

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	33823.1.1(B-4661)	1	15

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

STRUCTURE
SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 33823.1.1(B-4661) F.A. PROJ. BRZ-2227(1)
COUNTY WAKE
PROJECT DESCRIPTION BRIDGE NO. 151 ON -L- (SR 2227)
OVER POWELL 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 - 11	BORE LOG & CORE REPORT(S)
12	SOIL TEST RESULTS
13	SCOUR REPORT
14	CORE PHOTOGRAPH(S)
15	SITE PHOTOGRAPH(S)

CAUTION NOTICE

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

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACED) 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: 33823.1.1 ID: B-4661

PERSONNEL
C.M. BRUINSMA

J.R. TURNAGE

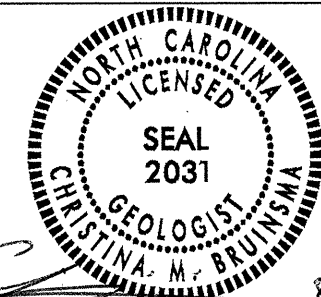
D.W. DIXON

INVESTIGATED BY **C.M. BRUINSMA**

CHECKED BY **N.T. ROBERSON**

SUBMITTED BY **N.T. ROBERSON**

DATE **AUGUST 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 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.

8-26-09

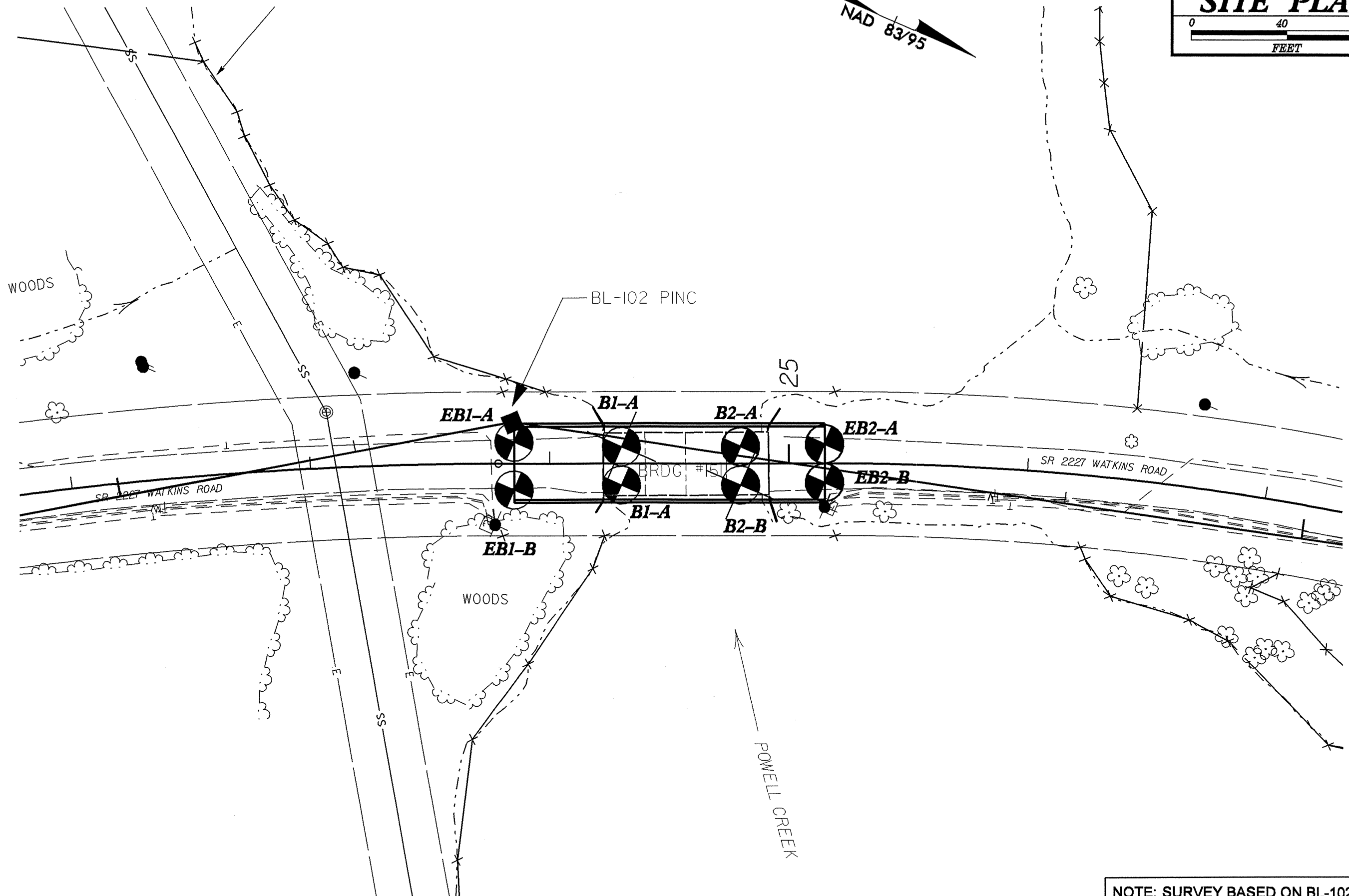
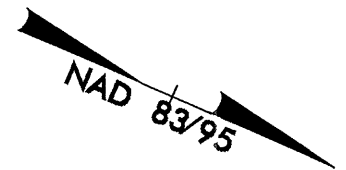
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
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GEOTECHNICAL ENGINEERING UNIT

PROJECT REFERENCE NO. 33823.11(B-4661)	SHEET NO. 2
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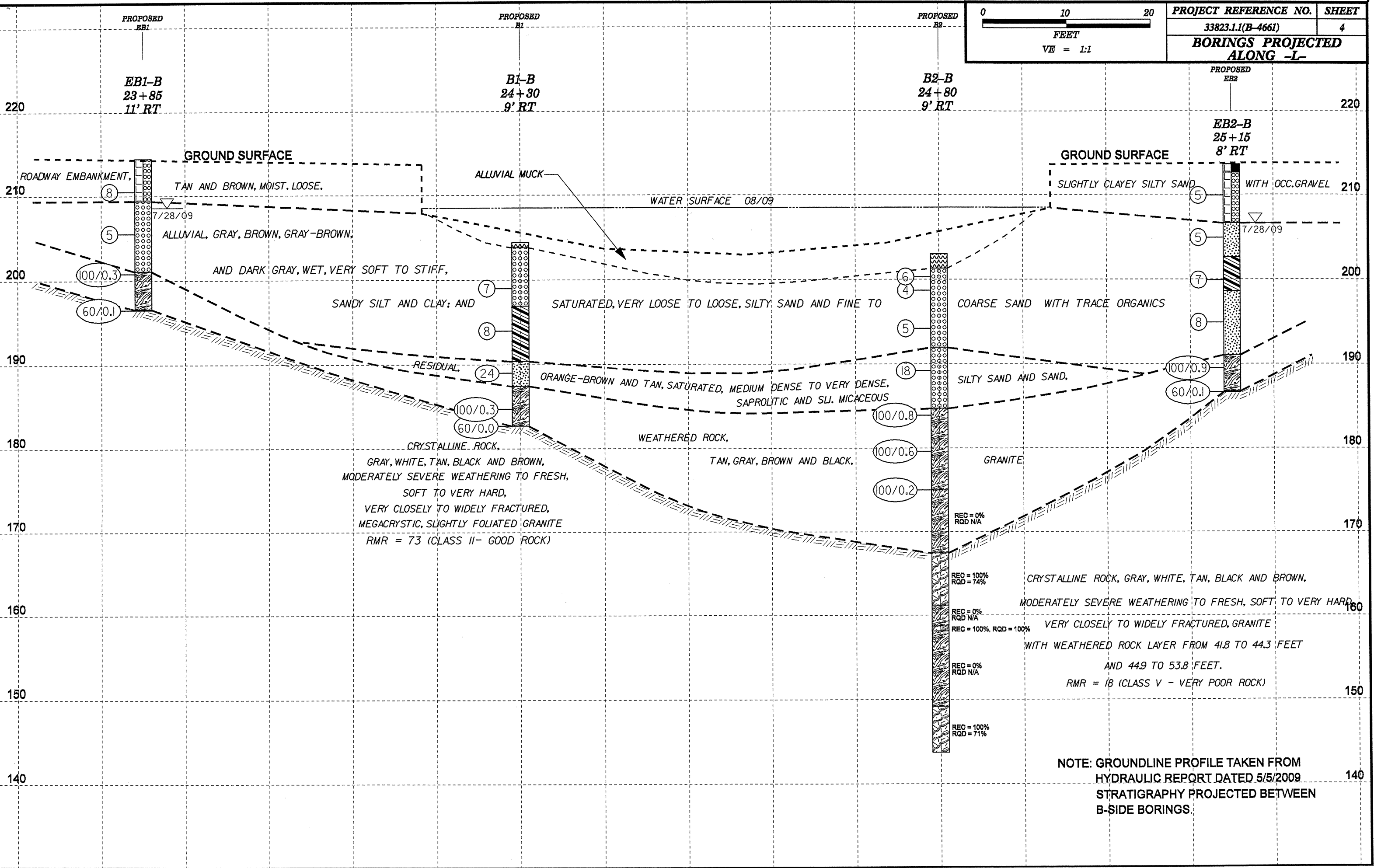
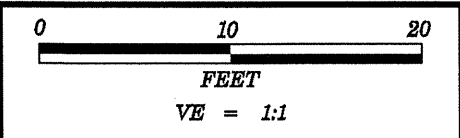
SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

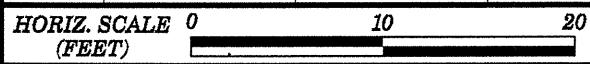
SOIL DESCRIPTION	GRADATION	ROCK DESCRIPTION	TERMS AND DEFINITIONS																																																																																																																																																																																																																																						
<p>SOIL 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, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:</p> <p style="text-align: center;"><i>VERY STIFF, BROWN SILT CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i></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)</p> <p>GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.</p> <p style="text-align: center;">ANGULARITY OF GRAINS</p> <p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p>	<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.</p> <p>ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p>	<p>ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.</p> <p>AQUIFER - A WATER BEARING FORMATION OR STRATA.</p> <p>ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.</p> <p>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.</p> <p>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.</p> <p>CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.</p> <p>COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.</p> <p>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.</p> <p>DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.</p> <p>DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.</p> <p>DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.</p> <p>FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.</p> <p>FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.</p> <p>FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.</p> <p>FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.</p> <p>FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.</p> <p>JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.</p> <p>LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.</p> <p>LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.</p> <p>MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.</p> <p>PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.</p> <p>RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.</p> <p>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.</p> <p>SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.</p> <p>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.</p> <p>SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.</p> <p>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.</p> <p>STRATA CORE RECOVERY (SREC) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.</p> <p>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.</p> <p>TOPSOIL (TS) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																																																																																																																																																																																						
<p style="text-align: center;">SOIL LEGEND AND AASHTO CLASSIFICATION</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>GENERAL CLASS.</th> <th colspan="4">GRANULAR MATERIALS (<= 35% PASSING #200)</th> <th colspan="4">SILT-CLAY MATERIALS (> 35% PASSING #200)</th> <th colspan="4">ORGANIC MATERIALS</th> </tr> <tr> <th>GROUP CLASS.</th> <th>A-1</th> <th>A-3</th> <th>A-2</th> <th>A-4</th> <th>A-5</th> <th>A-6</th> <th>A-7</th> <th>A-1, A-2</th> <th>A-3</th> <th>A-4, A-5</th> <th>A-6, A-7</th> <th></th> <th></th> <th></th> </tr> <tr> <th>SYMBOL</th> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>% PASSING</th> <td>10 30 40 60 75</td> <td>10 30 40 60 75</td> <td>10 30 40 60 75</td> <td>10 30 40 60 75</td> <td>10 30 40 60 75</td> <td>10 30 40 60 75</td> <td>10 30 40 60 75</td> <td>10 30 40 60 75</td> <td>10 30 40 60 75</td> <td>10 30 40 60 75</td> <td>10 30 40 60 75</td> <td>10 30 40 60 75</td> <td>10 30 40 60 75</td> <td>10 30 40 60 75</td> </tr> <tr> <th>LIQUID LIMIT PLASTIC INDEX</th> <td>6 10 15</td> <td>6 10 15</td> <td>6 10 15</td> <td>6 10 15</td> <td>6 10 15</td> <td>6 10 15</td> <td>6 10 15</td> <td>6 10 15</td> <td>6 10 15</td> <td>6 10 15</td> <td>6 10 15</td> <td>6 10 15</td> <td>6 10 15</td> <td>6 10 15</td> </tr> <tr> <th>GROUP INDEX</th> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <th>USUAL TYPES OF MAJOR MATERIALS</th> <td>STONE FRAGS. GRAVEL AND SAND</td> <td>FINE SAND</td> <td>SILTY OR CLAYEY GRAVEL AND SAND</td> <td>SILTY SOILS</td> <td>SILTY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER</td> <td>SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER</td> <td>SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER</td> <td>SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER</td> <td>HIGHLY ORGANIC SOILS</td> <td>HIGHLY ORGANIC SOILS</td> <td>HIGHLY ORGANIC SOILS</td> </tr> <tr> <th>GENERAL RATING AS A SUBGRADE</th> <td colspan="3">EXCELLENT TO GOOD</td> <td colspan="3">FAIR TO POOR</td> <td>FAIR TO POOR</td> <td>POOR</td> <td>UNSATURABLE</td> <td colspan="5"></td> </tr> </table> <p style="text-align: center;">PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30</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															% PASSING	10 30 40 60 75	10 30 40 60 75	10 30 40 60 75	10 30 40 60 75	10 30 40 60 75	10 30 40 60 75	10 30 40 60 75	10 30 40 60 75	10 30 40 60 75	10 30 40 60 75	10 30 40 60 75	10 30 40 60 75	10 30 40 60 75	10 30 40 60 75	LIQUID LIMIT PLASTIC INDEX	6 10 15	6 10 15	6 10 15	6 10 15	6 10 15	6 10 15	6 10 15	6 10 15	6 10 15	6 10 15	6 10 15	6 10 15	6 10 15	6 10 15	GROUP INDEX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL AND SAND	FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND	SILTY SOILS	SILTY SOILS	CLAYEY SOILS	CLAYEY SOILS	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER	HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS	GENERAL RATING AS A SUBGRADE	EXCELLENT TO GOOD			FAIR TO POOR			FAIR TO POOR	POOR	UNSATURABLE						<p style="text-align: center;">MINERALOGICAL COMPOSITION</p> <p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.</p> <p style="text-align: center;">COMPRESSIBILITY</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 style="text-align: center;">PERCENTAGE OF MATERIAL</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>ORGANIC MATERIAL</th> <th>GRANULAR SOILS</th> <th>SILT - CLAY SOILS</th> <th>OTHER MATERIAL</th> </tr> <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>>10%</td> <td>>20%</td> <td>HIGHLY</td> </tr> <tr> <td></td> <td></td> <td></td> <td>35% AND ABOVE</td> </tr> </table> <p style="text-align: center;">GROUND WATER</p> <p> WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING</p> <p> STATIC WATER LEVEL AFTER 24 HOURS</p> <p> PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA</p> <p> SPRING OR SEEP</p> <p style="text-align: center;">MISCELLANEOUS SYMBOLS</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td> ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION</td> <td> SPT TEST BORING</td> <td> SAMPLE DESIGNATIONS</td> </tr> <tr> <td> SOIL SYMBOL</td> <td> AUGER BORING</td> <td>S - BULK SAMPLE</td> </tr> <tr> <td> ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT</td> <td> CORE BORING</td> <td>SS - SPLIT SPOON SAMPLE</td> </tr> <tr> <td> INFERRED SOIL BOUNDARY</td> <td> MONITORING WELL</td> <td>ST - SHELBY TUBE SAMPLE</td> </tr> <tr> <td> INFERRED ROCK LINE</td> <td> PIEZOMETER INSTALLATION</td> <td>RS - ROCK SAMPLE</td> </tr> <tr> <td> ALLUVIAL SOIL BOUNDARY</td> <td> SLOPE INDICATOR INSTALLATION</td> <td>RT - RECOMPACTED TRIAXIAL SAMPLE</td> </tr> <tr> <td> DIP & DIP DIRECTION OF ROCK STRUCTURES</td> <td> SPT N-VALUE</td> <td>CBR - CALIFORNIA BEARING RATIO SAMPLE</td> </tr> <tr> <td> SOUNDING ROD</td> <td> SPT REFUSAL</td> <td></td> </tr> </table> <p style="text-align: center;">ABBREVIATIONS</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>AR - AUGER REFUSAL</td> <td>HL - 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>W - UNIT WEIGHT</td> </tr> <tr> <td>DNT - DILATOMETER TEST</td> <td>ORG. - ORGANIC</td> <td>W_d - DRY UNIT WEIGHT</td> </tr> <tr> <td>DPT - DYNAMIC PENETRATION TEST</td> <td>PMT - PRESSUREMETER TEST</td> <td></td> </tr> <tr> <td>F - VOID RATIO</td> <td>SAP. - SAPROLITIC</td> <td></td> </tr> <tr> <td>FOSS. - FOSSILIFEROUS</td> <td>SD. - SAND, SANDY</td> <td></td> </tr> <tr> <td>FRAC. - FRACTURED, FRACTURES</td> <td>SL. - SILT, SILTY</td> <td></td> </tr> <tr> <td>FRAGS. - FRAGMENTS</td> <td>SLI. - SLIGHTLY</td> <td></td> </tr> <tr> <td></td> <td>TCR - TRICONE REFUSAL</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				35% AND ABOVE	ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION	SPT TEST BORING	SAMPLE DESIGNATIONS	SOIL SYMBOL	AUGER BORING	S - BULK SAMPLE	ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT	CORE BORING	SS - SPLIT SPOON SAMPLE	INFERRED SOIL BOUNDARY	MONITORING WELL	ST - SHELBY TUBE SAMPLE	INFERRED ROCK LINE	PIEZOMETER INSTALLATION	RS - ROCK SAMPLE	ALLUVIAL SOIL BOUNDARY	SLOPE INDICATOR INSTALLATION	RT - RECOMPACTED TRIAXIAL SAMPLE	DIP & DIP DIRECTION OF ROCK STRUCTURES	SPT N-VALUE	CBR - CALIFORNIA BEARING RATIO SAMPLE	SOUNDING ROD	SPT REFUSAL		AR - AUGER REFUSAL	HL - 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	W - UNIT WEIGHT	DNT - DILATOMETER TEST	ORG. - ORGANIC	W _d - DRY UNIT WEIGHT	DPT - DYNAMIC PENETRATION TEST	PMT - PRESSUREMETER TEST		F - VOID RATIO	SAP. - SAPROLITIC		FOSS. - FOSSILIFEROUS	SD. - SAND, SANDY		FRAC. - FRACTURED, FRACTURES	SL. - SILT, SILTY		FRAGS. - FRAGMENTS	SLI. - SLIGHTLY			TCR - TRICONE REFUSAL		<p style="text-align: center;">ROCK HARDNESS</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 style="text-align: center;">ROCK HARDNESS</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>TERM</th> <th>SPACING</th> <th>TERM</th> <th>THICKNESS</th> </tr> <tr> <td>VERY WIDE</td> <td>MORE THAN 10 FEET</td> <td>VERY THICKLY BEDDED</td> <td>> 4 FEET</td> </tr> <tr> <td>WIDE</td> <td>3 TO 10 FEET</td> <td>THICKLY BEDDED</td> <td>1.5 - 4 FEET</td> </tr> <tr> <td>MODERATELY CLOSE</td> <td>1 TO 3 FEET</td> <td>THINLY BEDDED</td> <td>0.16 - 1.5 FEET</td> </tr> <tr> <td>CLOSE</td> <td>0.16 TO 1 FEET</td> <td>VERY THINLY BEDDED</td> <td>0.03 - 0.16 FEET</td> </tr> <tr> <td>VERY CLOSE</td> <td>LESS THAN 0.16 FEET</td> <td>THICKLY LAMINATED</td> <td>0.008 - 0.03 FEET</td> </tr> <tr> <td></td> <td></td> <td>THINLY LAMINATED</td> <td>< 0.008 FEET</td> </tr> </table> <p style="text-align: center;">INDURATION</p> <p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</p> <p>FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</p> <p>MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</p> <p>INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</p> <p>EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p>	TERM	SPACING	TERM	THICKNESS	VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	> 4 FEET	WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET	MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET	CLOSE	0.16 TO 1 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET	VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET			THINLY LAMINATED	< 0.008 FEET	<p>BENCH MARK: BL-102, STA. 13+37.83 -BL-</p> <p style="text-align: right;">ELEVATION: 213.42 FT.</p> <p>NOTES:</p>
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ARE USED TO DESCRIBE APPEARANCE.</p>	NONPLASTIC	PLASTICITY INDEX (PI)	DRY STRENGTH	LOW PLASTICITY	0-5	VERY LOW	MED. PLASTICITY	6-15	SLIGHT	HIGH PLASTICITY	16-25	MEDIUM		26 OR MORE	HIGH	<p style="text-align: center;">EQUIPMENT USED ON SUBJECT PROJECT</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>DRILL UNITS:</th> <th>ADVANCING TOOLS:</th> <th>HAMMER TYPE:</th> </tr> <tr> <td><input type="checkbox"/> MOBILE B-</td> <td><input type="checkbox"/> CLAY BITS</td> <td><input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL</td> </tr> <tr> <td><input type="checkbox"/> BK-51</td> <td><input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER</td> <td></td> </tr> <tr> <td><input type="checkbox"/> CME-45C</td> <td><input type="checkbox"/> 8" HOLLOW AUGERS</td> <td></td> </tr> <tr> <td><input type="checkbox"/> CME-550</td> <td><input type="checkbox"/> HARD FACED FINGER BITS</td> <td></td> </tr> <tr> <td><input type="checkbox"/> PORTABLE HOIST</td> <td><input type="checkbox"/> TUNG-CARBIDE INSERTS</td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER</td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/> TRICONE * STEEL TEETH</td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/> TRICONE * TUNG-CARB.</td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/> CORE BIT</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </table> <p style="text-align: center;">HAND TOOLS:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td><input type="checkbox"/> POST HOLE DIGGER</td> </tr> <tr> <td><input type="checkbox"/> HAND AUGER</td> </tr> <tr> <td><input type="checkbox"/> SOUNDING ROD</td> </tr> <tr> <td><input type="checkbox"/> VANE SHEAR TEST</td> </tr> </table>	DRILL UNITS:	ADVANCING TOOLS:	HAMMER TYPE:	<input type="checkbox"/> MOBILE B-	<input type="checkbox"/> CLAY BITS	<input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL	<input type="checkbox"/> BK-51	<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER		<input type="checkbox"/> CME-45C	<input type="checkbox"/> 8" HOLLOW AUGERS		<input type="checkbox"/> CME-550	<input type="checkbox"/> HARD FACED FINGER BITS		<input type="checkbox"/> PORTABLE HOIST	<input type="checkbox"/> TUNG-CARBIDE INSERTS			<input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER			<input type="checkbox"/> TRICONE * STEEL TEETH			<input type="checkbox"/> TRICONE * TUNG-CARB.			<input type="checkbox"/> CORE BIT					<input type="checkbox"/> POST HOLE DIGGER	<input type="checkbox"/> HAND AUGER	<input type="checkbox"/> SOUNDING ROD	<input type="checkbox"/> VANE SHEAR TEST	<p style="text-align: center;">FRACTURE SPACING</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>TERM</th> <th>SPACING</th> </tr> <tr> <td>VERY WIDE</td> <td>MORE THAN 10 FEET</td> </tr> <tr> <td>WIDE</td> <td>3 TO 10 FEET</td> </tr> <tr> <td>MODERATELY CLOSE</td> <td>1 TO 3 FEET</td> </tr> <tr> <td>CLOSE</td> <td>0.16 TO 1 FEET</td> </tr> <tr> <td>VERY CLOSE</td> <td>LESS THAN 0.16 FEET</td> </tr> </table> <p style="text-align: center;">BEDDING</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>TERM</th> <th>THICKNESS</th> </tr> <tr> <td>VERY THICKLY BEDDED</td> <td>> 4 FEET</td> </tr> <tr> <td>THICKLY BEDDED</td> <td>1.5 - 4 FEET</td> </tr> <tr> <td>THINLY BEDDED</td> <td>0.16 - 1.5 FEET</td> </tr> <tr> <td>VERY THINLY BEDDED</td> <td>0.03 - 0.16 FEET</td> </tr> <tr> <td>THICKLY LAMINATED</td> <td>0.008 - 0.03 FEET</td> </tr> <tr> <td>THINLY LAMINATED</td> <td>< 0.008 FEET</td> </tr> </table>	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																																																																																																					
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NOTE: SURVEY BASED ON BL-102 PINC
 -BL- STATION 13+37.83
 ELEVATION = 213.42 FT MSL
 BRIDGE SKEW = 90°

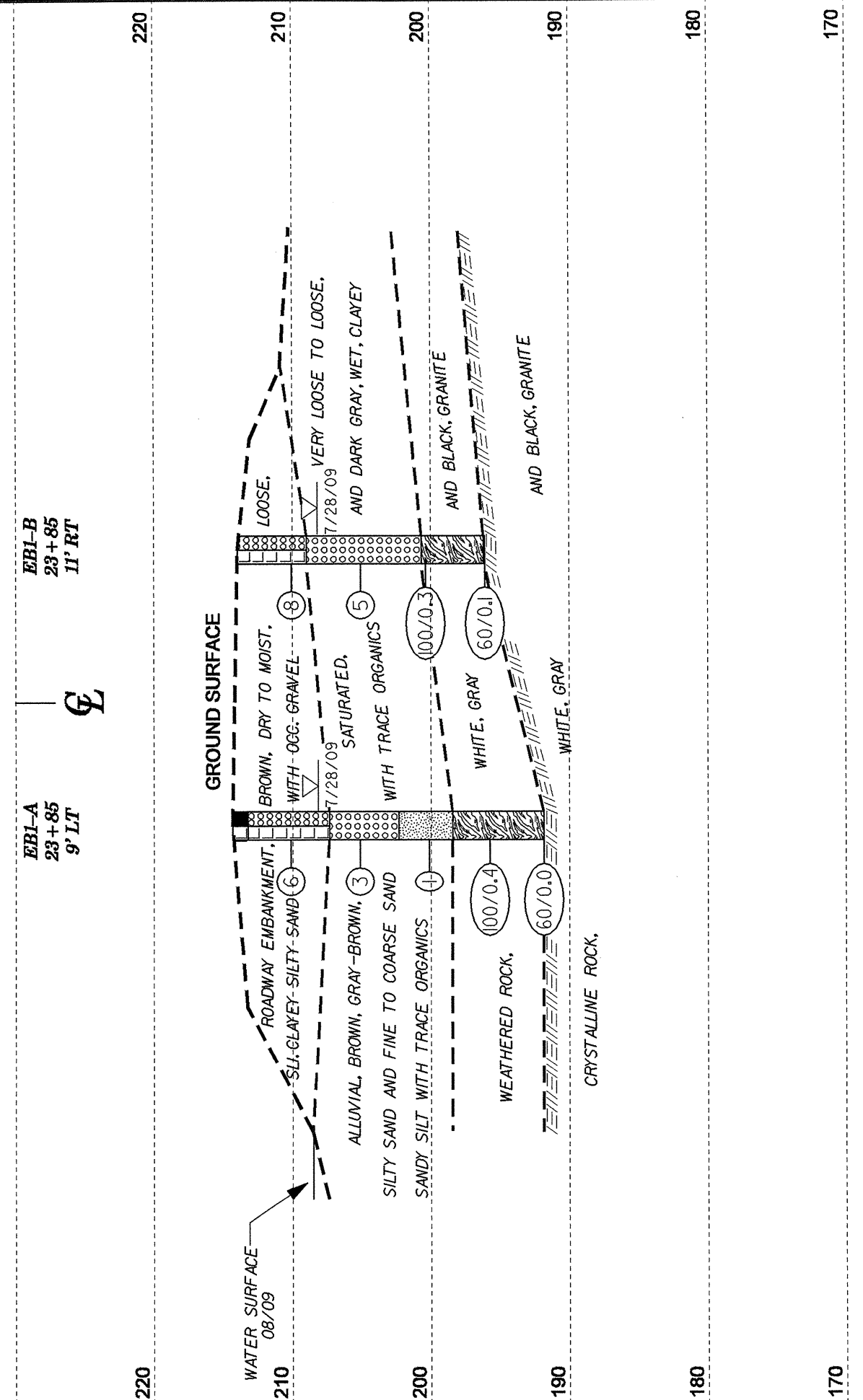


NOTE: GROUNDLINE PROFILE TAKEN FROM HYDRAULIC REPORT DATED 5/5/2009 STRATIGRAPHY PROJECTED BETWEEN B-SIDE BORINGS.



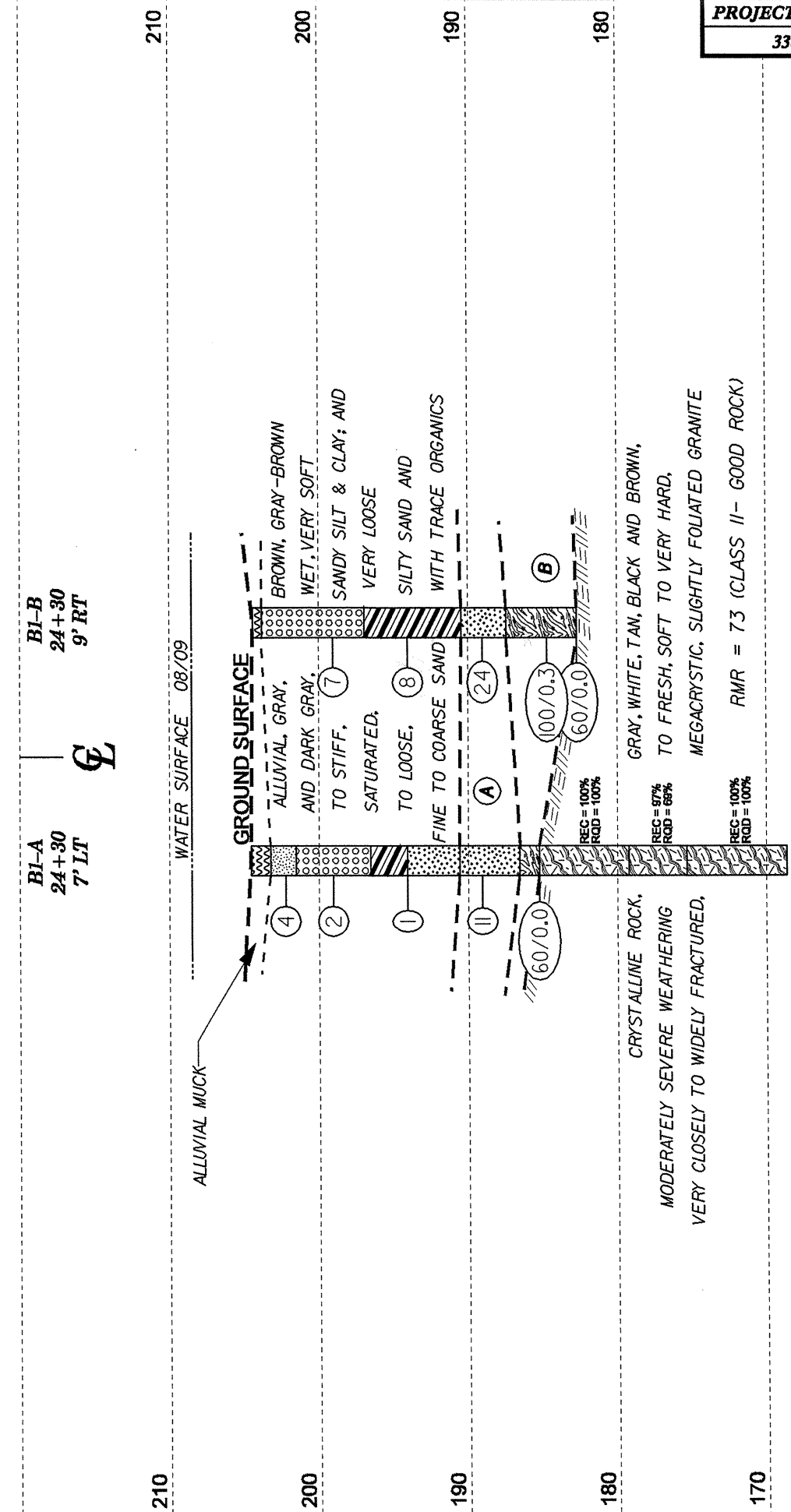
VE = 1:1

CROSS SECTION THROUGH END BENT 1

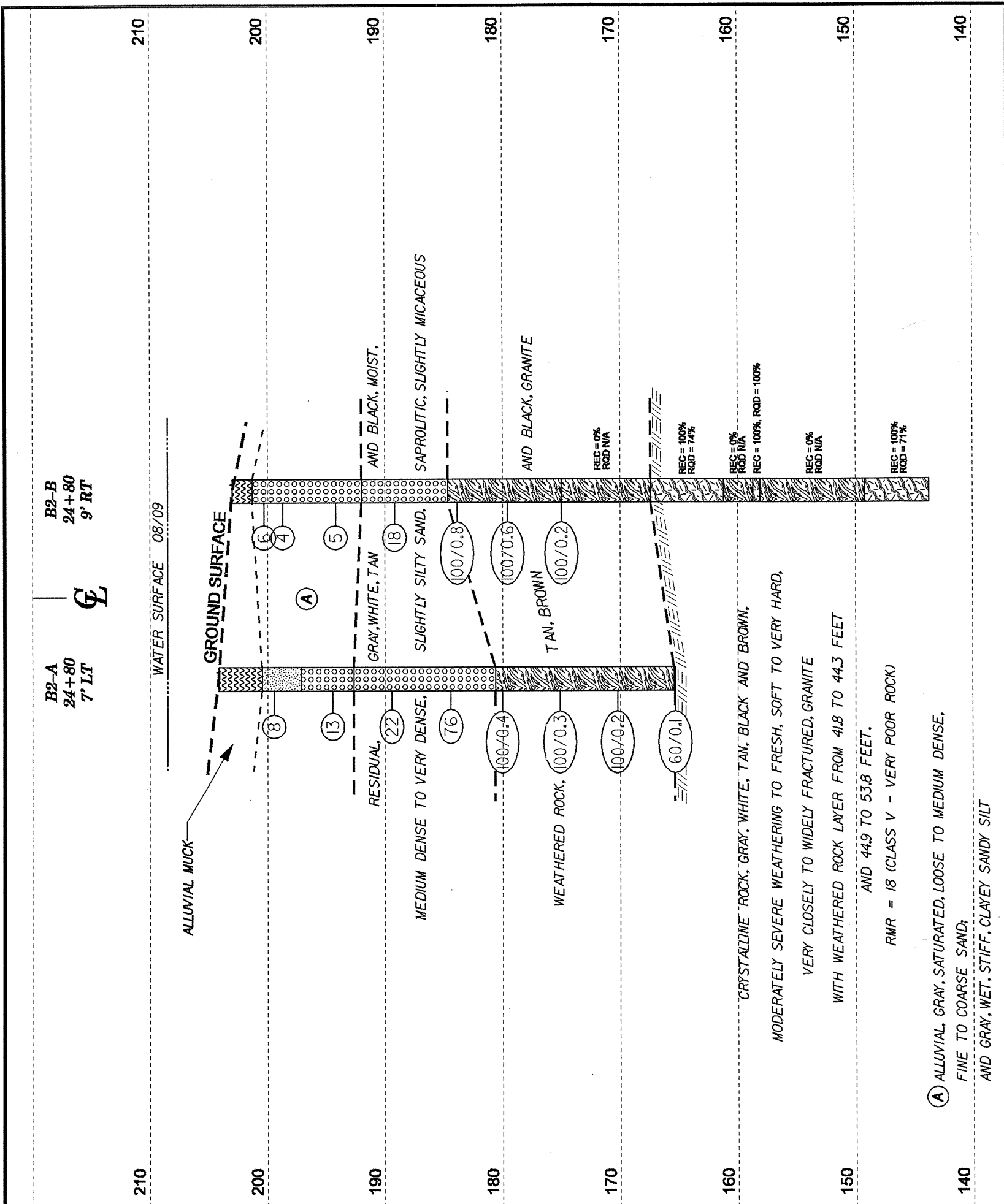


VE = 1:1

CROSS SECTION THROUGH BENT 1



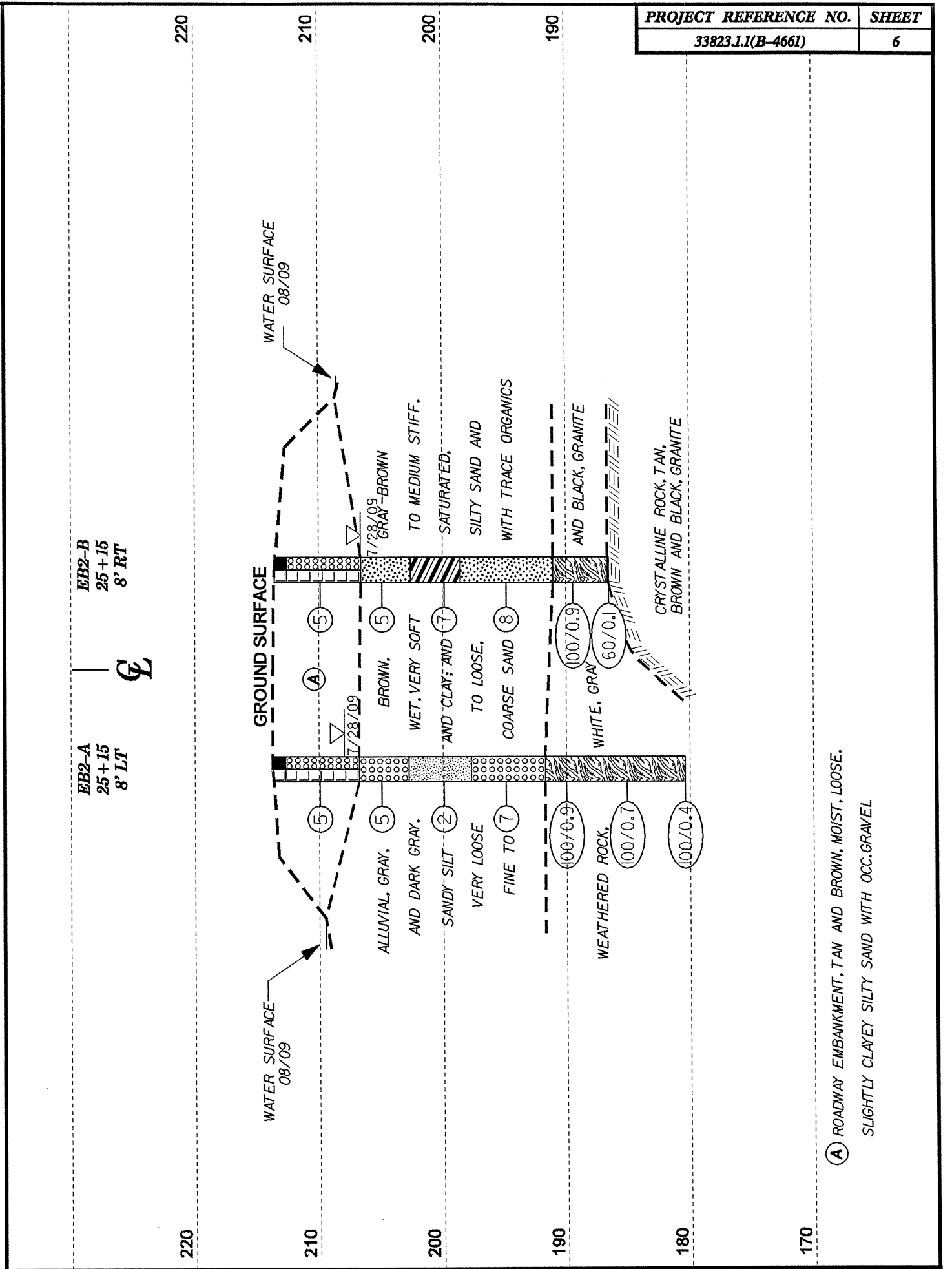
- (A) RESIDUAL, ORANGE-BROWN AND TAN, SATURATED, MEDIUM DENSE, CLAYEY SILTY SAND, SAPROLITIC AND SLIGHTLY MICACEOUS.
- (B) WEATHERED ROCK, TAN, BROWN AND BLACK, GRANITE



CROSS SECTION THROUGH BENT 2

HORIZ. SCALE 0 10 20 (FEET)

VE = 1:1



CROSS SECTION THROUGH END BENT 2

HORIZ. SCALE 0 10 20 (FEET)

VE = 1:1

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33823.1.1	ID. B-4661	COUNTY WAKE	GEOLOGIST Bruinsma, C. M.
SITE DESCRIPTION BRIDGE NO. 151 ON -L- (SR 2227/WATKINS ROAD) OVER POWELL CREEK			GROUND WTR (ft)
BORING NO. EB1-A	STATION 23+85	OFFSET 9ft LT	ALIGNMENT L
COLLAR ELEV. 214.3 ft	TOTAL DEPTH 22.5 ft	NORTHING 772,913	EASTING 2,148,080
DRILL MACHINE CME-550	DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
START DATE 07/28/09	COMP. DATE 07/28/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 22.5 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
215														GROUND SURFACE	0.0
														0.7' BITUMINOUS CONCRETE	1.1
														ROADWAY EMBANKMENT	
														BROWN, SLIGHTLY CLAYEY SILTY SAND	
210	211.1	3.2		5	3	3									
205	206.1	8.2		2	2	1									
200	201.1	13.2		1	WOH	1									
195	196.1	18.2													
190	191.8	22.5													
185															
180															
175															
170															
165															
160															
155															
150															
145															
140															
135															

PROJECT NO. 33823.1.1	ID. B-4661	COUNTY WAKE	GEOLOGIST Bruinsma, C. M.
SITE DESCRIPTION BRIDGE NO. 151 ON -L- (SR 2227/WATKINS ROAD) OVER POWELL CREEK			GROUND WTR (ft)
BORING NO. EB1-B	STATION 23+85	OFFSET 11ft RT	ALIGNMENT L
COLLAR ELEV. 214.0 ft	TOTAL DEPTH 17.9 ft	NORTHING 772,921	EASTING 2,148,098
DRILL MACHINE CME-550	DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
START DATE 07/28/09	COMP. DATE 07/28/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 17.8 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
215														GROUND SURFACE	0.0
														ROADWAY EMBANKMENT	
														BROWN, SLIGHTLY CLAYEY SILTY SAND	
210	211.1	2.9		5	3	5									
205	206.1	7.9		3	3	2									
200	201.2	12.8		3	100/0.3										
195	196.2	17.8													
190															
185															
180															
175															
170															
165															
160															
155															
150															
145															
140															
135															

NCDOT BORE DOUBLE B4661_GEO_BH_BRDG151.GPJ_NC_DOT.GDT_08/20/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 33823.1.1	ID. B-4661	COUNTY WAKE	GEOLOGIST Bruinsma, C. M.
SITE DESCRIPTION BRIDGE NO. 151 ON -L- (SR 2227/WATKINS ROAD) OVER POWELL CREEK			GROUND WTR (ft)
BORING NO. B1-A	STATION 24+30	OFFSET 7ft LT	ALIGNMENT L
COLLAR ELEV. 204.5 ft	TOTAL DEPTH 35.9 ft	NORTHING 772,955	EASTING 2,148,064
DRILL MACHINE CME-550	DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic	
START DATE 07/30/09	COMP. DATE 08/03/09	SURFACE WATER DEPTH 4.0ft	DEPTH TO ROCK 19.3 ft

PROJECT NO. 33823.1.1	ID. B-4661	COUNTY WAKE	GEOLOGIST Bruinsma, C. M.
SITE DESCRIPTION BRIDGE NO. 151 ON -L- (SR 2227/WATKINS ROAD) OVER POWELL CREEK			GROUND WTR (ft)
BORING NO. B1-A	STATION 24+30	OFFSET 7ft LT	ALIGNMENT L
COLLAR ELEV. 204.5 ft	TOTAL DEPTH 35.9 ft	NORTHING 772,955	EASTING 2,148,064
DRILL MACHINE CME-550	DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic	
START DATE 07/30/09	COMP. DATE 08/03/09	SURFACE WATER DEPTH 4.0ft	DEPTH TO ROCK 19.3 ft
CORE SIZE NWD3	TOTAL RUN 16.6 ft	DRILLER Turnage, J. R.	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			
205													204.5 GROUND SURFACE 0.0
	203.2	1.3	WOH	3	1								203.2 ALLUVIAL MUCK 1.3
200	200.0	4.5	1	1	1								201.5 DARK GRAY, CLAYEY SANDY SILT WITH WOOD FRAGMENTS 3.0
													GRAY, SLIGHTLY SILTY, FINE TO COARSE SAND WITH TRACE ORGANICS
195	195.0	9.5	WOH	WOH	1								196.5 DARK GRAY, SANDY SILTY CLAY WITH SAND SEAMS 8.0
													194.0 DARK GRAY, SILTY SAND 10.5
190	190.0	14.5	4	4	7								190.5 RESIDUAL ORANGE-BROWN AND TAN, CLAYEY SILTY SAND, SAPROLITIC, SLIGHTLY MICACEOUS 14.0
													188.5 WEATHERED ROCK BROWN, TAN AND BLACK, GRANITE 18.0
185	185.2	19.3	60/0										185.2 CRYSTALLINE ROCK GRAY, WHITE, TAN AND BLACK, MEGACRYSTIC GRANITE 19.3
													179.2 STRATA REC = 100% STRATA RQD = 100% 25.3
180													175.3 TAN, GRAY, BROWN AND BLACK, MEGACRYSTIC GRANITE 29.2
													STRATA REC = 97% STRATA RQD = 69%
175													168.6 GRAY, WHITE, BLACK AND PINK, MEGACRYSTIC, SLIGHTLY FOLIATED, GRANITE 35.9
													STRATA REC = 100% STRATA RQD = 100%
170													RMR = 73 (CLASS II - GOOD ROCK)
													Boring Terminated at Elevation 168.6 ft IN CRYSTALLINE ROCK (GRANITE)

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS
					REC. (%)	ROD (%)		REC. (%)	ROD (%)		
185.2											Begin Coring @ 19.3 ft
	185.2	19.3	1.7	1:15	(1.7)	(1.7)		(6.0)	(6.0)		185.2 CRYSTALLINE ROCK 19.3
	183.5	21.0	5.0	0:45/0.7	100%	100%		100%	100%		GRAY, WHITE, TAN AND BLACK, SLIGHTLY TO VERY SLIGHTLY WEATHERED, HARD, WIDELY FRACTURED, MEGACRYSTIC GRANITE (ROLESVILLE PLUTON)
180											
	178.5	26.0	4.9	1:15	(4.8)	(4.6)	RS-1	(3.8)	(2.7)		179.2 TAN, GRAY, BROWN AND BLACK, MODERATELY SEVERE TO MODERATELY WEATHERED, SOFT TO MEDIUM HARD, VERY CLOSE TO CLOSELY FRACTURED, MEGACRYSTIC GRANITE 25.3
175											
	173.6	30.9	5.0	0:55/0.9	100%	100%	RS-2	(6.7)	(6.7)		175.3 GRAY, WHITE, BLACK AND PINK, VERY SLIGHTLY WEATHERED TO FRESH, HARD TO VERY HARD, WIDELY FRACTURED, MEGACRYSTIC, SLIGHTLY FOLIATED, GRANITE 29.2
170											
	168.6	35.9		1:25	(5.0)	(5.0)					168.6 RMR = 73 (CLASS II - GOOD ROCK) 35.9
165											
160											
155											
150											
145											
140											
135											
130											
125											

NCDOT BORE DOUBLE B4661_GEO_BH_BRDG151.GPJ NC_DOT.GDT 08/20/09



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

PROJECT NO. 33823.1.1	ID. B-4661	COUNTY WAKE	GEOLOGIST Bruinsma, C. M.
SITE DESCRIPTION BRIDGE NO. 151 ON -L- (SR 2227/WATKINS ROAD) OVER POWELL CREEK			GROUND WTR (ft)
BORING NO. B1-B	STATION 24+30	OFFSET 9ft RT	ALIGNMENT L
COLLAR ELEV. 204.4 ft	TOTAL DEPTH 21.7 ft	NORTHING 772,962	EASTING 2,148,079
DRILL MACHINE CME-550	DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic	
START DATE 08/05/09	COMP. DATE 08/05/09	SURFACE WATER DEPTH 4.1ft	DEPTH TO ROCK 21.7 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
205													GROUND SURFACE	0.0
													ALLUVIAL MUCK	0.6
													LIGHT GRAY, FINE TO COARSE, SAND	
200	200.0	4.4												
			3	3	4									
195	195.0	9.4												
			3	3	5									
190	190.0	14.4												
			6	10	14									
185	185.0	19.4												
			100/0.3											
	182.7	21.7												
			60/0											
180														
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125														

PROJECT NO. 33823.1.1	ID. B-4661	COUNTY WAKE	GEOLOGIST Bruinsma, C. M.
SITE DESCRIPTION BRIDGE NO. 151 ON -L- (SR 2227/WATKINS ROAD) OVER POWELL CREEK			GROUND WTR (ft)
BORING NO. B2-A	STATION 24+80	OFFSET 7ft LT	ALIGNMENT L
COLLAR ELEV. 204.1 ft	TOTAL DEPTH 38.8 ft	NORTHING 773,001	EASTING 2,148,044
DRILL MACHINE CME-550	DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic	
START DATE 08/03/09	COMP. DATE 08/03/09	SURFACE WATER DEPTH 4.4ft	DEPTH TO ROCK 38.7 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
205													GROUND SURFACE	0.0
													ALLUVIAL MUCK	0.6
													GRAY, CLAYEY SANDY SILT	3.7
200	200.4	3.7												
			WOH	3	5									
195	195.4	8.7												
			6	6	7									
190	190.4	13.7												
			5	9	13									
185	185.4	18.7												
			19	34	42									
180	180.4	23.7												
			100/0.4											
175	175.4	28.7												
			100/0.3											
170	170.4	33.7												
			100/0.2											
165	165.4	38.7												
			60/0.1											
160														
155														
150														
145														
140														
135														
130														
125														

NCDOT BORE DOUBLE B4661 GEO_BH_BRDG151.GPJ NC_DOT_GDT 08/20/09

PROJECT NO. 33823.1.1	ID. B-4661	COUNTY WAKE	GEOLOGIST Bruinsma, C. M.
SITE DESCRIPTION BRIDGE NO. 151 ON -L- (SR 2227/WATKINS ROAD) OVER POWELL CREEK			GROUND WTR (ft)
BORING NO. B2-B	STATION 24+80	OFFSET 9ft RT	ALIGNMENT L
COLLAR ELEV. 203.0 ft	TOTAL DEPTH 59.3 ft	NORTHING 773,008	EASTING 2,148,059
DRILL MACHINE CME-550	DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic	
START DATE 08/04/09	COMP. DATE 08/04/09	SURFACE WATER DEPTH 5.5ft	DEPTH TO ROCK 35.6 ft

PROJECT NO. 33823.1.1	ID. B-4661	COUNTY WAKE	GEOLOGIST Bruinsma, C. M.
SITE DESCRIPTION BRIDGE NO. 151 ON -L- (SR 2227/WATKINS ROAD) OVER POWELL CREEK			GROUND WTR (ft)
BORING NO. B2-B	STATION 24+80	OFFSET 9ft RT	ALIGNMENT L
COLLAR ELEV. 203.0 ft	TOTAL DEPTH 59.3 ft	NORTHING 773,008	EASTING 2,148,059
DRILL MACHINE CME-550	DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic	
START DATE 08/04/09	COMP. DATE 08/04/09	SURFACE WATER DEPTH 5.5ft	DEPTH TO ROCK 35.6 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
205														203.0	0.0
														201.3	1.7
200	201.3	1.7	2	3	3								201.3	1.7	
	199.7	3.3	3	2	2										
195	195.2	7.8	4	3	2										
190	190.2	12.8	6	8	10										
185	185.2	17.8	30	60	40/0.3										
180	180.2	22.8	90	10/0.1											
175	175.2	27.8	100/0.2												
170															
165															
160															
155															
150															
145															
140															
135															
130															
125															
120															
115															
110															
105															
100															
95															

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (%)	RQD (%)		REC. (%)	RQD (%)			
175	175.0	28.0	1.3	0:45	(0.0)	N/A		(0.0)	N/A		Begin Coring @ 28.0 ft	28.0
	173.7	29.3	5.0	0:15/0.3	0%	N/A		0%	N/A		WEATHERED ROCK	
170	168.7	34.3	5.0	0:35	(0.0)	N/A		0%	N/A		TAN, BROWN AND BLACK, GRANITE	
				0:35								
				0:25								
				0:30								
165	163.7	39.3	5.0	0:25	(3.7)	(2.1)		(6.2)	(4.6)		CRYSTALLINE ROCK	35.6
				0:30	74%	42%		100%	74%		TAN, BROWN AND BLACK, MODERATELY SEVERE TO MODERATELY WEATHERED, SOFT TO MEDIUM HARD, VERY CLOSE TO MODERATELY CLOSELY FRACTURED, GRANITE	
				0:35								
				0:50								
160	158.7	44.3	5.0	0:45	(2.5)	(2.5)		(0.0)	N/A		WEATHERED ROCK	41.8
				0:34	50%	50%		0%	N/A		TAN, BROWN AND BLACK, GRANITE	
				0:20								
				0:20								
				0:35								
155	153.7	49.3	5.0	0:45	(0.6)	(0.6)		(0.6)	(0.6)		CRYSTALLINE ROCK	44.3
				0:20	12%	12%		100%	100%		TAN, BROWN AND BLACK, MODERATELY WEATHERED, MODERATELY HARD, CLOSELY FRACTURED, GRANITE	44.9
				0:20								
				0:30								
				0:20								
150	148.7	54.3	5.0	0:30	(0.5)	(0.5)		(0.0)	N/A		WEATHERED ROCK	53.8
				0:25	10%	10%		0%	N/A		TAN, BROWN AND BLACK, GRANITE	
				0:30								
				0:40								
145	143.7	59.3	5.0	0:45	(5.0)	(3.4)	RS-3	(5.5)	(3.9)		CRYSTALLINE ROCK	59.3
				0:30	100%	68%	RS-4	100%	71%		TAN, BROWN AND BLACK, MODERATELY SEVERE TO MODERATELY WEATHERED, MODERATE TO MEDIUM HARD, CLOSELY TO MODERATELY CLOSELY FRACTURED, GRANITE	
				0:45								
				0:50								
140												
135												
130												
125												
120												
115												
110												
105												
100												
95												

NCDOT BORE DOUBLE B4661_GEO_BH_BRDG151.GPJ NC_DOT.GDT 08/20/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33823.1.1	ID. B-4661	COUNTY WAKE	GEOLOGIST Bruinsma, C. M.
SITE DESCRIPTION BRIDGE NO. 151 ON -L- (SR 2227/WATKINS ROAD) OVER POWELL CREEK			GROUND WTR (ft)
BORING NO. EB2-A	STATION 25+15	OFFSET 8ft LT	ALIGNMENT L
COLLAR ELEV. 213.7 ft	TOTAL DEPTH 33.3 ft	NORTHING 773,033	EASTING 2,148,029
DRILL MACHINE CME-550	DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
START DATE 07/28/09	COMP. DATE 07/29/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
215														GROUND SURFACE	0.0
														0.7' BITUMINOUS CONCRETE	1.0
														0.3' ABC	
210	210.9	2.8	4	3	2									ROADWAY EMBANKMENT	
														BROWN, SLIGHTLY CLAYEY SILTY SAND	
205	205.9	7.8	1	2	3									ALLUVIAL	7.0
														GRAY, SLIGHTLY SILTY CLAYEY SAND	
200	200.9	12.8	1	1	1									DARK GRAY, SANDY CLAYEY SILT WITH	11.0
														TRACE ORGANICS	
195	195.9	17.8	2	4	3									TAN, FINE TO COARSE SAND	16.0
190	190.9	22.8	27	73/0.4										WEATHERED ROCK	22.0
														WHITE GRAY AND BLACK, GRANITE	
185	185.8	27.9	50	50/0.2											
180	180.8	32.9	100/0.4											Boring Terminated at Elevation 180.4 ft IN	33.3
														WEATHERED ROCK (GRANITE)	

PROJECT NO. 33823.1.1	ID. B-4661	COUNTY WAKE	GEOLOGIST Bruinsma, C. M.
SITE DESCRIPTION BRIDGE NO. 151 ON -L- (SR 2227/WATKINS ROAD) OVER POWELL CREEK			GROUND WTR (ft)
BORING NO. EB2-B	STATION 25+15	OFFSET 8ft RT	ALIGNMENT L
COLLAR ELEV. 213.6 ft	TOTAL DEPTH 27.0 ft	NORTHING 773,039	EASTING 2,148,044
DRILL MACHINE CME-550	DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
START DATE 07/27/09	COMP. DATE 07/27/09	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 26.9 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
215														GROUND SURFACE	0.0
														0.7' BITUMINOUS CONCRETE	1.0
														0.4' ABC	
210	210.9	2.7	4	2	3									ROADWAY EMBANKMENT	
														TAN AND BROWN, SLIGHTLY CLAYEY	
205	205.9	7.7	1	3	2									SILTY SAND WITH GRAVEL LAYER FROM	7.0
														4.0' TO 4.5'	
200	200.9	12.7	1	2	5									ALLUVIAL	11.0
														GRAY, SILTY SAND	
195	195.9	17.7	1	4	4									BLUE-GRAY, SILTY SANDY CLAY WITH	15.0
														TRACE ORGANICS	
190	190.9	22.7	15	41	59/0.4									GRAY, SILTY SAND	22.5
185	186.7	26.9	60/0.1											WEATHERED ROCK	26.9
														TAN, BROWN AND BLACK, GRANITE	27.0
180														CRYSTALLINE ROCK	
														TAN AND BLACK, GRANITE	
														Boring Terminated WITH STANDARD	
														PENETRATION TEST REFUSAL at	
														Elevation 186.6 ft IN	

NCDOT BORE DOUBLE B4661_GEO_BH_BRDG151.GPJ_NC_DOT.GDT_08/24/09

EB1-A

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-6	9 LT	23+85	8.2-9.7	A-1-b(0)	20	NP	63.6	18.9	9.4	8.1	89	43	18	-	-
SS-7	9 LT	23+85	13.2-14.7	A-4(0)	24	3	40.1	23.6	20.2	16.1	89	62	41	-	-

EB1-B

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-5	11 RT	23+08	7.9-9.4	A-1-b(0)	21	NP	70.5	21.8	3.7	4.0	91	42	9	-	-

B1-A

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-11	7 LT	24+30	4.5-6.0	A-1-b(0)	29	NP	72.6	18.2	4.1	5.0	85	39	9	-	-
SS-12	7 LT	24+30	9.5-10.5	A-6(7)	33	14	11.9	29.2	26.7	32.2	100	94	65	-	-
SS-13	7 LT	24+30	14.5-16.0	A-2-4(0)	34	6	48.5	22.8	16.6	12.1	93	57	30	-	-

B2-A

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-14	7 LT	24+80	13.7-15.2	A-1-b(0)	32	NP	58.0	26.3	11.7	4.0	86	49	17	-	-

B2-B

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-15	9 RT	24+80	1.7-3.2	A-1-b(0)	22	NP	66.6	15.3	9.1	9.1	88	37	18	-	-

EB2-A

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-8	8 LT	25+15	7.8-9.3	A-1-b(0)	24	2	59.6	18.9	7.4	14.1	92	48	23	-	-
SS-9	8 LT	25+15	12.8-14.3	A-4(2)	27	7	19.9	21.1	28.7	30.2	99	85	63	-	-
SS-10	8 LT	25+15	17.8-19.3	A-1-b(0)	29	NP	84.8	12.9	0.3	2.0	98	37	3	-	-

EB2-B

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-1	8 RT	25+15	2.7-4.2	A-1-b(0)	31	6	60.8	20.2	8.9	10.1	94	47	21	-	-
SS-2	8 RT	25+15	7.7-9.2	A-2-4(0)	26	NP	48.9	20.4	14.5	16.2	87	54	30	-	-
SS-3	8 RT	25+15	12.7-14.2	A-6(6)	27	12	13.3	23.4	26.9	36.4	100	90	70	-	-
SS-4	8 RT	25+15	17.7-19.2	A-2-4(0)	23	NP	59.6	31.0	3.3	6.0	98	59	11	-	-

B1-A

ROCK TEST RESULTS									
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AREA (in ²)	UNIT WEIGHT (lbs/ft ³)	H/D RATIO	ULTIMATE LOAD (ksi)	ULTIMATE LOAD (lbf)	SEC MOD @ 40% (Mpsi)
RS-1	7 LT	24+30	27.0-27.7	2.7172	161.2	2.27	6.18	16800	0.81
RS-2	7 LT	24+30	30.2-30.9	2.7172	164.5	2.27	11.89	32300	2.78

B2-B

ROCK TEST RESULTS									
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AREA (in ²)	UNIT WEIGHT (lbs/ft ³)	H/D RATIO	ULTIMATE LOAD (ksi)	ULTIMATE LOAD (lbf)	SEC MOD @ 40% (Mpsi)
RS-3	9 RT	24+80	54.9-55.6	2.7172	154.4	2.19	2.01	5450	0.09
RS-4	9 RT	24+80	56.0-56.7	2.7172	155.1	2.18	1.87	5090	0.11



**FIELD
 SCOUR REPORT**

WBS: 33823.1.1 TIP: B-4661 COUNTY: WAKE

DESCRIPTION(1): Bridge No. 151 on SR 2227 (Watkins Road) over Powell Creek

EXISTING BRIDGE

Information from: Field Inspection Microfilm _____ (reel _____ pos: _____)
 Other (explain) Hydraulics Report

Bridge No.: 151 Length: 69 Total Bents: 5 Bents in Channel: 5 Bents in Floodplain: 0
 Foundation Type: Driven wooden piles

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: None evident.

Interior Bents: None evident.

Channel Bed: None evident.

Channel Bank: None evident.

EXISTING SCOUR PROTECTION

Type(3): None evident.

Extent(4): None evident.

Effectiveness(5): None evident.

Obstructions(6): None observed at the time of investigation.

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): Surficial muck over fine to coarse sands

Channel Bank Material(8): Silty sand, silt, clay, and some fine to coarse sands.

Channel Bank Cover(9): Lake with moderate to older tree growth and shrubbery on shoreline.

Floodplain Width(10): ~600 feet (lake + floodplain)

Floodplain Cover(11): Moderate to large trees, shrubs and grasses.

Stream is(12): Aggrading _____ Degrading _____ Static

Channel Migration Tendency(13): None Evident.

Observations and Other Comments: Recreational lake. Dam is approximately 1000' downstream of bridge.

DESIGN SCOUR ELEVATIONS(14)

Feet x Meters _____

BENTS

B1	B2									
193.2	192.6									

Comparison of DSE to Hydraulics Unit theoretical scour:
 The Geotechnical Engineering Unit agrees with the Hydraulic Unit's theoretical scour elevations as noted above.

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-3, SS-7, SS-8, SS-9 (bank)
 SS-11, SS-12 (channel)

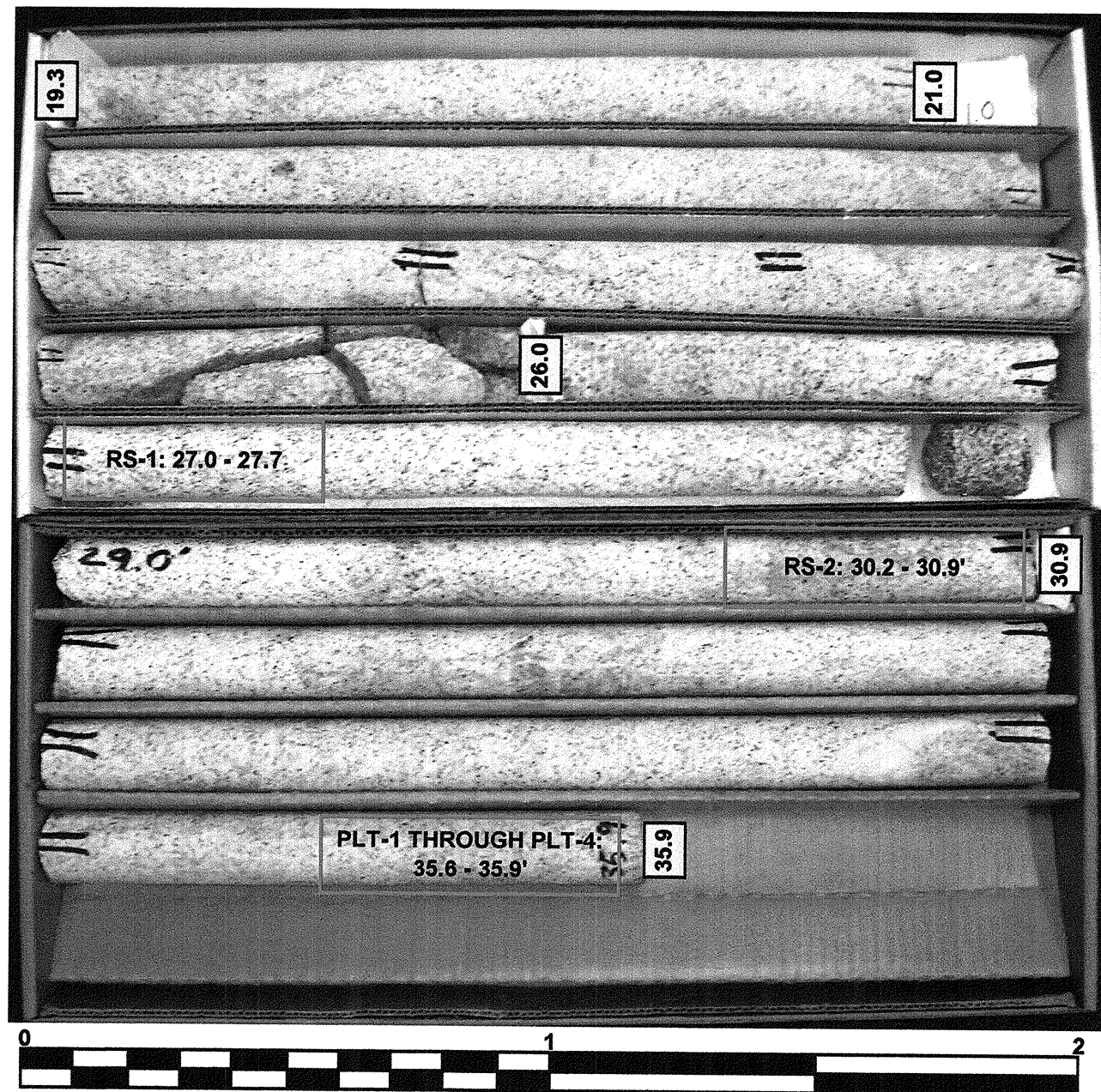
Reported by: Christina M. Bruinsma, L.G.

Date: 8/5/2009

CORE PHOTOGRAPHS

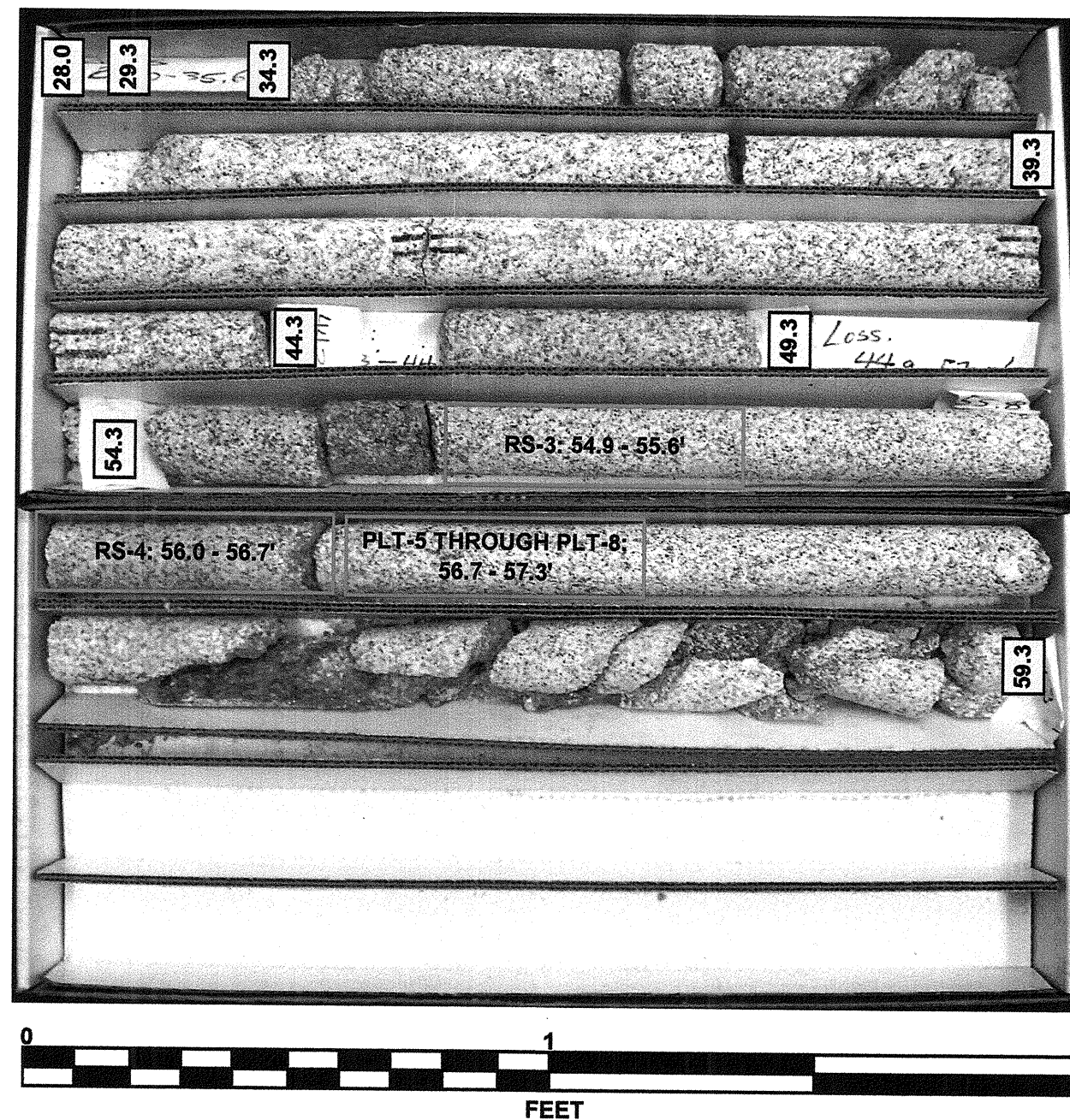
B1-A

BOXES 1 & 2: 19.3 - 35.9 FEET



B2-B

BOX 1 & 2: 28.0 - 59.3 FEET



SITE PHOTO

BRIDGE NO. 151 ON -L- (SR 2227, WATKINS ROAD) OVER POWELL CREEK, AT APPROXIMATE -L- STATION 26+50, 140' LT OF -L-



LOOKING SOUTHEAST