

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	33768.1.1 (B-4556)	1	10

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 33768.1.1 (B-4556) F.A. PROJ. BRSTP-0050(7)  
COUNTY JOHNSTON  
SITE DESCRIPTION BRIDGE NO. 74 ON -L- (NC 50) OVER BLACK CREEK AT STATION 16+44

**INVENTORY**

**CONTENTS**

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5	CROSS SECTIONS
6, 7	BORE LOGS
8	SOIL TEST RESULTS
9	SCOUR REPORT
10	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) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

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

PERSONNEL  
N.D. MOHS

J.R. MATULA

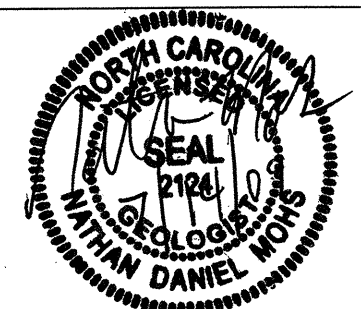
D.W. DIXON

INVESTIGATED BY N.D. MOHS

CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE JULY 2009



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: 33768.1.1 ID: B-4556**

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT

**SUBSURFACE INVESTIGATION**

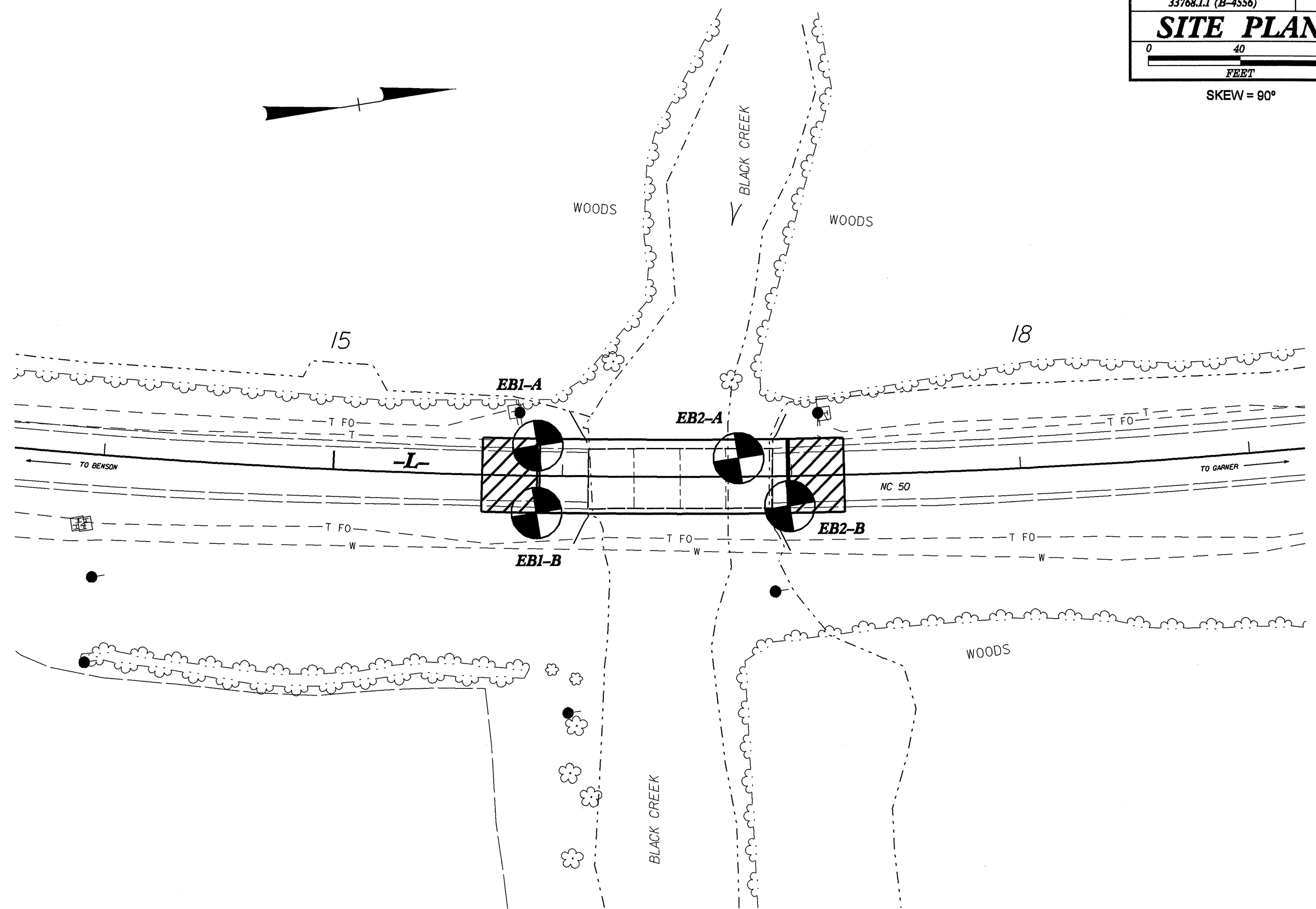
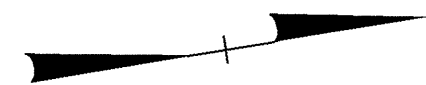
**SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

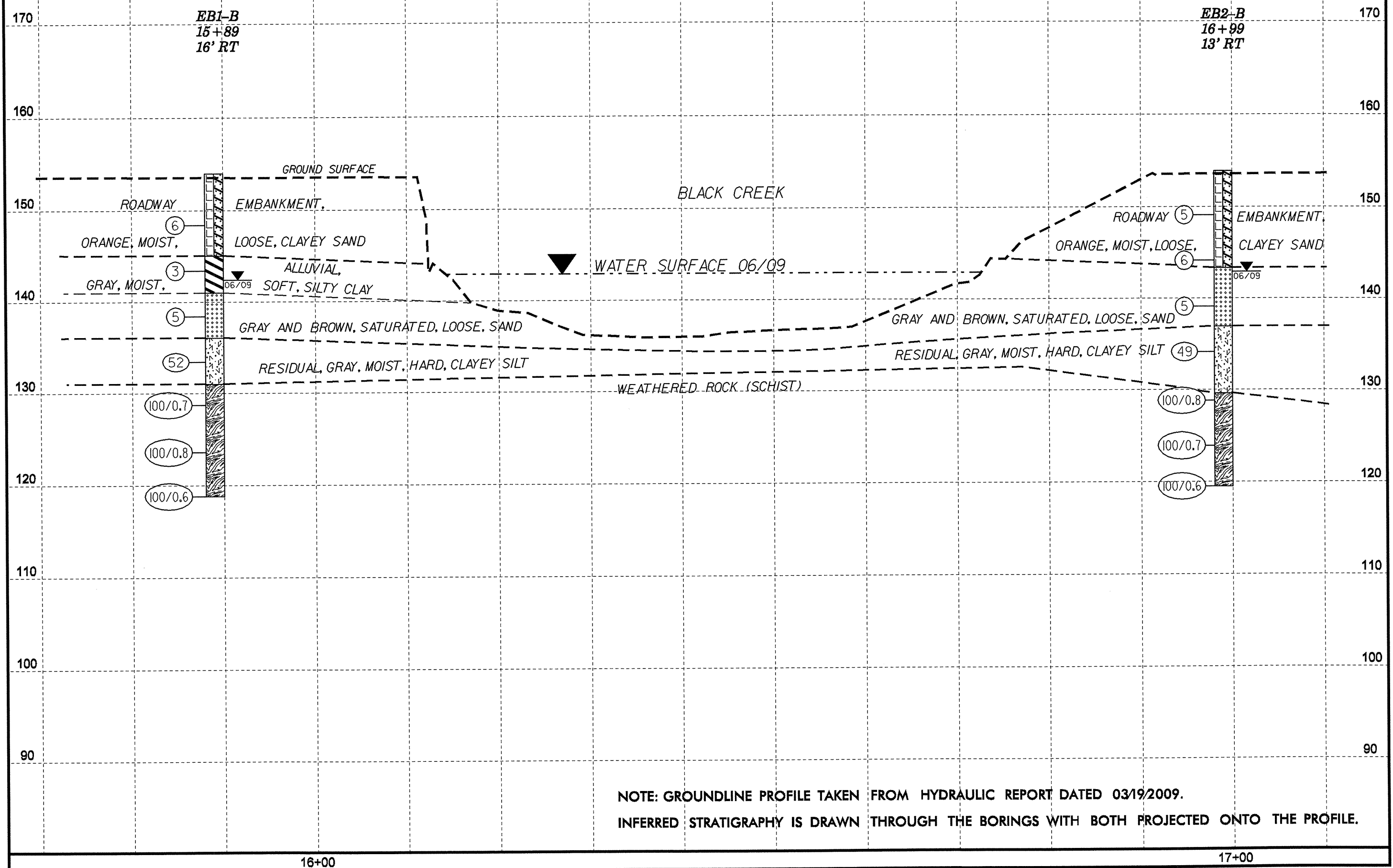
PROJECT REFERENCE NO. 33768.II(B-4556)  
SHEET NO. 2

SOIL DESCRIPTION	GRADATION	ROCK DESCRIPTION	TERMS AND DEFINITIONS																																																																																																																																																																																																																										
<p>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, ANGLE OF INTERNAL FRICTION, STRUCTURE, PLASTICITY, ETC. EXAMPLES: VERY STIFF, DARK SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGH PLASTIC, A-7-6</p> <p><b>SOIL LEGEND AND AASHTO CLASSIFICATION</b></p> <table border="1"><tr><th>GENERAL CLASS.</th><th colspan="7">GRANULAR MATERIALS (&lt;= 35% PASSING #200)</th><th colspan="7">SILT-CLAY MATERIALS (&gt; 35% PASSING #200)</th><th colspan="3">ORGANIC MATERIALS</th></tr><tr><th>GROUP CLASS.</th><td colspan="2">A-1</td><td colspan="2">A-3</td><td colspan="2">A-2</td><td colspan="2">A-4</td><td colspan="2">A-5</td><td colspan="2">A-6</td><td colspan="2">A-7</td><td colspan="2">A-1, A-2</td><td colspan="2">A-3</td><td colspan="2">A-4, A-5</td><td colspan="2">A-6, A-7</td><td></td></tr><tr><th>SYMBOL</th><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td></td></tr><tr><th>% PASSING</th><td colspan="2">10</td><td colspan="2">40</td><td colspan="2">200</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td></td></tr><tr><th>LIQUID LIMIT</th><td colspan="2">6 MX</td><td colspan="2">NP</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td></td></tr><tr><th>GROUP INDEX</th><td colspan="2">0</td><td colspan="2">0</td><td colspan="2">4 MX</td><td colspan="2">8 MX</td><td colspan="2">12 MX</td><td colspan="2">16 MX</td><td colspan="2">No MX</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td colspan="2">[Symbol]</td><td></td></tr></table> <p>USUAL TYPES OF MAJOR MATERIALS: STONE FRAGS., GRAVEL, SAND, FINE SAND, SILTY OR CLAYEY GRAVEL AND SAND, SILTY SOILS, CLAYEY SOILS</p> <p>FAIR TO POOR; POOR; UNSUITABLE</p> <p>PI OF A-7-5 SUBGROUP IS <math>\leq LL - 30</math>; PI OF A-7-6 SUBGROUP IS <math>&gt; LL - 30</math></p>	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			SYMBOL	[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]			% PASSING	10		40		200		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]			LIQUID LIMIT	6 MX		NP		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]			GROUP INDEX	0		0		4 MX		8 MX		12 MX		16 MX		No MX		[Symbol]		[Symbol]		[Symbol]		[Symbol]			<p><b>GRADATION</b></p> <p>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.</p> <p>THE ANGLE OF ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGLULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p> <p><b>MINERALOGICAL COMPOSITION</b></p> <p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.</p> <p><b>COMPRESSIBILITY</b></p> <p>SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31 MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50</p> <p><b>PERCENTAGE OF MATERIAL</b></p> <table border="1"><thead><tr><th>ORGANIC MATERIAL</th><th>GRANULAR SOILS</th><th>SILT - CLAY SOILS</th><th>OTHER MATERIAL</th></tr></thead><tbody><tr><td>TRACE OF ORGANIC MATTER</td><td>2 - 3%</td><td>3 - 5%</td><td>TRACE</td></tr><tr><td>LITTLE ORGANIC MATTER</td><td>3 - 5%</td><td>5 - 12%</td><td>LITTLE</td></tr><tr><td>MODERATELY ORGANIC</td><td>5 - 10%</td><td>12 - 20%</td><td>SOME</td></tr><tr><td>HIGHLY ORGANIC</td><td>&gt;10%</td><td>&gt;20%</td><td>HIGHLY</td></tr></tbody></table> <p><b>GROUND WATER</b></p> <p>WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING STATIC WATER LEVEL AFTER 24 HOURS PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA SPRING OR SEEP</p> <p><b>MISCELLANEOUS SYMBOLS</b></p> <table border="1"><tr><td>[Symbol] ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION</td><td>[Symbol] TEST BORING</td><td>[Symbol] SAMPLE DESIGNATIONS</td></tr><tr><td>[Symbol] SOIL SYMBOL</td><td>[Symbol] AUGER BORING</td><td>S - BULK SAMPLE</td></tr><tr><td>[Symbol] ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT</td><td>[Symbol] CORE BORING</td><td>SS - SPLIT SPOON SAMPLE</td></tr><tr><td>[Symbol] INFERRED SOIL BOUNDARY</td><td>[Symbol] MONITORING WELL</td><td>ST - SHELBY TUBE SAMPLE</td></tr><tr><td>[Symbol] INFERRED ROCK LINE</td><td>[Symbol] PIEZOMETER INSTALLATION</td><td>RS - ROCK SAMPLE</td></tr><tr><td>[Symbol] ALLUVIAL SOIL BOUNDARY</td><td>[Symbol] SLOPE INDICATOR INSTALLATION</td><td>RT - RECOMPACTED TRIAXIAL SAMPLE</td></tr><tr><td>[Symbol] DIP &amp; DIP DIRECTION OF ROCK STRUCTURES</td><td>[Symbol] SPT N-VALUE</td><td>CBR - CALIFORNIA BEARING RATIO SAMPLE</td></tr><tr><td>[Symbol] SOUNDING ROD</td><td>[Symbol] SPT REFUSAL</td><td></td></tr></table> <p><b>ABBREVIATIONS</b></p> <table border="1"><tr><td>AR - AUGER REFUSAL</td><td>HI. - HIGHLY</td><td>W - MOISTURE CONTENT</td></tr><tr><td>BT - BORING TERMINATED</td><td>MED. - MEDIUM</td><td>V - VERY</td></tr><tr><td>CL - CLAY</td><td>MICA - MICACEOUS</td><td>VST - VANE SHEAR TEST</td></tr><tr><td>CPT - CONE PENETRATION TEST</td><td>MOD. - MODERATELY</td><td>WEA. - WEATHERED</td></tr><tr><td>CSE. - COARSE</td><td>NP - NON PLASTIC</td><td>UNIT WEIGHT</td></tr><tr><td>DMT - DILATOMETER TEST</td><td>ORG. - ORGANIC</td><td>Wt - DRY UNIT WEIGHT</td></tr><tr><td>DPT - DYNAMIC PENETRATION TEST</td><td>SD. - SAND, SANDY</td><td></td></tr><tr><td>e - VOID RATIO</td><td>SAP. - SAPROLITIC</td><td></td></tr><tr><td>F - FINE</td><td>SL. - SILT, SILTY</td><td></td></tr><tr><td>FOSS. - FOSSILIFEROUS</td><td>SLI. - SLIGHTLY</td><td></td></tr><tr><td>FRAC. - FRACTURED, FRACTURES</td><td>TCR - TRICONE REFUSAL</td><td></td></tr><tr><td>FRAGS. - FRAGMENTS</td><td></td><td></td></tr></table>	ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	HIGHLY ORGANIC	>10%	>20%	HIGHLY	[Symbol] ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION	[Symbol] TEST BORING	[Symbol] SAMPLE DESIGNATIONS	[Symbol] SOIL SYMBOL	[Symbol] AUGER BORING	S - BULK SAMPLE	[Symbol] ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT	[Symbol] CORE BORING	SS - SPLIT SPOON SAMPLE	[Symbol] INFERRED SOIL BOUNDARY	[Symbol] MONITORING WELL	ST - SHELBY TUBE SAMPLE	[Symbol] INFERRED ROCK LINE	[Symbol] PIEZOMETER INSTALLATION	RS - ROCK SAMPLE	[Symbol] ALLUVIAL SOIL BOUNDARY	[Symbol] SLOPE INDICATOR INSTALLATION	RT - RECOMPACTED TRIAXIAL SAMPLE	[Symbol] DIP & DIP DIRECTION OF ROCK STRUCTURES	[Symbol] SPT N-VALUE	CBR - CALIFORNIA BEARING RATIO SAMPLE	[Symbol] SOUNDING ROD	[Symbol] SPT REFUSAL		AR - AUGER REFUSAL	HI. - HIGHLY	W - MOISTURE CONTENT	BT - BORING TERMINATED	MED. - MEDIUM	V - VERY	CL - CLAY	MICA - MICACEOUS	VST - VANE SHEAR TEST	CPT - CONE PENETRATION TEST	MOD. - MODERATELY	WEA. - WEATHERED	CSE. - COARSE	NP - NON PLASTIC	UNIT WEIGHT	DMT - DILATOMETER TEST	ORG. - ORGANIC	Wt - DRY UNIT WEIGHT	DPT - DYNAMIC PENETRATION TEST	SD. - SAND, SANDY		e - VOID RATIO	SAP. - SAPROLITIC		F - FINE	SL. - SILT, SILTY		FOSS. - FOSSILIFEROUS	SLI. - SLIGHTLY		FRAC. - FRACTURED, FRACTURES	TCR - TRICONE REFUSAL		FRAGS. - FRAGMENTS			<p>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:</p> <p><b>WEATHERED ROCK (WR)</b> [Symbol]</p> <p><b>CRYSTALLINE ROCK (CR)</b> [Symbol]</p> <p><b>NON-CRYSTALLINE ROCK (NCR)</b> [Symbol]</p> <p><b>COASTAL PLAIN SEDIMENTARY ROCK (CP)</b> [Symbol]</p> <p><b>WEATHERING</b></p> <p>FRESH: ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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. <i>IF TESTED, WOULD YIELD SPT REFUSAL.</i></p> <p>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. <i>IF TESTED, YIELDS SPT N VALUES &gt; 100 BPF.</i></p> <p>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. <i>IF TESTED, YIELDS SPT N VALUES &lt; 100 BPF.</i></p> <p>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.</p> <p><b>ROCK HARDNESS</b></p> <p>VERY HARD: CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.</p> <p>HARD: CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.</p> <p>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.</p> <p>MEDIUM HARD: CAN BE GROUVED 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.</p> <p>SOFT: CAN BE GROUVED 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.</p> <p>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 FINGER NAIL.</p>	<p><b>ALLUVIUM (ALLUV.)</b> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.</p> <p><b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA.</p> <p><b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.</p> <p><b>ARGILLACEOUS</b> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.</p> <p><b>ARTESIAN</b> - 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.</p> <p><b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.</p> <p><b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.</p> <p><b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.</p> <p><b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.</p> <p><b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.</p> <p><b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.</p> <p><b>FAULT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.</p> <p><b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.</p> <p><b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOADED FROM PARENT MATERIAL.</p> <p><b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.</p> <p><b>FORMATION (FM)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.</p> <p><b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.</p> <p><b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.</p> <p><b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.</p> <p><b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.</p> <p><b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.</p> <p><b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.</p> <p><b>ROCK QUALITY DESIGNATION (ROQ)</b> - 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.</p> <p><b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.</p> <p><b>SILL</b> - 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.</p> <p><b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.</p> <p><b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - 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.</p> <p><b>STRATA CORE RECOVERY (SREC)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.</p> <p><b>STRATA ROCK QUALITY DESIGNATION (SROQ)</b> - 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.</p> <p><b>TOPSOIL (TS)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p> <p><b>BENCH MARK:</b> BL-103, BL STATION 16+66.1</p> <p align="right"><b>ELEVATION:</b> 153.59 FT.</p> <p><b>NOTES:</b></p>
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																																																																																																																																																																																																								
SYMBOL	[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]																																																																																																																																																																																																								
% PASSING	10		40		200		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]																																																																																																																																																																																																								
LIQUID LIMIT	6 MX		NP		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]		[Symbol]																																																																																																																																																																																																								
GROUP INDEX	0		0		4 MX		8 MX		12 MX		16 MX		No MX		[Symbol]		[Symbol]		[Symbol]		[Symbol]																																																																																																																																																																																																								
ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL																																																																																																																																																																																																																										
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE																																																																																																																																																																																																																										
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE																																																																																																																																																																																																																										
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME																																																																																																																																																																																																																										
HIGHLY ORGANIC	>10%	>20%	HIGHLY																																																																																																																																																																																																																										
[Symbol] ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION	[Symbol] TEST BORING	[Symbol] SAMPLE DESIGNATIONS																																																																																																																																																																																																																											
[Symbol] SOIL SYMBOL	[Symbol] AUGER BORING	S - BULK SAMPLE																																																																																																																																																																																																																											
[Symbol] ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT	[Symbol] CORE BORING	SS - SPLIT SPOON SAMPLE																																																																																																																																																																																																																											
[Symbol] INFERRED SOIL BOUNDARY	[Symbol] MONITORING WELL	ST - SHELBY TUBE SAMPLE																																																																																																																																																																																																																											
[Symbol] INFERRED ROCK LINE	[Symbol] PIEZOMETER INSTALLATION	RS - ROCK SAMPLE																																																																																																																																																																																																																											
[Symbol] ALLUVIAL SOIL BOUNDARY	[Symbol] SLOPE INDICATOR INSTALLATION	RT - RECOMPACTED TRIAXIAL SAMPLE																																																																																																																																																																																																																											
[Symbol] DIP & DIP DIRECTION OF ROCK STRUCTURES	[Symbol] SPT N-VALUE	CBR - CALIFORNIA BEARING RATIO SAMPLE																																																																																																																																																																																																																											
[Symbol] SOUNDING ROD	[Symbol] SPT REFUSAL																																																																																																																																																																																																																												
AR - AUGER REFUSAL	HI. - HIGHLY	W - MOISTURE CONTENT																																																																																																																																																																																																																											
BT - BORING TERMINATED	MED. - MEDIUM	V - VERY																																																																																																																																																																																																																											
CL - CLAY	MICA - MICACEOUS	VST - VANE SHEAR TEST																																																																																																																																																																																																																											
CPT - CONE PENETRATION TEST	MOD. - MODERATELY	WEA. - WEATHERED																																																																																																																																																																																																																											
CSE. - COARSE	NP - NON PLASTIC	UNIT WEIGHT																																																																																																																																																																																																																											
DMT - DILATOMETER TEST	ORG. - ORGANIC	Wt - DRY UNIT WEIGHT																																																																																																																																																																																																																											
DPT - DYNAMIC PENETRATION TEST	SD. - SAND, SANDY																																																																																																																																																																																																																												
e - VOID RATIO	SAP. - SAPROLITIC																																																																																																																																																																																																																												
F - FINE	SL. - SILT, SILTY																																																																																																																																																																																																																												
FOSS. - FOSSILIFEROUS	SLI. - SLIGHTLY																																																																																																																																																																																																																												
FRAC. - FRACTURED, FRACTURES	TCR - TRICONE REFUSAL																																																																																																																																																																																																																												
FRAGS. - FRAGMENTS																																																																																																																																																																																																																													

PROJECT REFERENCE NO.	SHEET
33768.1.1 (B-4556)	3
<b>SITE PLAN</b>	
FEET	

SKEW = 90°

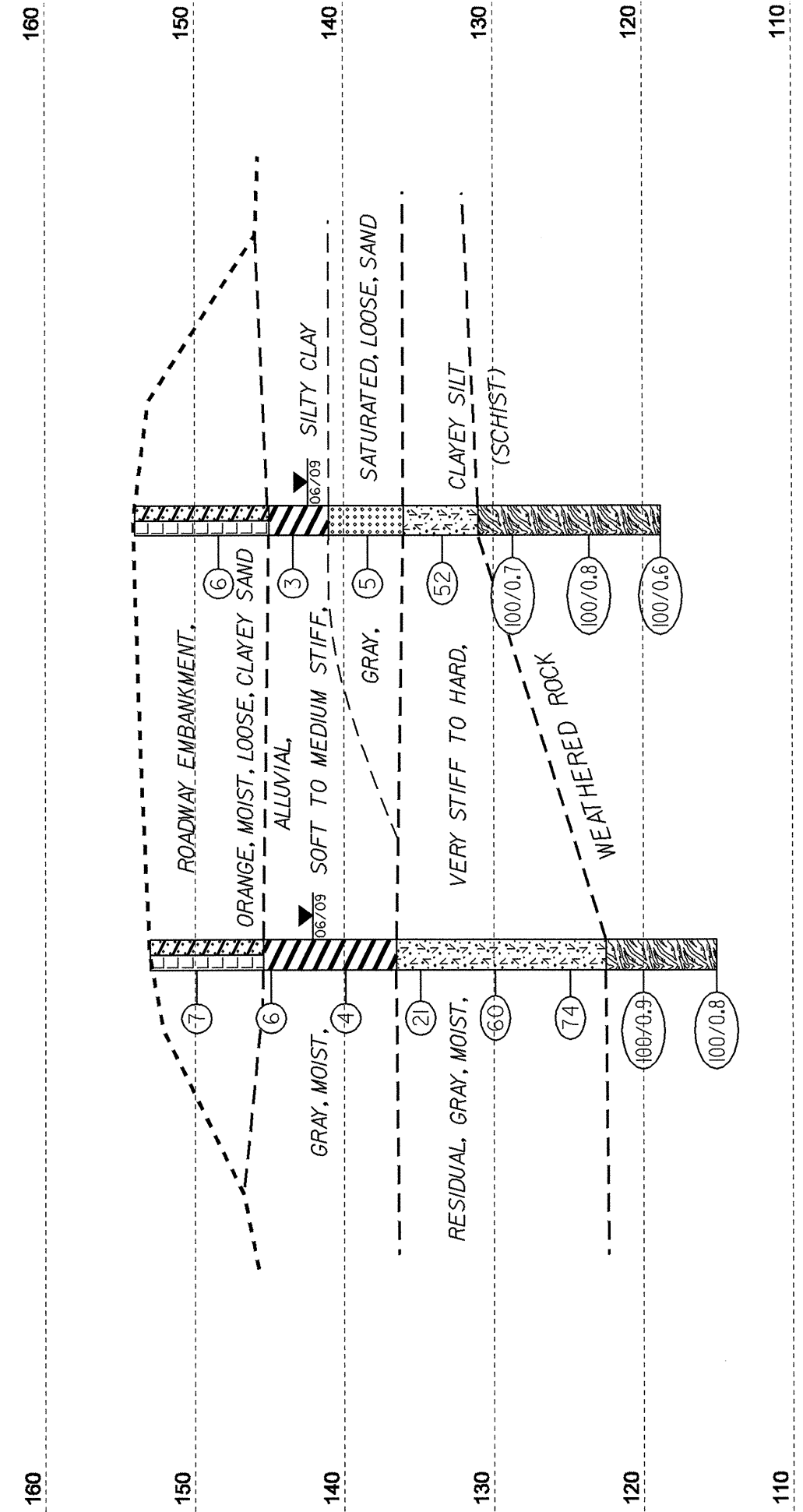
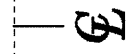




NOTE: GROUNDLINE PROFILE TAKEN FROM HYDRAULIC REPORT DATED 03/19/2009.  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.

EB1-A  
15+89  
13' LT

EB1-B  
15+89  
16' RT



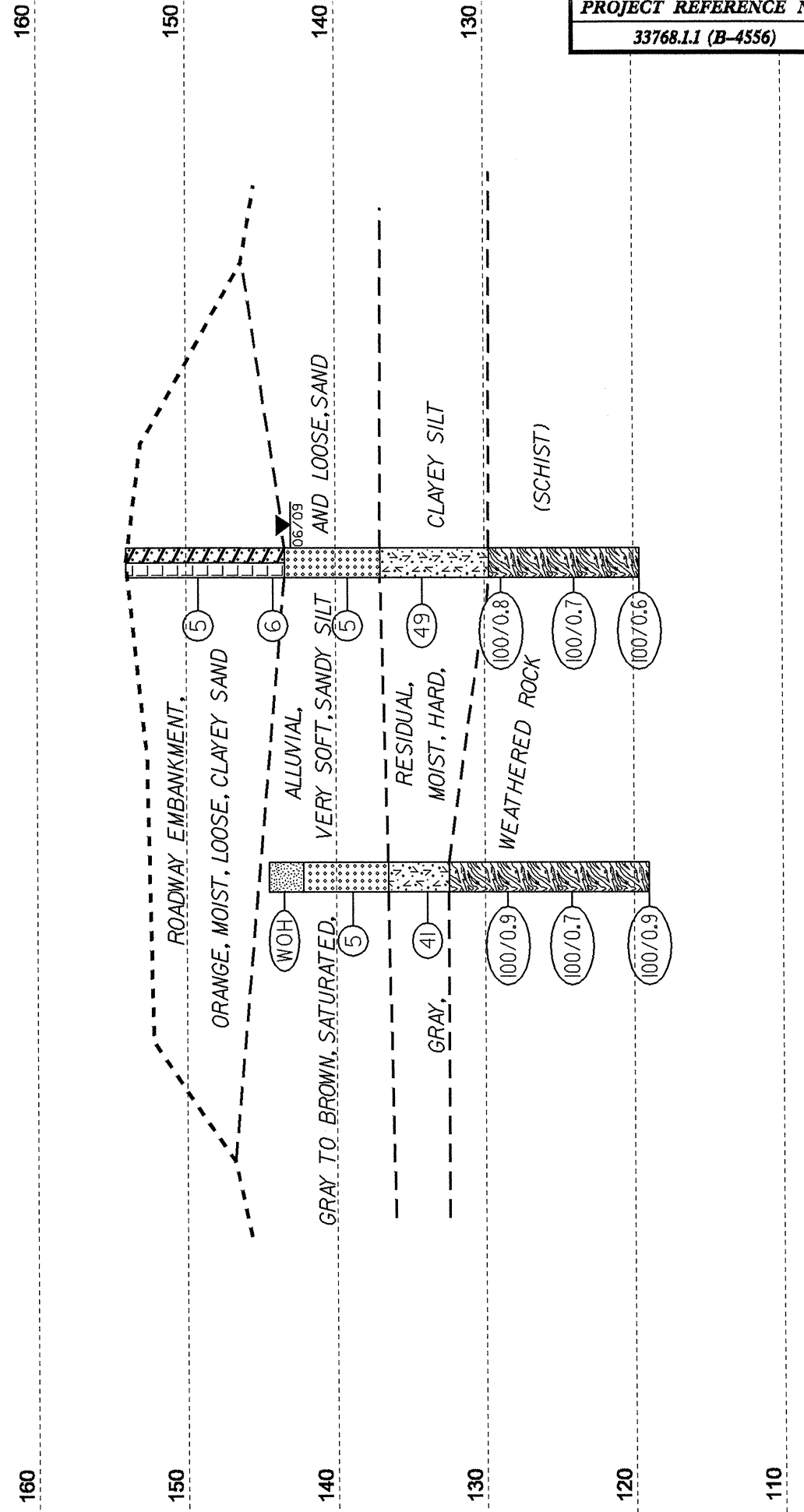
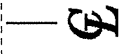
HORIZ. SCALE 0 10 20 (FEET)

VE = 1:1

CROSS SECTION THROUGH END BENT 1

EB2-A  
16+77  
8' LT

EB2-B  
16+99  
13' RT



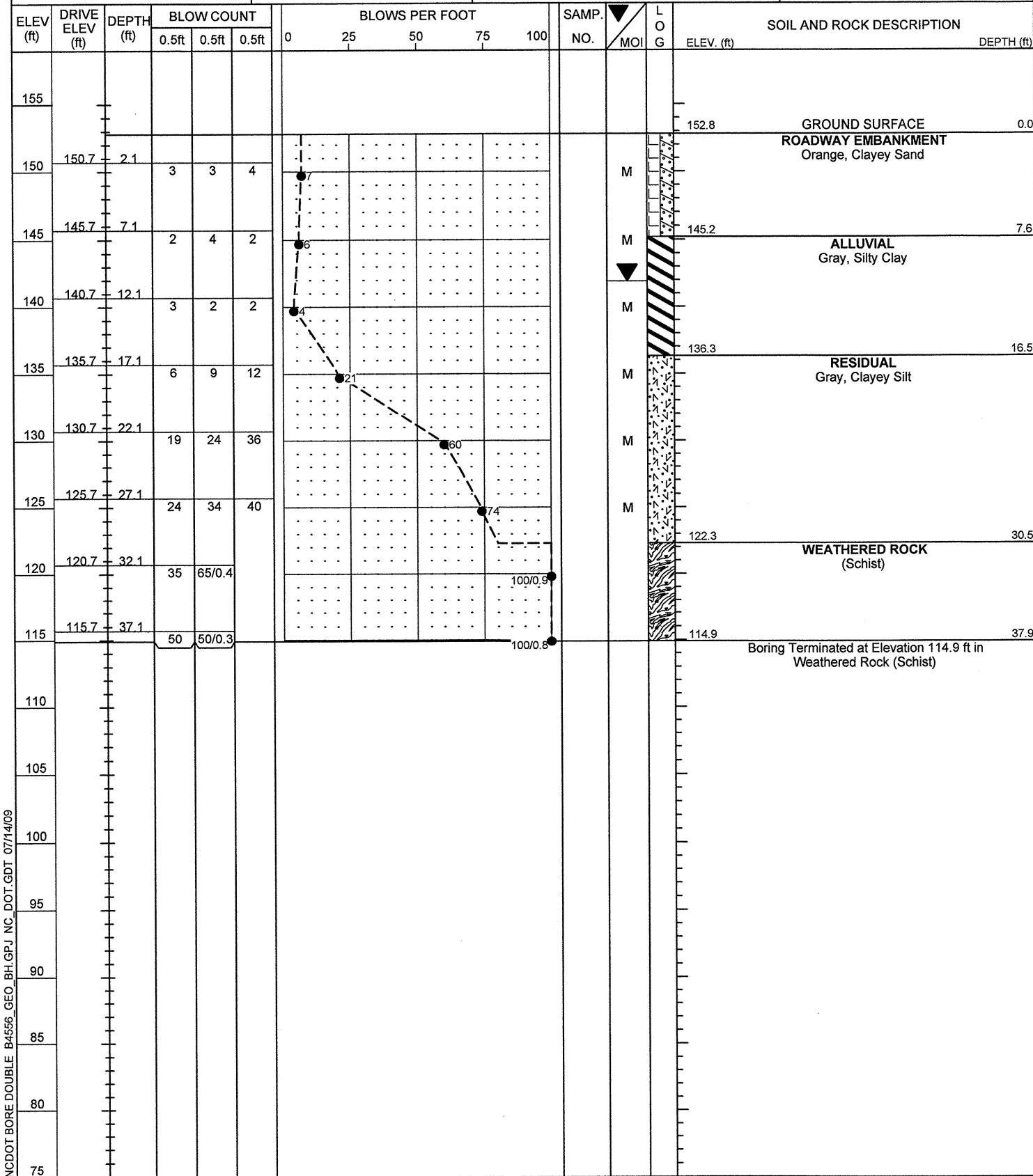
HORIZ. SCALE 0 10 20 (FEET)

VE = 1:1

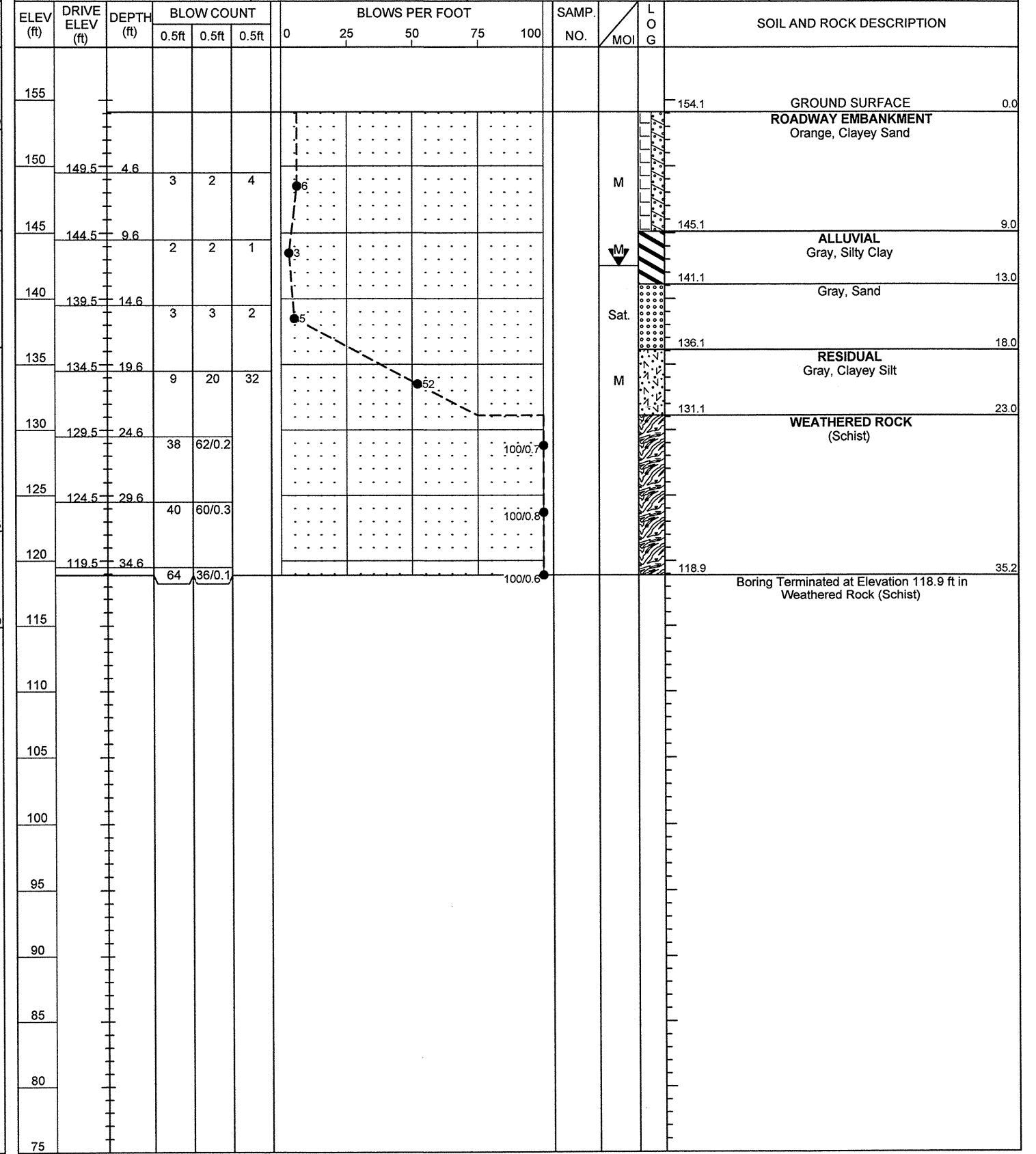
CROSS SECTION THROUGH END BENT 2



PROJECT NO. 33768.1.1	ID. B-4556	COUNTY Johnston	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION Bridge No. 74 on -L- (NC 50) over Black Creek at Station 16+44			GROUND WTR (ft)
BORING NO. EB1-A	STATION 15+89	OFFSET 13ft LT	ALIGNMENT -L-
COLLAR ELEV. 152.8 ft	TOTAL DEPTH 37.9 ft	NORTHING 623,419	EASTING 2,133,480
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
START DATE 06/25/09	COMP. DATE 06/25/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A



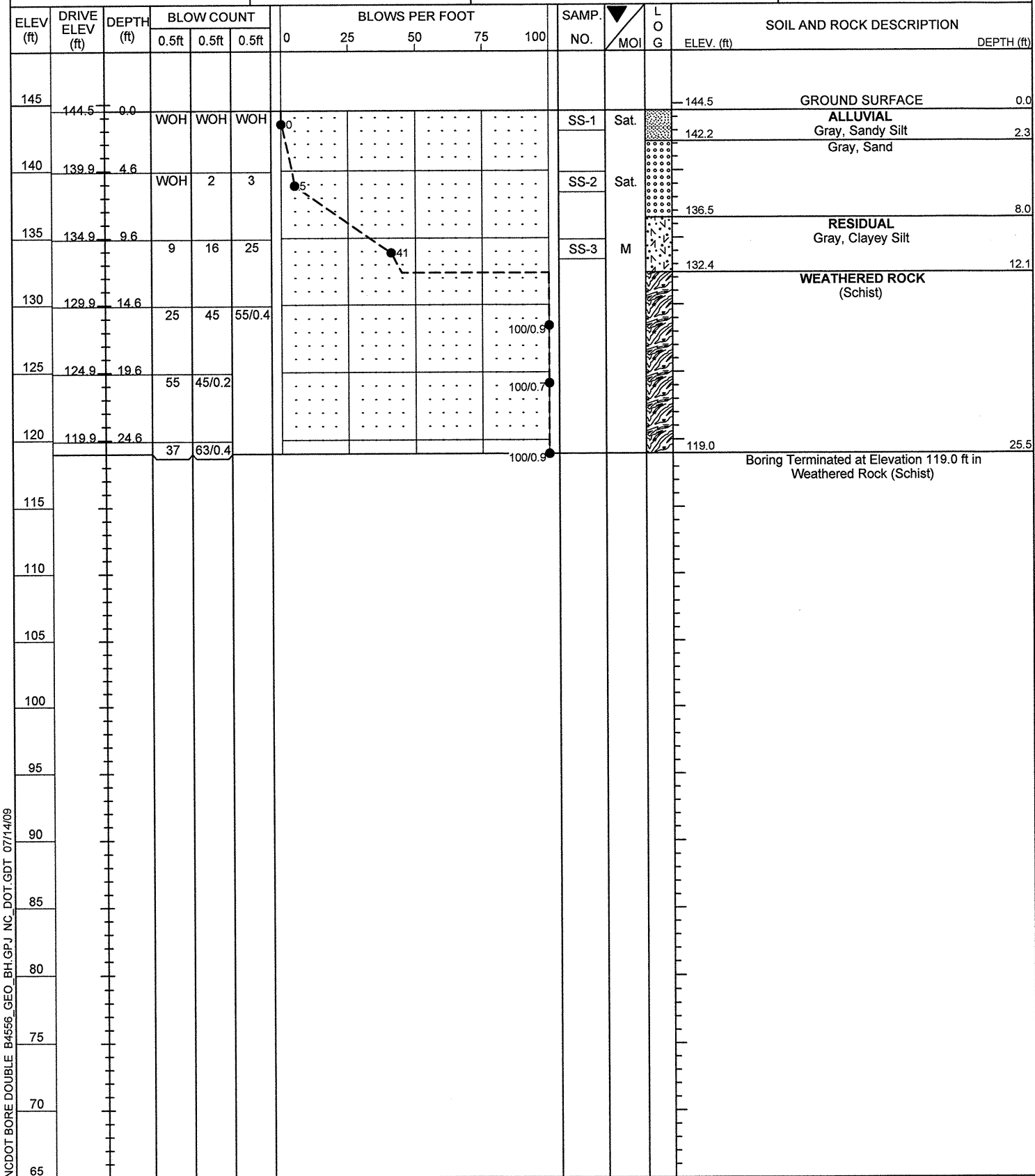
PROJECT NO. 33768.1.1	ID. B-4556	COUNTY Johnston	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION Bridge No. 74 on -L- (NC 50) over Black Creek at Station 16+44			GROUND WTR (ft)
BORING NO. EB1-B	STATION 15+89	OFFSET 16ft RT	ALIGNMENT -L-
COLLAR ELEV. 154.1 ft	TOTAL DEPTH 35.2 ft	NORTHING 623,414	EASTING 2,133,509
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
START DATE 06/24/09	COMP. DATE 06/24/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A



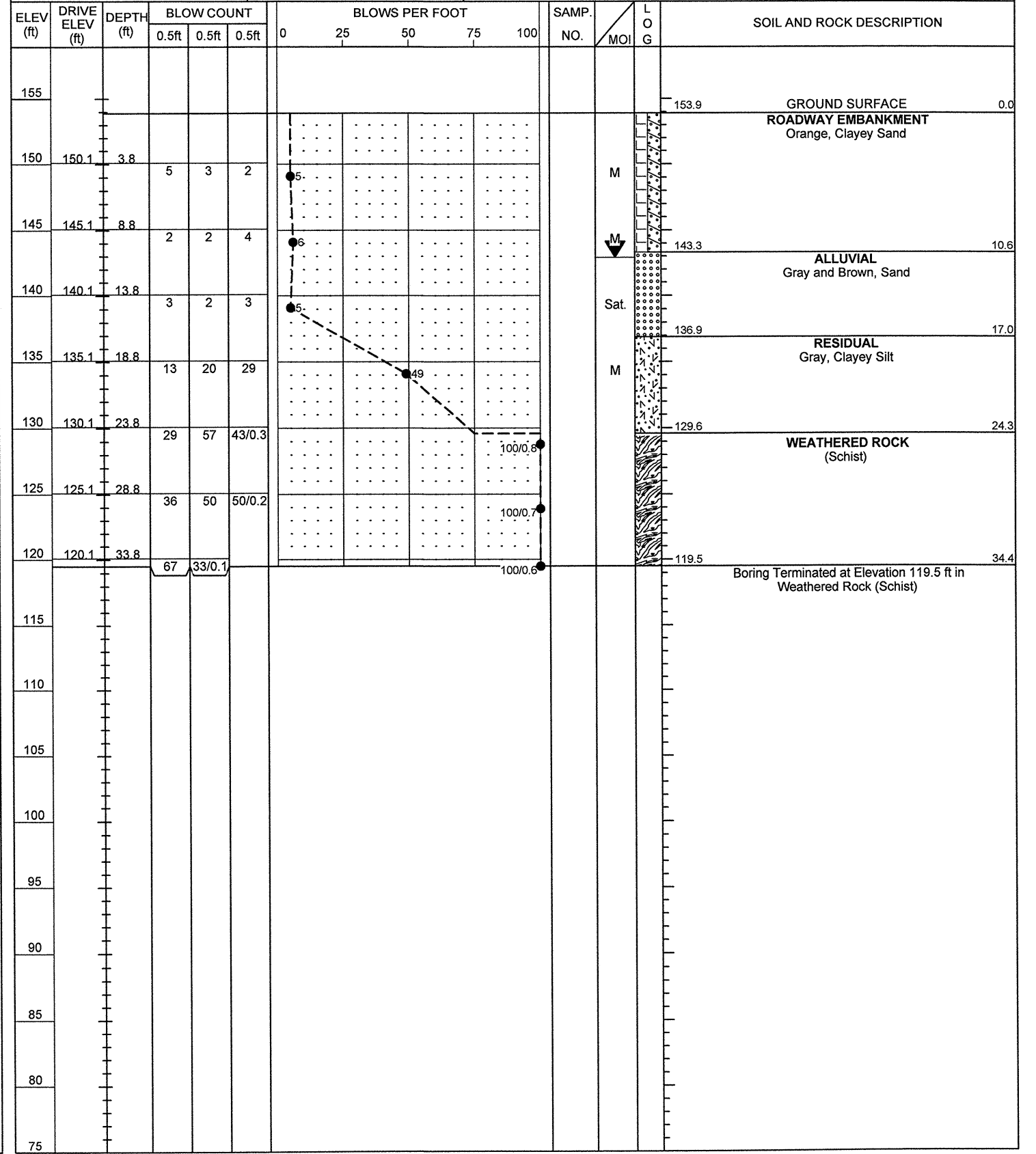
NCDOT BORE DOUBLE B4556\_GEO\_BH.GPJ NC\_DOT.GDT 07/14/09

**NCDOT GEOTECHNICAL ENGINEERING UNIT**  
**BORELOG REPORT**

PROJECT NO. 33768.1.1	ID. B-4556	COUNTY Johnston	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION Bridge No. 74 on -L- (NC 50) over Black Creek at Station 16+44			GROUND WTR (ft)
BORING NO. EB2-A	STATION 16+77	OFFSET 8ft LT	ALIGNMENT -L-
COLLAR ELEV. 144.5 ft	TOTAL DEPTH 25.5 ft	NORTHING 623,505	EASTING 2,133,499
DRILL MACHINE CME-550X	DRILL METHOD Wash Boring	HAMMER TYPE Automatic	
START DATE 07/13/05	COMP. DATE 07/13/05	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A



PROJECT NO. 33768.1.1	ID. B-4556	COUNTY Johnston	GEOLOGIST Mohs, N. D.
SITE DESCRIPTION Bridge No. 74 on -L- (NC 50) over Black Creek at Station 16+44			GROUND WTR (ft)
BORING NO. EB2-B	STATION 16+99	OFFSET 13ft RT	ALIGNMENT -L-
COLLAR ELEV. 153.9 ft	TOTAL DEPTH 34.4 ft	NORTHING 623,523	EASTING 2,133,523
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
START DATE 06/26/09	COMP. DATE 06/26/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A



NCDOT BORE DOUBLE B4556\_GEO\_BH.GPJ NC\_DOT\_GDT\_07/14/09

**EB2-A**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-1	8' LT	16+77	0.0-1.5	A-4(4)	26	8	2.6	34.7	38.4	24.3	100	99	73	-	-
SS-2	8' LT	16+77	4.6-6.1	A-3(0)	21	NP	49.5	44.5	2.9	3.0	95	65	9	-	-
SS-3	8' LT	16+77	9.6-11.1	A-5(14)	48	9	2.8	3.6	79.3	14.2	100	99	95	-	-





# FIELD SCOUR REPORT

WBS: 33768.1.1 TIP: B-4556 COUNTY: Johnston

DESCRIPTION(1): Bridge No. 74 on -L- (NC 50) over Black Creek at Station 16+44

### EXISTING BRIDGE

Information from: Field Inspection  Microfilm \_\_\_\_\_ (reel \_\_\_\_\_ pos: \_\_\_\_\_)  
 Other (explain) \_\_\_\_\_

Bridge No.: 74 Length: 80.4' Total Bents: 5 Bents in Channel: 3 Bents in Floodplain: 2

Foundation Type: Concrete caps on timber piles with steel crutch bents.

### EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: None

Interior Bents: None

Channel Bed: None

Channel Bank: None

### EXISTING SCOUR PROTECTION

Type(3): Wooden wing walls at end bents.

Extent(4): 5' to 6' up and down stream.

Effectiveness(5): Effective

Obstructions(6): None

### INSTRUCTIONS

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

### DESIGN INFORMATION

Channel Bed Material(7): Soft Sandy Silt (A-4), and loose Sand (A-3).

Channel Bank Material(8): Soft Sandy Silt (A-4), and loose Sand (A-3).

Channel Bank Cover(9): Grass

Floodplain Width(10): Approximately 150'

Floodplain Cover(11): Grass and tress

Stream is(12): Aggrading \_\_\_\_\_ Degrading \_\_\_\_\_ Static

Channel Migration Tendency(13): None

Observations and Other Comments: \_\_\_\_\_

### DESIGN SCOUR ELEVATIONS(14)

Feet  Meters \_\_\_\_\_

130.5																			

Comparison of DSE to Hydraulics Unit theoretical scour:  
 The Design Scour Elevation across the site is 130.5', compared to the Hydraulic Units Theoretical Scour Elevation of 122.5' for the 100 year event.

### SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

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

Reported by: Aditya Mohs N.D. Mohs Date: 6/25/2009

Site Photograph

Bridge No. 74 on -L- (NC 50) Over Black Creek at Station 16+44



Looking West

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 33771.1.1(B-4560) F.A. PROJ. BRZ-1331(10)  
COUNTY JOHNSTON  
PROJECT DESCRIPTION BRIDGE NO. 102 ON -L- SR 1331  
(FEDERAL ROAD) OVER BLACK CREEK

**INVENTORY**

**CONTENTS**

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE(S)
5-6	CROSS SECTION(S)
7-10	BORE LOG(S)
11	SOIL TEST RESULTS
12	SCOUR REPORT
13	SITE PHOTOGRAPH(S)

**CAUTION NOTICE**

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN PLACE BY CONTACTING THE N.C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT 1919 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

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

**PROJECT: 33771.1.1 ID: B-4560**

PERSONNEL

O.B. OTI

T.T. WALKER

CONSULTANT PERSONNEL

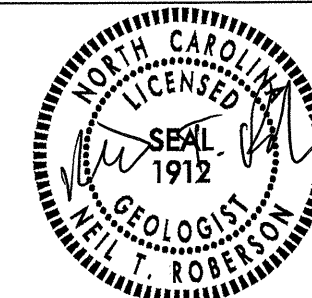
FOR

INVESTIGATED BY O.B. OTI

CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE AUGUST 2009



8/26/09

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 IS IT CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

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

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

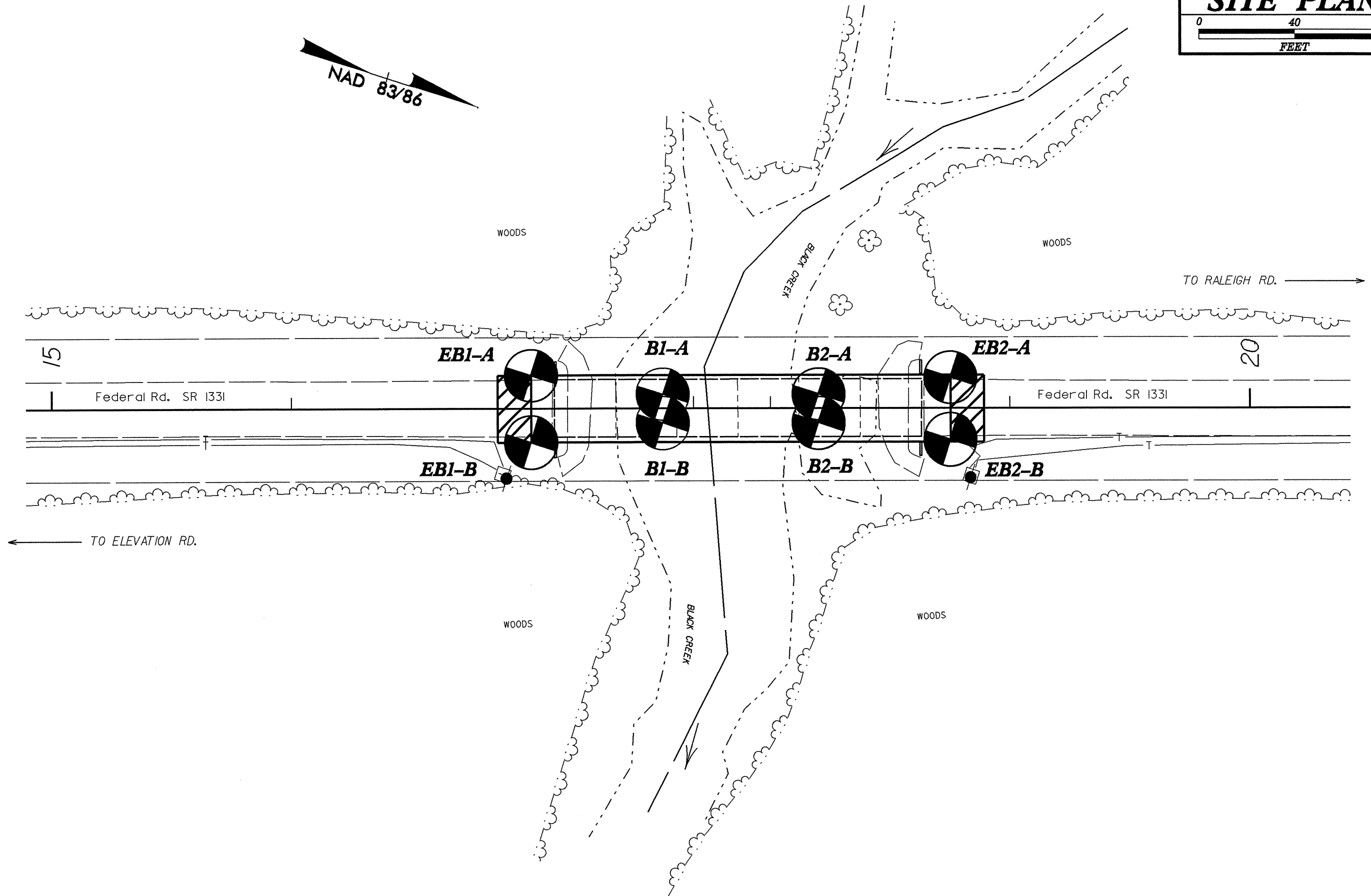
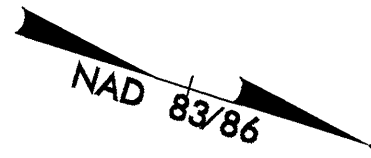
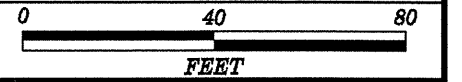
**SUBSURFACE INVESTIGATION**

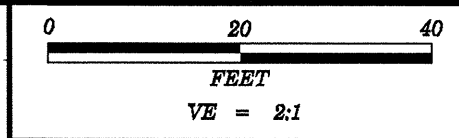
**SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

SOIL DESCRIPTION		GRADATION		ROCK DESCRIPTION		TERMS AND DEFINITIONS	
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 T208, 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: <i>VERY STIFF, GRAY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HEAVY PLASTIC, A-7-6</i>		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.		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:		ALLOUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. ADUJFER - 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 (ROQ) - 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.	
<b>SOIL LEGEND AND AASHTO CLASSIFICATION</b>		<b>MINERALOGICAL COMPOSITION</b>		<b>WEATHERING</b>		<b>ROCK HARDNESS</b>	
GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS		MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.		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 YIELD 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.		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 FINGER NAIL.	
<b>COMPRESSIBILITY</b>		<b>PERCENTAGE OF MATERIAL</b>		<b>GROUND WATER</b>		<b>ROCK QUALITY DESIGNATION (ROQ)</b>	
SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31 MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50		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		WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING STATIC WATER LEVEL AFTER 24 HOURS PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA SPRING OR SEEP		VERY SEVERE 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 ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. IF TESTED, YIELDS SPT N VALUES > 100 BPF VERY SEVERE 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.	
<b>ANGULARITY OF GRAINS</b>		<b>GROUND WATER</b>		<b>MISCELLANEOUS SYMBOLS</b>		<b>ROCK HARDNESS</b>	
THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.		WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING STATIC WATER LEVEL AFTER 24 HOURS PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA SPRING OR SEEP		ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY DIP & DIP DIRECTION OF ROCK STRUCTURES SOUNDING ROD		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 FINGER NAIL.	
<b>CONSISTENCY OR DENSENESS</b>		<b>ABBREVIATIONS</b>		<b>EQUIPMENT USED ON SUBJECT PROJECT</b>		<b>INDURATION</b>	
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> )		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 - SAPROLITE 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 <sub>d</sub> - DRY UNIT WEIGHT		DRILL UNITS: MOBILE B- BK-51 CME-45C CME-550 PORTABLE HOIST 6" HOLLOW AUGERS 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		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.	
<b>TEXTURE OR GRAIN SIZE</b>		<b>SOIL MOISTURE - CORRELATION OF TERMS</b>		<b>FRACTURE SPACING</b>		<b>BEDDING</b>	
U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053		SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION LL LIQUID LIMIT - SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE PL PLASTIC LIMIT - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE OM OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE SL SHRINKAGE LIMIT - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE		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		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	
<b>PLASTICITY</b>		<b>SOIL MOISTURE - CORRELATION OF TERMS</b>		<b>FRACTURE SPACING</b>		<b>BEDDING</b>	
NONPLASTIC PLASTICITY INDEX (PI) DRY STRENGTH 0-5 VERY LOW 6-15 SLIGHT 16-25 MEDIUM 26 OR MORE HIGH		SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION LL LIQUID LIMIT - SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE PL PLASTIC LIMIT - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE OM OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE SL SHRINKAGE LIMIT - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE		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		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	
<b>COLOR</b>		<b>SOIL MOISTURE - CORRELATION OF TERMS</b>		<b>FRACTURE SPACING</b>		<b>BEDDING</b>	
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.		SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION LL LIQUID LIMIT - SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE PL PLASTIC LIMIT - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE OM OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE SL SHRINKAGE LIMIT - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE		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		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	

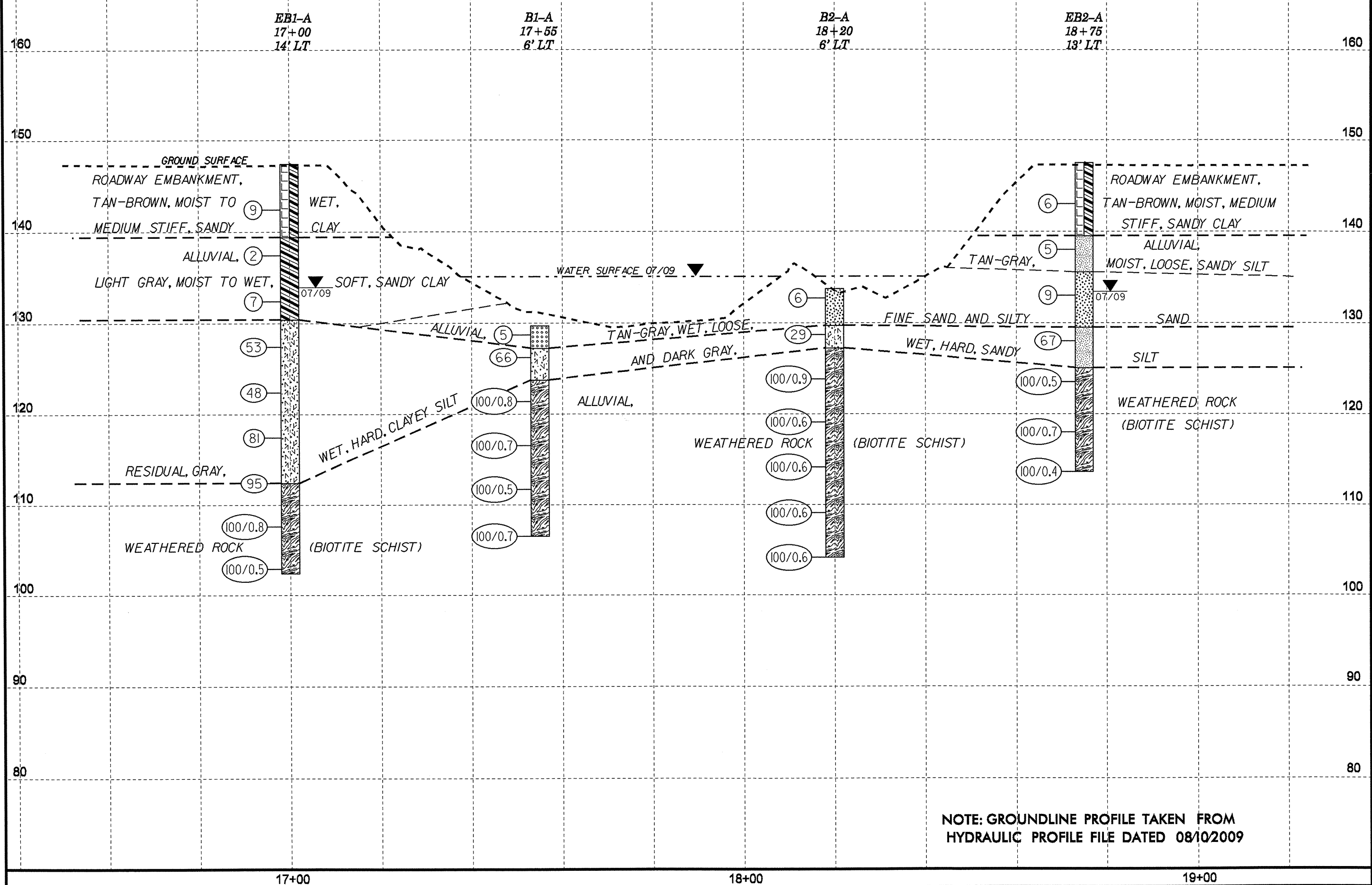


# SITE PLAN





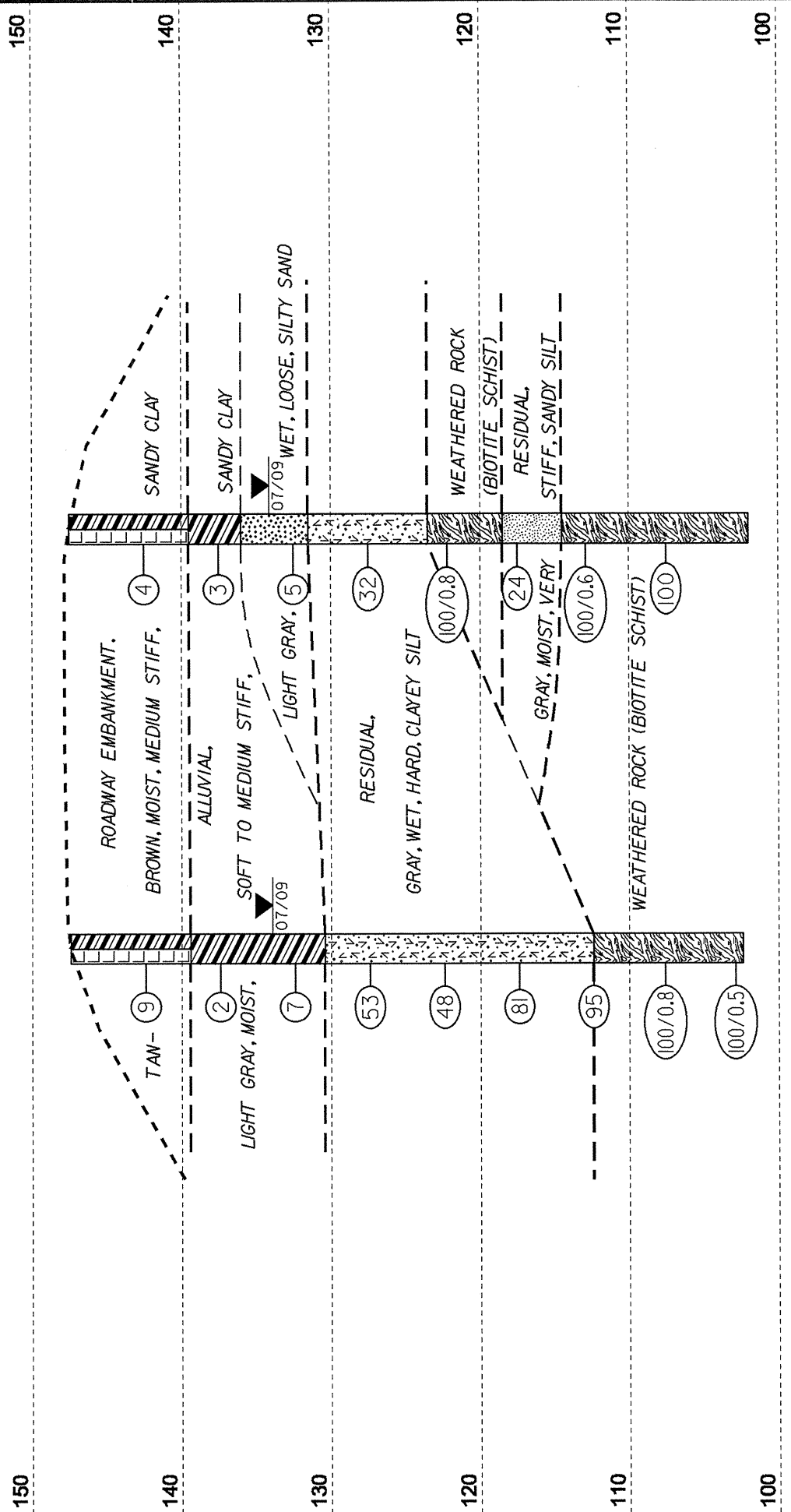
PROJECT REFERENCE NO.	SHEET
33771.LI(B-4560)	4
PROFILE BORINGS PROJECTED ALONG -L-	



NOTE: GROUNDLINE PROFILE TAKEN FROM HYDRAULIC PROFILE FILE DATED 08/10/2009

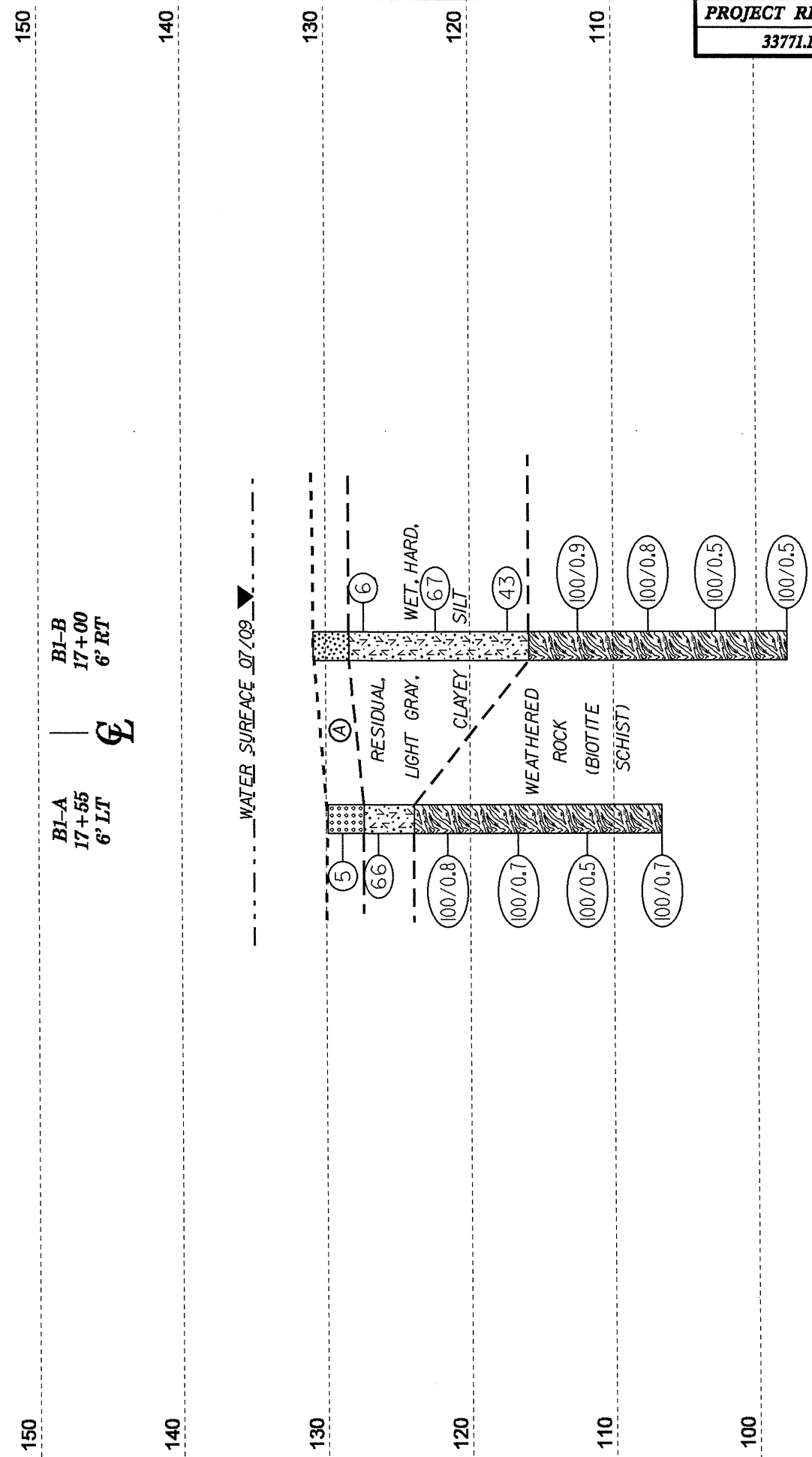
EBI-B  
17+00  
14' RT

EBI-A  
17+00  
14' LT

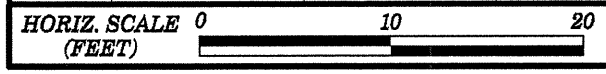


BI-B  
17+00  
6' RT

BI-A  
17+55  
6' LT

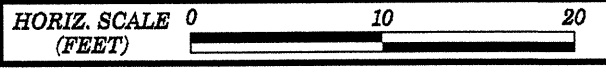


(A) ALLUVIAL TAN-GRAY, WET, LOOSE, SILTY AND FINE SAND



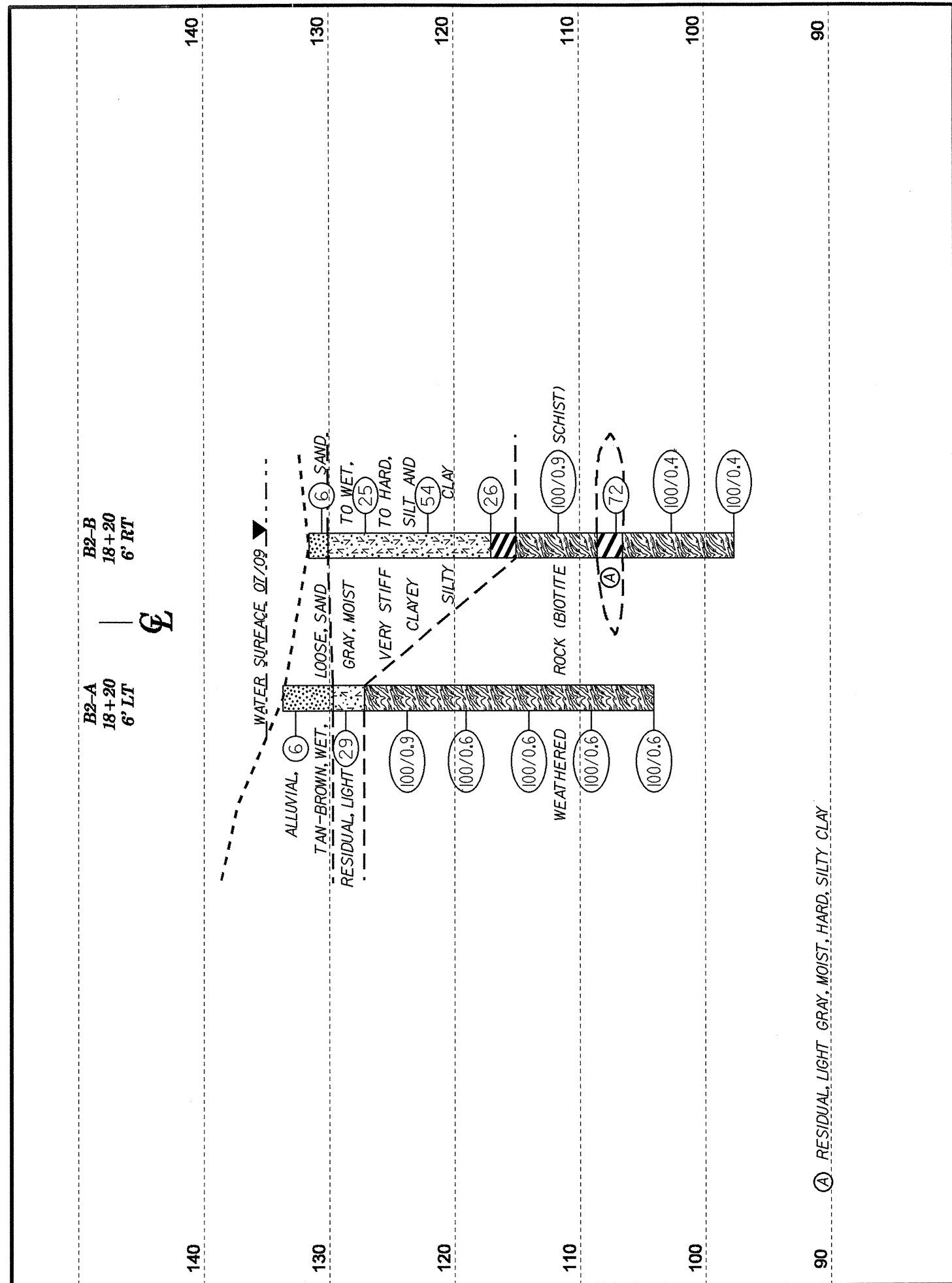
VE = 1:1

CROSS SECTION THROUGH END BENT 1



VE = 1:1

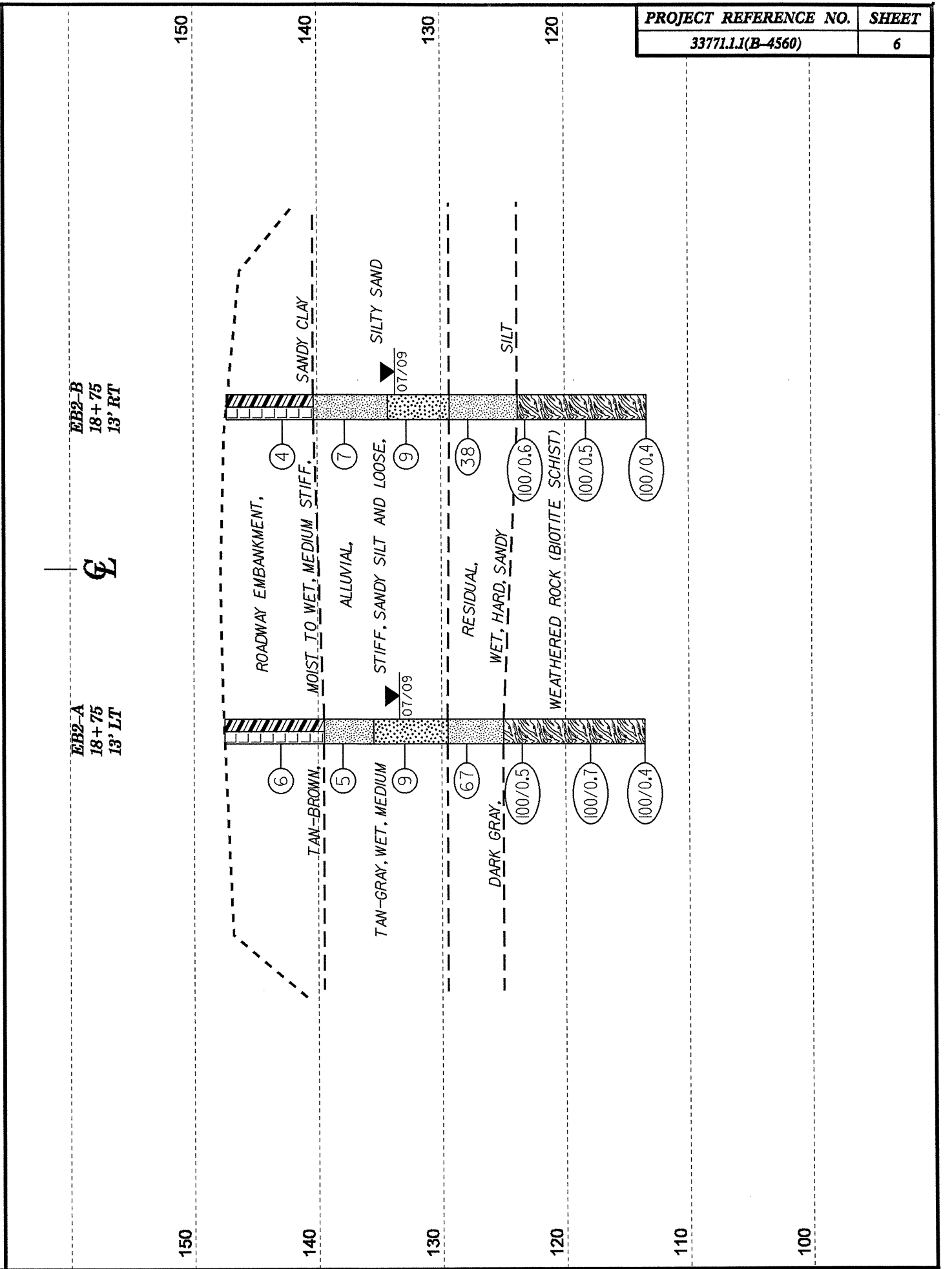
CROSS SECTION THROUGH BENT 1



HORIZ. SCALE 0 10 20 (FEET)

VE = 1:1

CROSS SECTION THROUGH BENT 2



HORIZ. SCALE 0 10 20 (FEET)

VE = 1:1

CROSS SECTION THROUGH END BENT 2

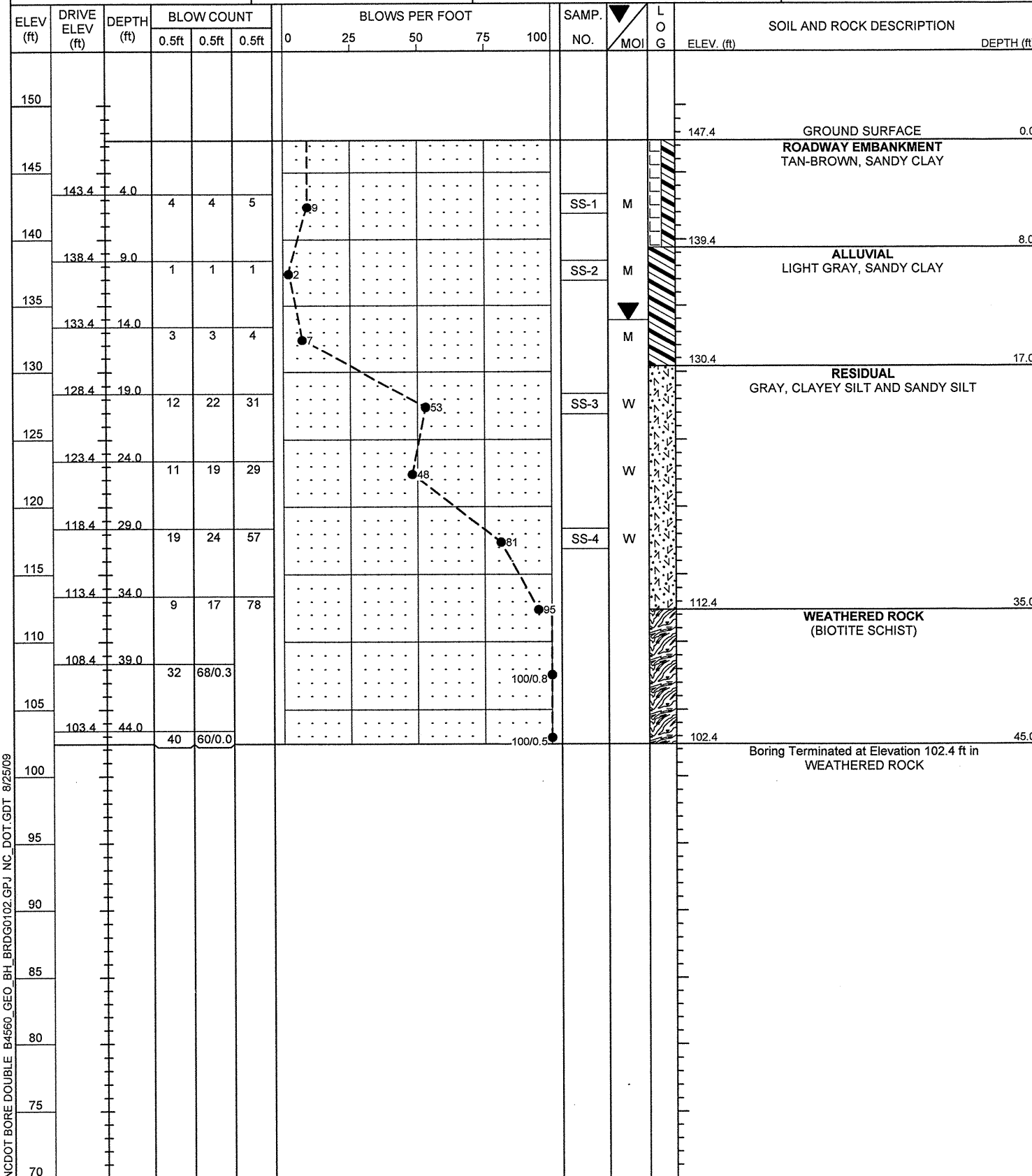




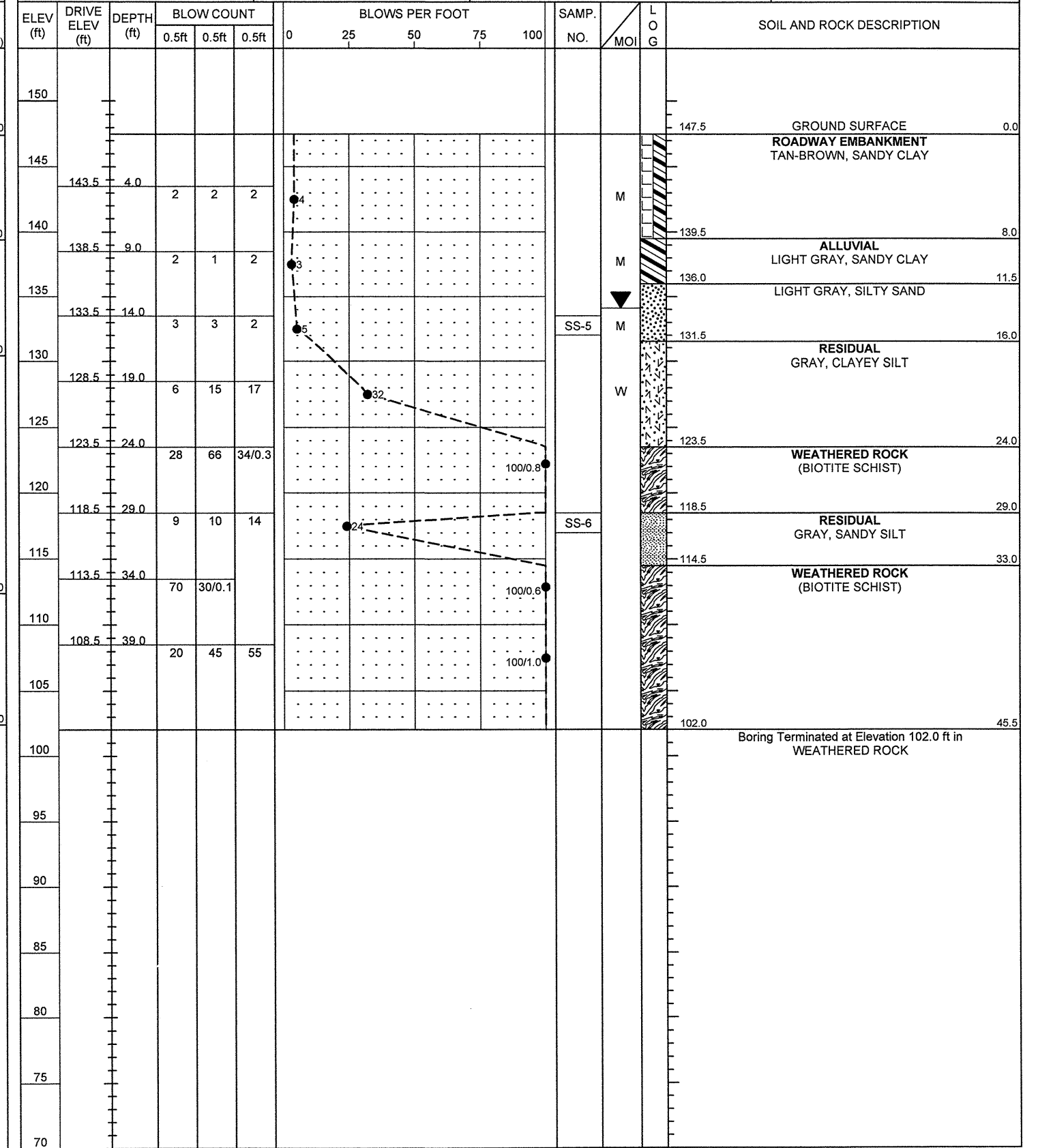
# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

PROJECT NO. 33771.1.1	ID. B-4560	COUNTY JOHNSTON	GEOLOGIST Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 102 ON -L- SR 1331 (FEDERAL ROAD) OVER BLACK CREEK			GROUND WTR (ft)
BORING NO. EB1-A	STATION 17+00	OFFSET 14ft LT	ALIGNMENT -L-
COLLAR ELEV. 147.4 ft	TOTAL DEPTH 45.0 ft	NORTHING 625,437	EASTING 2,139,157
DRILL MACHINE CME-550	DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
START DATE 07/29/09	COMP. DATE 07/29/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A



PROJECT NO. 33771.1.1	ID. B-4560	COUNTY JOHNSTON	GEOLOGIST Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 102 ON -L- SR 1331 (FEDERAL ROAD) OVER BLACK CREEK			GROUND WTR (ft)
BORING NO. EB1-B	STATION 17+00	OFFSET 14ft RT	ALIGNMENT -L-
COLLAR ELEV. 147.5 ft	TOTAL DEPTH 45.5 ft	NORTHING 625,445	EASTING 2,139,184
DRILL MACHINE CME-550	DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
START DATE 07/29/09	COMP. DATE 07/29/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

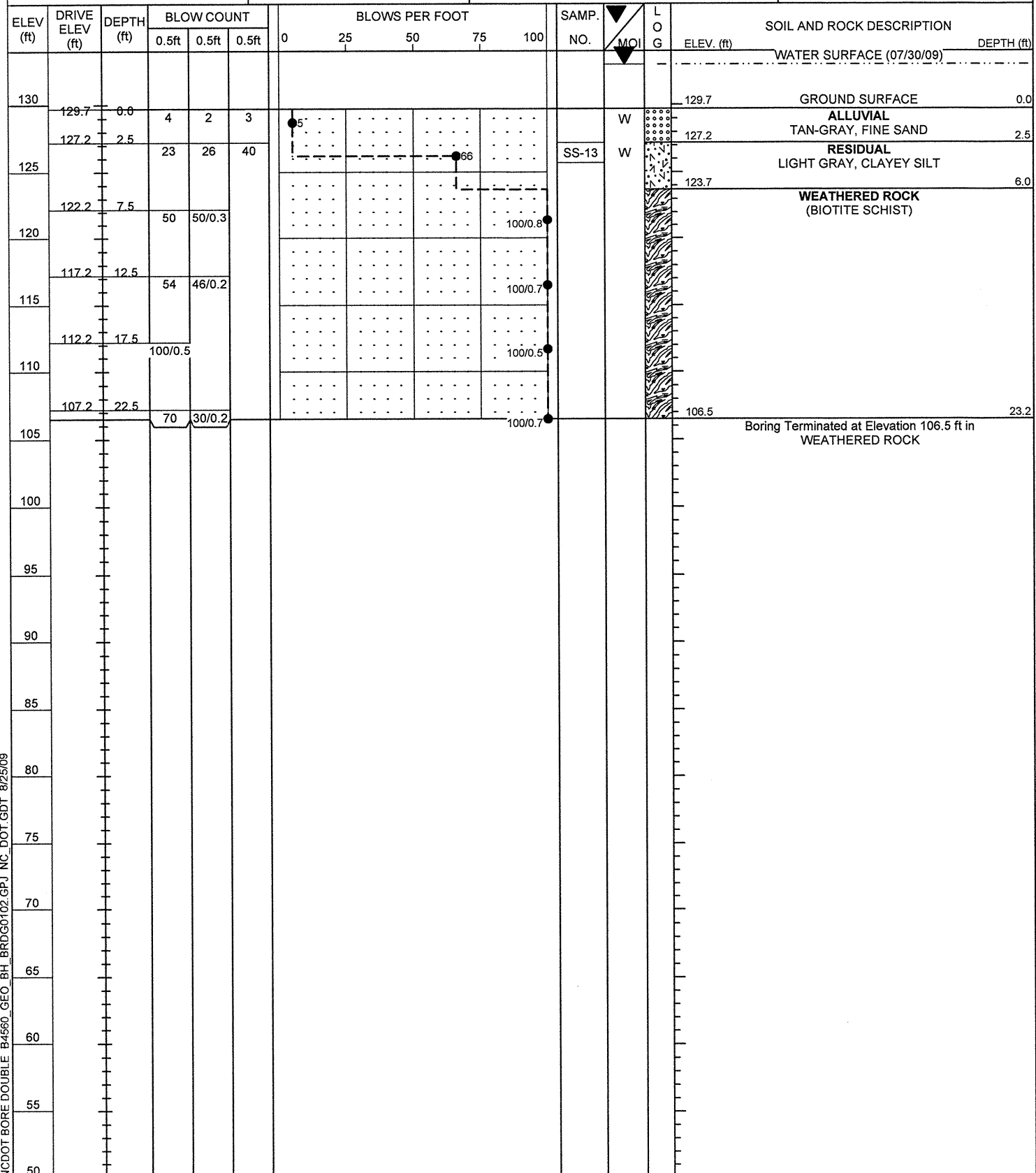


NCDOT BORE DOUBLE B4560\_GEO\_BH\_BRDGG0102.GPJ NC\_DOT\_GDT\_8/25/09

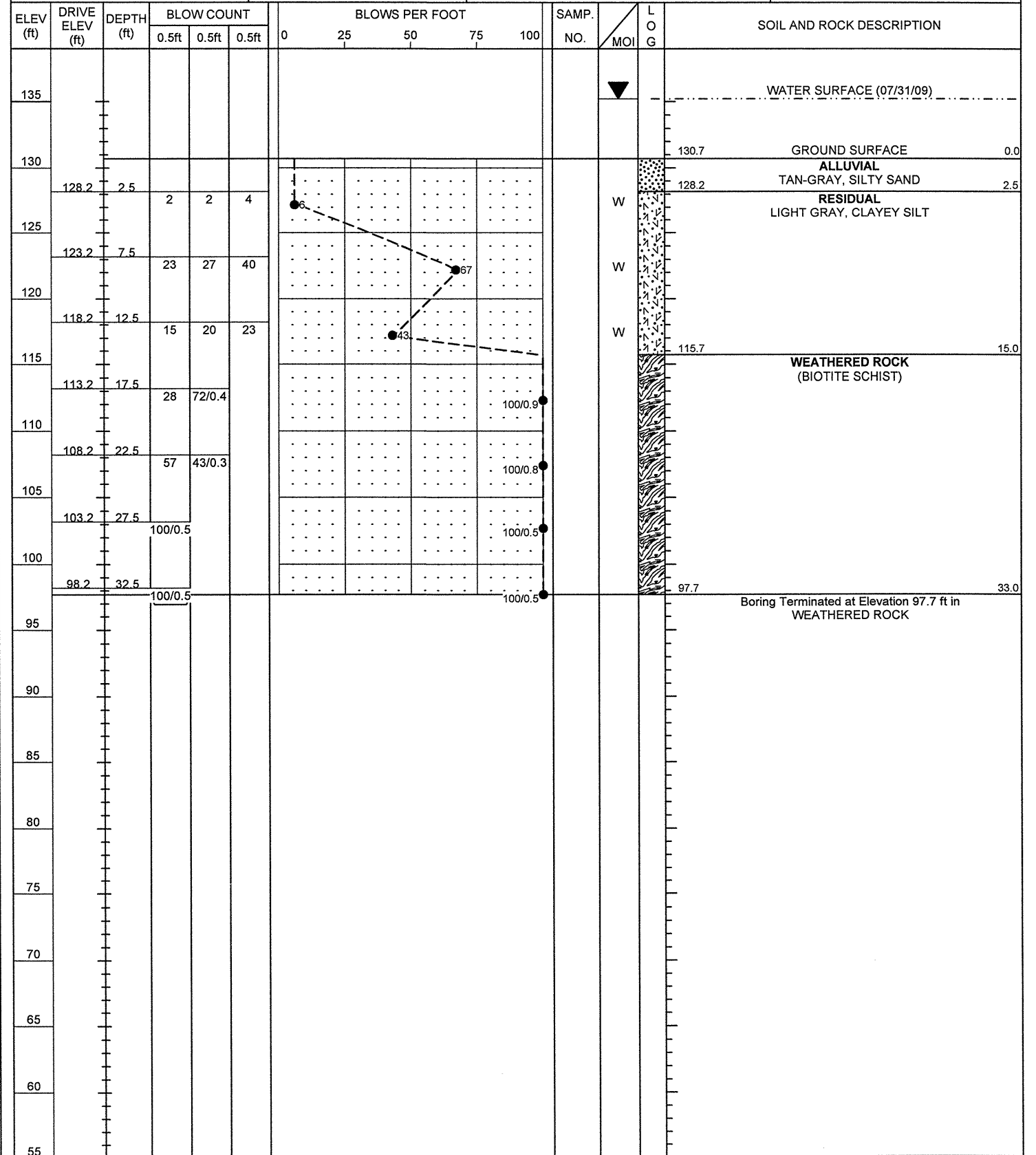


**NCDOT GEOTECHNICAL ENGINEERING UNIT**  
**BORELOG REPORT**

PROJECT NO. 33771.1.1	ID. B-4560	COUNTY JOHNSTON	GEOLOGIST Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 102 ON -L- SR 1331 (FEDERAL ROAD) OVER BLACK CREEK			GROUND WTR (ft)
BORING NO. B1-A	STATION 17+55	OFFSET 6ft LT	ALIGNMENT -L-
COLLAR ELEV. 129.7 ft	TOTAL DEPTH 23.2 ft	NORTHING 625,491	EASTING 2,139,148
DRILL MACHINE CME-550	DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
START DATE 07/30/09	COMP. DATE 07/30/09	SURFACE WATER DEPTH 3.3ft	DEPTH TO ROCK N/A



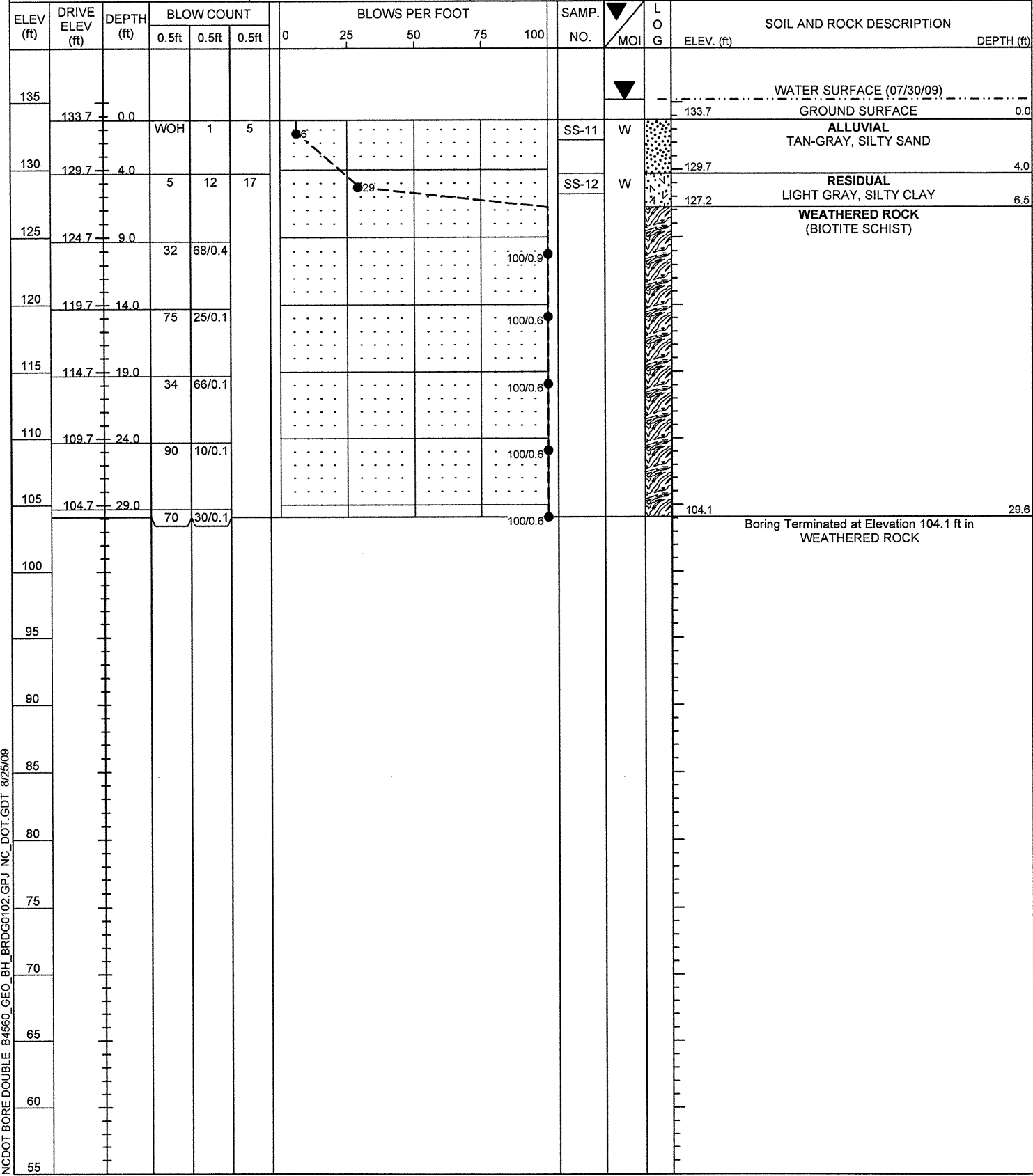
PROJECT NO. 33771.1.1	ID. B-4560	COUNTY JOHNSTON	GEOLOGIST Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 102 ON -L- SR 1331 (FEDERAL ROAD) OVER BLACK CREEK			GROUND WTR (ft)
BORING NO. B1-B	STATION 17+55	OFFSET 6ft RT	ALIGNMENT -L-
COLLAR ELEV. 130.7 ft	TOTAL DEPTH 33.0 ft	NORTHING 625,495	EASTING 2,139,159
DRILL MACHINE CME-550	DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
START DATE 07/31/09	COMP. DATE 07/31/09	SURFACE WATER DEPTH 4.5ft	DEPTH TO ROCK N/A



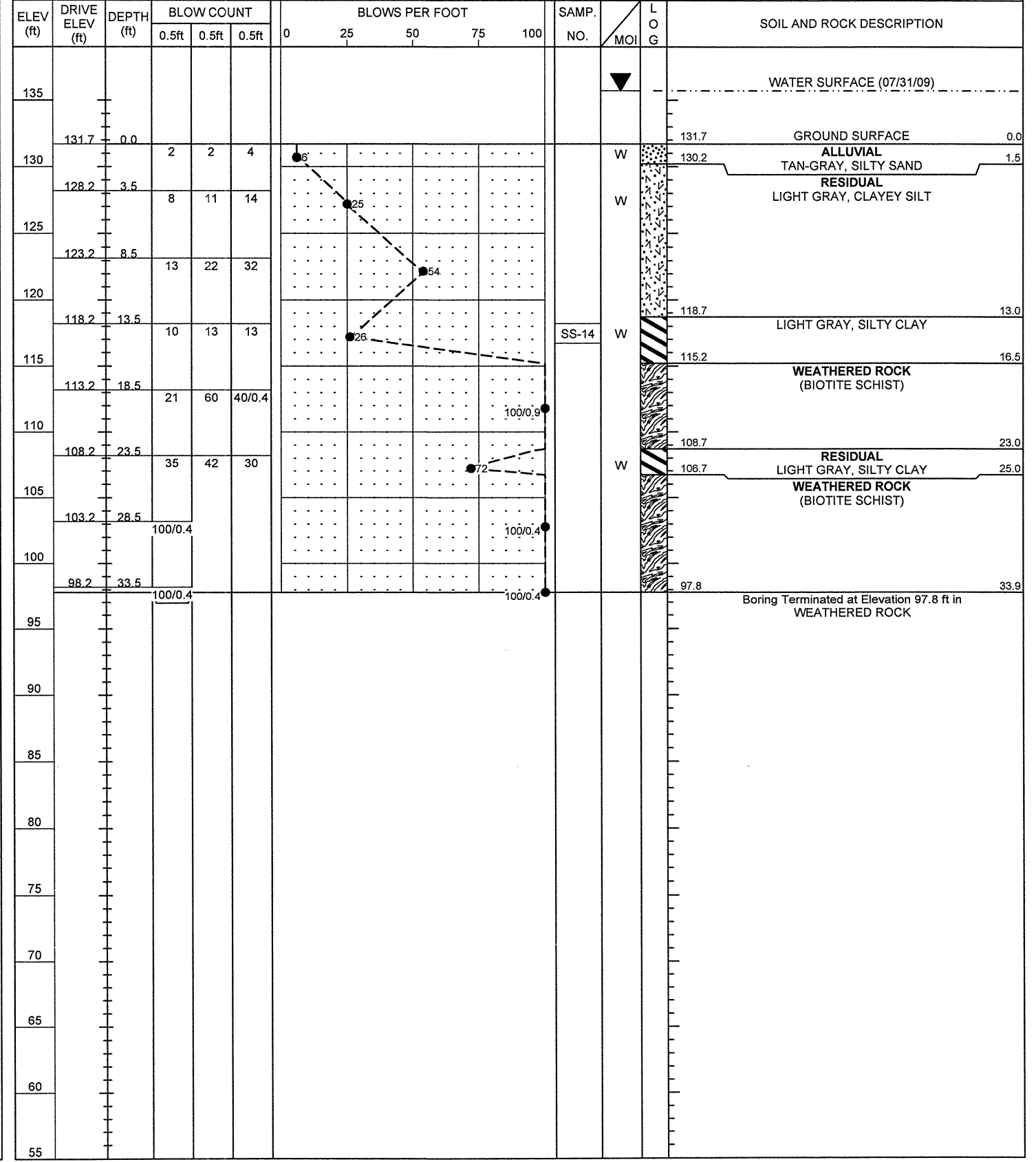
NCDOT BORE DOUBLE B4560\_GEO\_BH\_BRDG0102.GPJ NC\_DOT\_GDT 8/25/09



PROJECT NO. 33771.1.1	ID. B-4560	COUNTY JOHNSTON	GEOLOGIST Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 102 ON -L- SR 1331 (FEDERAL ROAD) OVER BLACK CREEK			GROUND WTR (ft)
BORING NO. B2-A	STATION 18+20	OFFSET 6ft LT	ALIGNMENT -L-
COLLAR ELEV. 133.7 ft	TOTAL DEPTH 29.6 ft	NORTHING 625,553	EASTING 2,139,128
DRILL MACHINE CME-550	DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
START DATE 07/30/09	COMP. DATE 07/30/09	SURFACE WATER DEPTH 1.5ft	DEPTH TO ROCK N/A



PROJECT NO. 33771.1.1	ID. B-4560	COUNTY JOHNSTON	GEOLOGIST Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 102 ON -L- SR 1331 (FEDERAL ROAD) OVER BLACK CREEK			GROUND WTR (ft)
BORING NO. B2-B	STATION 18+20	OFFSET 6ft RT	ALIGNMENT -L-
COLLAR ELEV. 131.7 ft	TOTAL DEPTH 33.9 ft	NORTHING 625,557	EASTING 2,139,139
DRILL MACHINE CME-550	DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
START DATE 07/31/09	COMP. DATE 07/31/09	SURFACE WATER DEPTH 4.0ft	DEPTH TO ROCK N/A



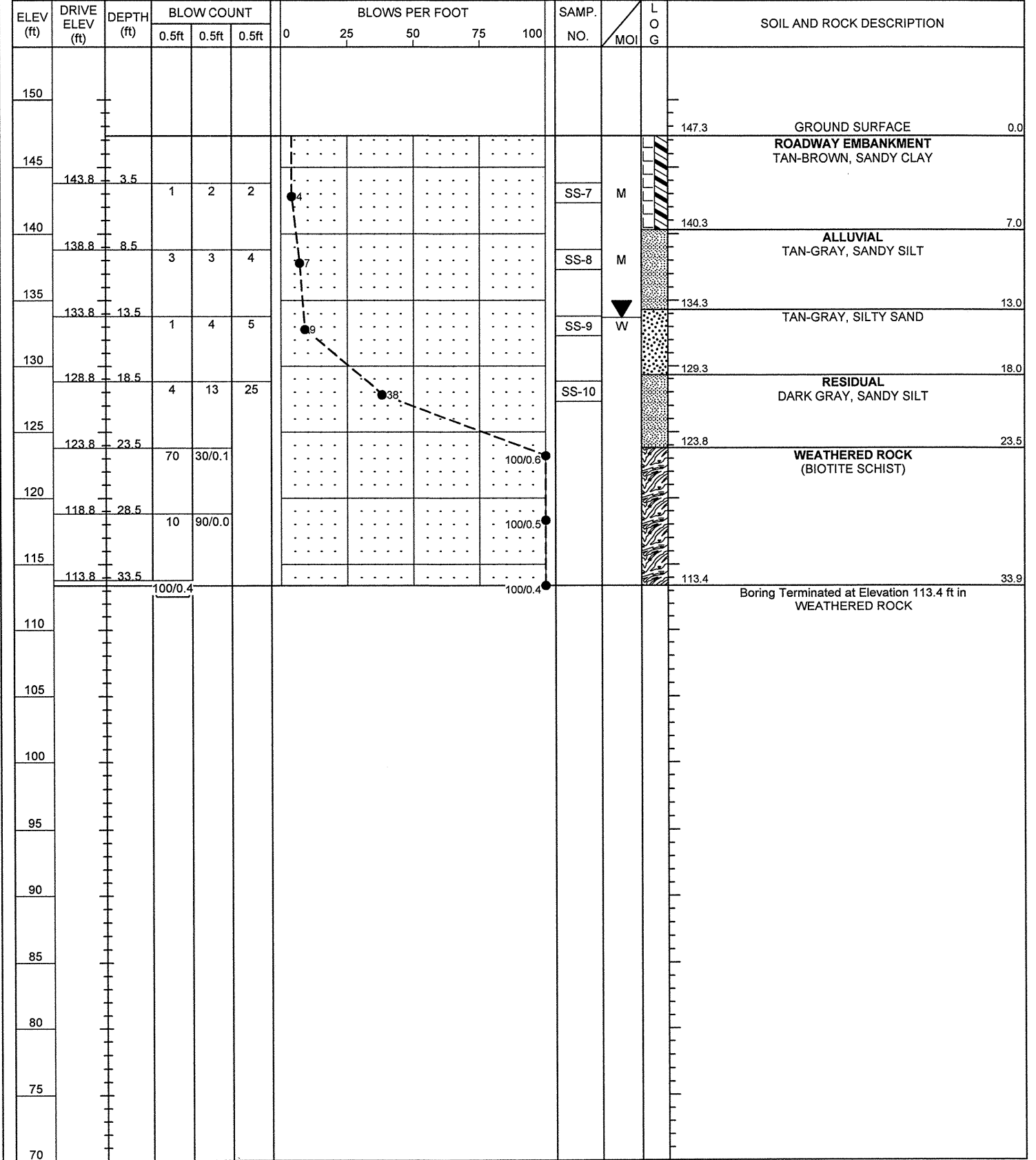
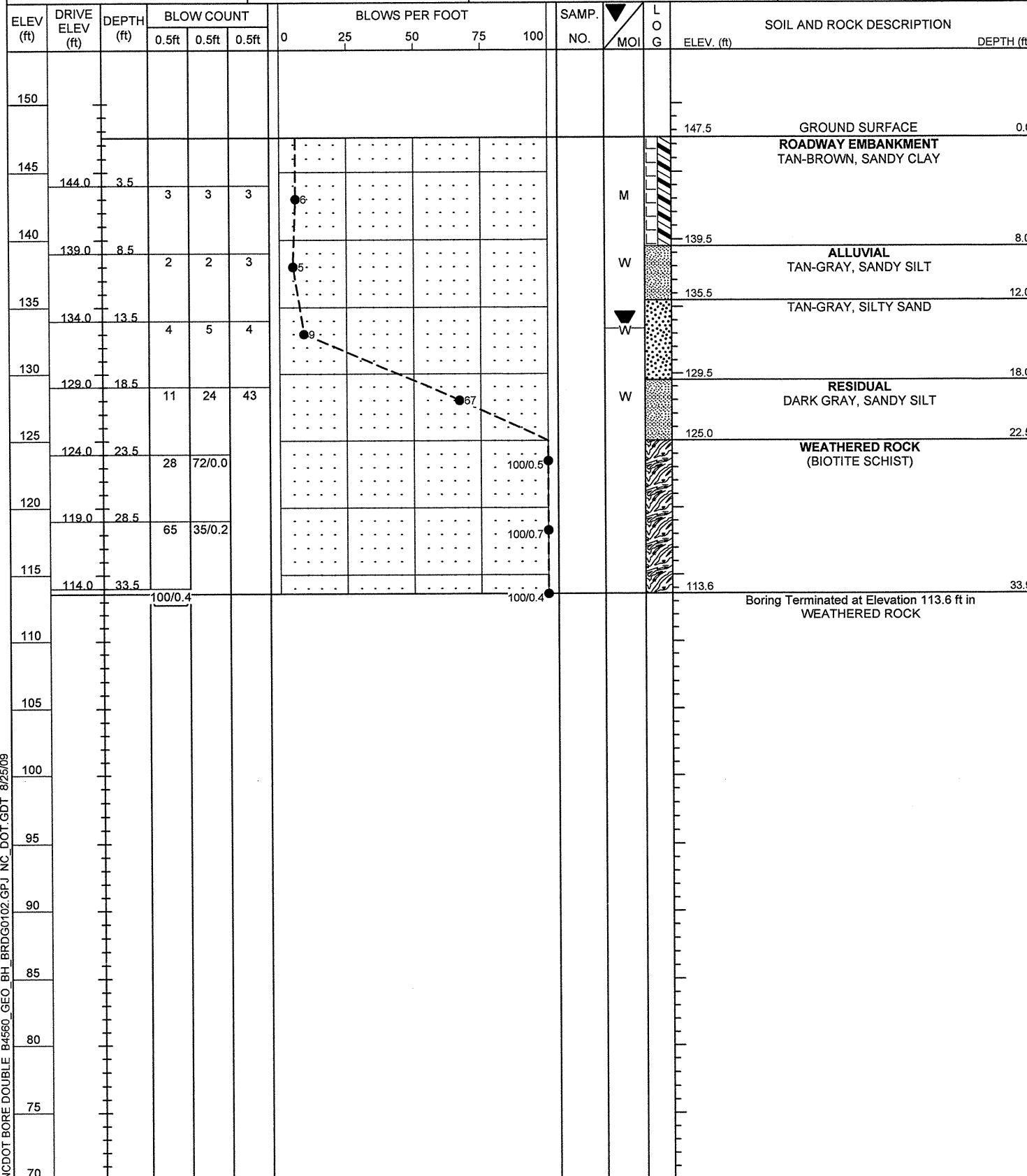
NCDOT BORE DOUBLE B4560\_GEO\_BH\_BRD0102.GPJ NC\_DOT\_GDT 8/25/09



**NCDOT GEOTECHNICAL ENGINEERING UNIT**  
**BORELOG REPORT**

PROJECT NO. 33771.1.1	ID. B-4560	COUNTY JOHNSTON	GEOLOGIST Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 102 ON -L- SR 1331 (FEDERAL ROAD) OVER BLACK CREEK			GROUND WTR (ft)
BORING NO. EB2-A	STATION 18+75	OFFSET 13ft LT	ALIGNMENT -L-
COLLAR ELEV. 147.5 ft	TOTAL DEPTH 33.9 ft	NORTHING 625,604	EASTING 2,139,105
DRILL MACHINE CME-550		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
START DATE 07/29/09	COMP. DATE 07/29/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

PROJECT NO. 33771.1.1	ID. B-4560	COUNTY JOHNSTON	GEOLOGIST Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 102 ON -L- SR 1331 (FEDERAL ROAD) OVER BLACK CREEK			GROUND WTR (ft)
BORING NO. EB2-B	STATION 18+75	OFFSET 13ft RT	ALIGNMENT -L-
COLLAR ELEV. 147.3 ft	TOTAL DEPTH 33.9 ft	NORTHING 625,612	EASTING 2,139,129
DRILL MACHINE CME-550		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
START DATE 07/29/09	COMP. DATE 07/29/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A



NCDOT BORE DOUBLE B4560\_GEO\_BH\_BRDGO102.GPJ NC\_DOT\_GDT\_8/25/09

**EB1-A**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-1	14' LT	17+00	4.0-5.5	A-6(1)	29	15	32.2	34.3	8.3	25.2	97	77	37	-	-
SS-2	14' LT	17+00	9.0-10.5	A-6(7)	28	11	1.6	27.6	34.5	36.3	99	98	80	-	-
SS-3	14' LT	17+00	19.0-20.5	A-5(10)	46	9	9.5	4.6	65.8	20.1	93	85	81	-	-
SS-4	14' LT	17+00	29.0-30.5	A-4(4)	35	6	21.8	10.1	56.1	12.1	100	86	70	-	-

**EB1-B**

<b>SOIL TEST RESULTS</b>															
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	14' RT	17+00	14.0-15.5	A-2-4(0)	20	NP	7.7	72.7	11.6	8.1	100	99	28	-	-
SS-6	14' RT	17+00	0.0-0.0	A-4(8)	38	7	5.2	7.3	71.4	16.1	100	96	91	-	-

**B1-A**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-13	6' LT	17+55	2.5-4.0	A-5(13)	47	8	2.4	3.4	74.0	20.1	100	99	95	-	-

**B2-A**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-11	6' LT	18+20	0.0-1.5	A-2-4(0)	20	NP	25.2	59.3	9.5	6.0	96	88	21	-	-

**B2-B**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-12	6' RT	18+20	4.0-5.5	A-5(12)	45	9	2.2	5.4	74.2	18.1	100	99	94	-	-
SS-14	6' RT	18+20	13.5-15.0	A-7-5(14)	44	11	3.4	5.2	73.2	18.1	100	98	93	-	-

**EB2-B**

<b>SOIL TEST RESULTS</b>															
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-7	13' RT	18+75	3.5-5.0	A-6(3)	36	18	31.0	32.4	8.4	28.2	95	78	39	-	-
SS-8	13' RT	18+75	8.5-10.0	A-4(0)	18	2	1.4	53.9	28.6	16.1	100	100	61	-	-
SS-9	13' RT	18+75	0.0-0.0	A-2-4(0)	20	NP	36.2	53.2	5.6	5.0	100	93	16	-	-
SS-10	13' RT	18+75	18.5-20.0	A-4(8)	37	8	10.7	10.1	71.2	8.1	100	92	83	-	-



# FIELD SCOUR REPORT

WBS: 33771.1.1 TIP: B-4560 COUNTY: Johnston

DESCRIPTION(1): Bridge No. 102 on -L- (SR 1331) over the Black Creek

### EXISTING BRIDGE

Information from: Field Inspection  Microfilm \_\_\_\_\_ (reel \_\_\_\_\_ pos: \_\_\_\_\_)  
 Other (explain) \_\_\_\_\_

Bridge No.: 102 Length: 151 Total Bents: 7 Bents in Channel: 2 Bents in Floodplain: 5  
 Foundation Type: Timber piles with additional crutch H-piles

#### EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: None

Interior Bents: Local scour at all piers in channel

Channel Bed: Minor Local and contraction scour

Channel Bank: Local scour around Bent 5

#### EXISTING SCOUR PROTECTION

Type(3): Concrete covered End Bent slopes.

Extent(4): Concrete = 75' L x 25' W

Effectiveness(5): Both are effective

Obstructions(6): None

#### INSTRUCTIONS

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

### DESIGN INFORMATION

Channel Bed Material(7): Alluvial, tan-brown, silty sand (SS-11)

Channel Bank Material(8): Alluvial, tan - gray, sandy silt (SS-8)

Channel Bank Cover(9): Grass vines, shrubs small and large trees

Floodplain Width(10): +/- 600 feet

Floodplain Cover(11): Grass, trees, shrubs and woods

Stream is(12): Aggrading \_\_\_\_\_ Degrading X Static \_\_\_\_\_

Channel Migration Tend.(13): South East towards End Bent 1

Observations and Other Comments: \_\_\_\_\_

#### DESIGN SCOUR ELEVATIONS(14)

Feet X Meters \_\_\_\_\_

#### BENTS

B1-A	B1-B	B2-A	B2-B
124	122	127	122

Comparison of DSE to Hydraulics Unit theoretical scour:  
 Design Scour Elevations are 3.0 to 5.0 feet higher at bent 1 and 3.0 to 8.0 feet higher at bent 2 compared to the Hydraulics Unit's estimates for the 100year storm events

#### SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

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

See Sheet 11,  
 "Soil Test Results",  
 for samples:  
 SS-11  
 SS-8

Reported by: *Quah B. Othman* Date: 8/28/07



SITE PHOTO

BRIDGE NO. 102 ON SR 1331 (FEDERAL ROAD) OVER BLACK CREEK



LOOKING NORTH TOWARD END BENT 1