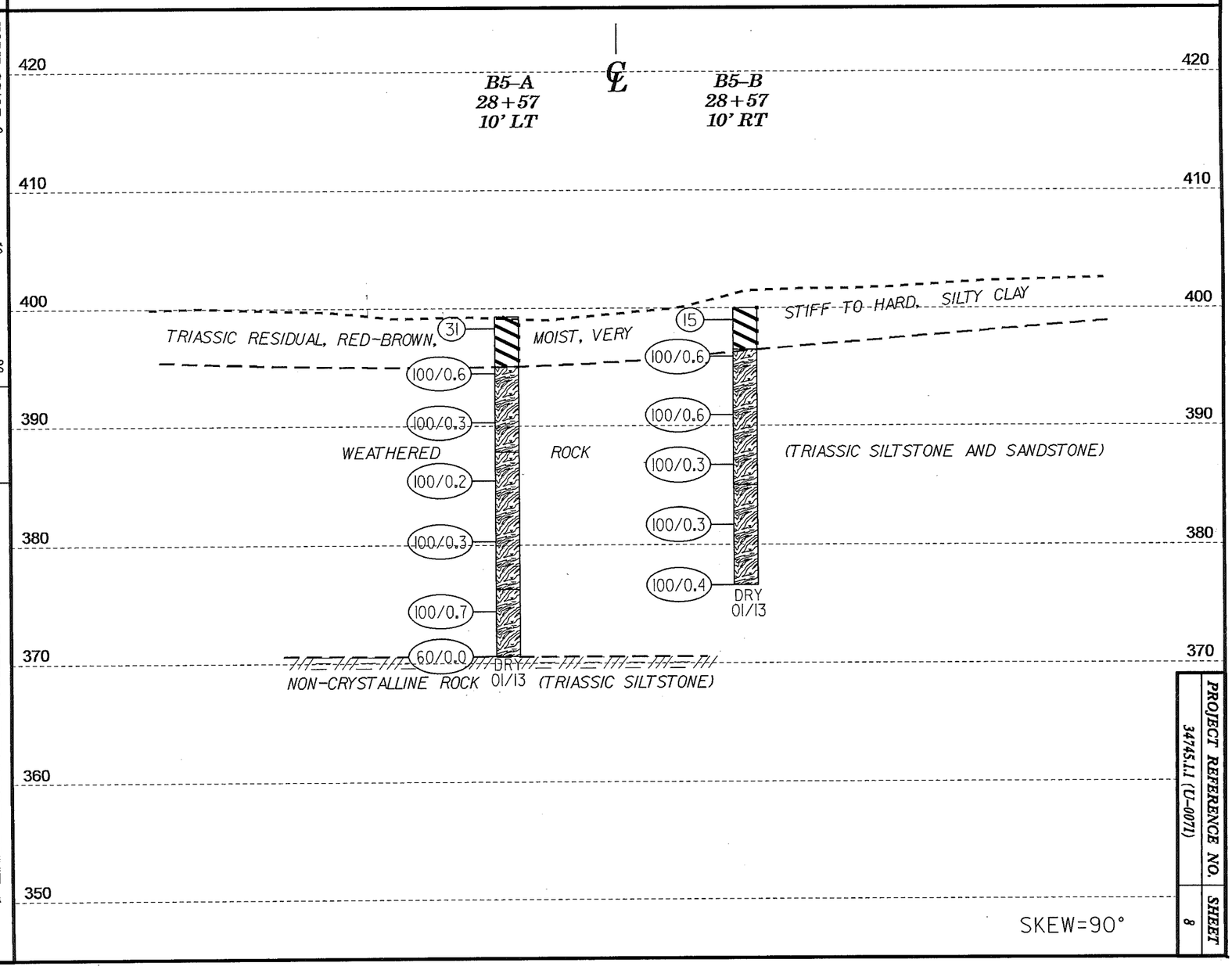
CROSS SECTION THROUGH BENT 4



HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

CROSS SECTION THROUGH BENT 5

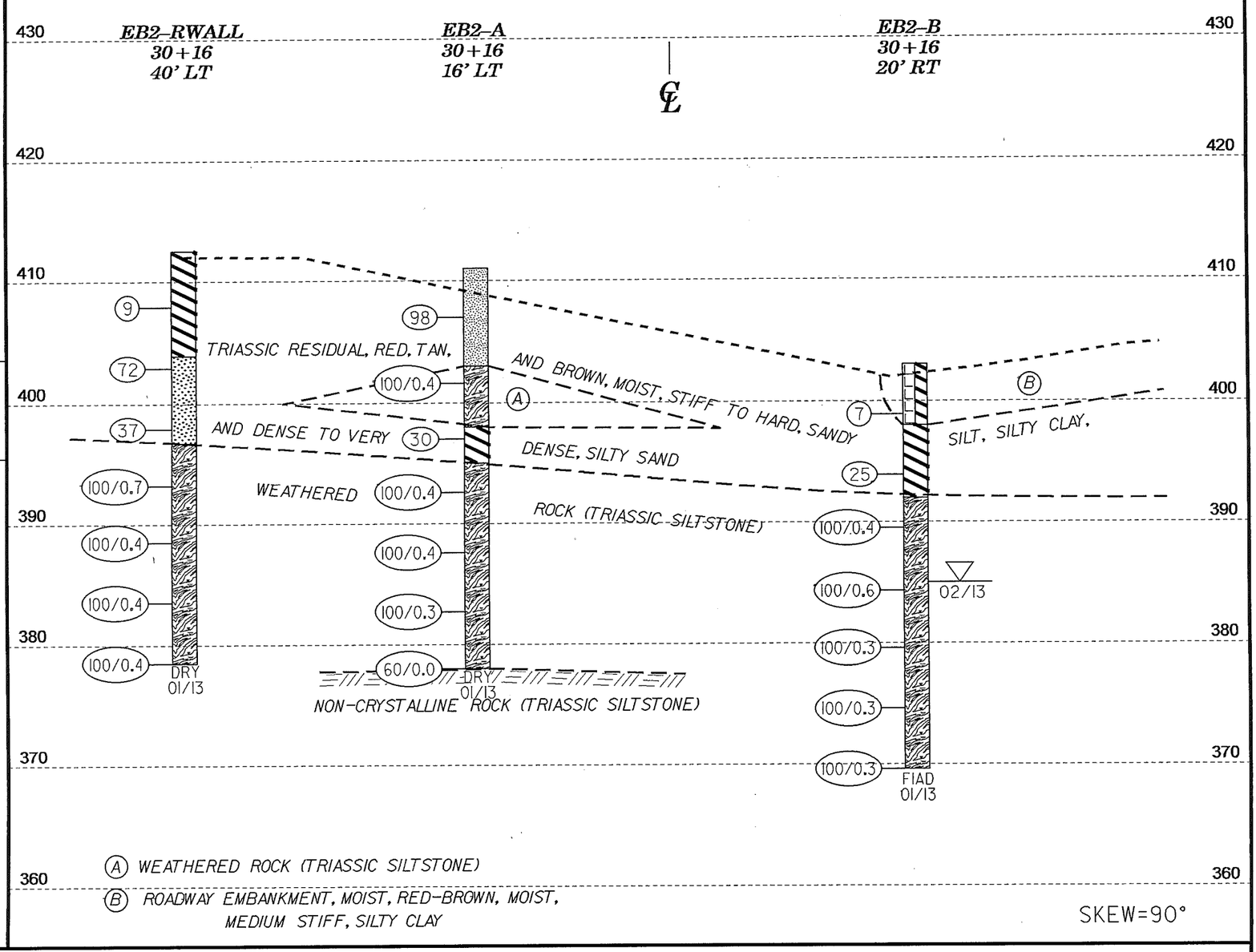


PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	8

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

CROSS SECTION THROUGH END BENT 2



PROJECT REFERENCE NO.	SHEET
34745.1.1 (U-0071)	9

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147			GROUND WTR (ft)
BORING NO. EB1-A	STATION 20+91	OFFSET 20 ft LT	ALIGNMENT -DFFLY- — 0 HR. Dry
COLLAR ELEV. 388.1 ft	TOTAL DEPTH 28.8 ft	NORTHING 806,679	EASTING 2,040,246 — 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE RFO0067 CME-550X 82% 12/18/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 07/29/10	COMP. DATE 07/29/10	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
390										388.1 GROUND SURFACE	0.0
385	384.7	3.4	7	5	6	11		M		TRIASSIC RESIDUAL TAN-BROWN, SANDY SILT	
380	379.7	8.4	20	67	33/0.4	100/0.9				379.2 WEATHERED ROCK (TRIASSIC SANDSTONE)	8.9
375	374.7	13.4	100/0.3			100/0.3					
370	369.7	18.4	100/0.2			100/0.2					
365	364.7	23.4	100/0.4			100/0.4					
360	359.7	28.4	100/0.4			100/0.4				359.3 Boring Terminated at Elevation 359.3 ft in WEATHERED ROCK (TRIASSIC SANDSTONE)	28.8

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147			GROUND WTR (ft)
BORING NO. EB1-B	STATION 21+00	OFFSET 20 ft RT	ALIGNMENT -DFFLY- — 0 HR. 13.3
COLLAR ELEV. 385.6 ft	TOTAL DEPTH 28.6 ft	NORTHING 806,703	EASTING 2,040,213 — 24 HR. 2.0
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 02/27/13	COMP. DATE 02/27/13	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
390										385.6 GROUND SURFACE	0.0
385	382.1	3.5	1	2	3	5		M		TRIASSIC RESIDUAL TAN-BROWN AND RED-BROWN, SILTY CLAY	
380	377.1	8.5	13	15	20	35		M		373.1 WEATHERED ROCK (TRIASSIC SILTSTONE)	12.5
375	372.1	13.5	100/0.2			100/0.2					
370	367.1	18.5	100/0.5			100/0.5				367.6 (TRIASSIC SANDSTONE)	18.0
365	362.1	23.5	100/0.2			100/0.2				363.6 (TRIASSIC SILTSTONE)	22.0
360	357.1	28.5	60/0.1			60/0.1				357.1 NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE) Boring Terminated with Standard Penetration Test Refusal at Elevation 357.0 ft in NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	28.5

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.	
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147				GROUND WTR (ft)
BORING NO. B1-A	STATION 22+38	OFFSET 10 ft LT	ALIGNMENT -DFFLY-	0 HR. N/A
COLLAR ELEV. 382.0 ft	TOTAL DEPTH 34.1 ft	NORTHING 806,600	EASTING 2,040,118	24 HR. 15.0
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic	
DRILLER Conley, H. R.	START DATE 02/28/13	COMP. DATE 02/28/13	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
385											
										382.0 GROUND SURFACE	0.0
380										TRIASSIC RESIDUAL RED-BROWN, SILTY CLAY	
	378.5	3.5	13	25	28	53					
375										373.5	8.5
	373.5	8.5	25	75/0.4		100/0.9				WEATHERED ROCK (TRIASSIC SILTSTONE)	
370											
	368.5	13.5	100/0.3			100/0.3					
365											
	363.5	18.5	30	70/0.2		100/0.7					
360											
	358.5	23.5	50	50/0.1		100/0.6					
355											
	353.5	28.5	100/0.5			100/0.5					
350											
	348.5	33.5	60	40/0.1		100/0.6				347.9	34.1
										Boring Terminated at Elevation 347.9 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)	

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.	
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147				GROUND WTR (ft)
BORING NO. B1-B	STATION 22+38	OFFSET 10 ft RT	ALIGNMENT -DFFLY-	0 HR. Dry
COLLAR ELEV. 383.4 ft	TOTAL DEPTH 23.7 ft	NORTHING 806,617	EASTING 2,040,109	24 HR. Dry
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Conley, H. R.	START DATE 02/27/13	COMP. DATE 02/27/13	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
385										
	383.4	0.0								383.4 GROUND SURFACE 0.0
			6	10	15	25		M		TRIASSIC RESIDUAL RED-BROWN, SILTY CLAY
380	379.9	3.5								
			18	45	50	95		M		378.4 5.0
375	374.9	8.5								WEATHERED ROCK (TRIASSIC SILTSTONE)
			37	63/0.3		100/0.8				
370	369.9	13.5								
			100/0.3			100/0.3				
365	364.9	18.5								
			100/0.2			100/0.2				
360	359.9	23.5								
			100/0.2			100/0.2				359.7 23.7
										Boring Terminated at Elevation 359.7 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147			**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 24+13	**OFFSET** 10 ft LT	**ALIGNMENT** -DFFLY- — **0 HR.** Dry
COLLAR ELEV. 373.8 ft	**TOTAL DEPTH** 21.0 ft	**NORTHING** 806,536	**EASTING** 2,039,953 — **24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Conley, H. R.	**START DATE** 01/10/13	**COMP. DATE** 01/10/13	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
375										
	373.8	0.0								373.8 GROUND SURFACE 0.0
			7	10	14	24		M		**TRIASSIC RESIDUAL** RED-BROWN, SILTY CLAY
370	370.2	3.6								369.9 3.9
			30	45	55/0.4	100/0.9				**WEATHERED ROCK** (TRIASSIC SILTSTONE)
365	365.2	8.6								
			100/0.4			100/0.4				
360	360.2	13.6								
			31	69/0.3		100/0.8				
355	355.2	18.6								
			42	58/0.2		100/0.7				
	352.8	21.0								352.8 21.0
			60/0.0			60/0.0				Boring Terminated with Standard Penetration Test Refusal at Elevation 352.8 ft on NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.	
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147				GROUND WTR (ft)
BORING NO. B2-B	STATION 24+13	OFFSET 10 ft RT	ALIGNMENT -DFFLY-	0 HR. N/A
COLLAR ELEV. 374.2 ft	TOTAL DEPTH 55.1 ft	NORTHING 806,556	EASTING 2,039,948	24 HR. 17.6
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic	
DRILLER Conley, H. R.	START DATE 01/22/13	COMP. DATE 01/22/13	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
375										374.2 GROUND SURFACE	0.0
										TRIASSIC RESIDUAL RED-BROWN, SILTY CLAY	
370	370.8	3.4	25	56	44/0.3					370.3	3.9
						100/0.8				WEATHERED ROCK (TRIASSIC SILTSTONE)	
365	365.8	8.4	100/0.3			100/0.3					
360	360.8	13.4	72	28/0.1		100/0.6					
355	355.8	18.4	100/0.4			100/0.4				352.7	21.5
										NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	
350	350.8	23.4	60/0.1			60/0.1				350.7	23.5
							RS-6			GRAY TO DARK RED, HARD, SLIGHTLY WEATHERED, MODERATELY CLOSE TO WIDE FRACTURE SPACING, INDURATED, FINE GRAINED, TRIASSIC SANDSTONE REC=100% RQD=98% RMR=67	
										346.2	28.0
345										DARK RED, MEDIUM HARD, SLIGHTLY WEATHERED, CLOSE TO WIDE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE REC=93% RQD=87% RMR=50	
340							RS-7			338.6	35.6
335							RS-8			GRAY TO DARK RED, MEDIUM HARD TO HARD, SLIGHTLY WEATHERED, CLOSE TO WIDE FRACTURE SPACING, INDURATED, COARSE GRAINED, TRIASSIC SANDSTONE REC=100% RQD=98% RMR=69	
330											
325										321.2	53.0
320										DARK RED, MEDIUM HARD, SLIGHTLY WEATHERED, WIDE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE REC=100% RQD=100% RMR=64	
										319.1	55.1
										Boring Terminated with Standard Penetration Test Refusal at Elevation 319.1 ft in NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Mohs, N. D.	
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147				GROUND WTR (ft)
BORING NO. B2-B	STATION 24+13	OFFSET 10 ft RT	ALIGNMENT -DFFLY-	0 HR. N/A
COLLAR ELEV. 374.2 ft	TOTAL DEPTH 55.1 ft	NORTHING 806,556	EASTING 2,039,948	24 HR. 17.6
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic	
DRILLER Conley, H. R.	START DATE 01/22/13	COMP. DATE 01/22/13	SURFACE WATER DEPTH N/A	
CORE SIZE NWC3	TOTAL RUN 31.6 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
350.7											Begin Coring @ 23.5 ft	
350	350.7	23.5	1.6	1:51/1.0 0:45/0.6	(1.5) 94%	(1.5) 94%		(4.5) 100%	(4.4) 98%		350.7 GRAY TO DARK RED, HARD, SLIGHTLY WEATHERED, MODERATELY CLOSE TO WIDE FRACTURE SPACING, INDURATED, FINE GRAINED, TRIASSIC SANDSTONE REC=100% RQD=98% RMR=67	23.5
	349.1	25.1	5.0	1:00/1.0 1:01/1.0 1:16/1.0	(4.5) 90%	(4.5) 90%	RS-6					
345	344.1	30.1	5.0	1:13/1.0 1:20/1.0 1:00/1.0 0:56/1.0 1:01/1.0 1:00/1.0 1:03/1.0	(5.0) 100%	(5.0) 100%	RS-7	(7.1) 93%	(6.6) 87%		346.2 DARK RED, MEDIUM HARD, SLIGHTLY WEATHERED, CLOSE TO WIDE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE REC=93% RQD=87% RMR=50	28.0
340	339.1	35.1	5.0	2:11/1.0 1:01/1.0 1:00/1.0 1:11/1.0 1:06/1.0	(5.0) 100%	(5.0) 100%	RS-8	(17.4) 100%	(17.0) 98%		338.6 GRAY TO DARK RED, MEDIUM HARD TO HARD, SLIGHTLY WEATHERED, CLOSE TO WIDE FRACTURE SPACING, INDURATED, COARSE GRAINED, TRIASSIC SANDSTONE REC=100% RQD=98% RMR=69	35.6
335	334.1	40.1	5.0	1:00/1.0 0:56/1.0 0:50/1.0 1:02/1.0 1:00/1.0	(5.0) 100%	(5.0) 100%						
330	329.1	45.1	5.0	1:21/1.0 1:11/1.0 1:00/1.0 0:56/1.0 1:01/1.0	(5.0) 100%							
325	324.1	50.1	5.0	1:00/1.0 0:52/1.0 1:00/1.0 1:21/1.0 1:16/1.0	(5.0) 100%	(5.0) 100%					321.2 DARK RED, MEDIUM HARD, SLIGHTLY WEATHERED, WIDE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE REC=100% RQD=100% RMR=64	53.0
320	319.1	55.1						(2.1) 100%	(2.1) 100%		319.1 Boring Terminated with Standard Penetration Test Refusal at Elevation 319.1 ft in NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	55.1

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147			GROUND WTR (ft)
BORING NO. B3-A	STATION 25+39	OFFSET 10 ft LT	ALIGNMENT -DFFLY- / 0 HR. N/A
COLLAR ELEV. 378.4 ft	TOTAL DEPTH 55.1 ft	NORTHING 806,519	EASTING 2,039,826 / 24 HR. 12.7
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 01/14/13	COMP. DATE 01/15/13	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
380										378.4 GROUND SURFACE	0.0
375	375.0	3.4	8	16	30	46		M		TRIASSIC RESIDUAL RED, SILTY CLAY	
370	370.0	8.4	9	12	13	25		M			
365	365.0	13.4	10	24	36	60		M		362.5	15.9
360	360.0	18.4	100/0.3			100/0.3				WEATHERED ROCK (TRIASSIC SILTSTONE)	
355	355.0	23.4	100/0.2			100/0.2				354.8	23.6
350							RS-3			352.6 / 351.8 NON-CRYSTALLINE ROCK RED-BROWN, HARD, SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, FINE GRAINED, TRIASSIC SANDSTONE REC=95% RQD=95% RMR=59	25.8 / 26.6
345										DARK RED AND GRAY, MEDIUM HARD, MODERATELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE REC=100% RQD=100% RMR=53	
340							RS-4			RED TO GRAY, HARD, VERY SLIGHTLY TO MODERATELY WEATHERED, CLOSE TO WIDE FRACTURE SPACING, INDURATED, FINE TO COARSE GRAINED, TRIASSIC SANDSTONE REC=99% RQD=99% RMR=74	
335										333.0	45.4
330							RS-5			DARK RED, GRAY, AND WHITE, MEDIUM HARD TO HARD, SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE REC=99% RQD=99% RMR=63	
325										323.3	55.1
										Boring Terminated with Standard Penetration Test Refusal at Elevation 323.3 ft in NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147			GROUND WTR (ft)
BORING NO. B3-A	STATION 25+39	OFFSET 10 ft LT	ALIGNMENT -DFFLY- / 0 HR. N/A
COLLAR ELEV. 378.4 ft	TOTAL DEPTH 55.1 ft	NORTHING 806,519	EASTING 2,039,826 / 24 HR. 12.7
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 01/14/13	COMP. DATE 01/15/13	SURFACE WATER DEPTH N/A
CORE SIZE NWC3	TOTAL RUN 31.5 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
354.8											Begin Coring @ 23.6 ft	
	354.8 / 353.3	23.6 / 25.1	1.5	0:50/0.5 1:05/1.0	(1.4) 93%	(1.4) 93%		(2.1) 95%	(2.1) 95%		354.8 / 352.6 / 351.8 NON-CRYSTALLINE ROCK RED-BROWN, HARD, SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, FINE GRAINED, TRIASSIC SANDSTONE REC=95% RQD=95% RMR=59	23.6 / 25.8 / 26.6
350			5.0	1:06/1.0 0:38/1.0 0:41/1.0 0:41/1.0 0:33/1.0	(5.0) 100%	(5.0) 100%		(0.8) 100% (18.6) 99%	(0.8) 100% (18.6) 99%		DARK RED AND GRAY, MEDIUM HARD, MODERATELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE REC=100% RQD=100% RMR=53	
	348.3	30.1					RS-3					
345			5.0	0:46/1.0 0:43/1.0 0:38/1.0 0:36/1.0 0:34/1.0	(5.0) 100%	(5.0) 100%						
	343.3	35.1										
340			5.0	0:51/1.0 0:39/1.0 0:45/1.0 0:48/1.0 0:48/1.0	(5.0) 100%	(5.0) 100%					RED TO GRAY, HARD, VERY SLIGHTLY TO MODERATELY WEATHERED, CLOSE TO WIDE FRACTURE SPACING, INDURATED, FINE TO COARSE GRAINED, TRIASSIC SANDSTONE REC=99% RQD=99% RMR=74	
	338.3	40.1										
335			5.0	1:45/1.0 1:00/1.0 0:53/1.0 1:21/1.0 1:06/1.0	(4.8) 96%	(4.8) 96%	RS-4				333.0	45.4
	333.3	45.1										
330			5.0	2:11/1.0 0:42/1.0 0:39/1.0 0:53/1.0 0:46/1.0	(4.9) 98%	(4.9) 98%	RS-5	(9.6) 99%	(9.6) 99%		DARK RED, GRAY, AND WHITE, MEDIUM HARD TO HARD, SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE REC=99% RQD=99% RMR=63	
	328.3	50.1										
325			5.0	1:07/1.0 0:36/1.0 1:14/1.0 1:05/1.0 0:45/1.0	(5.0) 100%	(5.0) 100%						
	323.3	55.1									323.3	55.1
											Boring Terminated with Standard Penetration Test Refusal at Elevation 323.3 ft in NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	

NCDOT BORE DOUBLE U0071_GEO_DFFLY_BH.GPJ NC_DOT.GDT 3/21/13

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147			**GROUND WTR (ft)**
BORING NO. B3-B	**STATION** 25+46	**OFFSET** 10 ft RT	**ALIGNMENT** -DFFLY- — **0 HR.** Dry
COLLAR ELEV. 378.1 ft	**TOTAL DEPTH** 24.0 ft	**NORTHING** 806,539	**EASTING** 2,039,819 — **24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Conley, H. R.	**START DATE** 01/10/13	**COMP. DATE** 01/10/13	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
380										378.1 GROUND SURFACE 0.0
375										**TRIASSIC RESIDUAL** RED-BROWN, SILTY CLAY
	373.3	4.8	5	10	12	22		M		
370	369.1	9.0	6	12	17	29		M		
365	364.1	14.0	100/0.3			100/0.3				364.1 14.0 **WEATHERED ROCK** (TRIASSIC SILTSTONE)
360	359.1	19.0	100/0.4			100/0.4				
355	354.1	24.0	60/0.0			60/0.0				354.1 24.0 Boring Terminated with Standard Penetration Test Refusal at Elevation 354.1 ft on NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147			**GROUND WTR (ft)**
BORING NO. B4-A	**STATION** 26+82	**OFFSET** 10 ft LT	**ALIGNMENT** -DFFLY- — **0 HR.** Dry
COLLAR ELEV. 381.7 ft	**TOTAL DEPTH** 10.6 ft	**NORTHING** 806,530	**EASTING** 2,039,682 — **24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Conley, H. R.	**START DATE** 01/29/13	**COMP. DATE** 01/29/13	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
385											
										381.7 GROUND SURFACE	0.0
380	379.2	2.5	2	2	3	5		M		**TRIASSIC RESIDUAL** TAN-BROWN, SANDY SILT	
375	374.2	7.5	100/0.5			100/0.5				374.7	7.0
	371.1	10.6	60/0.0			60/0.0				**WEATHERED ROCK** (TRIASSIC SILTSTONE) 371.1	10.6
										Boring Terminated with Standard Penetration Test Refusal at Elevation 371.1 ft on NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147			GROUND WTR (ft)
BORING NO. B4-B	STATION 26+82	OFFSET 10 ft RT	ALIGNMENT -DFFLY- / 0 HR. N/A
COLLAR ELEV. 377.3 ft	TOTAL DEPTH 45.2 ft	NORTHING 806,550	EASTING 2,039,686 / 24 HR. 32.0
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD NW Casing w/ Core	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 02/15/13	COMP. DATE 02/15/13	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
380											
										377.3 GROUND SURFACE	0.0
375										TRIASSIC RESIDUAL RED-BROWN, SANDY SILT	
	373.8	3.5	2	2	10	12		M			
370										369.3	8.0
	368.8	8.5	100/0.3			100/0.3				WEATHERED ROCK (TRIASSIC SANDSTONE)	
365											
	363.8	13.5	100/0.2			100/0.2					
360											
	358.8	18.5	100/0.3			100/0.3					
355											
	353.8	23.5	100/0.3			100/0.3					
350											
	348.8	28.5	100/0.2			100/0.2				348.6	28.7
							RS-1			NON-CRYSTALLINE ROCK DARK RED AND GRAY, HARD, VERY SLIGHTLY TO SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, FINE GRAINED, TRIASSIC SANDSTONE REC=100% RQD=100% RMR=77	
345										344.0	33.3
340							RS-2			DARK RED, MEDIUM HARD TO HARD, SLIGHTLY TO MODERATELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE REC=95% RQD=70% RMR=55	
										338.3	39.0
335											
										332.1	45.2
										DARK RED AND GRAY, HARD, SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, FINE GRAINED, TRIASSIC SANDSTONE REC=92% RQD=92% RMR=77	
										Boring Terminated at Elevation 332.1 ft in NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147			GROUND WTR (ft)
BORING NO. B4-B	STATION 26+82	OFFSET 10 ft RT	ALIGNMENT -DFFLY- / 0 HR. N/A
COLLAR ELEV. 377.3 ft	TOTAL DEPTH 45.2 ft	NORTHING 806,550	EASTING 2,039,686 / 24 HR. 32.0
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD NW Casing w/ Core	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 02/15/13	COMP. DATE 02/15/13	SURFACE WATER DEPTH N/A
CORE SIZE NWC3	TOTAL RUN 16.5 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
348.6											Begin Coring @ 28.7 ft	
	348.6	28.7	1.5	1:08/1.0	(1.5)	(1.5)		(4.5)	(4.5)		348.6 NON-CRYSTALLINE ROCK	28.7
	347.1	30.2		:25/0.5	100%	100%	RS-1	98%	98%		DARK RED AND GRAY, HARD, VERY SLIGHTLY TO SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, FINE GRAINED, TRIASSIC SANDSTONE	
345			5.0	:37/1.0 :33/1.0 :35/1.0	(4.8)	(4.2)					344.0 REC=100% RQD=100% RMR=77	33.3
				:55/1.0 :53/1.0	96%	84%						
	342.1	35.2						(5.4)	(40.0)			
			5.0	:59/1.0 :38/1.0 :39/1.0	(4.9)	(4.4)		95%	702%		DARK RED, MEDIUM HARD TO HARD, SLIGHTLY TO MODERATELY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, TRIASSIC SILTSTONE	
340				:38/1.0 :26/1.0	98%	88%	RS-2				338.3 REC=95% RQD=70% RMR=55	39.0
	337.1	40.2						(5.7)	(5.7)			
			5.0	1:06/1.0 :40/1.0 :36/1.0	(4.5)	(4.5)		92%	92%		DARK RED AND GRAY, HARD, SLIGHTLY WEATHERED, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, INDURATED, FINE GRAINED, TRIASSIC SANDSTONE	
335				:54/1.0 1:04/1.0	90%	90%					332.1 REC=92% RQD=92% RMR=77	45.2
	332.1	45.2									Boring Terminated at Elevation 332.1 ft in NON-CRYSTALLINE ROCK (TRIASSIC SANDSTONE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147			GROUND WTR (ft)
BORING NO. B5-A	STATION 28+57	OFFSET 10 ft LT	ALIGNMENT -DFFLY- / 0 HR. N/A
COLLAR ELEV. 399.3 ft	TOTAL DEPTH 28.7 ft	NORTHING 806,586	EASTING 2,039,514 / 24 HR. Dry
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD NW Casing w/ SPT	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 02/05/13	COMP. DATE 02/05/13	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
400	399.3	0.0								399.3 GROUND SURFACE	0.0
			5	15	16	31		M		**TRIASSIC RESIDUAL** RED-BROWN, SILTY CLAY	
395	395.6	3.7	3	80	20/0.1	100/0.6				395.1 **WEATHERED ROCK** (TRIASSIC SILTSTONE)	4.2
390	390.6	8.7	100/0.3			100/0.3					
385	385.6	13.7	100/0.2			100/0.2				387.8 (TRIASSIC SANDSTONE)	11.5
380	380.6	18.7	100/0.3			100/0.3					
375	375.6	23.7	29	45	55/0.2	100/0.7				376.3 (TRISASSIC SILTSTONE)	23.0
	370.6	28.7	60/0.0			60/0.0				370.6 Boring Terminated with Standard Penetration Test Refusal at Elevation 370.6 ft on NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	28.7

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147			GROUND WTR (ft)
BORING NO. B5-B	STATION 28+57	OFFSET 10 ft RT	ALIGNMENT -DFFLY- / 0 HR. Dry
COLLAR ELEV. 400.0 ft	TOTAL DEPTH 23.4 ft	NORTHING 806,604	EASTING 2,039,523 / 24 HR. Dry
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Conley, H. R.	START DATE 01/29/13	COMP. DATE 01/29/13	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
400	400.0	0.0	5	6	9	15		M		400.0 GROUND SURFACE 0.0
	397.0	3.0	15	90	10/0.1	100/0.6				**TRIASSIC RESIDUAL** RED-BROWN, SILTY CLAY 396.5 3.5
395	392.0	8.0	14	70	30/0.1	100/0.6				**WEATHERED ROCK** (TRIASSIC SILTSTONE)
390	387.0	13.0	100/0.3			100/0.3				385.0 15.0
385	382.0	18.0	100/0.3			100/0.3				(TRIASSIC SANDTONE)
380	377.0	23.0	100/0.4			100/0.4				376.6 23.4
										Boring Terminated at Elevation 376.6 ft in WEATHERED ROCK (TRIASSIC SANDSTONE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147			GROUND WTR (ft)
BORING NO. EB2-A	STATION 30+16	OFFSET 16 ft LT	ALIGNMENT -DFFLY- — 0 HR. Dry
COLLAR ELEV. 411.0 ft	TOTAL DEPTH 33.0 ft	NORTHING 806,670	EASTING 2,039,375 — 24 HR. Dry
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Froats, H. L.	START DATE 01/30/13	COMP. DATE 01/30/13	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
415											
410										411.0 GROUND SURFACE	0.0
	408.0	3.0	6	18	80	98		M		TRIASSIC RESIDUAL TAN-BROWN, SANDY SILT	
405										403.0	8.0
	403.0	8.0	23	50	50/0.4	100/0.4				WEATHERED ROCK (TRIASSIC SILTSTONE)	
400										398.0	13.0
	398.0	13.0	10	12	18	30		M		TRIASSIC RESIDUAL RED-BROWN, SILTY CLAY	
395										395.0	16.0
	393.0	18.0	100/0.4			100/0.4				WEATHERED ROCK (TRIASSIC SILTSTONE)	
390											
	388.0	23.0	100/0.4			100/0.4					
385											
	383.0	28.0	100/0.3			100/0.3					
380										378.0	33.0
	378.0	33.0	60/0.0			60/0.0				Boring Terminated with Standard Penetration Test Refusal at Elevation 378.0 ft on NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)	

WBS 34745.1.1	TIP U-0071	COUNTY DURHAM	GEOLOGIST Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147			GROUND WTR (ft)
BORING NO. EB2-B	STATION 30+16	OFFSET 20 ft RT	ALIGNMENT -DFFLY- — 0 HR. 18.0
COLLAR ELEV. 403.0 ft	TOTAL DEPTH 33.4 ft	NORTHING 806,698	EASTING 2,039,399 — 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Froats, H. L.	START DATE 01/31/13	COMP. DATE 01/31/13	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
405										
										403.0 GROUND SURFACE 0.0
400	399.9	3.1	2	3	4	7		M		ROADWAY EMBANKMENT RED-BROWN, SILTY CLAY
										398.0 5.0
395	394.9	8.1	4	11	14	25		M		TRIASSIC RESIDUAL RED-BROWN, SILTY CLAY
										392.0 11.0
390	389.9	13.1	100/0.4			100/0.4				WEATHERED ROCK (TRIASSIC SILTSTONE)
385	384.9	18.1	80	20/0.1		100/0.6				
380	379.9	23.1	100/0.3			100/0.3				
375	374.9	28.1	100/0.3			100/0.3				
370	369.9	33.1	100/0.3			100/0.3				369.6 33.4
										Boring Terminated at Elevation 369.6 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)

WBS 34745.1.1	**TIP** U-0071	**COUNTY** DURHAM	**GEOLOGIST** Oti, O. B.
SITE DESCRIPTION STRUCTURE NO. 11 ON -DFFLY- OVER EAST END CONNECTOR AND NC 147			**GROUND WTR (ft)**
BORING NO. EB2-RWAL	**STATION** 30+16	**OFFSET** 40 ft LT	**ALIGNMENT** -DFFLY- — **0 HR.** Dry
COLLAR ELEV. 412.5 ft	**TOTAL DEPTH** 34.0 ft	**NORTHING** 806,652	**EASTING** 2,039,360 — **24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 91% 12/18/2012		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Conley, H. R.	**START DATE** 01/31/13	**COMP. DATE** 01/31/13	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
415										
										412.5 GROUND SURFACE 0.0
410										**TRIASSIC RESIDUAL** RED-BROWN, SILTY CLAY
	408.9	3.6	4	5	4	9		M		
405										403.9 8.6
	403.9	8.6	22	21	51	72		M		TAN-BROWN, SILTY SAND
400										
	398.9	13.6	9	17	20	37		M		396.7 15.8
395										**WEATHERED ROCK** (TRIASSIC SILTSTONE)
	393.9	18.6	60	40/0.2		100/0.7				
390										
	388.9	23.6	100/0.4			100/0.4				
385										
	383.9	28.6	100/0.4			100/0.4				
380										
	378.9	33.6	100/0.4			100/0.4				378.5 34.0
										Boring Terminated at Elevation 378.5 ft in WEATHERED ROCK (TRIASSIC SILTSTONE)

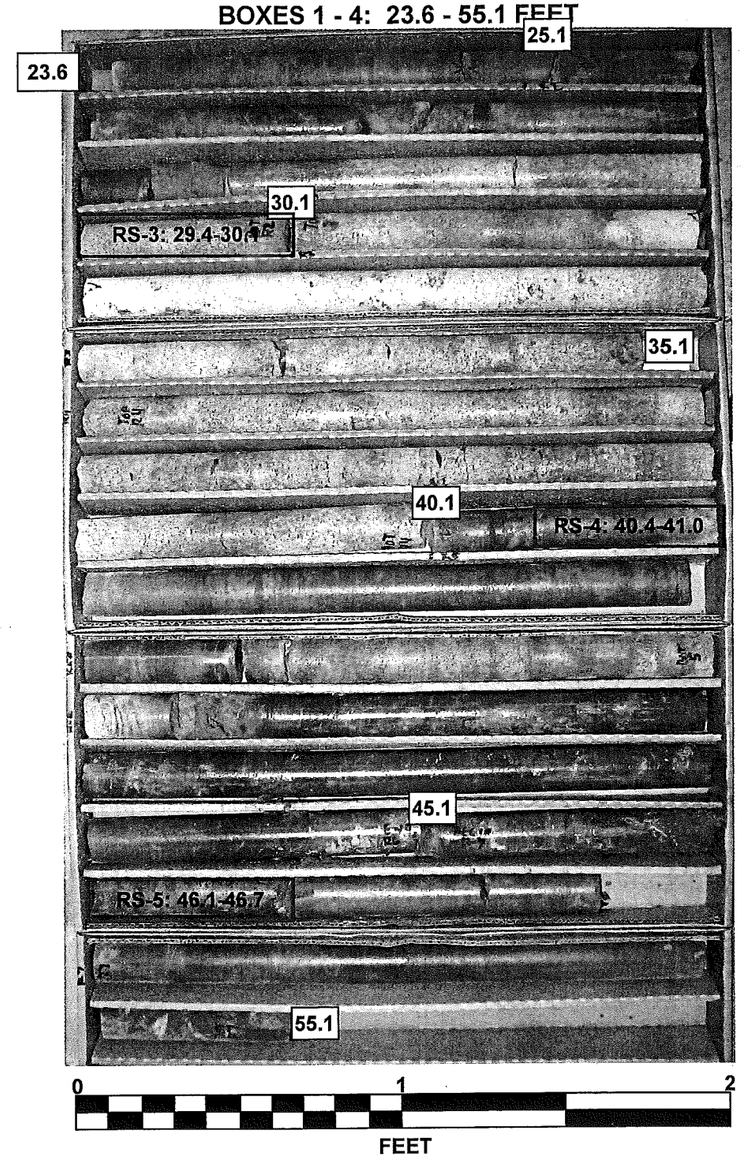
CORE PHOTOGRAPHS

B2-B

BOXES 1 - 4: 23.5 -55.1 FEET

B3-A

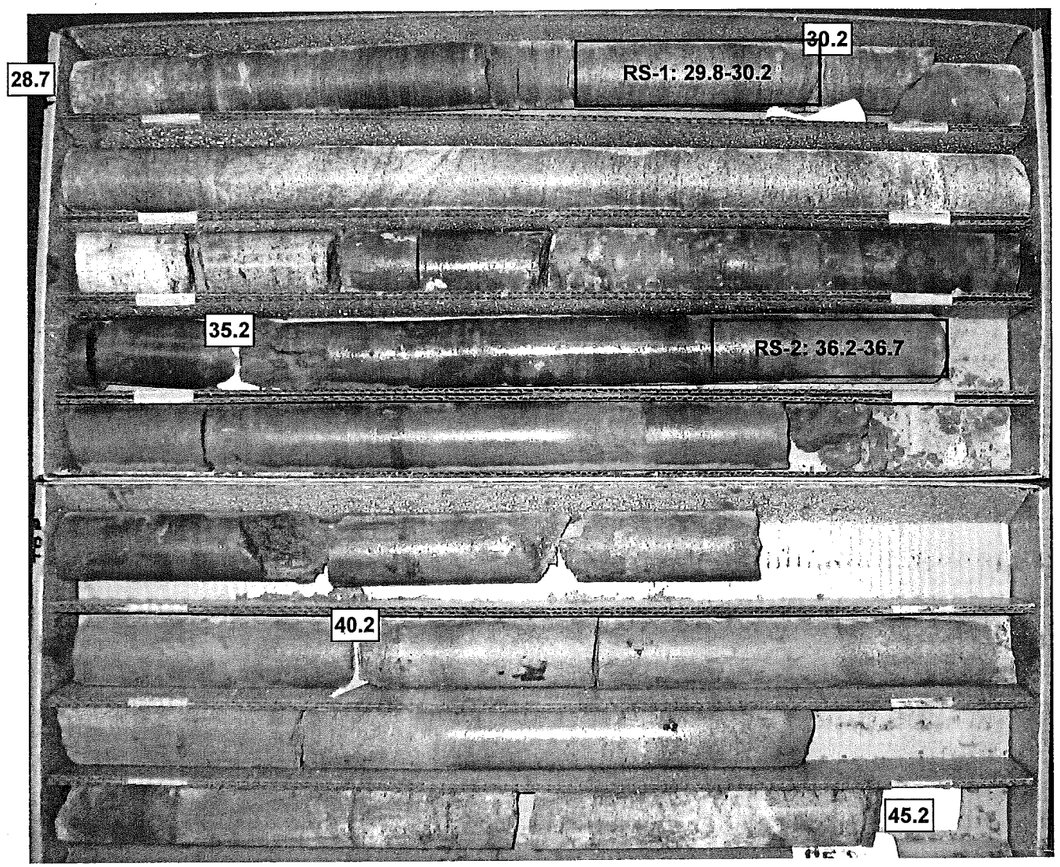
BOXES 1 - 4: 23.6 - 55.1 FEET

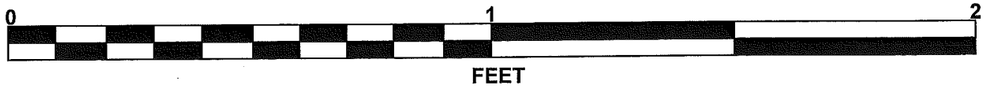


CORE PHOTOGRAPHS

B4-B

BOXES 1 & 2 28.7- 45.2 FEET





ROCK CORE TEST RESULTS

SAMPLE NO.	BORING	OFFSET	STATION	DEPTH INTERVAL	H/D RATIO	UNIT WT lbs/ft3	Ultimate lbf	Ultimate ksi	Ultimate (corrected) ksi	Sec. Mod. @ 40% Mpsi
RS-1	B4-B	10' RT	26+82	29.8-30.3	1.98	156.4	27200	9.978	8.98	1.219
RS-2	B4-B	10' RT	26+82	36.2-36.7	2.00	161.9	24000	8.871	8.86	0.617
RS-3	B3-A	10' LT	25+39	29.4-30.1	1.95	149.3	14800	5.412	5.39	1.575
RS-4	B3-A	10' LT	25+39	40.4-41.0	1.79	159.4	31300	11.569	11.43	1.747
RS-5	B3-A	10' LT	25+39	46.1-46.7	2.00	163.5	16920	6.254	6.26	0.764
RS-6	B2-B	10' RT	24+13	25.1-25.6	1.99	158.5	35800	13.318	13.31	1.86
RS-7	B2-B	10' RT	24+13	32.1-32.8	1.99	161.6	23900	8.796	8.77	0.604
RS-8	B2-B	10'RT	24+13	37.5-38.1	1.98	153.8	23700	8.676	8.68	1.057