

PROJECT: 33037.1.1 ID: B-3406

# STATE OF NORTH CAROLINA

## DEPARTMENT OF TRANSPORTATION

### DIVISION OF HIGHWAYS

### GEOTECHNICAL ENGINEERING UNIT

# STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 33037.1.1 I.D. NO. B-3406  
 F.A. PROJECT BRZ-1321(1)  
 COUNTY AVERY  
 PROJECT DESCRIPTION BRIDGE No. 28  
OVER CURTIS CREEK ON SR 1321(CURTIS CREEK RD.)

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-3406	1	44
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
33037.1.1	BRZ-1321(1)	P.E. CONST.	

### CAUTION NOTICE

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

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

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

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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.



Avery E. Riggs, Jr.  
SIGNATURE

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

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B-3406	33037.1.1	2	44

**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 WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: <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. THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.		HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS: WEATHERED ROCK (WR) - NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT. CRYSTALLINE ROCK (CR) - FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. NON-CRYSTALLINE ROCK (NCR) - FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD 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 LESTERITE, SANDSTONE, CEMENTED SHELL BEDS, ETC.		ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR SOIL MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL. FLOOD PLAIN (F.P.) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR B.P.F.) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS LESS THAN 0.1 FOOT PENETRATION WITH 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (S.R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.			
<b>SOIL LEGEND AND AASHTO CLASSIFICATION</b>		<b>MINERALOGICAL COMPOSITION</b>		<b>WEATHERING</b>		<b>WEATHERING</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.		FRESH - ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. VERY SLIGHT (V. SLI.) - ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE. SLIGHT (SLI.) - ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. MODERATE (MOD.) - SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK. MODERATELY SEVERE (MOD. SEV.) - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i> SEVERE (SEV.) - ALL ROCKS EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT, SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, YIELDS SPT N VALUES &gt; 100 BPF</i> 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> 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.		SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 30 MODERATELY COMPRESSIBLE LIQUID LIMIT 31-50 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50		FRESH - ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. VERY SLIGHT (V. SLI.) - ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE. SLIGHT (SLI.) - ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. MODERATE (MOD.) - SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK. MODERATELY SEVERE (MOD. SEV.) - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i> SEVERE (SEV.) - ALL ROCKS EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT, SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, YIELDS SPT N VALUES &gt; 100 BPF</i> 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> 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.	
GROUP CLASS. A-1, A-1-b, A-3, A-2, A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, A-7-5, A-7-6, A-3, A-4, A-5, A-6, A-7		<b>PERCENTAGE OF MATERIAL</b>		<b>GROUND WATER</b>		<b>ROCK HARDNESS</b>			
SYMBOL		ORGANIC MATERIAL GRANULAR SOILS SILT-CLAY SOILS OTHER MATERIAL		WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING. STATIC WATER LEVEL AFTER 24 HOURS. PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA HOLE CAVE SPRING OR SEEPAGE		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 PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. SOFT - CAN BE GROOVED 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.			
% PASSING # 10, # 40, # 200		TRACE OF ORGANIC MATTER 2 - 3% LITTLE ORGANIC MATTER 3 - 5% MODERATELY ORGANIC 5 - 10% HIGHLY ORGANIC >10%		SOUNDING ROD WATER LOSS		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 PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. SOFT - CAN BE GROOVED 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.			
LIQUID LIMIT PLASTIC INDEX GROUP INDEX		<b>GROUND WATER</b>		<b>ROCK HARDNESS</b>		<b>INDURATION</b>			
USUAL TYPES OF MAJOR MATERIALS		WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING. STATIC WATER LEVEL AFTER 24 HOURS. PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA HOLE CAVE SPRING OR SEEPAGE		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.		BENCH MARK: NCOOT Traverse Station Rebar & Cap Stamped "BL10" Located at Station 10+54.02 -BL- ELEVATION: 3036.30' BENCH MARK: #2 PK Nail in Concrete Walk Leading to Foot Bridge over Elk River -L- Station 13+88.4, 70.46 Ft LT ELEVATION: 3038.08'			
GEN. RATING AS A SUBGRADE		<b>MISCELLANEOUS SYMBOLS</b>		<b>INDURATION</b>		<b>INDURATION</b>			
EXCELLENT TO GOOD FAIR TO POOR FAIR TO POOR POOR UNSUITABLE		ROADWAY EMBANKMENT WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS INFERRED SOIL BOUNDARIES INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY DIP/DIP DIRECTION OF ROCK STRUCTURES		SPT TEST BORING CPT TEST BORING AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION SLOPE INDICATOR INSTALLATION SPT N-VALUE SPT TEST SAMPLE		FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.			
<b>CONSISTENCY OR DENSENESS</b>		<b>ABBREVIATIONS</b>		<b>INDURATION</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 FRACS. - FRAGMENTS MED. - MEDIUM PMT - PRESSUREMETER TEST SD. - SAND, SANDY SL. - SILT, SILTY SLI. - SLIGHTLY TCR - TRICONE REFUSAL γ - UNIT WEIGHT γ <sub>d</sub> - DRY UNIT WEIGHT W - MOISTURE CONTENT V - VERY VST - VANE SHEAR TEST		SOUNDING ROD WATER LOSS		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.			
VERY LOOSE 4 TO 10 LOOSE 10 TO 30 MEDIUM DENSE 30 TO 50 DENSE 50 TO 100 VERY DENSE >100		N/A		SOUNDING ROD WATER LOSS		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.			
VERY SOFT 2 TO 4 SOFT 4 TO 8 MEDIUM STIFF 8 TO 15 STIFF 15 TO 30 VERY STIFF 30 TO 50 HARD >50		0.25 TO 0.5 0.5 TO 1 1 TO 2 2 TO 4 >4		SOUNDING ROD WATER LOSS		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>EQUIPMENT USED ON SUBJECT PROJECT</b>		<b>INDURATION</b>		<b>INDURATION</b>			
U.S. STD. SIEVE SIZE OPENING (MM) 4, 10, 40, 60, 200, 270 4.76, 2.0, 0.42, 0.25, 0.075, 0.053		DRILL UNITS: MOBILE B-57, BK-51, CME-45C, CME-750, PORTABLE HOIST, OTHER DIEDRICH D-50, OTHER		ADVANCING TOOLS: DRAG 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, OTHER 2-1/4" H.S.A.		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.			
BOULDER (BLDR.) COBBLE (COB.) GRAVEL (GR.) COARSE SAND (CSE, SD.) FINE SAND (F, SD.) SILT (SL.) CLAY (CL.)		DRILL UNITS: MOBILE B-57, BK-51, CME-45C, CME-750, PORTABLE HOIST, OTHER DIEDRICH D-50, OTHER		ADVANCING TOOLS: DRAG 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, OTHER 2-1/4" H.S.A.		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.			
GRAIN SIZE MM 305, 12", 75, 3", 2.0, 0.25, 0.05, 0.005		DRILL UNITS: MOBILE B-57, BK-51, CME-45C, CME-750, PORTABLE HOIST, OTHER DIEDRICH D-50, OTHER		ADVANCING TOOLS: DRAG 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, OTHER 2-1/4" H.S.A.		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>SOIL MOISTURE - CORRELATION OF TERMS</b>		<b>EQUIPMENT USED ON SUBJECT PROJECT</b>		<b>INDURATION</b>		<b>INDURATION</b>			
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION		DRILL UNITS: MOBILE B-57, BK-51, CME-45C, CME-750, PORTABLE HOIST, OTHER DIEDRICH D-50, OTHER		ADVANCING TOOLS: DRAG 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, OTHER 2-1/4" H.S.A.		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.			
LL - LIQUID LIMIT (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE PL - PLASTIC LIMIT OM - OPTIMUM MOISTURE SL - SHRINKAGE LIMIT - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE		DRILL UNITS: MOBILE B-57, BK-51, CME-45C, CME-750, PORTABLE HOIST, OTHER DIEDRICH D-50, OTHER		ADVANCING TOOLS: DRAG 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, OTHER 2-1/4" H.S.A.		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>PLASTICITY</b>		<b>EQUIPMENT USED ON SUBJECT PROJECT</b>		<b>INDURATION</b>		<b>INDURATION</b>			
NONPLASTIC 0-5 VERY LOW LOW PLASTICITY 6-15 SLIGHT MED. PLASTICITY 16-25 MEDIUM HIGH PLASTICITY 26 OR MORE HIGH		DRILL UNITS: MOBILE B-57, BK-51, CME-45C, CME-750, PORTABLE HOIST, OTHER DIEDRICH D-50, OTHER		ADVANCING TOOLS: DRAG 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, OTHER 2-1/4" H.S.A.		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>COLOR</b>		<b>EQUIPMENT USED ON SUBJECT PROJECT</b>		<b>INDURATION</b>		<b>INDURATION</b>			
DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YEL-BRN, BLUE-GRAY) MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.		DRILL UNITS: MOBILE B-57, BK-51, CME-45C, CME-750, PORTABLE HOIST, OTHER DIEDRICH D-50, OTHER		ADVANCING TOOLS: DRAG 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, OTHER 2-1/4" H.S.A.		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.			

STATE PROJECT NO.: 33037.1.1  
 I.D. NO.: B-3406  
 FEDERAL PROJECT NO.: BRZ-1321(1)  
 COUNTY: Avery

DESCRIPTION: Bridge 28 over Curtis Creek on SR 1321 (Curtis Creek Rd.)

SUBJECT: Structure Subsurface Investigation – Inventory Report

### Project Description

The project site is located on Curtis Creek Road (SR 1321) just east of its intersection with NC 194 in Avery County, North Carolina (See Site Vicinity Map, Sheet 6). The proposed project consists of a replacement bridge structure and a detour bridge structure. The detour structure will be constructed approximately 40 feet south of the existing bridge. Based on the Preliminary General Drawings, the center of the proposed bridge will be at Station 13+44.00 along the -L- survey line. The new bridge structure will have a clear roadway width of 27.5 feet. The new bridge structure will be approximately 40 feet long with the bents constructed on a skew angle of 75° to the -L- survey line. The new bridge structure will be a single span bridge.

The existing Bridge No. 28 structure is approximately 30.5 feet long with a bridge deck width of approximately 18 feet (outside to outside). The existing bridge is situated within the flood plain of Curtis Creek and the Elk River along a two lane paved road SR 1321 (Curtis Creek Road). The bridge consists of a timber deck overlain with asphalt on steel girders supported on timber abutments on shallow foundations. SR 1321 (Curtis Creek Road) runs approximately east and west and has roadway embankment shoulders. The flood plain for the Elk River/ Curtis Creek extends approximately 150 feet on the west and 50 feet on the east side of the creek and is covered with mostly of residential areas, a church and church asphalt parking area and some large to small trees and undergrowth. A buried private water line and electric line runs along the western creek bank. Overhead power lines and communication lines cross the creek on the immediately south of the existing bridge.

Based upon the Preliminary General Drawings provided by NCDOT, the finished grade elevations for the new bridge structure will be approximately elevation 3035 feet at the west approach and approximately elevation 3036 feet at the east approach. Based on the Preliminary General Drawing, the proposed structure will be along the same vertical and horizontal alignment as the existing bridge. Earthwork is anticipated at the approaches and the new shoulders will be benched into the existing embankment. Fill depths on the order of 2 to 3 feet are anticipated, above the flood plain, along the shoulders at the east and west approaches. In addition, the existing fill slopes will be cut back and reworked at the end bents to a slope of 1.5:1 (horizontal to vertical) and Class II Rip-Rap erosion protection will be placed.

A geotechnical investigation was conducted between April 24 and April 28, 2006. All borings for both structures were performed on the roadway embankment shoulders or in the flood plain of Curtis Creek. All borings were performed with a Diedrich D-50 mounted on a track carrier. Representative soil samples were collected for visual classification in the field and for laboratory classification analysis by the NCDOT accredited S&ME soil testing laboratory.

Due to the project having a letting date of February 20, 2007 and the fish moratorium preventing drilling activities until April 15, 2006, a geophysical survey was requested in order to provide preliminary rock elevations for foundation design.

Limited geophysical testing was performed to provide an approximation of top of parent bedrock (hard crystalline rock or auger refusal material). Testing performed included seismic refraction, ground penetrating radar (GPR), multi-node resistivity, and 2-D multi-channel analysis of surface waves (MASW). Testing was performed to the right of the proposed alignment along two lines (as shown on the attached Test Location Plan) that parallel Curtis Creek. Due to site conditions, only the GPR could be performed across the proposed end bents (EB1 and EB2).

### Physiography and Geology

The proposed project site is located in the western portion of the Blue Ridge Physiographic Province of North Carolina as part of the Appalachian Mountain system. The Blue Ridge Province is characterized by high mountain ridges with broad and rounded summits, with steep slopes, dissected by alluvial valleys and swiftly flowing streams. The Blue Ridge belt consists of a series of thrust sheets stacked one on another. Locally, the thrust faults bounding sheets can be mapped at the surface. The oldest rocks of the Blue Ridge belt are Middle Proterozoic-age, massive to layered, biotite granitic to granodioritic gneisses (Horton and Zullo, 1991). Intrusive into these basement complex gneisses are younger, more massive granites. Based on previous mapping and our knowledge of the local geology, the parent rock is interpreted to be biotite granitic gneiss (NC Geologic Map). This unit is competent and relatively resistant to weathering.

### Foundation Materials – Bridge No. 28

The borings were advanced to depths ranging from 15.4 to 35.2 feet (elevations 3021.2 to 3000.7 feet) at collar elevations ranging from 3036.6 to 3033.6 feet.

Artificial fill material was encountered in boring EB2-A to a depth of about 3 feet (elevation 3032.9 feet) below the collar elevation. The artificial fill consists of medium stiff brown and tan fine to coarse sandy silt (A-4). The SPT N-value in the artificial fill was 7 blows per foot (bpf).

Alluvial deposits were encountered from the ground surface at borings EB1-A, EB1-B and EB2-B to depths of about 3.5 to 4.8 feet (elevations 3033.1 to 3028.8 feet) beneath the collar elevation. The alluvium consists of soft brown fine to coarse sandy silt (A-4) with some approximately 1.5 feet diameter boulders and stiff light brown fine to coarse sandy silty clay (A-6). SPT N-values in the alluvium ranged from 2 bpf to 100 blows per 0.8 feet of penetration. The higher blow counts are inflated due to boulders and are not representative of the consistency of the soils.

Alluvial/colluvial deposits were encountered beneath the alluvium and artificial fill materials in all borings to depths ranging from about 9.1 to 11.3 feet (elevations 3027.0 to 3022.3 feet) beneath collar elevations. The alluvial/colluvial deposits encountered consist of medium dense brown to gray and white cobbles to boulders (0.5 to 1.5 feet in diameter) with silty fine to coarse sands (A-1-a). The creek channel typically consists of cobbles and boulders. The standard penetration test (SPT) N-values for the alluvial/colluvial deposits range from 26 blows per foot to 60 blows with no penetration. The blow counts are inflated due to cobbles and boulders.

Beneath the alluvium/colluvium in borings EB1-A, EB1-B, EB2-A, and EB2-B, crystalline rock (granitic gneiss) was encountered and extended to the termination of borings. The top of crystalline rock was encountered at depths of 9.1 to 11.3 feet (elevations 3027.0 to 3022.3 feet) beneath the collar elevations. A completely weathered rock seam was encountered within the crystalline rock in boring EB1-B between the depths of 16.0 to 17.2 feet (elevations 3018.0 to 3016.8 feet). A completely weathered to very severely weathered rock seam was also encountered in boring EB2-A between the depths of 23.3 to 25.2 feet (elevations 3012.6 to 3010.7 feet). The completely weathered to very severely weathered rock consists of brown-gray and white granitic gneiss.

The crystalline rock was evaluated utilizing rock coring techniques by advancing an NQ2 core barrel. Coring activities recovered 70 to 100 percent of the rock cored. Rock Quality Designation (RQD) values range from 8 to 50 percent. Borings EB1-A, EB1-B, EB2-A, and EB2-B were terminated in moderately hard to hard gray-brown and white granitic gneiss at elevations ranging from 3021.2 to 3000.7 feet.

### Foundation Materials – Detour Bridge

The borings were advanced to depths ranging from 10.4 to 16.0 feet (elevations 3024.0 to 3018.3 feet) at collar elevations ranging from 3037.2 to 3034.3 feet.

Alluvial deposits were encountered from the ground surface in all borings to depths ranging from about 3.5 to 4.0 feet (elevations 3033.2 to 3030.8 feet) beneath collar elevations. Typically, alluvial deposits encountered consist of loose to medium dense brown clayey silty fine to coarse sands (A-2-4) with trace of gravel and soft to medium stiff brown fine to coarse sandy silt (A-4). The standard penetration test (SPT) N-values for the alluvial deposits range from 3 to 13 blows per foot.

Alluvium/colluvium deposits were encountered beneath the upper alluvial deposits in all borings. The alluvium/colluvium consists of medium dense to dense brown, gray and white cobbles to boulders (0.5 to 1.5 feet in diameter) with brown silty fine to coarse sands (A-1-a). The SPT N-values for the alluvium/colluvium deposits range from 52 bpf to 60 blows with no penetration. The blow counts are inflated due to cobbles and boulders.

Beneath the alluvium/colluvium, residual soils were encountered in borings EB1-A and EB1-B at 8.6 to 9.5 feet (elevations 3025.8 to 3024.8 feet) consisting of hard dark gray fine sandy silt (A-4) and dense gray silty fine to coarse sand (A-2-4). The residuum transitions to hard rock in borings EB1-A and EB1-B. Weathered rock was encountered beneath the alluvium/colluvium in boring EB2-A consisting of gray granitic gneiss and extended to the top of hard rock (elevation 3026.4 feet). Hard rock was encountered directly beneath the alluvium/colluvium in boring EB2-B. No standard penetration test (SPT) N-values were performed in the residual soils or weathered rock materials.

The weathered rock and residual soils transition to crystalline rock (granitic gneiss and metasilstone) at depths of 9.5 to 10.7 feet (elevations 3027.7 to 3023.8 feet) beneath collar elevations. Coring activities recovered 94 to 98 percent of the rock cored. Rock Quality Designation (RQD) values range from 0 to 76 percent. Boring EB1-A encountered a dark gray metasilstone above a brown, gray and white granitic gneiss between the depths of 10.5 to 14.7 feet (elevations 3023.8 to 3019.6 feet) beneath the collar elevation. All borings were terminated in soft to hard brown, gray and white granitic gneiss at elevations ranging from 3024.0 to 3018.3 feet.

#### Notes to Designer

The Diedrich D-50 drill rig is equipped with a rope, cathead and Safety Hammer to perform Standard Penetration tests.

#### Groundwater

Static groundwater levels were measured at Bridge No. 28 within borings EB1-B, EB2-A, and EB2-B at depths ranging from about 0.5 to 5.0 feet (elevations 3033.6 to 3030.9 feet). Boring EB1-A caved dry after 24 hours after completion of drilling. Static groundwater levels were measured at the detour structure within borings EB2-A Detour and EB2-B Detour at depths ranging from about 1.0 to 2.5 feet (elevations 3036.2 to 3034.6 feet). Groundwater depths were not measured in the remaining borings. The creek elevation at the time of our field investigation was 3031.9 feet on May 1, 2006. The normal water surface elevation for Curtis Creek is 3029.0+/- feet.

#### Geophysical Survey

Seismic Refraction Survey: A 120-foot seismic refraction line was performed at both test locations. The refraction method consists of measuring travel times of generated compression waves (P-waves) across a linear array. The slope of arrival times along the array indicates the velocity of the compression wave through the material. Depths to higher velocity ( $v_p$ ) strata (i.e., rock) can be determined from the location of a slope change in the velocity plots.

The seismic refraction testing was conducted using a 16 channel GeoMetrics ES3000 seismograph. Each channel was connected to a 4.5 Hz geophone placed at 8-foot spacing along the array. Each geophone, which was placed in direct contact with the ground, recorded the arrival times of the generated waves. For this survey, the energy source consisted of a sledgehammer striking a metal plate. End-shots and mid-line shot records were collected for both test locations,

however only the end shots were used for the analysis on the EB2 side. Travel times were evaluated using the intercept-time method with the OYO Corporation's SeisImager software (*Pickwin v. 3.14 and Plotrefa v. 2.73*). The results of refraction survey are presented on the attached "Geophysical Cross Section Sheets." In addition, the surface of the refractor (interpreted as saturated alluvium/colluvium) has been included on the "Geophysical Cross Section Sheets."

Multi-Node Electrical Resistivity Survey: Electrical resistivity measurements were taken along the EB1-Side Array and EB2-Side Array. The resistivity measurements provide an indication of how the subsurface materials carry an electric charge. The resistivity survey was performed using a Sting/Swift automated resistivity measurement system and stainless steel stakes were used as the electrodes. Dipole-Dipole electrode arrays were automatically selected and moved around by the Sting/Swift system and the resistance between two particular electrodes were calculated.

For this particular resistivity survey, 28 electrodes were placed at regular intervals (5 feet on the EB1 side and 4 feet on the EB2 side) along each line. The resistivity analysis was conducted using the EarthImager 2D software from Advanced Geosciences, Inc. The results of the resistivity survey are presented on the attached "Geophysical Cross Section Sheets." Based on our experience, crystalline rock may have an apparent resistivity of 1,000  $\Omega$ -ft to in excess of 10,000  $\Omega$ -ft and groundwater has a comparative resistivity of less than 500  $\Omega$ -ft. Comparatively saline water can have a resistivity approaching 0  $\Omega$ -ft. The contour line with an apparent resistivity of approximately 1,500  $\Omega$ -ft is included on the attached "Geophysical Cross Section Sheets." This line is within the saturated alluvium/colluvium layer.

2-D MASW Survey: A 2-D MASW survey was also performed along both the EB1-Side Array and EB2-Side Array. MASW (Multi-channel analysis of surface waves) consists of recording different frequency surface waves generated from an active energy source (also a sledgehammer striking a metal plate) traveling across a linear array. Analysis of surface waves (R-waves) can be used to determine shear-wave velocities ( $v_s$ ) as surface waves are fundamentally similar in behavior to shear waves (S-waves) and surface waves propagate to depths that are proportional to their frequencies. The recorded surface waves are transformed from time domain into frequency domain, from which the phase characteristics of the surface waves can be calculated. A dispersion curve is developed allowing the phase velocity ( $C_f$ ) of particular frequency waves to be determined. Through a complex inversion process, a shear wave-velocity profile is developed.

The testing was also conducted using the 16-channel Geometrics ES3000 seismograph and the 4.5 Hz geophones. The geophones were spaced at 4-foot intervals for a total array length of 60 feet. After the surface waves were recorded from a particular active source, the entire array was moved 12 feet further along the array until data was obtained along the entire 120-foot line. Six separate "shot records" that were recorded for each line were transposed to the common mid point prior to developing the dispersion curves used for analysis. The analysis was conducted using the OYO Corporation's SeisImager software (*Pickwin v. 3.14, WaveEq, and GeoPlot v. 8.11*). The results of the 2-D MASW survey are presented on the attached "Geophysical Cross Section Sheets." Based on our experience, the upper few feet of hard crystalline rock (auger refusal material) typically has shear-wave velocities of 1,000 feet per second (fps) to 2,500 fps. The estimated top of bedrock line represents a shear-wave velocity of approximately 1,000 fps (1.0 kft/sec). The estimate top of bedrock line has also been included on the attached "Geophysical Cross Section Sheets."

Ground Penetrating Radar Survey: The area was evaluated using a Geophysical Survey Systems model SIR3000 data acquisition unit in conjunction with a 500 MHz and 300 MHz antenna. The system utilizes a radar wave impulse, broadcast into the substrate, and with assumptions made about the dielectric constant of the soil, determinations can be made about the depth of underlying rock and other geological features.

#### Discussion

Generally, all tests performed show approximately 3 feet or less of apparent soft soils that transition with depth to other materials (harder soils, colluvium/alluvium, rock, etc.) within about 2 to 16 feet of the ground surface. Based on the borings performed along the geophysical test line, it appears the 2-D MASW survey most accurately estimated the bedrock surface. Ground Penetrating Radar, Electrical Resistivity, and Seismic Refraction rely on significant changes in

subsurface materials (evidenced by reflections, apparent resistivity, and refractions). A subsurface transition from soft alluvial soils to bouldery alluvium/colluvium could result in reflections and/or significant changes in apparent resistivity. In addition, the reflections observed from the GPR survey and refractors from Seismic Refraction could have occurred at the water table. The 2-D MASW method does not rely on significant changes in material properties (i.e., reflections, etc.) nor is it affected by the water table.

The differences in the estimated rock surface between the methods appear to have been affected by the transitional alluvium/colluvium layer as well as by the water table. The following should be considered when evaluating the results of each test.

- For the refraction survey, the slope of the arrival time line for the mid-line shots on the EB2 side appeared unreasonably high, particularly when considering the end shots. As such, the mid-line shot records for the EB2 side were not included in the analysis.
- Our classification of the rock cores indicates the rock is moderately hard to soft and completely to very slightly weathered. We suspect the velocity change from the saturated alluvium/colluvium (below the water table) to soft rock was relatively minor. Therefore the significant refractor was observed at the soft alluvium to bouldery alluvium/colluvium boundary rather than at the rock boundary. Performing a shear-wave Seismic Refraction survey would eliminate the water table refractor.
- A change in apparent resistivity could have resulted from the water table.
- The resistivity profiles appear to be affected by some interference or discontinuity in the ground at the beginning of both profiles. This may be due to interference with the existing bridge, something buried in the ground, an irregularity of the surface resistivity approaching the road shoulder, or because the lines were closest to the creek at the end near the road. This interference is particularly noticeable on the EB1 side.
- In addition, the resistivity scale is also skewed due to a very high resistance value being produced by the inversion process. As such, the inverted profile on the EB1 side is likely not a realistic representation of subsurface conditions. There does, however, appear to be a zone of lower resistivity material overlying a higher resistivity material, moving along the profile away from the road.
- For the MASW analysis, the fundamental mode dispersion curve is selected prior to inversion. Higher mode dispersion curves are sometimes present, though easily distinguishable from the fundamental mode. In some cases, however, the fundamental mode can be hard to distinguish from higher modes, particularly if there is a significant velocity inversion from low to high and back to low velocity (i.e., thin cemented layers) or if there is a sudden, large increase in velocity (i.e., a few feet of alluvial soils overlying bedrock). The fundamental mode dispersion curve appeared to be affected by the higher modes for this survey.
- Because rock is relatively shallow at the site and the total array length was limited to 120 feet, additional shot records would be required to provide better definition in the subsurface conditions for the 2-D MASW survey.
- Reflections indicative of boulders and cobbles were observed in the ground penetration radar survey, particularly on the EB2 side, near the existing bridge and downstream of the Curtis Creek Bridge. In addition, observed reflections could also have been from the water table.

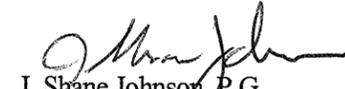
#### Qualification of Report

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The findings contained in this report were based on the applicable standards of our profession at the time this report was prepared. No other warranty, expressed or implied, is made.

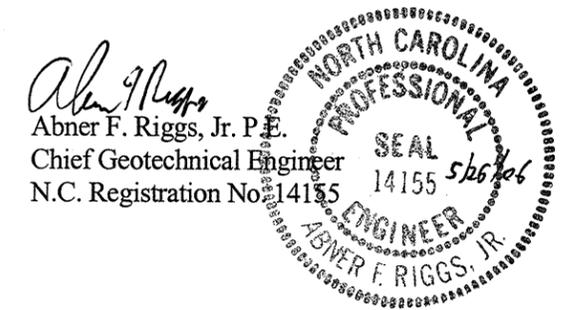
The findings submitted in this report are based, in part, upon the data obtained from the subsurface exploration. The nature and extent of subsurface variations between the borings may not become evident until construction. If variations appear evident, then the findings contained in this report may need to be re-evaluated. In the event that any changes in the nature, design, or location of the structure are planned, the findings contained in this report will not be considered valid unless the changes are reviewed by S&ME, and the findings of the report are modified or verified in writing.

S&ME appreciates the opportunity to be your geotechnical consultant on this project. If you have any questions or need additional information in regard to this report, please contact us.

Very truly yours,  
S&ME, Inc.

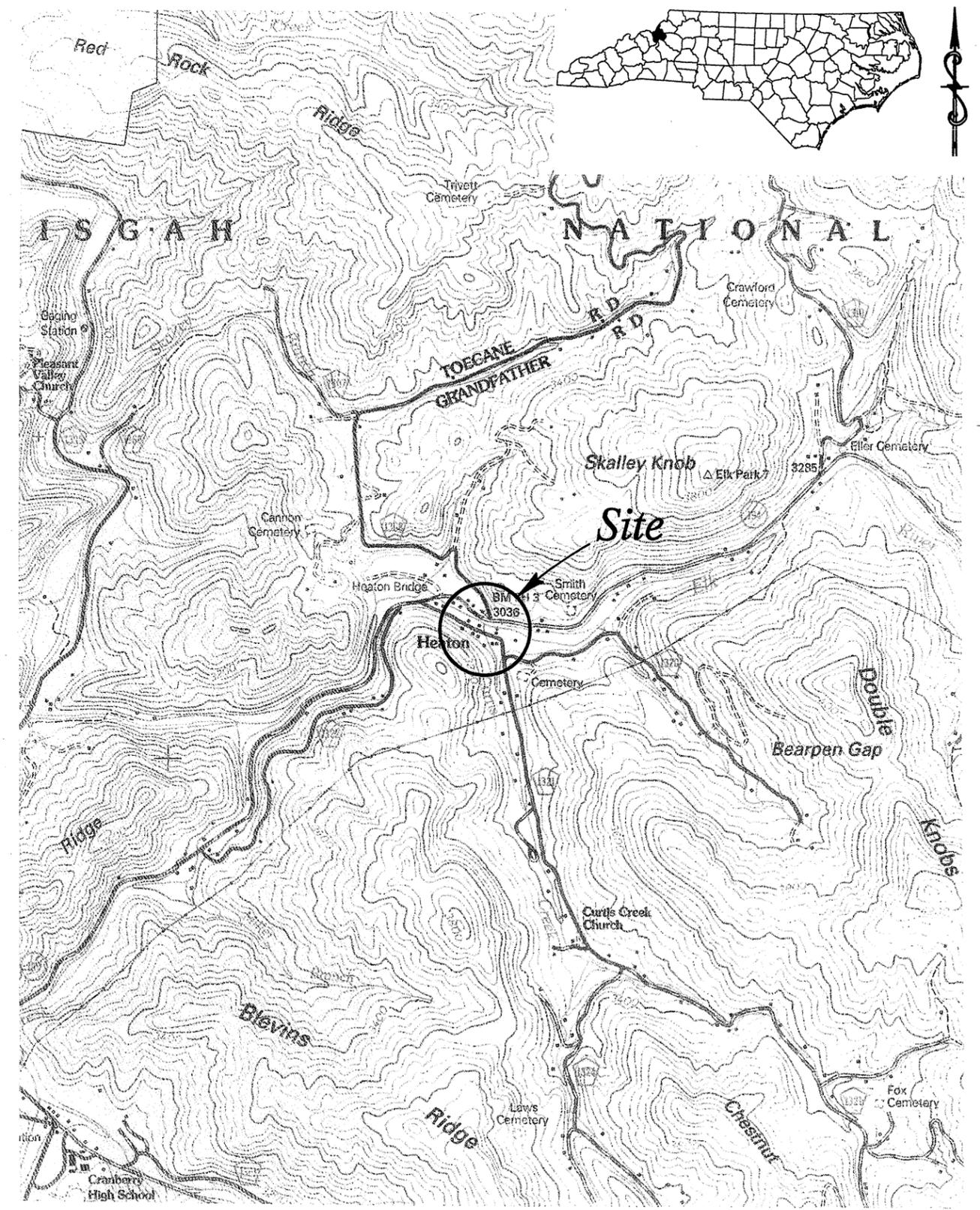
  
J. Shane Johnson, P.G.  
Project Geologist  
N.C. Registration No. 1753

Attachments



**PROJECT: 33037.1.1 ID: B-3406**

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
B-3406	33037.1.1	6	44



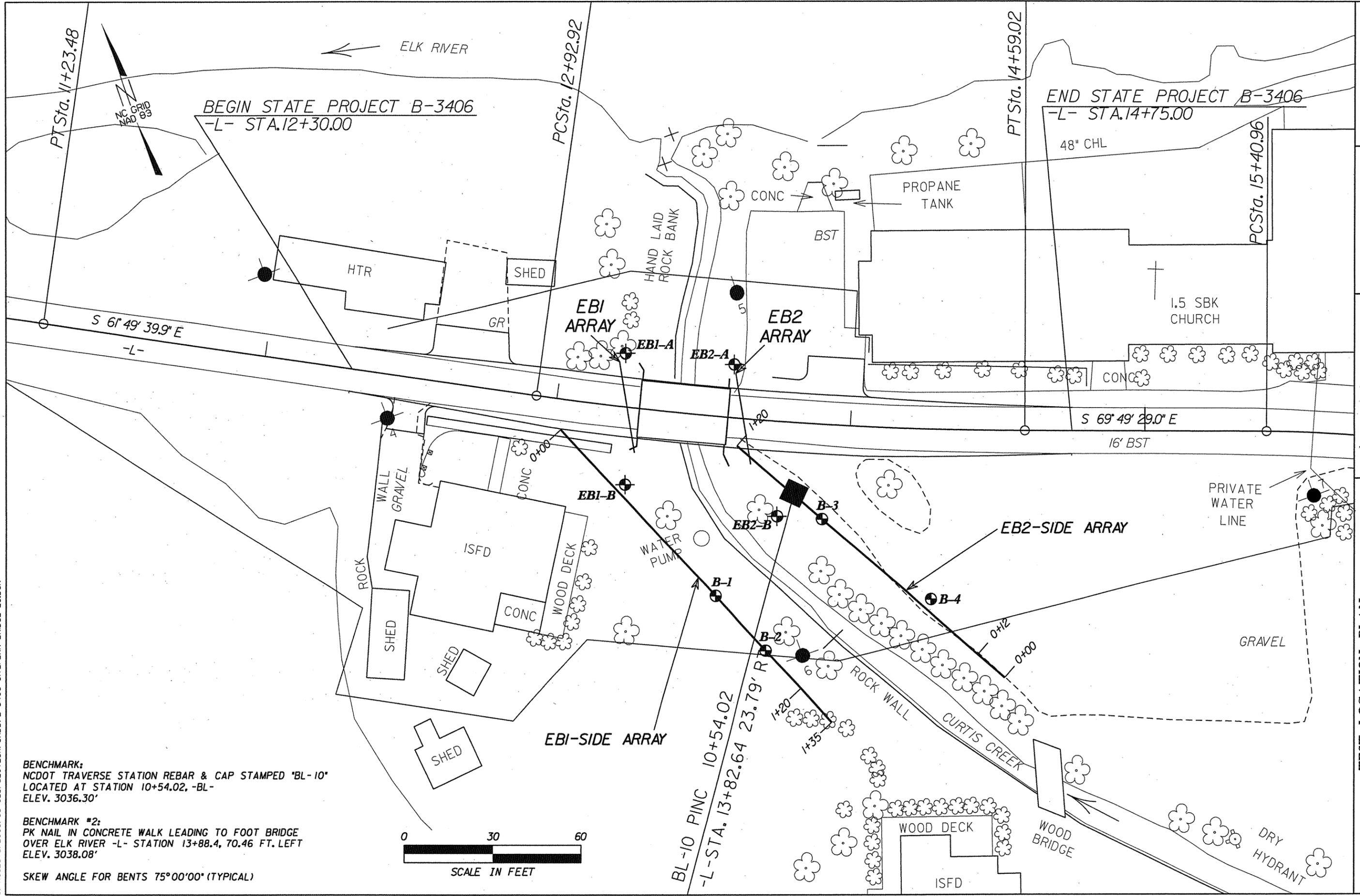
S:\PROJECTS\2006\06-023\GEOTECHNICAL\CADD\B-3406 SITEVIC 11X17

SCALE:	1:24,000
CHECKED BY:	AFR
DRAWN BY:	TRP
DATE:	MAY 2006
JOB NO.	1051-06-023



**SITE VICINITY MAP**  
 REPLACEMENT OF BRIDGE No. 28  
 OVER CURTIS CREEK ON SR 132 I  
 STATE PROJECT NO. 33037.1.1 TIP NO. B-3406  
 FEDERAL I.D. NO. BRZ-1321(I)  
 AVERY COUNTY, NORTH CAROLINA

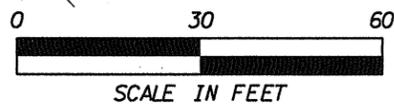
SPROJECTS/2006/06-023/GEOTECH/CADD/B-3406 SITEPLAN BRIDGE 28.DGN



**BENCHMARK:**  
 NCDOT TRAVERSE STATION REBAR & CAP STAMPED "BL-10"  
 LOCATED AT STATION 10+54.02, -BL-  
 ELEV. 3036.30'

**BENCHMARK #2:**  
 PK NAIL IN CONCRETE WALK LEADING TO FOOT BRIDGE  
 OVER ELK RIVER -L- STATION 13+88.4, 70.46 FT. LEFT  
 ELEV. 3038.08'

SKREW ANGLE FOR BENTS 75°00'00" (TYPICAL)

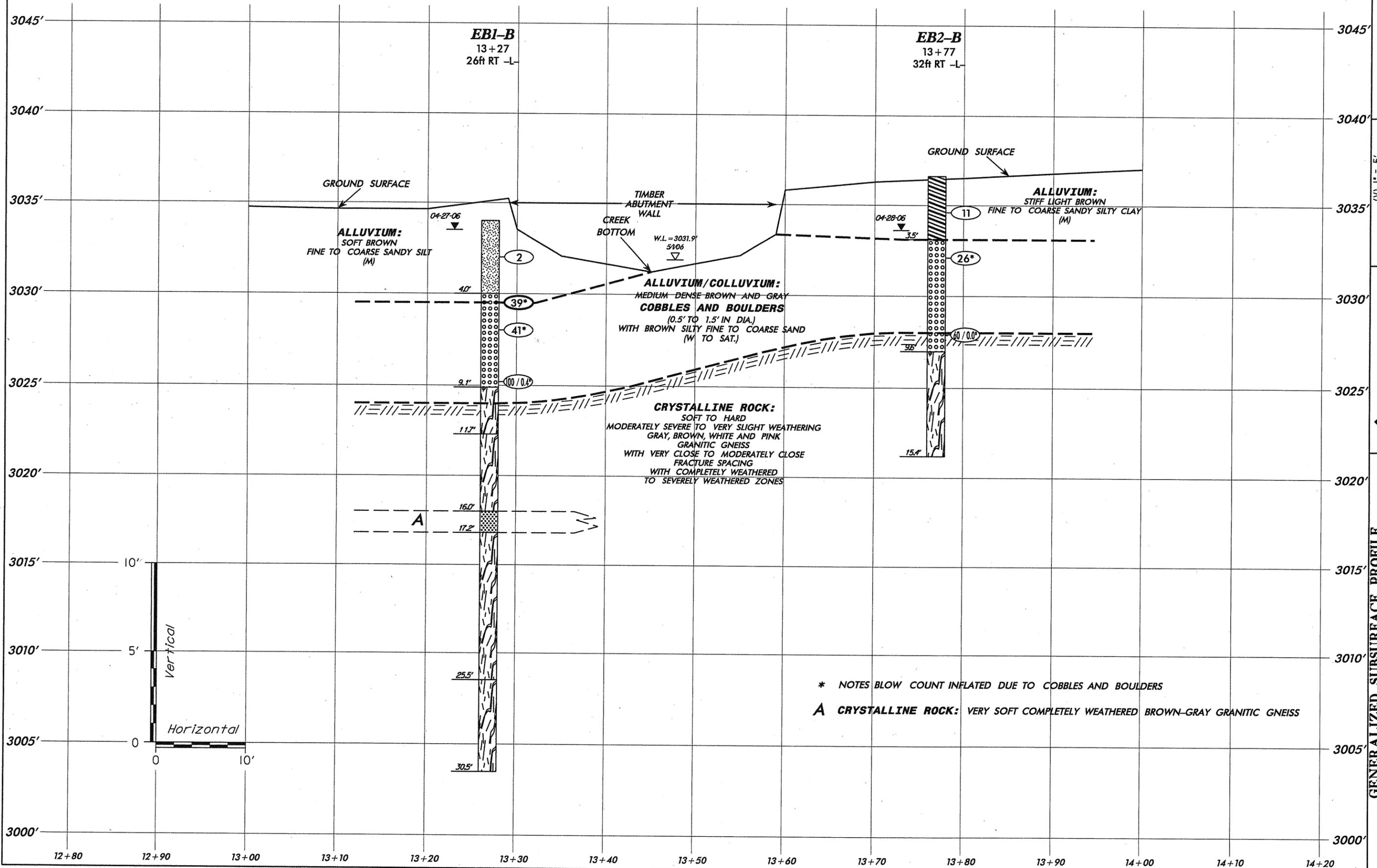


<b>TEST LOCATION PLAN</b> BRIDGE No. 28		APPROVED BY: AFR
REPLACEMENT OF BRIDGE No. 28 OVER CURTIS CREEK ON SR 1321		DRAWN BY: TRP
TIP No. B-3406 WBS No. 33037.1.1 FEDERAL I.D. BRZ-1321(I)		SHEET 7 OF 44
AVERY COUNTY, NORTH CAROLINA		JOB NO. 1051-06-023
ENVIRONMENTAL SERVICES ENGINEERING TESTING		DATE: MAY 2006
S&ME		SCALE: 1" = 30'

← TO NC 194

# GENERALIZED SUBSURFACE PROFILE, BRIDGE No. 28 - 10.0 FT. RIGHT OF -L-

TO SR 1320 →



\* NOTES BLOW COUNT INFLATED DUE TO COBBLES AND BOULDERS

**A** CRYSTALLINE ROCK: VERY SOFT COMPLETELY WEATHERED BROWN-GRAY GRANITIC GNEISS

S:\PROJECTS\2006\06-023\GEO\TECH\CADD\B-3406 PROFILE\_XSECTIONS.DGN

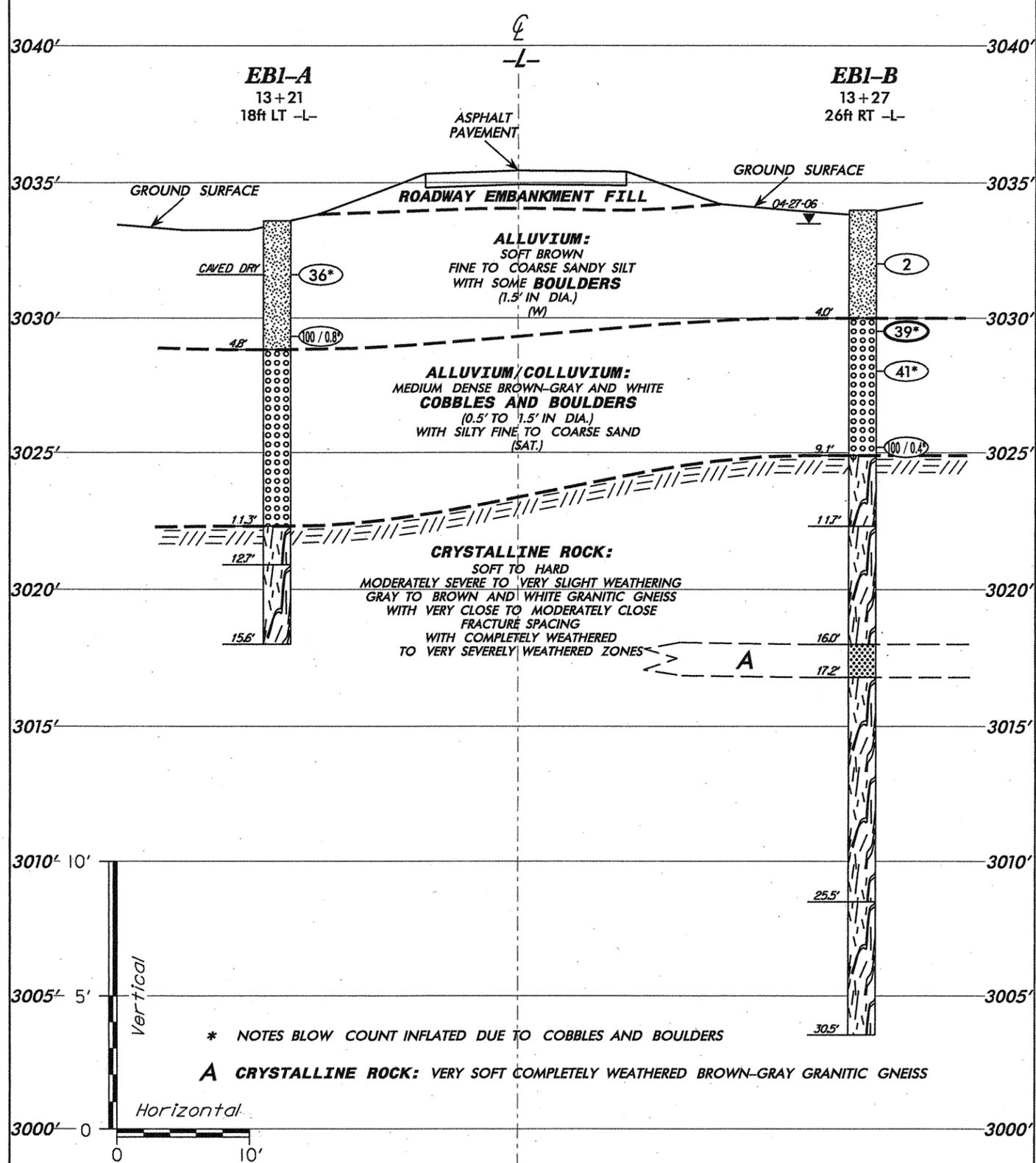
**S&ME**  
ENVIRONMENTAL SERVICES  
ENGINEERING - TESTING

APPROVED BY: AFR  
DRAWN BY: TRP  
DATE: MAY 2006  
JOB NO. 1051-06-023  
SHEET 8 OF 44

SCALE: (V) 1" = 5'  
(H) 1" = 10'

**GENERALIZED SUBSURFACE PROFILE**  
BRIDGE No. 28 - 10.0 FT. RIGHT OF -L-  
REPLACEMENT OF BRIDGE No. 28  
OVER CURTIS CREEK ON SR 1321  
TIP No. B-3406 STATE PROJECT No. 33037.1.1 FEDERAL I.D. BRZ-132 (1.1)  
AVERY COUNTY, NORTH CAROLINA

GENERALIZED SUBSURFACE CROSS SECTION THROUGH BRIDGE No.28 - END BENT No.1



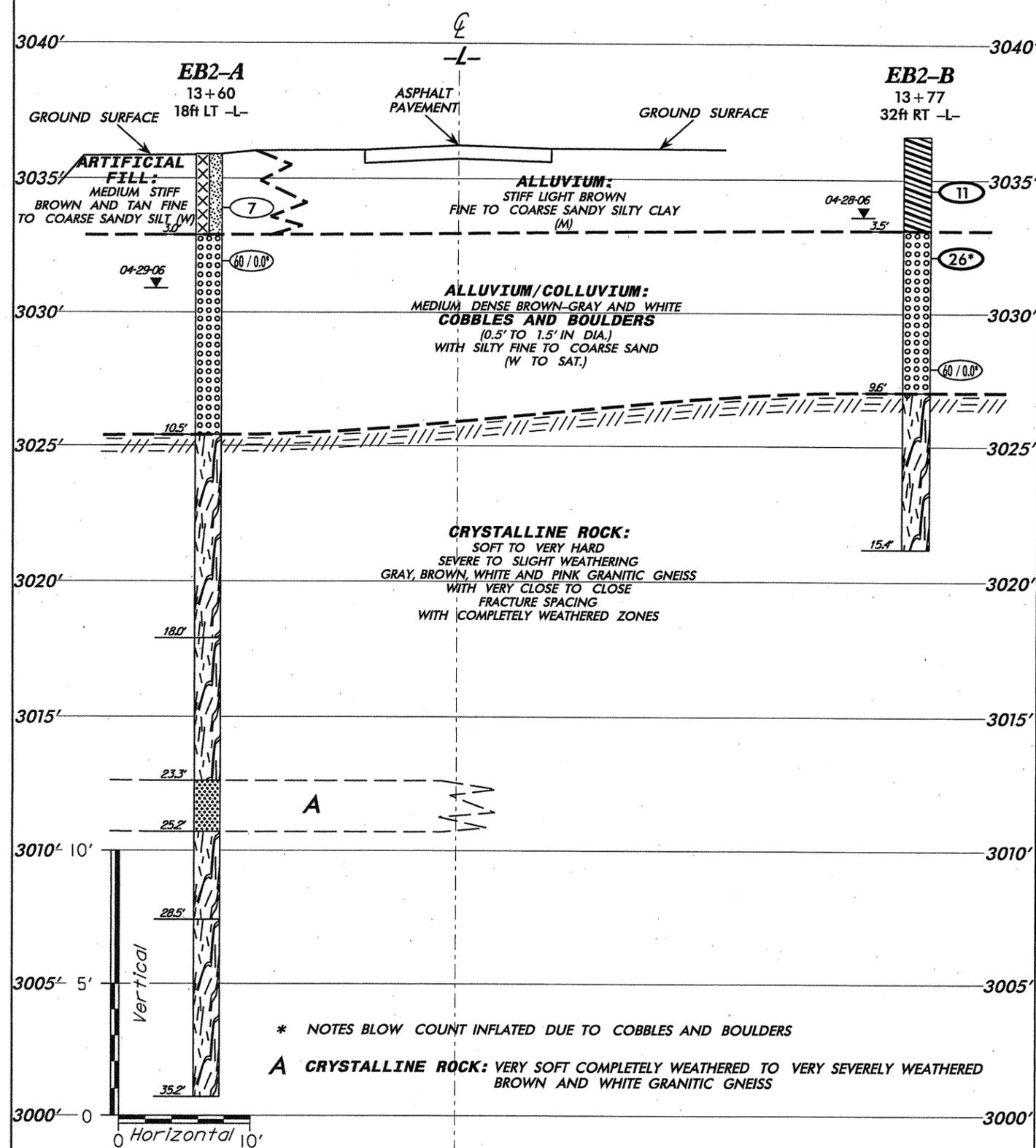
\* NOTES BLOW COUNT INFLATED DUE TO COBBLES AND BOULDERS  
**A** CRYSTALLINE ROCK: VERY SOFT COMPLETELY WEATHERED BROWN-GRAY GRANITIC GNEISS

SCALE: (V) 1"=5' (H) 1"= 10'  
 CHECKED BY: AFR  
 DRAWN BY: TRP  
 DATE: MAY 2006  
 JOB NO. 1051-06-023



GENERALIZED SUBSURFACE CROSS SECTION  
 THROUGH BRIDGE No. 28 - END BENT No. 1  
 REPLACEMENT OF BRIDGE No. 28  
 OVER CURTIS CREEK ON SR 1321  
 TIP No. B-3406 STATE PROJECT No. 33037.1.1  
 FEDERAL ID No. BRZ-1321(I)  
 AVERY COUNTY, NORTH CAROLINA

GENERALIZED SUBSURFACE CROSS SECTION THROUGH BRIDGE No.28 - END BENT No.2



\* NOTES BLOW COUNT INFLATED DUE TO COBBLES AND BOULDERS  
**A** CRYSTALLINE ROCK: VERY SOFT COMPLETELY WEATHERED TO VERY SEVERELY WEATHERED BROWN AND WHITE GRANITIC GNEISS

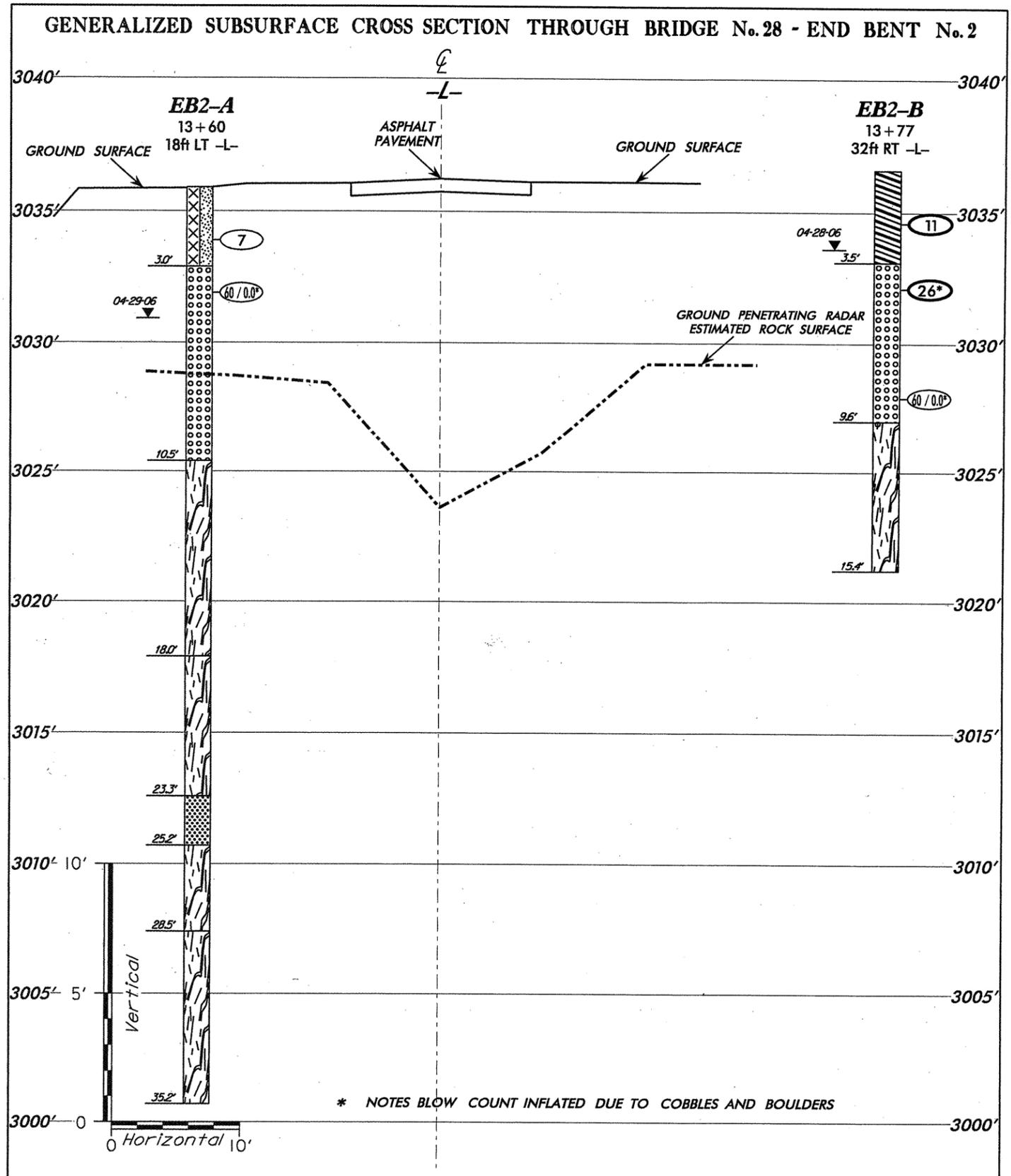
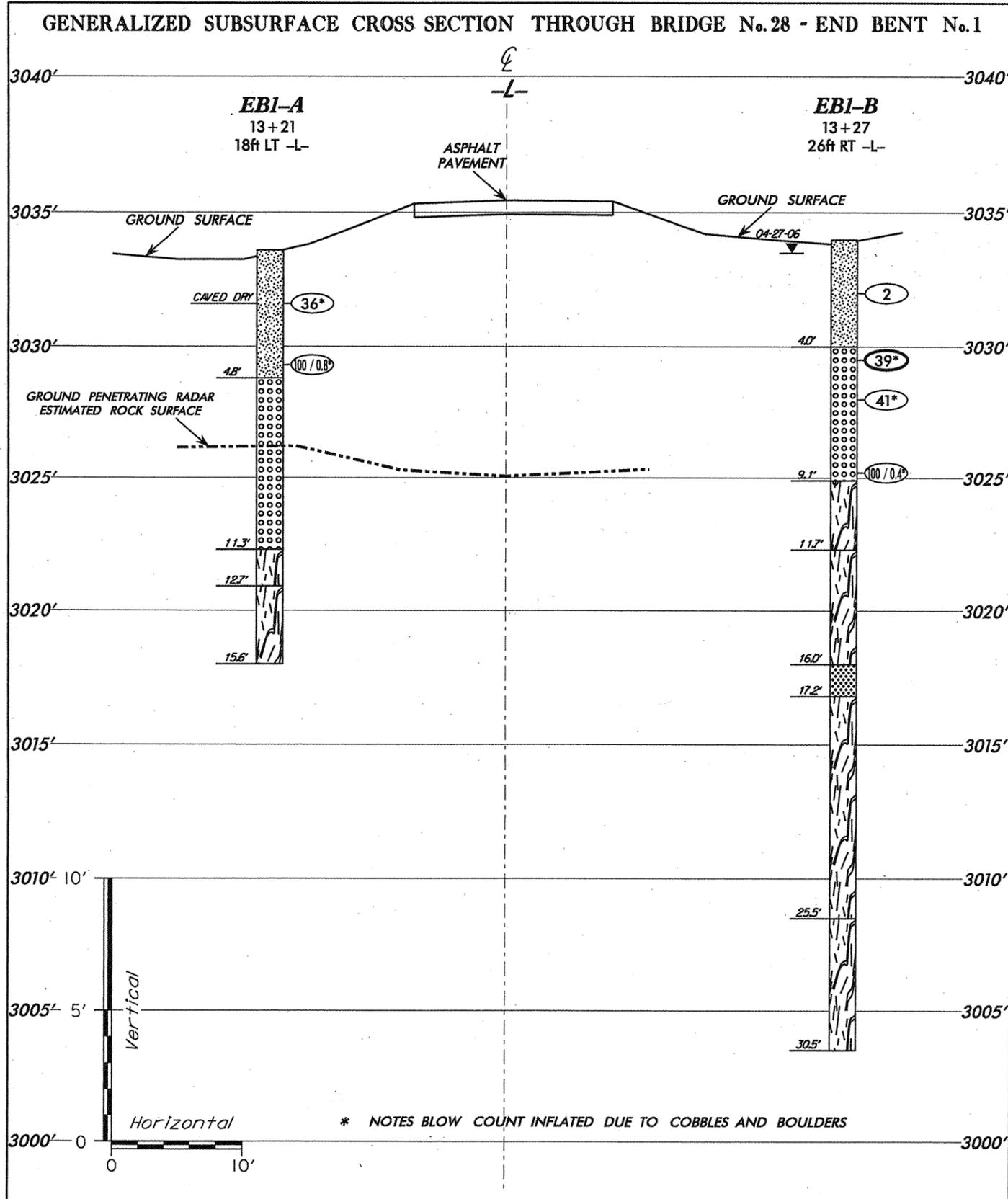
SCALE: (V) 1"=5' (H) 1"= 10'  
 CHECKED BY: AFR  
 DRAWN BY: TRP  
 DATE: MAY 2006  
 JOB NO. 1051-06-023



GENERALIZED SUBSURFACE CROSS SECTION  
 THROUGH BRIDGE No. 28 - END BENT No. 2  
 REPLACEMENT OF BRIDGE No. 28  
 OVER CURTIS CREEK ON SR 1321  
 TIP No. B-3406 STATE PROJECT No. 33037.1.1  
 FEDERAL ID No. BRZ-1321(I)  
 AVERY COUNTY, NORTH CAROLINA

SHEET NO. 9 OF 44

S:\PROJECTS\2006\06-023\GEOTECH\CADD\B-3406 PROFILE\_XSECTIONS.DGN



S:\PROJECTS\2006\06-023\GEOTECH\CADD\B-3406 PROFILE.XSECTIONS.DGN

SCALE:	(V) 1"=5' (H) 1"= 10'
CHECKED BY:	AFR
DRAWN BY:	TRP
DATE:	MAY 2006
JOB NO.	105 1-06-023



**GENERALIZED SUBSURFACE CROSS SECTION**  
 THROUGH BRIDGE No. 28 - END BENT No. 1  
 REPLACEMENT OF BRIDGE No. 28  
 OVER CURTIS CREEK ON SR 132 I  
 TIP No. B-3406 STATE PROJECT No. 33037.1.1  
 FEDERAL ID No. BRZ-132 I(1)  
 AVERY COUNTY, NORTH CAROLINA

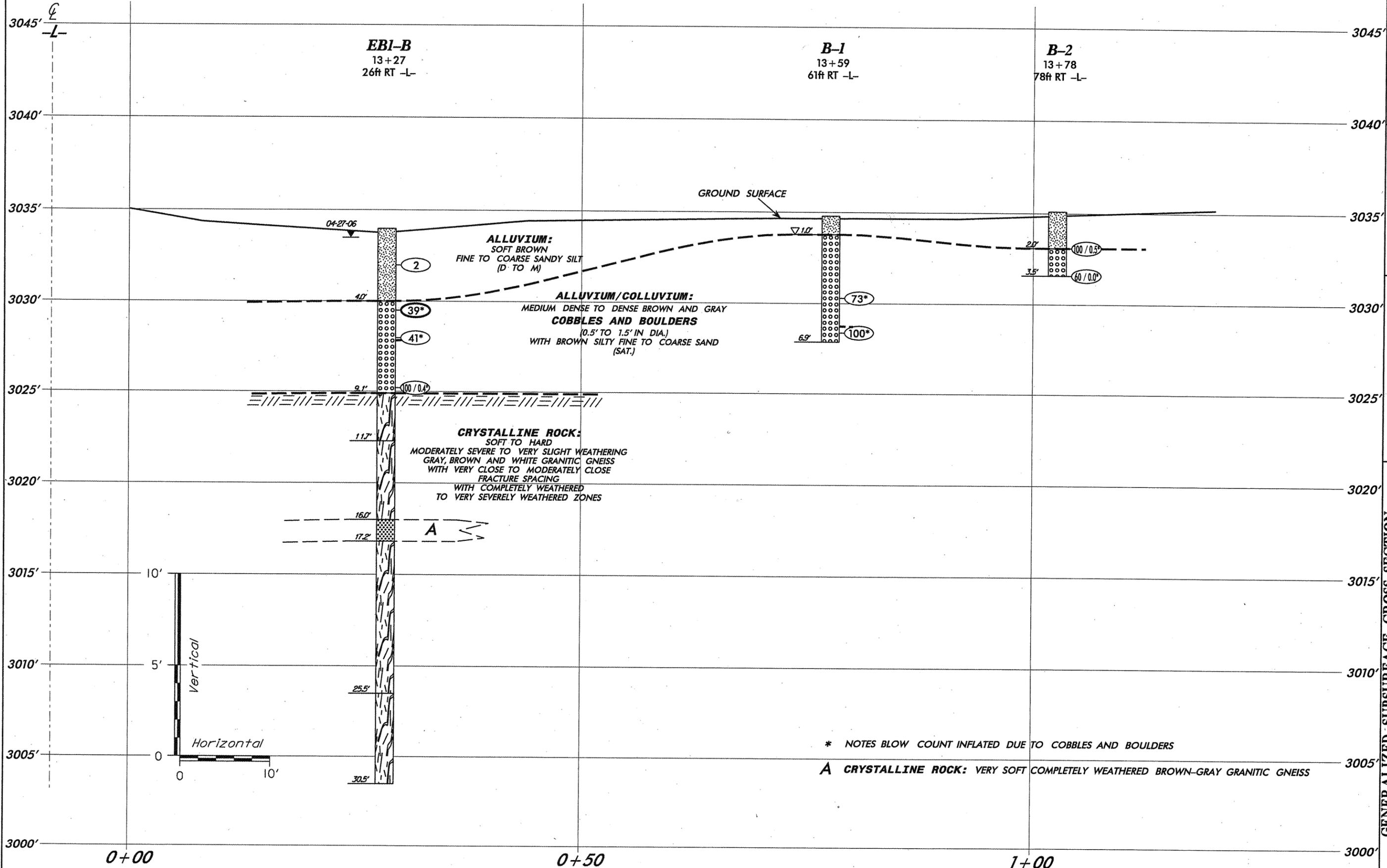
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CHECKED BY:	AFR
DRAWN BY:	TRP
DATE:	MAY 2006
JOB NO.	105 1-06-023



**GENERALIZED SUBSURFACE CROSS SECTION**  
 THROUGH BRIDGE No. 28 - END BENT No. 2  
 REPLACEMENT OF BRIDGE No. 28  
 OVER CURTIS CREEK ON SR 132 I  
 TIP No. B-3406 STATE PROJECT No. 33037.1.1  
 FEDERAL ID No. BRZ-132 I(1)  
 AVERY COUNTY, NORTH CAROLINA

SHEET NO.	10
OF	44

# GENERALIZED SUBSURFACE CROSS SECTION ALONG EB1-SIDE ARRAY



\* NOTES BLOW COUNT INFLATED DUE TO COBBLES AND BOULDERS

**A** CRYSTALLINE ROCK: VERY SOFT COMPLETELY WEATHERED BROWN-GRAY GRANITIC GNEISS

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GENERALIZED SUBSURFACE CROSS SECTION

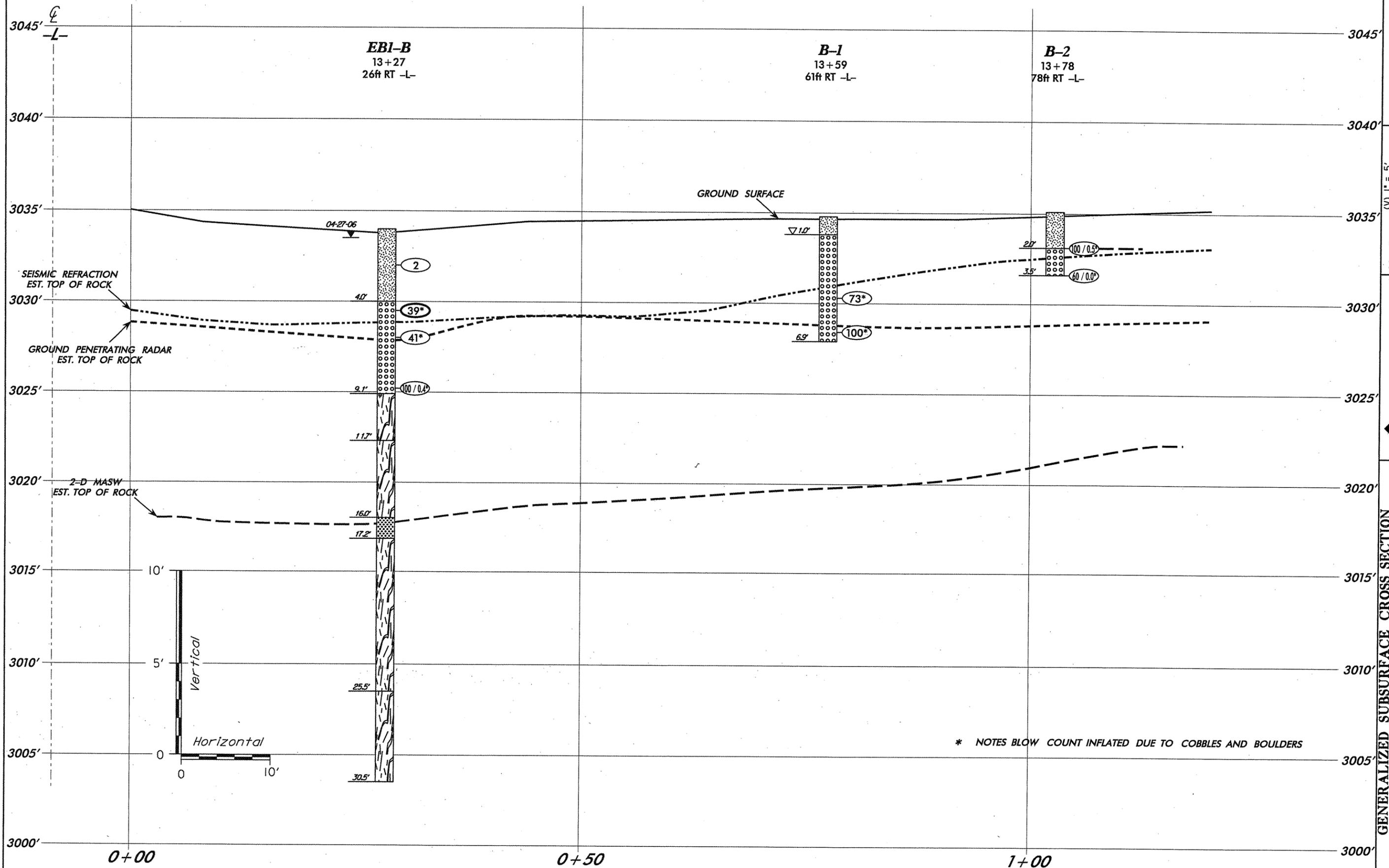
ALONG EB1-SIDE ARRAY  
REPLACEMENT OF BRIDGE No. 28  
OVER CURTIS CREEK ON SR 132 I  
TIP No. B-3406 WBS No. 33037-1-1 FEDERAL I.D. BRZ-132 (1)  
AVERY COUNTY, NORTH CAROLINA



SCALE: (V) 1" = 5'  
(H) 1" = 10'  
DATE: MAY 2006  
JOB NO. 105 1-06-023

APPROVED BY: AFR  
DRAWN BY: TRP  
SHEET 11 OF 44

# GENERALIZED SUBSURFACE CROSS SECTION ALONG EBI-SIDE ARRAY



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**GENERALIZED SUBSURFACE CROSS SECTION**

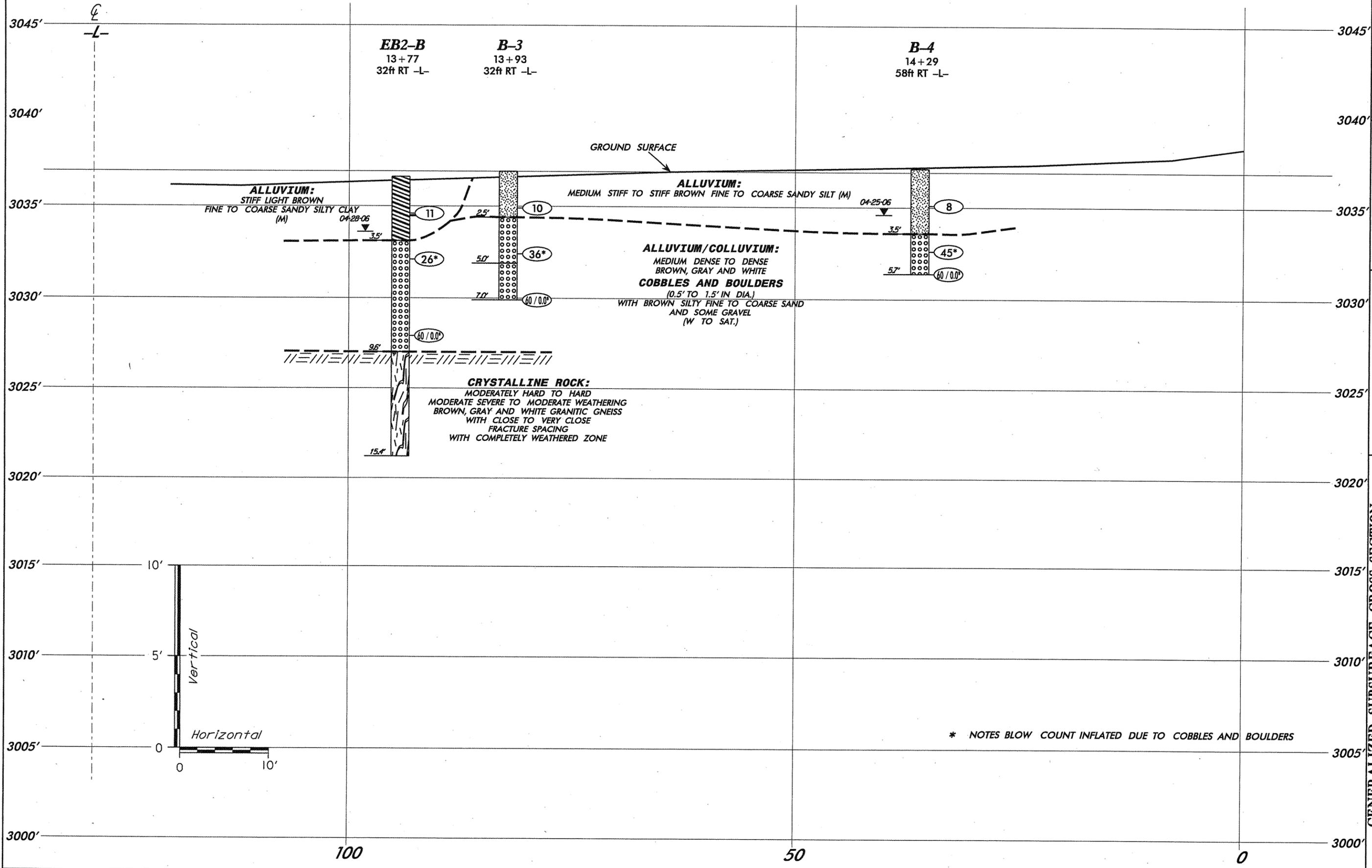
ALONG EBI-SIDE ARRAY  
REPLACEMENT OF BRIDGE No. 28  
OVER CURTIS CREEK ON SR 132 I  
TIP No. B-3406 WBS No. 33037.1.1 FEDERAL I.D. BRZ-132 (1.1)  
AVERY COUNTY, NORTH CAROLINA



SCALE: (V) 1" = 5'  
(H) 1" = 10'  
DATE: MAY 2006  
JOB NO. 105 1-06-023

APPROVED BY: AFR  
DRAWN BY: TRP  
SHEET 12 OF 44

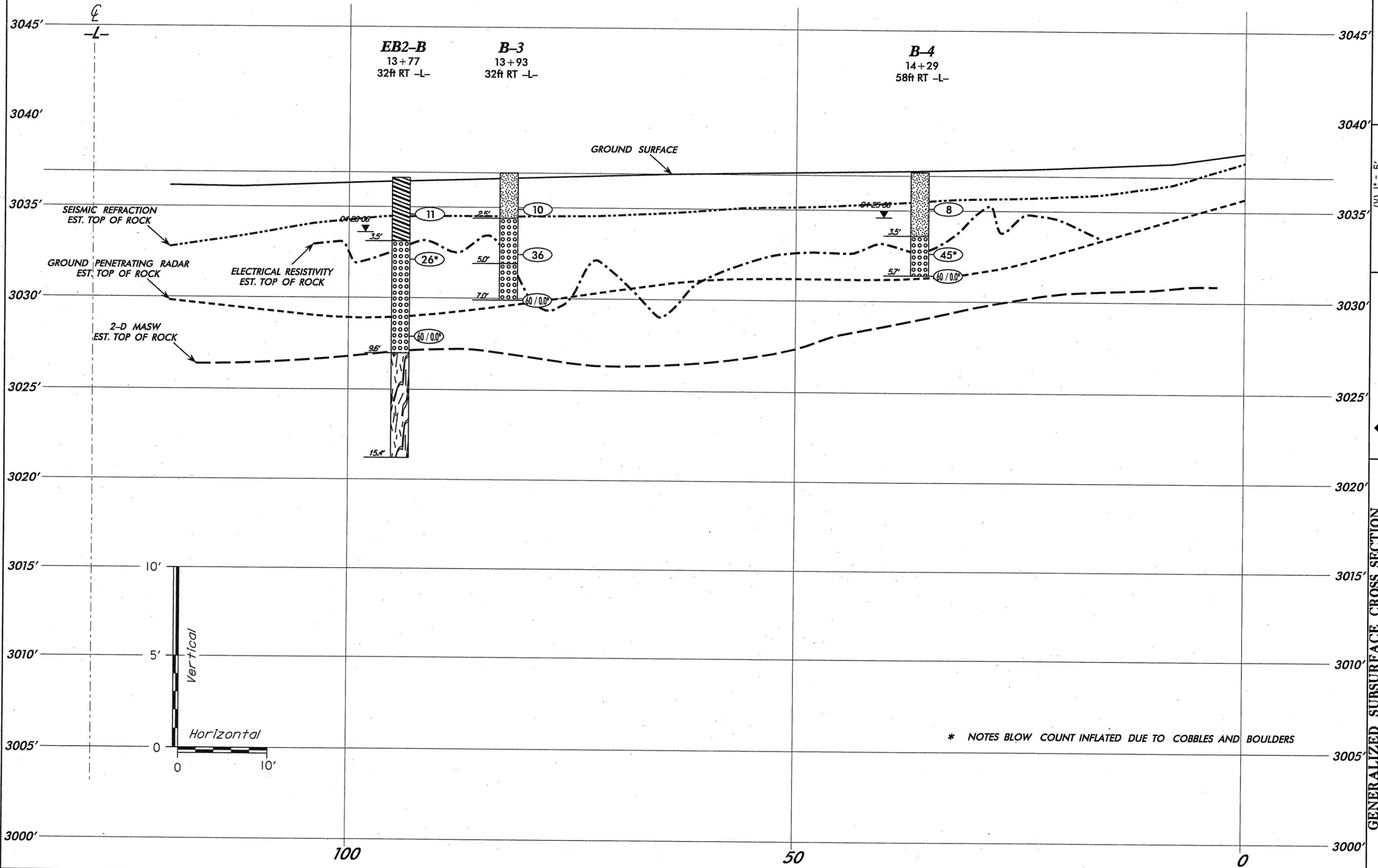
# GENERALIZED SUBSURFACE CROSS SECTION ALONG EB2-SIDE ARRAY



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<p style="font-size: 8px; margin: 0;">S&amp;ME ENVIRONMENTAL SERVICES ENGINEERING - TESTING</p>	SCALE: (V) 1" = 5' (H) 1" = 10'	DATE: MAY 2006	JOB NO. 105 I-06-023	APPROVED BY: AFR DRAWN BY: TRP SHEET 13 OF 44
GENERALIZED SUBSURFACE CROSS SECTION ALONG EB2-SIDE ARRAY REPLACEMENT OF BRIDGE No. 28 OVER CURTIS CREEK ON SR 1321 TIP No. B-3406 STATE PROJECT No. 33037-1-1 FEDERAL I.D. BRZ-132 (1) AVERY COUNTY, NORTH CAROLINA				

# GENERALIZED SUBSURFACE CROSS SECTION ALONG EB2-SIDE ARRAY



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**GENERALIZED SUBSURFACE CROSS SECTION**

ALONG EB2-SIDE ARRAY  
REPLACEMENT OF BRIDGE No. 28  
OVER CURTIS CREEK ON SR 132 I  
STATE PROJECT No. 33037.1.1 FEDERAL I.D. BRZ-132 (1)  
TIP No. B-3406 AVERY COUNTY, NORTH CAROLINA



SCALE: (V) 1" = 5'  
(H) 1" = 10'  
DATE: MAY 2006  
JOB NO. 105 I-06-023

APPROVED BY: AFR  
DRAWN BY: TRP  
SHEET 14 OF 44



PROJECT NO. 33037.1.1		ID. B-3406		COUNTY Avery		GEOLOGIST S. Laney									
SITE DESCRIPTION Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)							GROUND WATER (ft)								
BORING NO. EB1-A		BORING LOCATION 13+21		OFFSET 18.0 ft LT		ALIGNMENT -L-	0 HR. N/A								
COLLAR ELEV. 3,033.6 ft		NORTHING 894,308.1		EASTING 1,131,517.4			24 HR. DRY CAVE @ 2.0								
TOTAL DEPTH 15.6 ft		DRILL MACHINE Diedrich D-50		DRILL METHOD 2-1/4" HSA/NQ-2 Core Barrel		HAMMER TYPE MANUAL									
DATE STARTED 4/27/06		COMPLETED 4/27/06		SURFACE WATER DEPTH N/A											
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION			
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100		
3,033.6															
3,032.6	1.0				GROUND SURFACE								3,033.6	0.00	
3,030.1	3.5	5	15	21									3,028.8	4.8	
		10	90/0.3												
														3,020.9	12.7
														3,018.0	15.6
					BORING TERMINATED AT ELEV. 3018.0 FEET IN CRYSTALLINE ROCK: MODERATELY HARD GRAY-BROWN AND WHITE GRANITIC GNEISS.										

ALLUVIUM:  
SOFT BROWN FINE SANDY SILT  
(A-4)  
WITH SOME BOULDERS (1.5 FEET IN  
DIAMETER)

ALLUVIUM/COLLUVIUM:  
MEDIUM DENSE BROWN, GRAY AND  
WHITE COBBLES TO BOULDERS (0.5 TO  
1.5 FEET IN DIAMETER) WITH SILTY FINE  
TO COARSE SAND  
(A-1-a)

CRYSTALLINE ROCK:  
MODERATELY HARD, MODERATELY  
SEVERE WEATHERING, GRAY AND  
BROWN GRANITIC GNEISS WITH VERY  
CLOSE TO CLOSE FRACTURE SPACING  
8 JOINTS @ 30° TO 45°

CRYSTALLINE ROCK:  
MODERATELY HARD, MODERATELY  
SEVERE TO SLIGHT WEATHERING  
GRAY-BROWN AND WHITE GRANITIC  
GNEISS WITH VERY CLOSE TO CLOSE  
FRACTURE SPACING  
2 JOINTS @ 30° TO 45°

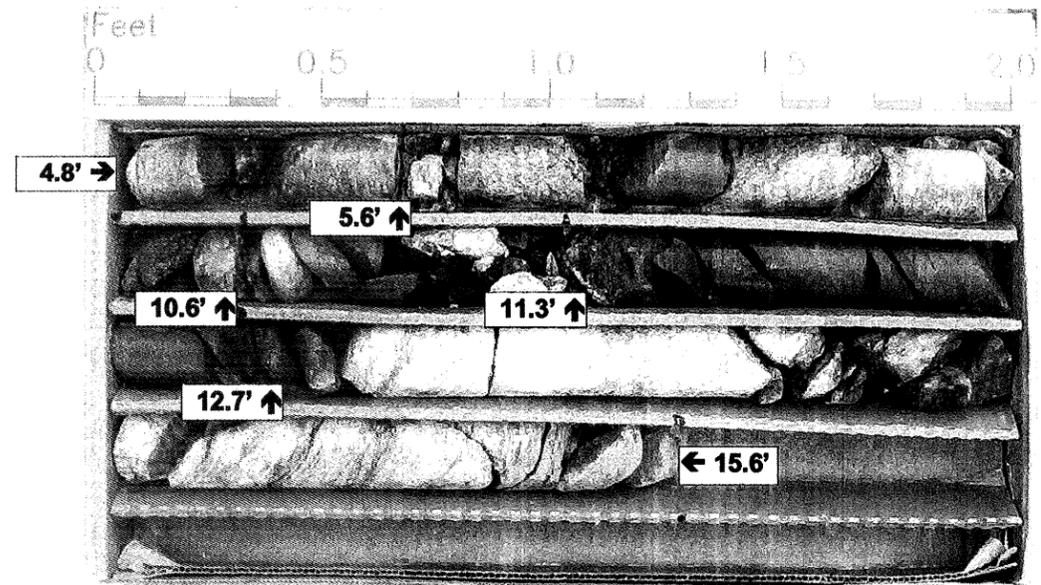
- 1) ADVANCED 2-1/4" HSA TO 3.5 FEET.
- 2) SET NW CASING TO 4.8 FEET WITH NW CASING ADVANCER.
- 3) ADVANCED NQ-2 CORE BARREL FROM 4.8 TO 15.6 FEET.
- 4) CREEK WATER USED AS DRILLING FLUID.
- 5) APPROXIMATE DRILLING FLUID DENSITY 62.4 PCF.
- 6) NO DRILLING FLUID LOSS OBSERVED.
- 7) \*BLOW COUNTS INFLATED DUE TO COBBLES AND BOULDERS.

NCDOT BORE SINGLE 51-023.GPJ NCDOT.GDT 5/25/06

PROJECT NO. 33037.1.1	ID. B-3406	COUNTY Avery	GEOLOGIST S. Laney
SITE DESCRIPTION Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)			GROUND WATER (ft)
BORING NO. EB1-A	BORING LOCATION 13+21	OFFSET 18.0 ft LT	ALIGNMENT -L-
COLLAR ELEV. 3,033.6 ft	NORTHING 894,308.1	EASTING 1,131,517.4	0 HR. N/A
TOTAL DEPTH 15.6 ft	DRILL MACHINE Diedrich D-50	DRILL METHOD 2-1/4" HSA/NQ-2 Core Barrel	HAMMER TYPE MANUAL
DATE STARTED 4/27/06	COMPLETED 4/27/06	SURFACE WATER DEPTH N/A	
CORE SIZE NQ-2	TOTAL RUN 10.8 ft	DRILLER L. Shrader	
24 HR. DRY CAVE @ 2.0			

WBS No: 33037.1.1	ID: B-3406	County: Avery	Boring No.: EB1-A
Site Description: Bridge No. 28 over Curtis Creek on SR 1321 (Curtis Creek Rd.)			Driller: L. Shrader
Collar Elev.: 3033.6 ft.	Core Size: NQ-2	Equipment: Diedrich D-50	Geologist: S. Laney
Elev. at T.D.: 3018.0 ft.	Total Depth: 15.6 ft.	Total Run: 10.8 ft.	Date: 4/27/06

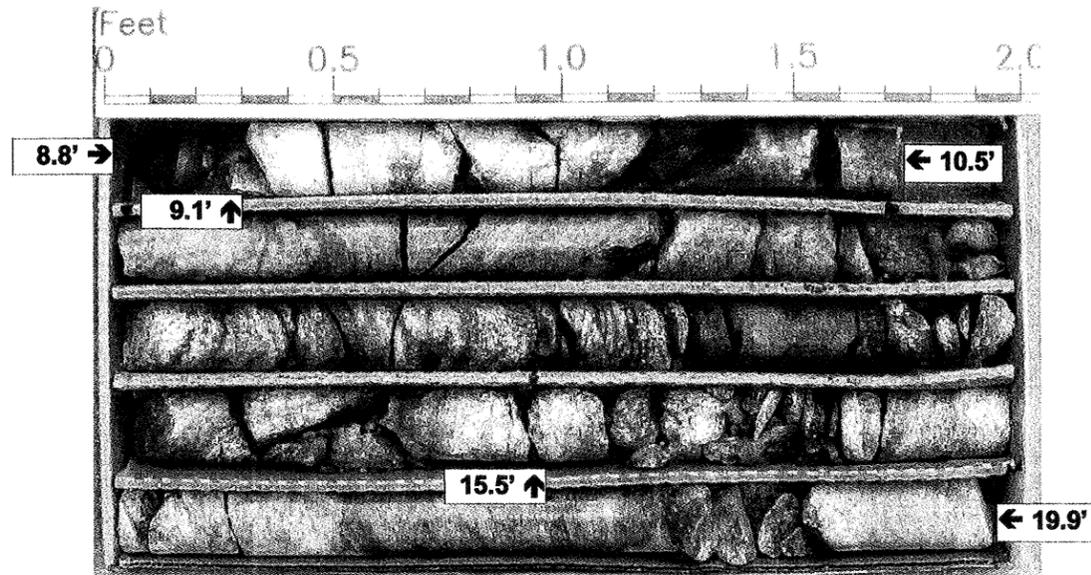
ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS
				REC. (%)	RQD (%)		REC. (%)	RQD (%)		
										Begin Coring @ 4.8 ft
3,028.8	4.8	0.8	0:45/0.8	(0.5)	(N/A)					ALLUVIUM/COLLUVIUM: MEDIUM DENSE BROWN, GRAY AND WHITE COBBLES TO BOULDERS (0.5 TO 1.5 FEET IN DIAMETER) WITH SILTY FINE TO COARSE SAND (A-1-a)
3,028.0	5.6	5.0	2:15 1:20 1:10 1:00	63% (1.5)	(N/A)					
3,023.0	10.6	5.0	1:50	(4.9)	(1.1)					
			0:50 1:30 1:00 1:00	98%	22%	(4.3)	(1.1)	100%	26%	CRYSTALLINE ROCK: MODERATELY HARD, MODERATELY SEVERE WEATHERING, GRAY AND BROWN GRANITIC GNEISS WITH VERY CLOSE TO CLOSE FRACTURE SPACING 8 JOINTS @ 30° TO 45° CRYSTALLINE ROCK: MODERATELY HARD, MODERATELY SEVERE TO SLIGHT WEATHERING GRAY-BROWN AND WHITE GRANITIC GNEISS WITH VERY CLOSE TO CLOSE FRACTURE SPACING 2 JOINTS @ 30° TO 45° BORING TERMINATED AT ELEV. 3018.0 FEET IN CRYSTALLINE ROCK: MODERATELY HARD GRAY-BROWN AND WHITE GRANITIC GNEISS.
3,018.0	15.6									



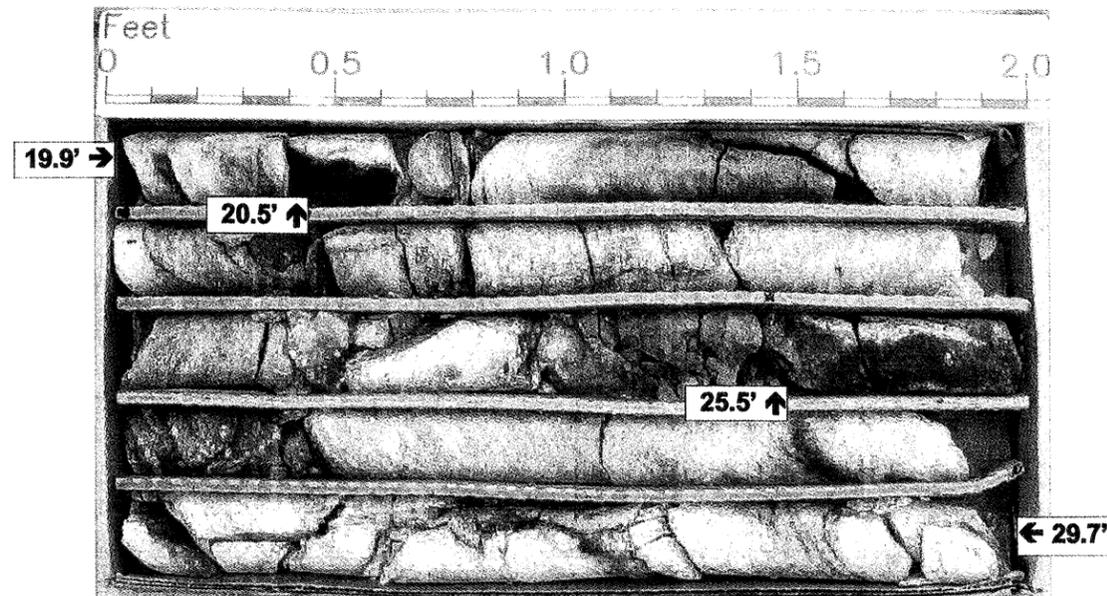
Box 1 of 1  
Top of Box @ 4.8 feet; Bottom of Box @ 15.6 feet



WBS No: 33037.1.1	ID: B-3406	County: Avery	Boring No.: EB1-B
Site Description: Bridge No. 28 over Curtis Creek on SR 1321 (Curtis Creek Rd.)		Driller: L. Shrader	
Collar Elev.: 3034.0 ft.	Core Size: NQ-2	Equipment: Diedrich D-50	Geologist: S. Laney
Elev. at T.D.: 3003.5 ft.	Total Depth: 30.5 ft.	Total Run: 21.7 ft.	Date: 4/26/06

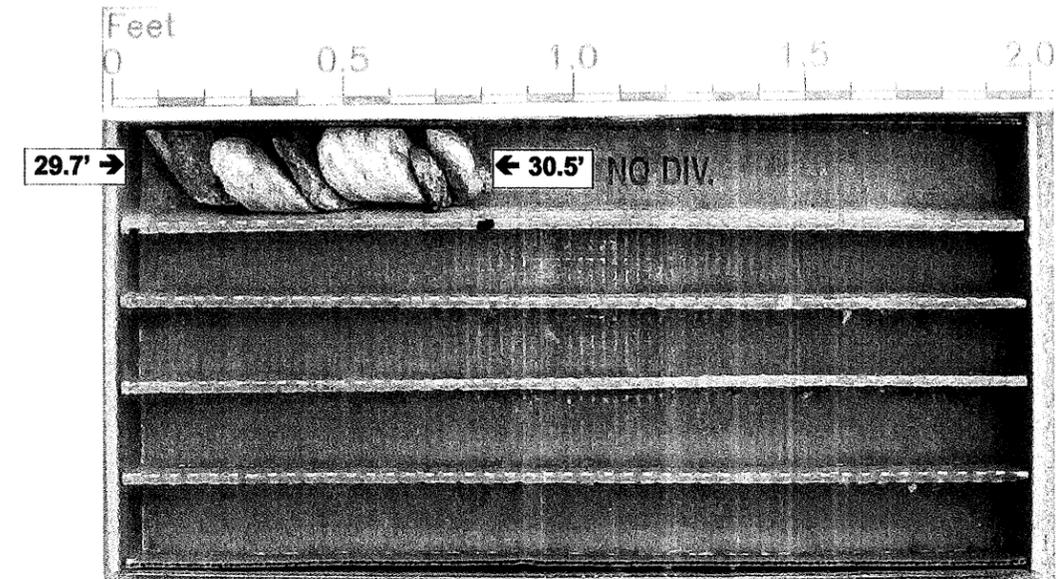


Box 1 of 3  
Top of Box @ 8.8 feet; Bottom of Box @ 19.9 feet



Box 2 of 3  
Top of Box @ 19.9 feet; Bottom of Box @ 29.7 feet

WBS No: 33037.1.1	ID: B-3406	County: Avery	Boring No.: EB1-B
Site Description: Bridge No. 28 over Curtis Creek on SR 1321 (Curtis Creek Rd.)		Driller: L. Shrader	
Collar Elev.: 3034.0 ft.	Core Size: NQ-2	Equipment: Diedrich D-50	Geologist: S. Laney
Elev. at T.D.: 3003.5 ft.	Total Depth: 30.5 ft.	Total Run: 21.7 ft.	Date: 4/26/06



Box 3 of 3  
Top of Box @ 29.7 feet; Bottom of Box @ 30.5 feet



PROJECT NO. 33037.1.1		ID. B-3406		COUNTY Avery		GEOLOGIST S. Laney							
SITE DESCRIPTION Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)							GROUND WATER (ft)						
BORING NO. EB2-A		BORING LOCATION 13+60		OFFSET 18.0 ft LT		ALIGNMENT -L-		0 HR. N/A					
COLLAR ELEV. 3,035.9 ft		NORTHING 894,291.8		EASTING 1,131,551.0		24 HR. 5.0 on 04-29-06							
TOTAL DEPTH 35.2 ft		DRILL MACHINE Diedrich D-50		DRILL METHOD 2-1/4" HSA/NQ-2 Core Barrel		HAMMER TYPE MANUAL							
DATE STARTED 4/25/06		COMPLETED 4/28/06		SURFACE WATER DEPTH N/A									
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
3,035.9													GROUND SURFACE
3,034.9	1.0												ARTIFICIAL FILL: MEDIUM STIFF BROWN AND TAN FINE TO COARSE SANDY SILT (A-4)
3,031.9	4.0	4	3	4									ALLUVIUM/COLLUVIUM: MEDIUM DENSE BROWN AND GRAY COBBLES TO BOULDERS (0.5 TO 1.5 FEET IN DIAMETER) WITH BROWN FINE TO COARSE SAND (A-1-a)
													CRYSTALLINE ROCK: MEDIUM HARD TO MODERATELY HARD, MODERATELY TO MODERATELY SEVERE WEATHERING, BROWN, GRAY AND WHITE GRANITIC GNEISS WITH VERY CLOSE TO CLOSE FRACTURE SPACING AND WITH COMPLETELY WEATHERED ZONES FROM 12.1 TO 12.5 FEET, 14.8 TO 15.2 FEET AND 16.5 TO 17.3 FEET. 8 JOINTS @ 0° to 10° 10 JOINTS @ 30° to 45°
													CRYSTALLINE ROCK: HARD TO VERY HARD MODERATE TO SLIGHT WEATHERING GRAY, BROWN, WHITE AND PINK GRANITIC GNEISS WITH VERY CLOSE TO CLOSE FRACTURE SPACING 6 JOINTS @ 0° to 10° 4 JOINTS @ 30° to 45° 1 JOINT @ 60°
													CRYSTALLINE ROCK: VERY SOFT COMPLETELY WEATHERED TO VERY SEVERELY WEATHERED BROWN AND WHITE GRANITIC GNEISS CRYSTALLINE ROCK: SOFT TO MEDIUM HARD, SEVERE TO MODERATELY SEVERE WEATHERING, BROWN, GRAY AND WHITE GRANITIC GNEISS WITH VERY CLOSE TO CLOSE FRACTURE SPACING AND WITH A COMPLETELY WEATHERED ZONE FROM 28.1 TO 28.5 FEET 7 JOINTS @ 0° to 10° 1 JOINT @ 60°
													CRYSTALLINE ROCK: MEDIUM HARD TO HARD, MODERATELY SEVERE TO SLIGHT WEATHERING BROWN, GRAY AND WHITE GRANITIC GNEISS WITH VERY CLOSE TO CLOSE FRACTURE SPACING 7 JOINTS @ 0° to 10° 8 JOINTS @ 30° to 45° 1 JOINT @ 60° 2 JOINTS @ 90°
													1) ADVANCED 2-1/4" HSA TO 4.6 FEET. 2) SET NW CASING TO 4.6 FEET. 3) ADVANCED NQ-2 CORE BARREL FROM 4.6 TO 10.5 FEET. 4) ADVANCED NW CASING WITH NW CASING ADVANCER TO 10.5 FEET. 5) ADVANCED NQ-2 CORE BARREL TO 35.2 FEET. 6) CREEK WATER USED AS DRILLING FLUID. 7) APPROXIMATE DRILLING FLUID DENSITY 62.4 PCF. 8) DRILLING FLUID LOSS OBSERVED AT 25.2 FEET. 9) *BLOW COUNT INFLATED DUE TO COBBLES AND BOULDERS.

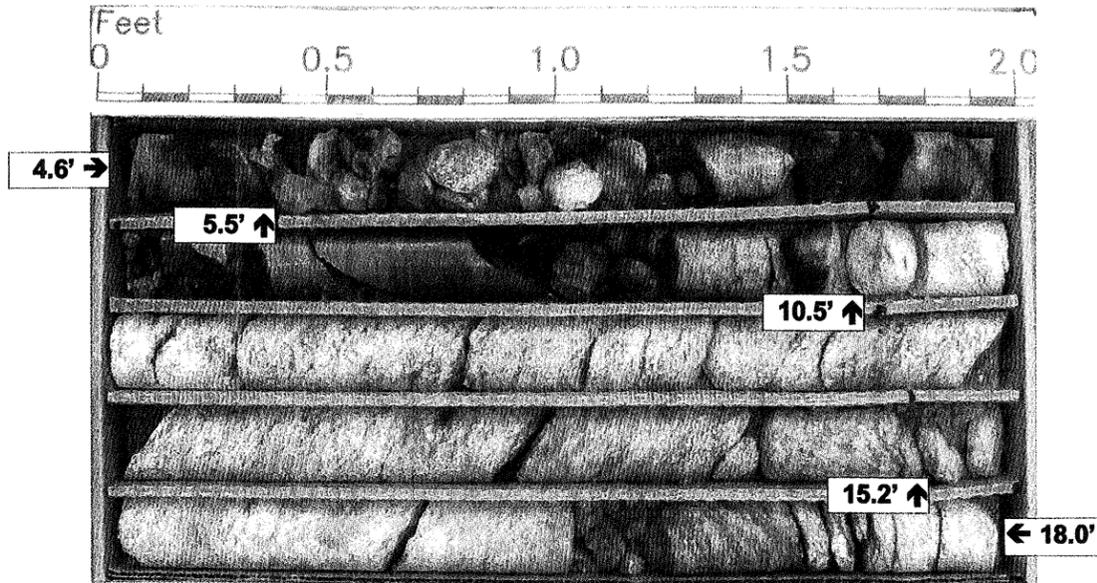
NCDOT BORE SINGLE 51-023.GPJ NCDOT.GDT 5/25/06



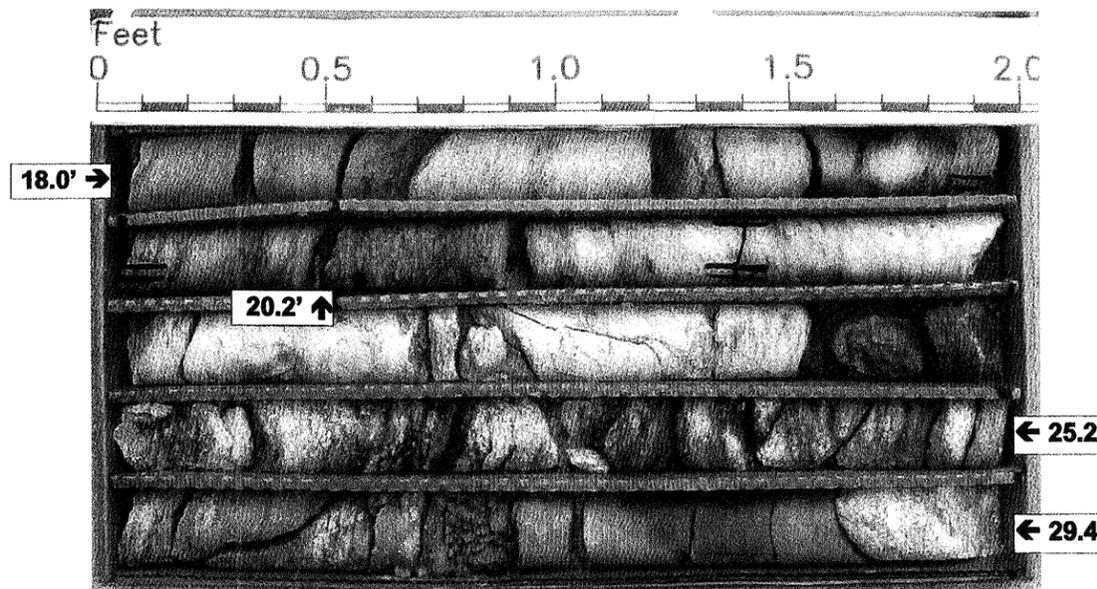
PROJECT NO. 33037.1.1		ID. B-3406		COUNTY Avery		GEOLOGIST S. Laney				
SITE DESCRIPTION Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)							GROUND WATER (ft)			
BORING NO. EB2-A		BORING LOCATION 13+60		OFFSET 18.0 ft LT		ALIGNMENT -L-		0 HR. N/A		
COLLAR ELEV. 3,035.9 ft		NORTHING 894,291.8		EASTING 1,131,551.0		24 HR. 5.0 on 04-29-06				
TOTAL DEPTH 35.2 ft		DRILL MACHINE Diedrich D-50		DRILL METHOD 2-1/4" HSA/NQ-2 Core Barrel		HAMMER TYPE MANUAL				
DATE STARTED 4/25/06		COMPLETED 4/28/06		SURFACE WATER DEPTH N/A						
CORE SIZE NQ-2		TOTAL RUN 30.6 ft		DRILLER L. Shrader						
ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (%)	RQD (%)	SAMP. NO.	STRATA REC. (%)	RQD (%)	LOG	DESCRIPTION AND REMARKS
										Begin Coring @ 4.6 ft
3,031.3	4.6	0.9	0:30/0.9	(0.3)	(N/A)					
3,030.4	5.5	5.0	0:40	33%	(N/A)					ALLUVIUM/COLLUVIUM: MEDIUM DENSE BROWN AND GRAY COBBLES TO BOULDERS (0.5 TO 1.5 FEET IN DIAMETER) WITH BROWN FINE TO COARSE SAND (A-1-a)
3,025.4	10.5		0:45	(3.4)	(N/A)					
			1:20	68%						
			1:00							CRYSTALLINE ROCK: MEDIUM HARD TO MODERATELY HARD, MODERATELY TO MODERATELY SEVERE WEATHERING, BROWN, GRAY AND WHITE GRANITIC GNEISS WITH VERY CLOSE TO CLOSE FRACTURE SPACING AND WITH COMPLETELY WEATHERED ZONES FROM 12.1 TO 12.5 FEET, 14.8 TO 15.2 FEET AND 16.5 TO 17.3 FEET. 8 JOINTS @ 0° to 10° 10 JOINTS @ 30° to 45°
3,020.7	15.2	4.7	1:00	(3.9)	(1.9)		(21.6)	(9.4)		
			0:45	83%	40%		87%	38%		
			1:00							
3,017.9	20.2	5.0	0:30/0.7	(4.4)	(2.5)					
			0:45	88%	50%					
			1:00							
3,015.7	25.2	5.0	1:00	(3.5)	(2.2)					
			0:45	70%	44%					
			1:00							
3,010.7	25.2	5.0	1:00	(4.8)	(0.4)					
			0:30	96%	8%					
			0:45							
3,005.7	30.2	5.0	1:00	(5.0)	(2.4)					
			0:30	100%	48%					
			0:45							
3,000.7	35.2		0:45							
			1:00							
			0:30							

NCDOT CORE SINGLE 51-023.GPJ NCDOT.GDT 5/25/06

WBS No: 33037.1.1	ID: B-3406	County: Avery	Boring No.: EB2-A
Site Description: Bridge No. 28 over Curtis Creek on SR 1321 (Curtis Creek Rd.)		Driller: L. Shrader	
Collar Elev.: 3035.9 ft.	Core Size: NQ-2	Equipment: Diedrich D-50	Geologist: S. Laney
Elev. at T.D.: 3000.7 ft.	Total Depth: 35.2 ft.	Total Run: 30.6 ft.	Date: 4/25/06

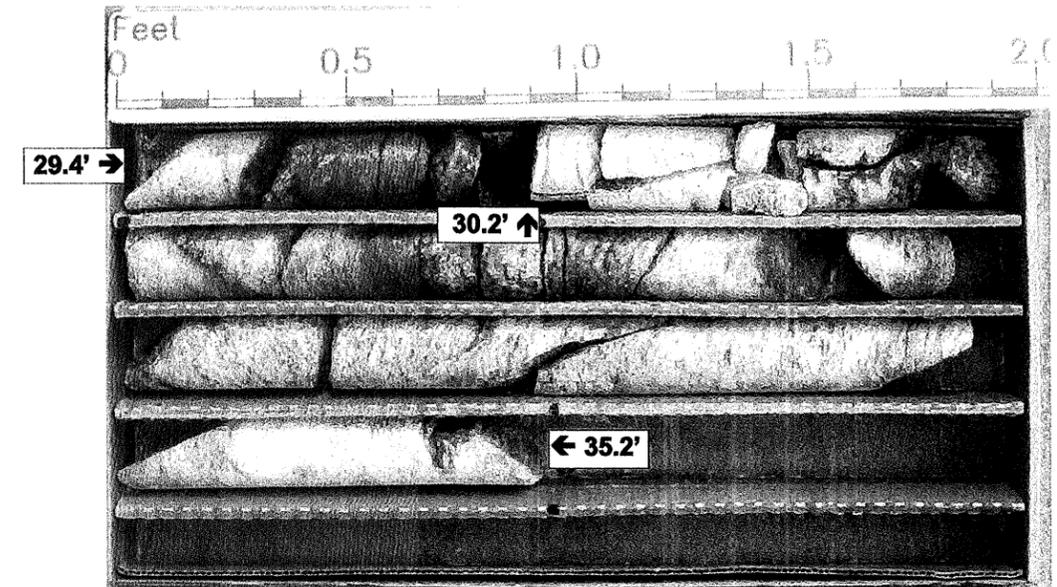


Box 1 of 3  
Top of Box @ 4.6 feet; Bottom of Box @ 18.0 feet



Box 2 of 3  
Top of Box @ 18.0 feet; Bottom of Box @ 29.4 feet

WBS No: 33037.1.1	ID: B-3406	County: Avery	Boring No.: EB2-A
Site Description: Bridge No. 28 over Curtis Creek on SR 1321 (Curtis Creek Rd.)		Driller: L. Shrader	
Collar Elev.: 3035.9 ft.	Core Size: NQ-2	Equipment: Diedrich D-50	Geologist: S. Laney
Elev. at T.D.: 3000.7 ft.	Total Depth: 35.2 ft.	Total Run: 30.6 ft.	Date: 4/25/06

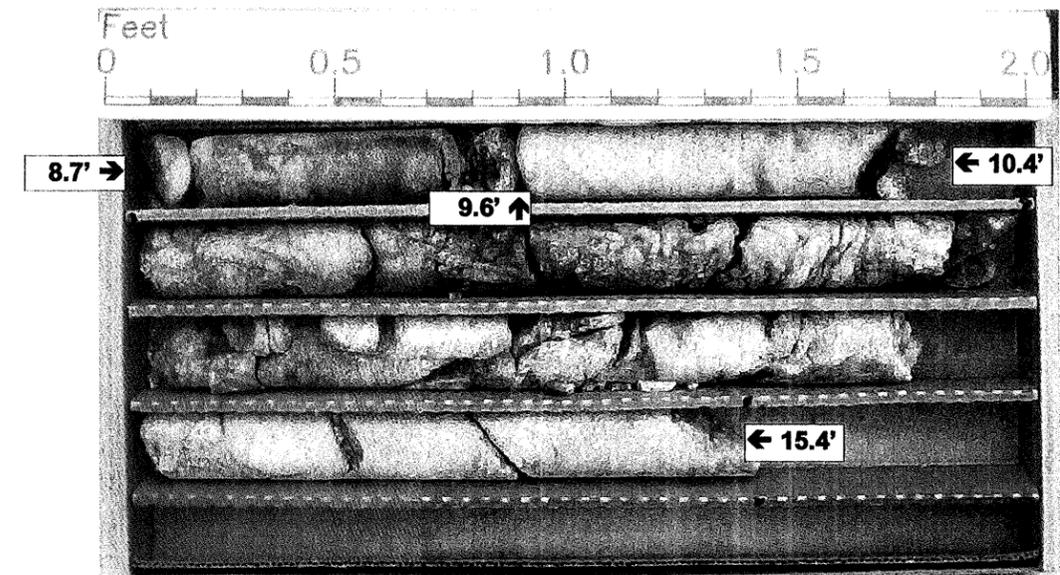


Box 3 of 3  
Top of Box @ 29.4 feet; Bottom of Box @ 35.2 feet



PROJECT NO. 33037.1.1		ID. B-3406		COUNTY Avery		GEOLOGIST S. Laney				
SITE DESCRIPTION Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)						GROUND WATER (ft)				
BORING NO. EB2-B		BORING LOCATION 13+77		OFFSET 32.0 ft RT		ALIGNMENT -L-				
COLLAR ELEV. 3,036.6 ft		NORTHING 894,238.7		EASTING 1,131,546.9		0 HR. N/A				
TOTAL DEPTH 15.4 ft		DRILL MACHINE Diedrich D-50		DRILL METHOD 2-1/4" HSA/NQ-2 Core Barrel		24 HR. 3.0 on 04-28-06				
DATE STARTED 4/27/06		COMPLETED 4/27/06		SURFACE WATER DEPTH N/A						
CORE SIZE NQ-2		TOTAL RUN 6.7 ft		DRILLER L. Shrader						
ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (ft) %	RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	RQD (ft) %	LOG	DESCRIPTION AND REMARKS
										Begin Coring @ 8.7 ft
3,027.9	8.7	1.7	2:00	(1.6)	(N/A)					
3,026.2	10.4	5.0	1:00/0.7	94%	(1.7)		(5.5)	(2.5)		ALLUVIUM/COLLUVIUM: MEDIUM DENSE BROWN, GRAY AND WHITE COBBLES TO BOULDERS (0.5 TO 1.5 FEET IN DIAMETER) WITH SILTY FINE TO COARSE SAND (A-1-a)
			1:00	(4.7)	34%					
			0:50	94%						
3,021.2	15.4		0:50							CRYSTALLINE ROCK: HARD TO MODERATELY HARD, MODERATE SEVERE TO MODERATE WEATHERING, BROWN, GRAY AND WHITE GRANITIC GNEISS WITH CLOSE TO VERY CLOSE FRACTURE SPACING AND WITH A COMPLETELY WEATHERED ZONE FROM 12.1 TO 12.4 FEET. 8 JOINTS @ 30° TO 45° 2 JOINTS @ 0° TO 10° BORING TERMINATED AT ELEV. 3021.2 FEET IN CRYSTALLINE ROCK: HARD GRAY AND WHITE GRANITIC GNEISS.

WBS No: 33037.1.1	ID: B-3406	County: Avery	Boring No.: EB2-B
Site Description: Bridge No. 28 over Curtis Creek on SR 1321 (Curtis Creek Rd.)			Driller: L. Shrader
Collar Elev.: 3036.6 ft.	Core Size: NQ-2	Equipment: Diedrich D-50	Geologist: S. Laney
Elev. at T.D.: 3021.2 ft.	Total Depth: 15.4 ft.	Total Run: 6.7 ft.	Date: 4/27/06



Box 1 of 1  
Top of Box @ 8.7 feet; Bottom of Box @ 15.4 feet



PROJECT NO. 33037.1.1		ID. B-3406		COUNTY Avery		GEOLOGIST S. Laney								
SITE DESCRIPTION Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)						GROUND WATER (ft)								
BORING NO. B-1		BORING LOCATION 13+59		OFFSET 61.0 ft RT		ALIGNMENT -L-								
COLLAR ELEV. 3,034.8 ft		NORTHING 894,220.0		EASTING 1,131,517.9		0 HR. 1.0								
TOTAL DEPTH 6.9 ft		DRILL MACHINE Diedrich D-50		DRILL METHOD 2-1/4" HSA		HAMMER TYPE MANUAL								
DATE STARTED 4/28/06		COMPLETED 4/28/06		SURFACE WATER DEPTH N/A										
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L MOI	O G	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80					100
3,034.8					GROUND SURFACE									
3,031.3	3.5	11	40	33										ALLUVIUM: SOFT BROWN FINE SANDY SILT (A-4)
3,029.4	5.4	11	38	62										ALLUVIUM/COLLUVIUM: DENSE BROWN AND GRAY COBBLES TO BOULDERS (0.5 TO 1.5 FEET IN DIAMETER) WITH SILTY FINE TO COARSE SAND (A-1-b)
BORING TERMINATED BY AUGER REFUSAL AT ELEV. 3027.9 FEET IN ALLUVIAL/COLLUVIAL COBBLES AND BOULDERS.														
1) ADVANCED 2-1/4" HSA TO 5.4 FEET. 2) * BLOW COUNTS INFLATED DUE TO COBBLES AND BOULDERS.														

NCDOT BORE SINGLE 51-023.GPJ NCDOT.GDT 5/25/06



PROJECT NO. 33037.1.1		ID. B-3406		COUNTY Avery		GEOLOGIST S. Laney								
SITE DESCRIPTION Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)						GROUND WATER (ft)								
BORING NO. B-2		BORING LOCATION 13+78		OFFSET 78.0 ft RT		ALIGNMENT -L-								
COLLAR ELEV. 3,035.1 ft		NORTHING 894,196.9		EASTING 1,131,527.7		0 HR. DRY								
TOTAL DEPTH 3.5 ft		DRILL MACHINE Diedrich D-50		DRILL METHOD 2-1/4" HSA		HAMMER TYPE MANUAL								
DATE STARTED 4/24/06		COMPLETED 4/24/06		SURFACE WATER DEPTH N/A										
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L MOI	O G	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80					100
3,035.1					GROUND SURFACE									
3,034.1	1.0													ALLUVIUM: SOFT BROWN FINE TO COARSE SANDY SILT (A-4)
3,031.6	3.5	1	1	99/0.0										ALLUVIUM/COLLUVIUM: DENSE BROWN AND GRAY COBBLES TO BOULDERS (0.5 TO 1.5 FEET IN DIAMETER) WITH BROWN FINE TO COARSE SANDY SILT (A-1-a)
BORING TERMINATED WITH STANDARD PENETRATION TEST REFUSAL AT ELEV. 3031.6 FEET IN ALLUVIAL/COLLUVIAL COBBLES AND BOULDERS.														
1) ADVANCED 2-1/4" HSA TO 3.5 FEET. 2) * BLOW COUNTS INFLATED DUE TO COBBLES AND BOULDERS.														

NCDOT BORE SINGLE 51-023.GPJ NCDOT.GDT 5/25/06



PROJECT NO. 33037.1.1		ID. B-3406		COUNTY Avery		GEOLOGIST S. Laney								
SITE DESCRIPTION Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)						GROUND WATER (ft)								
BORING NO. B-3		BORING LOCATION 13+93		OFFSET 32.0 ft RT		ALIGNMENT -L-								
COLLAR ELEV. 3,036.9 ft		NORTHING 894,232.6		EASTING 1,131,560.7		0 HR. DRY								
TOTAL DEPTH 7.0 ft		DRILL MACHINE Diedrich D-50		DRILL METHOD 2-1/4" HSA		HAMMER TYPE MANUAL								
DATE STARTED 4/25/06		COMPLETED 4/25/06		SURFACE WATER DEPTH N/A										
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80					100
3,036.9														GROUND SURFACE
3,035.9	1.0													
3,033.4	3.5	5	5	5								M		ALLUVIUM: STIFF BROWN FINE TO COARSE SANDY SILT (A-4)
		14	20	16								W		ALLUVIUM: DENSE BROWN AND GRAY SILTY FINE TO COARSE SAND (A-1-b)
3,029.9	7.0											No Rec.		ALLUVIUM/COLLUVIUM: DENSE COBBLES TO BOULDERS (0.5 TO 1.5 FEET IN DIAMETER) WITH BROWN FINE TO COARSE SANDY SILT (A-1-a)
														BORING TERMINATED WITH STANDARD PENETRATION TEST REFUSAL AT ELEV. 3029.9 FEET IN ALLUVIAL/COLLUVIAL COBBLES AND BOULDERS. 1) ADVANCED 2-1/4" HSA TO 7.0 FEET. 2) *BLOW COUNTS INFLATED DUE TO COBBLES AND BOULDERS.

NCDOT BORE SINGLE 51-023.GPJ NCDOT.GDT 5/25/06



PROJECT NO. 33037.1.1		ID. B-3406		COUNTY Avery		GEOLOGIST S. Laney								
SITE DESCRIPTION Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)						GROUND WATER (ft)								
BORING NO. B-4		BORING LOCATION 14+29		OFFSET 58.0 ft RT		ALIGNMENT -L-								
COLLAR ELEV. 3,037.1 ft		NORTHING 894,194.0		EASTING 1,131,586.0		0 HR. DRY								
TOTAL DEPTH 5.7 ft		DRILL MACHINE Diedrich D-50		DRILL METHOD 2-1/4" HSA		HAMMER TYPE MANUAL								
DATE STARTED 4/24/06		COMPLETED 4/24/06		SURFACE WATER DEPTH N/A										
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80					100
3,037.1														GROUND SURFACE
3,036.1	1.0													
3,033.6	3.5	3	3	5								M		ALLUVIUM: MEDIUM STIFF LIGHT BROWN FINE TO COARSE SANDY SILT (A-4)
		18	23	22								Sat.		ALLUVIUM/COLLUVIUM: DENSE BROWN COBBLES TO BOULDERS (0.5 TO 1.5 FEET IN DIAMETER) WITH FINE TO COARSE SANDY SILT (A-1-a)
3,031.4	5.7											No Rec.		BORING TERMINATED WITH STANDARD PENETRATION TEST REFUSAL AT ELEV. 3031.4 FEET IN ALLUVIAL/COLLUVIAL COBBLES AND BOULDERS. 1) ADVANCED 2-1/4" HSA TO 5.7 FEET. 2) *BLOW COUNTS INFLATED DUE TO COBBLES AND BOULDERS.

NCDOT BORE SINGLE 51-023.GPJ NCDOT.GDT 5/25/06

**SUMMARY OF LABORATORY TEST DATA**

Soil Classification and Gradation

Boring No.	Sample No.	Sample Depth Feet	AASHTO Classification		% Passing Sieve #				Coarse Sand	Fine Sand	Silt	Clay	LL	PL	PI	Organic Content %	Moisture Content %
					10	40	60	200									
EB1-B	SS-1	4.0-5.0	N.A.	N.A.	34	21	17	12	49	20	21	10	N.A.	N.A.	N.A.	N.A.	N.A.
EB2-B	SS-2	1.0-2.5	A-6	(3)	86	65	57	47	34	15	24	27	38	26	12	N.A.	N.A.
EB2-B	SS-3	3.5-5.0	N.A.	N.A.	28	13	10	6	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

N.A.: Not Analyzed  
 N.P.: Non Plastic

Project Name: Bridge No. 28 over Curtis Creek on SR 1321

S&ME Project No.: 1051-06-023

State Project No. 33037.1.1

County: Avery

Federal ID No.: BRZ-1321 (1)

TIP No.: B-3406

Checked By: JSJ & AFR



# FIELD SCOUR REPORT

WBS: 33073.1.1 TIP: B-3406 COUNTY: Avery

DESCRIPTION(1): Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)

### EXISTING BRIDGE

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

Bridge No.: 28 Length: 30'6" Total Bents: 2 Bents in Channel: 0 Bents in Floodplain: 2  
 Foundation Type: \_\_\_\_\_

### EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: Minor signs of erosion at the End Bents

Interior Bents: N/A (single span bridge)

Channel Bed: None observed

Channel Bank: None observed

### EXISTING SCOUR PROTECTION

Type(3): Timber abutments with timber wingwalls

Extent(4): Timber wingwalls extend a few feet beyond the timber abutments

Effectiveness(5): Relatively effective with some minor erosion at both abutments

Obstructions(6): None observed

### 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): Brown and gray cobbles and boulders with brown silty fine to coarse SAND (A-1-a) and brown fine to coarse sandy SILT (A-4)

Channel Bank Material(8): Brown fine to coarse sandy SILT (A-4) and brown clayey silty coarse to fine SAND (A-2-4) with trace of gravel

Channel Bank Cover(9): Small to large diameter trees, grass & brush. Cobbles have been deposited on the creek banks

Floodplain Width(10): The site is located within the Elk River Floodplain and the Curtis Creek Floodplain 150' +/- on the west side of the creek and 50' +/- on the east side of the creek perpendicular to floodplain of Elk River.

Floodplain Cover(11): Residential house with grass lawns and forest on the west side of the creek and residential houses and a church and church asphalt parking lot on the east side of the creek

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

Channel Migration Tendency(13): Migration tendency to the west

Observations and Other Comments: Two large boulders located on the west side of the creek south of the proposed structure. A private water line and electric line are located near the western creek bank. Overhead power and telephone line along south side of existing bridge. Dry Stacked and mortar stone wall exists on the western creek bank left of the existing bridge.

Reported by: *[Signature]* Date: 4/29/06

### DESIGN SCOUR ELEVATIONS(14)

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

	BENTS											
	B1	B2	B3	B4								
SB Lanes, Lt												
SB Lanes, Rt												
NB Lanes, Lt												
NB Lanes, Rt												

Comparison of DSE to Hydraulics Unit theoretical scour:

\_\_\_\_\_ The Bridge Survey and Hydraulic Design Report (8-12-05) reports no (0.0') contraction or local scour.

*[Signature]* 53006

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

Bed or Bank	Bank	Bed				
Sample No.	SS-1	SS-1				
Retained #4	43	55				
Passed #10	44	34				
Passed #40	30	21				
Passed #200	18	12				
Coarse Sand	19	17				
Fine Sand	8	7				
Silt	9	7				
Clay	8	3				
LL	30	N.A.				
PI	23	N.A.				
AASHTO	A-2-4 (0)	(A-1-a) *	*Visual			
Station	12+96	13+27				
Offset	14' LT -DET-	26' RT -L-				
Depth	1.0'-2.5'	4.0'-5.0'				

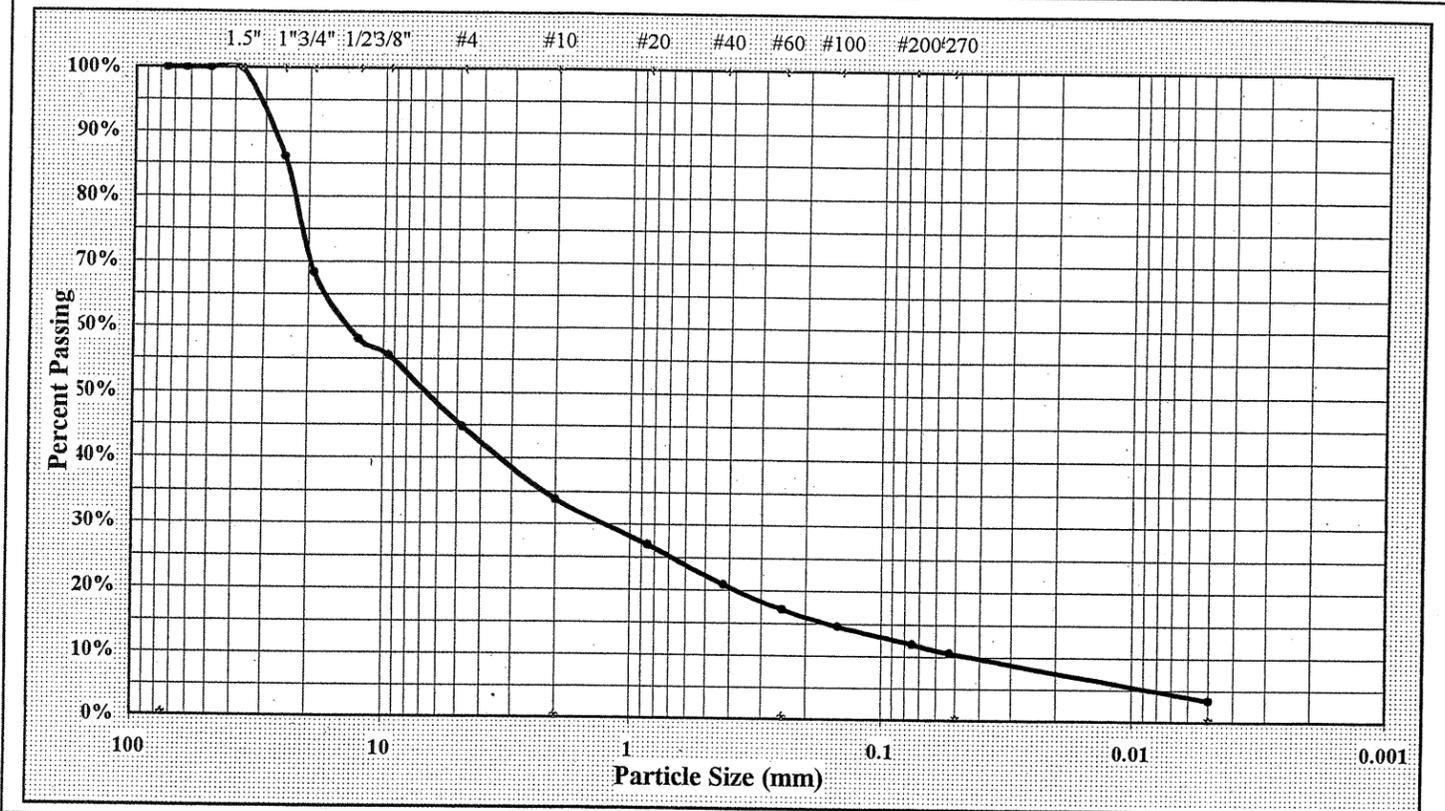


### Particle Size Analysis of Soils

AASHTO T 88 as Modified by NCDOT

S&ME Project #: **1051-06-023** Report Date: 5/8/06  
 Project Name: **BRIDGE 28 OVER CURTIS CREEK ON S.R. 1321** Test Date(s): 5/3-5/6/06  
 Client Name: NCDOT  
 Client Address: RALEIGH, NC  
 State Project #: 33037.1.1 F.A. Project No: BRZ-1321 (1) TIP NO: B-3406

Boring #: EB1-B Sample #: SS-1 Sample Date: 4/24-28/06  
 Location: STA. 13+27 Offset: 26' RT Depth: 4.0-5.0  
 Sample Description: BROWN COBBLES AND BOULDERS WITH SILTY F. TO CSE. SAND (A-1-a)



As Defined by NCDOT			
Gravel	< 75 mm and > 2.00 mm	Fine Sand	< 0.25 mm and > 0.05 mm
Coarse Sand	< 2.00 mm and > 0.25 mm	Silt	< 0.05 and > 0.005 mm
		Clay	< 0.005 mm
Maximum Particle Size	1.5"	Coarse Sand	16.6%
		Fine Sand	6.7%
Gravel	66.2%	Silt	7%
		Clay	3%
Apparent Relative Density	2.650	Moisture Content	% Passing #200 11.9%
Liquid Limit	N.A.	Plastic Limit	N.A.
		Plastic Index	N.A.

Soil Mortar (-#10 Sieve)			
Coarse Sand	49.2%	Fine Sand	19.7%
		Silt	21%
		Clay	10%
Description of Sand & Gravel Particles:	Rounded <input type="checkbox"/>	Angular <input type="checkbox"/>	Hard & Durable <input type="checkbox"/>
	Soft <input type="checkbox"/>	Weathered & Friable <input type="checkbox"/>	
Mechanical Stirring Apparatus (A)	Length of Dispersion Period: 1 min.	Dispersing Agent:	Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT  
 AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test  
 AASHTO T265: Laboratory Determination of Moisture Content of Soils  
 AASHTO T89: Determining the Liquid Limit of Soils  
 AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils  
 AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes  
 ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Stewart Laney \_\_\_\_\_  
 Signature Signature

### Particle Size Analysis of Soils

AASHTO T 88 as Modified by NCDOT

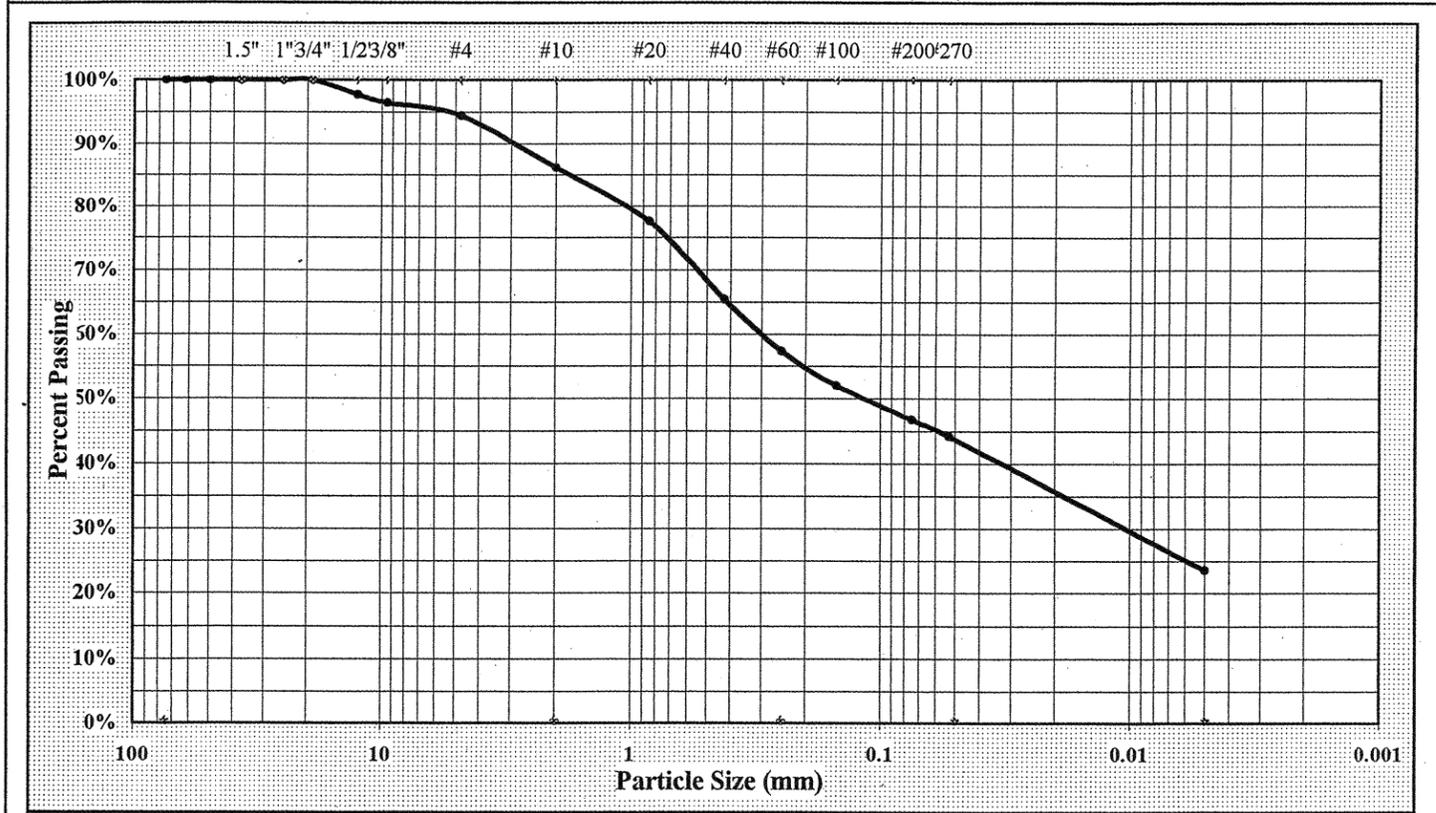


S&ME Project #: **1051-06-023**  
 Project Name: **BRIDGE 28 OVER CURTIS CREEK ON S.R.1321**  
 Client Name: NCDOT  
 Client Address: RALEIGH, NC  
 State Project #: 33037.1.1

Report Date: 5/8/06  
 Test Date(s): 5/3-8/06

F.A. Project No: BRZ-1321 (1)      TIP NO: B-3406

Boring #: EB2-B	Sample #: SS-2	Sample Date: 4/24-28/06
Location: STA. 13+77	Offset: 32' RT	Depth: 1.0-2.5'
Sample Description: BROWN FINE TO COARSE SANDY SILTY CLAY (A-6)		



As Defined by NCDOT		Fine Sand	< 0.25 mm and > 0.05 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm
Coarse Sand	< 2.00 mm and > 0.25 mm	Clay	< 0.005 mm

Maximum Particle Size	3/4"	Coarse Sand	28.9%	Silt	21%
Gravel	13.8%	Fine Sand	13.1%	Clay	24%
Apparent Relative Density	2.650	Moisture Content		% Passing #200	46.7%
Liquid Limit	38	Plastic Limit	26	Plastic Index	12

#### Soil Mortar (-#10 Sieve)

Coarse Sand	33.5%	Fine Sand	15.2%	Silt	24%	Clay	27%
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Description of Sand & Gravel Particles: Rounded  Angular  Hard & Durable  Soft  Weathered & Friable   
 Mechanical Stirring Apparatus (A)      Length of Dispersion Period: 1 min.      Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT      AASHTO T265: Laboratory Determination of Moisture Content of Soils  
 AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test      AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils  
 AASHTO T89: Determining the Liquid Limit of Soils      AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes      ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Stewart Laney      \_\_\_\_\_  
 Signature      Signature

### Particle Size Analysis of Soils

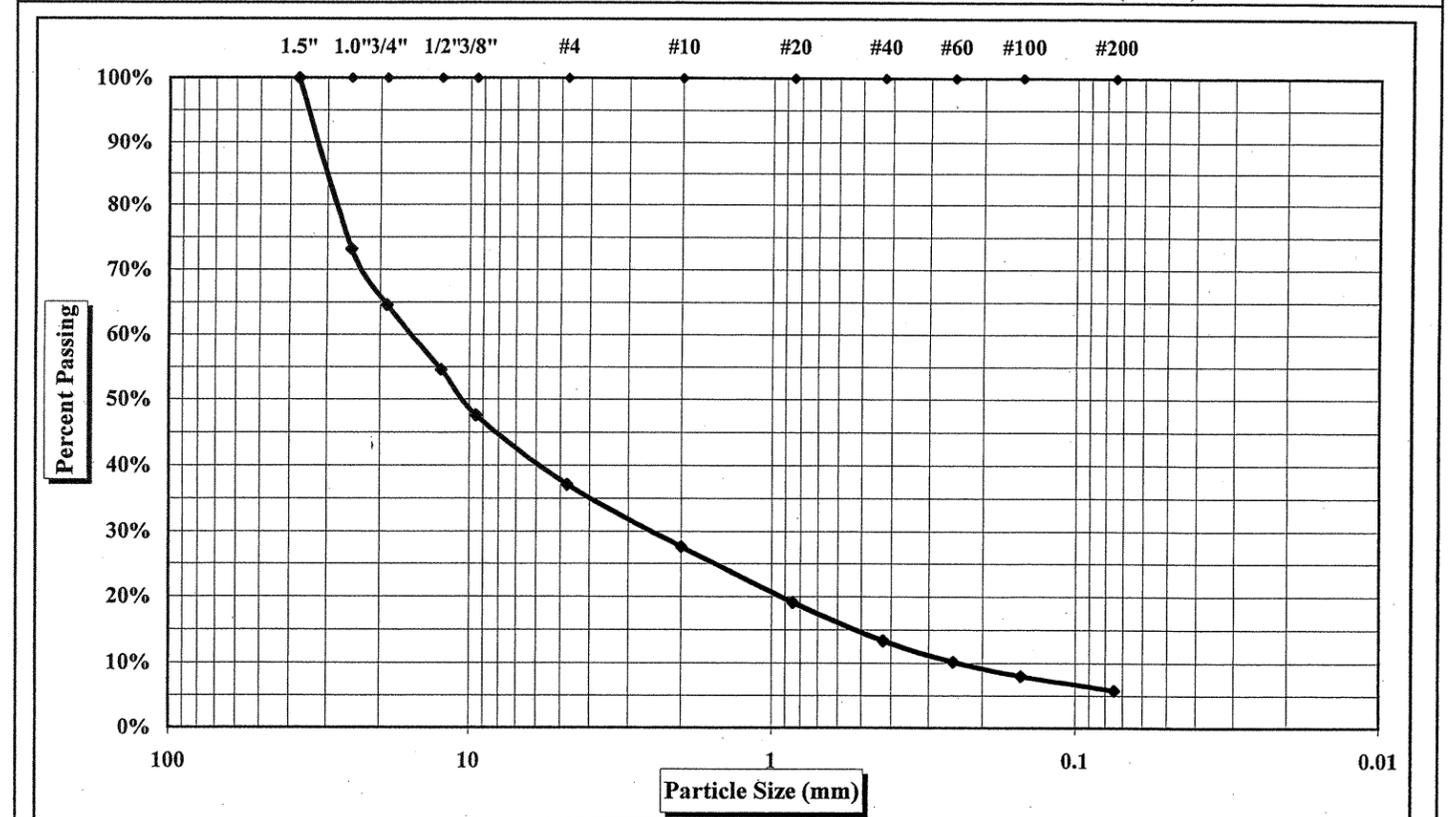
ASTM D 422



S&ME Project #: **1051-06-023**  
 Project Name: **BRIDGE 28 OVER CURTIS CREEK ON S.R.1321**  
 Client Name: NCDOT  
 Client Address: RALEIGH, NC

Report Date: 5/8/06  
 Test Date(s): 5/3-8/06

Boring #: EB2-B	Sample #: SS-3	Sample Date: 4/24-28/06
Location: STA.13+77	Offset: 32' RT	Depth: 3.5-5.0'
Sample Description: BROWN COBBLES AND BOULDERS WITH F. TO CSE. SAND (A-1-a)		



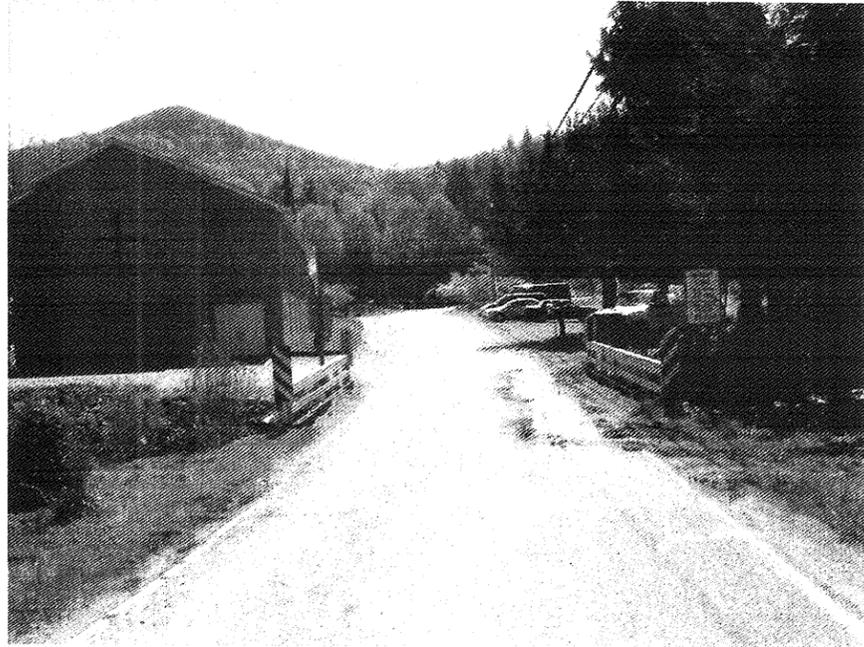
Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	0.0%	Gravel	63%	Medium Sand	14%
Silt & Clay (% Passing #200)	5.8%	Coarse Sand	9%	Fine Sand	8%
Apparent Relative Density		Moisture Content		Organic Content	
Liquid Limit	N.A.	Plastic Limit	N.A.	Plastic Index	N.A.

Description of Sand & Gravel  
 Rounded  Angular  Hard & Durable  Soft  Weathered & Friable

References: 0      \_\_\_\_\_  
 0      \_\_\_\_\_  
 0      \_\_\_\_\_  
 0      \_\_\_\_\_  
 Hydrometer portion of test method not utilized.

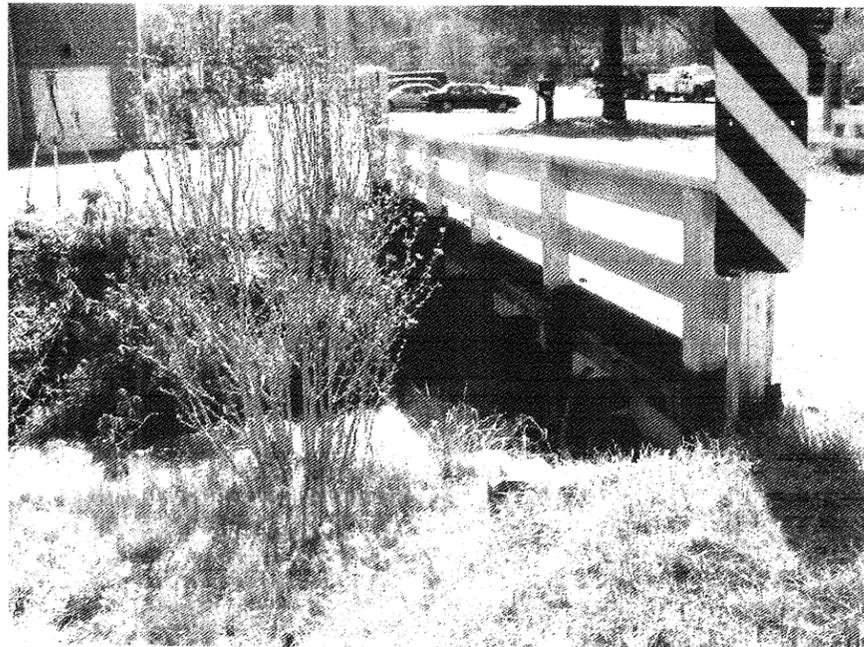
Technical Responsibility: Stewart Laney      \_\_\_\_\_  
 Signature      Position



**Photograph No. 1:**  
This photograph was taken from the west approach of the replacement bridge, along the -L- alignment, looking east, at the existing bridge.



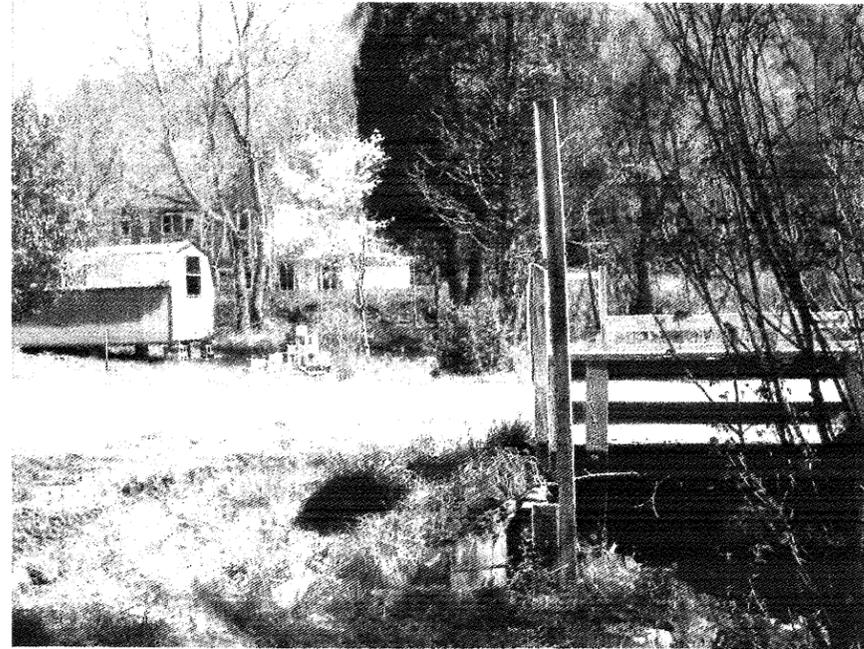
**Photograph No. 3:**  
This photograph was taken from the right side of the -L- alignment, looking east, along the existing bridge.



**Photograph No. 2:**  
This photograph was taken from the left side of the -L- alignment, looking east, along the existing bridge.



**Photograph No. 4:**  
This photograph was taken from the left side of the -L- alignment, looking south, across proposed End Bent No. 1 of the replacement bridge.



**Photograph No. 5:**  
This photograph was taken from the right side of the -L- alignment, looking north, across proposed End Bent No. 1 of the replacement bridge.



**Photograph No. 7:**  
This photograph was taken from the right side of the -L- alignment, looking north, across proposed End Bent No. 2 of the replacement bridge.



**Photograph No. 6:**  
This photograph was taken from the left side of the -L- alignment, looking south, across proposed End Bent No. 2 of the replacement bridge.



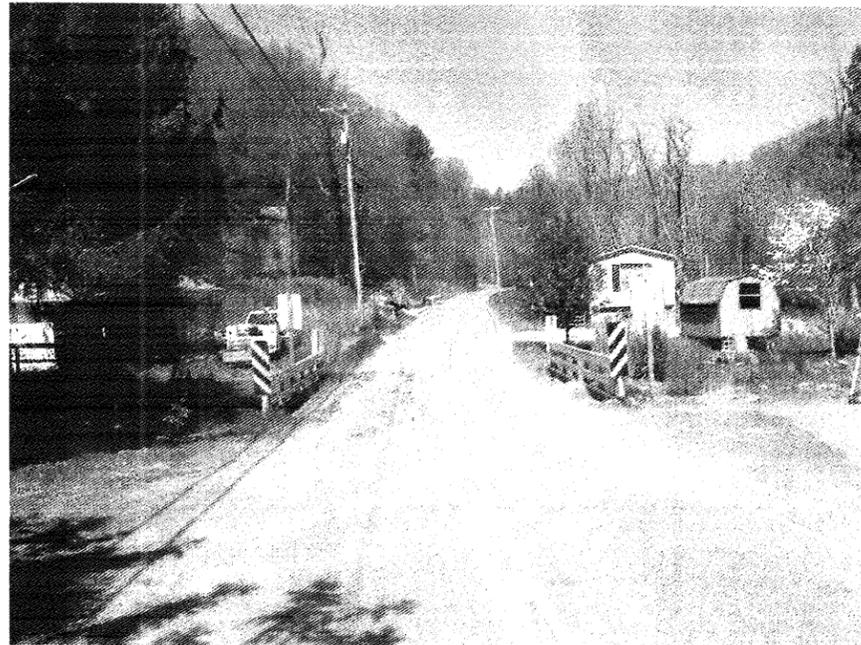
**Photograph No. 8:**  
This photograph was taken from the existing bridge, looking south (upstream) at Curtis Creek.



**Photograph No. 9:**  
This photograph was taken from the existing bridge, looking north (downstream) at Curtis Creek.



**Photograph No. 11:**  
This photograph was taken from the right side of the -L- alignment, looking south, along the EB1-side MASW array line.

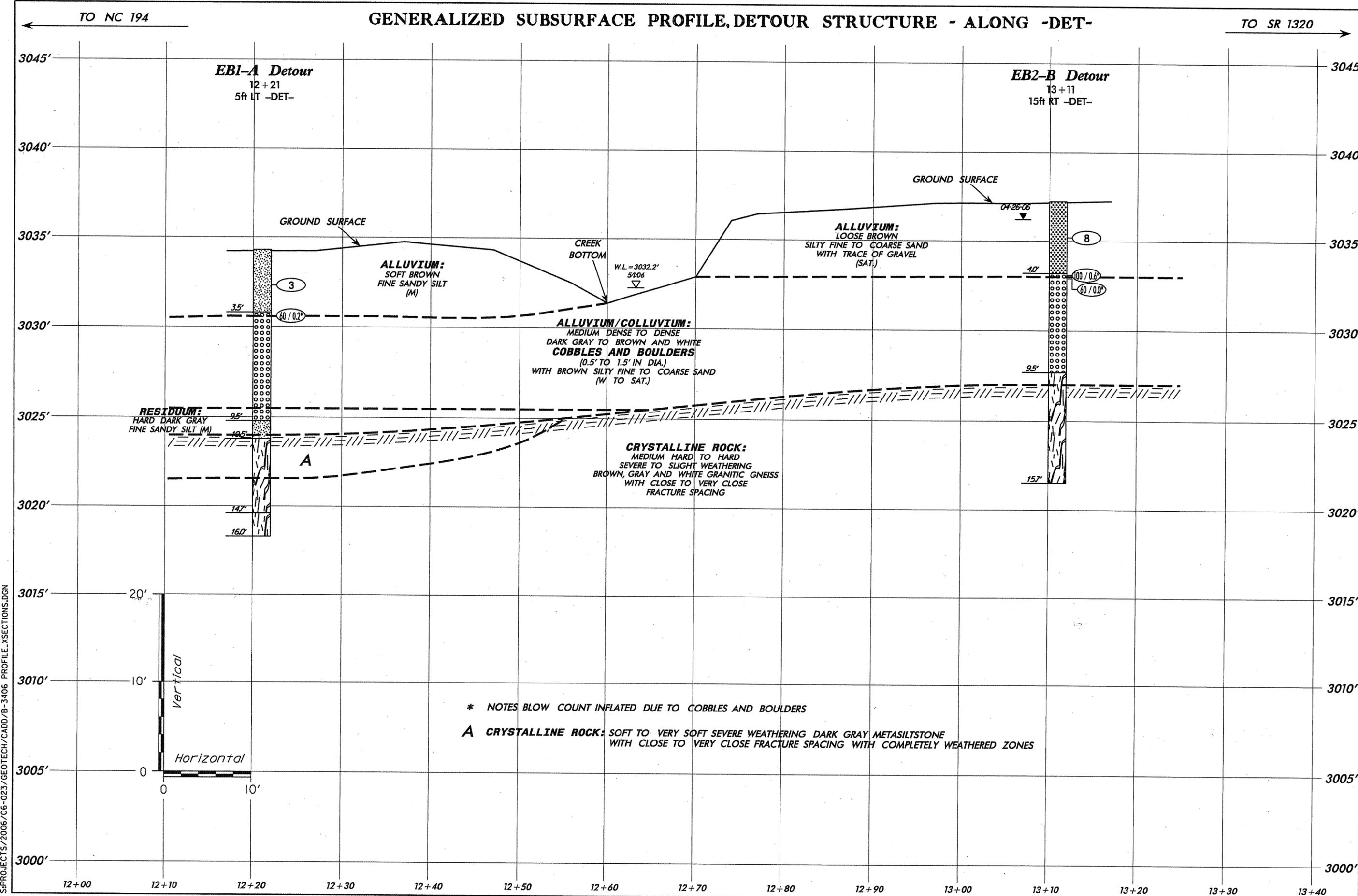


**Photograph No. 10:**  
This photograph was taken from the east approach of the replacement bridge, along the -L- alignment, looking west at the existing bridge.



**Photograph No. 12:**  
This photograph was taken from the right side of the -L- alignment, looking south, along the EB2-side MASW array line.





\* NOTES BLOW COUNT INFLATED DUE TO COBBLES AND BOULDERS

**A** CRYSTALLINE ROCK: SOFT TO VERY SOFT SEVERE WEATHERING DARK GRAY METASILTSTONE WITH CLOSE TO VERY CLOSE FRACTURE SPACING WITH COMPLETELY WEATHERED ZONES

S:\PROJECTS\2006\06-023\GEOTECH\CADD\B-3406 PROFILE.XSECTIONS.DGN

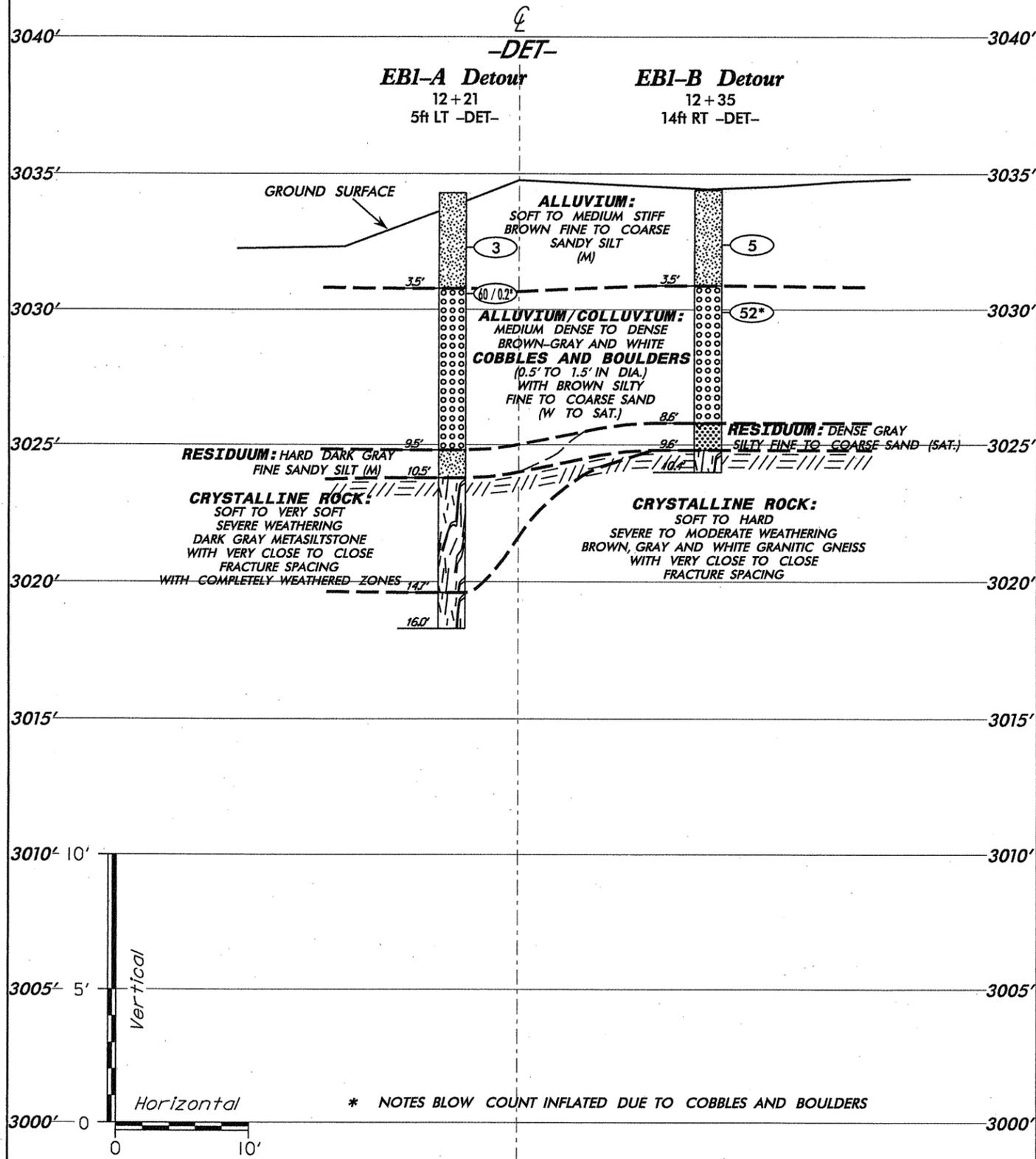
**GENERALIZED SUBSURFACE PROFILE**  
DETOUR STRUCTURE - ALONG -DET-  
REPLACEMENT OF BRIDGE No. 28  
OVER CURTIS CREEK ON SR 1321  
TIP No. B-3406 STATE PROJECT No. 33037.1.1 FEDERAL I.D. BRZ-132 (1)  
AVERY COUNTY, NORTH CAROLINA

**S&ME**  
ENVIRONMENTAL SERVICES  
ENGINEERING TESTING

APPROVED BY: AFR  
DRAWN BY: TRP  
DATE: MAY 2006  
JOB NO. 105 1-06-023  
SHEET 33 OF 44

SCALE: (V) 1" = 5'  
(H) 1" = 10'

GENERALIZED SUBSURFACE CROSS SECTION THROUGH DETOUR STRUCTURE - END BENT No.1

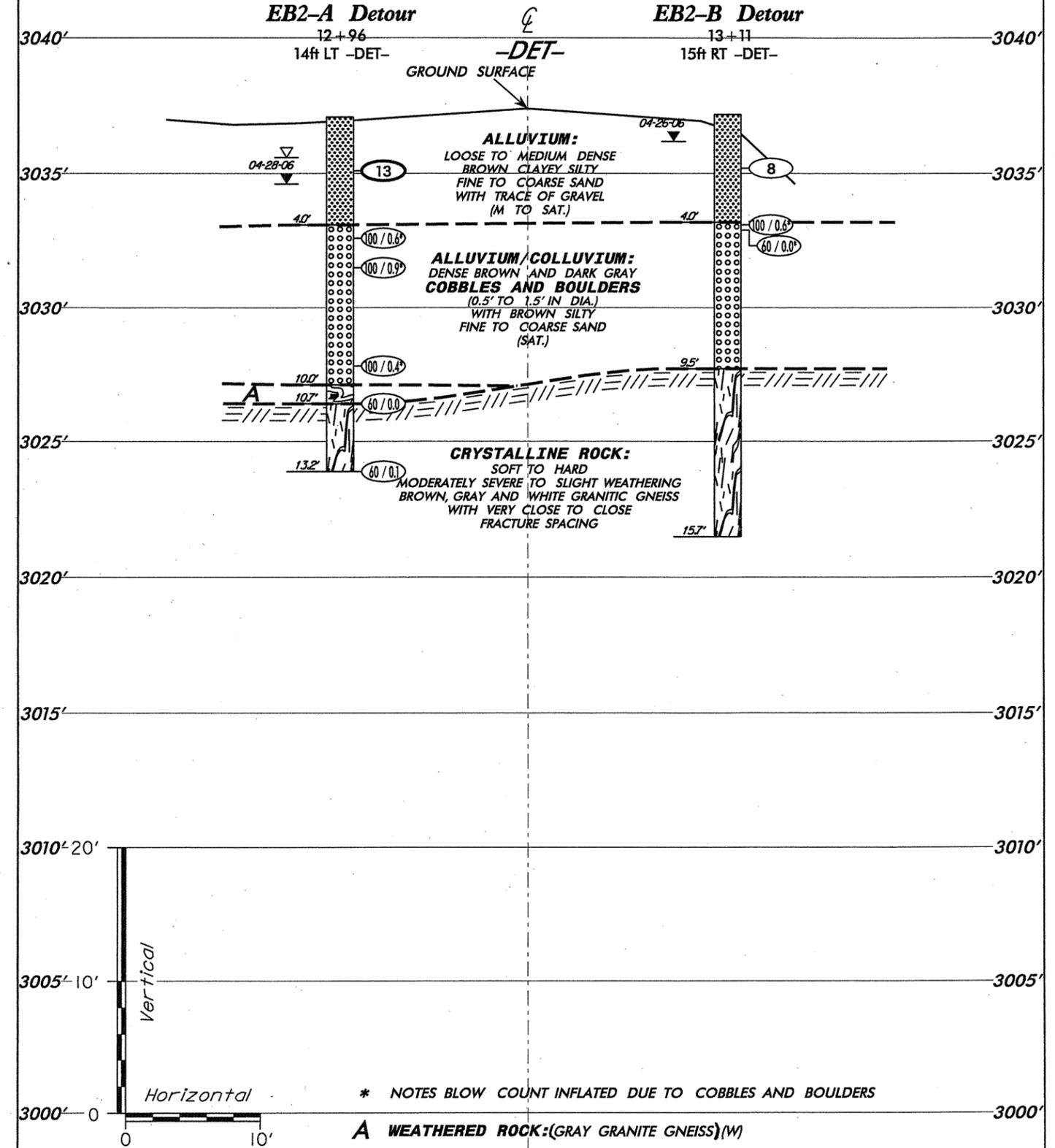


SCALE: (V) 1"=5' (H) 1"= 10'  
 CHECKED BY: AFR  
 DRAWN BY: TRP  
 DATE: MAY 2006  
 JOB NO. 1051-06-023



**GENERALIZED SUBSURFACE CROSS SECTION**  
 THROUGH DETOUR STRUCTURE - END BENT No. 1  
 REPLACEMENT OF BRIDGE No. 28  
 OVER CURTIS CREEK ON SR 132 I  
 TIP No. B-3406 STATE PROJECT No. 33037.1.1  
 FEDERAL ID No. BRZ-132 (1)  
 AVERY COUNTY, NORTH CAROLINA

GENERALIZED SUBSURFACE CROSS SECTION THROUGH DETOUR STRUCTURE - END BENT No.2



SCALE: (V) 1"=5' (H) 1"= 10'  
 CHECKED BY: AFR  
 DRAWN BY: TRP  
 DATE: MAY 2006  
 JOB NO. 1051-06-023



**GENERALIZED SUBSURFACE CROSS SECTION**  
 THROUGH DETOUR STRUCTURE - END BENT No. 2  
 REPLACEMENT OF BRIDGE No. 28  
 OVER CURTIS CREEK ON SR 132 I  
 TIP No. B-3406 STATE PROJECT No. 33037.1.1  
 FEDERAL ID No. BRZ-132 (1)  
 AVERY COUNTY, NORTH CAROLINA

SHEET NO. 34 OF 44

S:\PROJECTS\2006\06-023\GEOTECH\CADD\B-3406 PROFILE\_XSECTIONS.DGN



PROJECT NO. 33037.1.1		ID. B-3406		COUNTY Avery		GEOLOGIST S. Laney							
SITE DESCRIPTION Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)							GROUND WATER (ft)						
BORING NO. EB1-A Detour		BORING LOCATION 12+21		OFFSET 5.0 ft LT		ALIGNMENT -DET-	0 HR. N/A						
COLLAR ELEV. 3,034.3 ft		NORTHING 894,255.1		EASTING 1,131,498.1			24 HR. N/M						
TOTAL DEPTH 16.0 ft		DRILL MACHINE Diedrich D-50		DRILL METHOD 2-1/4" HSA/NQ-2 Core Barrel		HAMMER TYPE MANUAL							
DATE STARTED 4/28/06		COMPLETED 4/28/06		SURFACE WATER DEPTH N/A									
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100
3,034.3					GROUND SURFACE							3,034.3	0.00
3,033.3	1.0												
3,030.8	3.5	1	1	2						M		3,030.8	3.5
		60/0.2								W			
												3,024.8	9.5
												3,023.8	10.5
												3,019.6	14.7
												3,018.3	16.0
					BORING TERMINATED AT ELEV. 3018.3 FEET IN CRYSTALLINE ROCK: MEDIUM HARD BROWN GRAY AND WHITE GRANITIC GNEISS.								

**ALLUVIUM:**  
SOFT BROWN FINE SANDY SILT (A-4)

**ALLUVIUM/COLLUVIUM:**  
MEDIUM DENSE BROWN, GRAY AND WHITE COBBLES TO BOULDERS (0.5 TO 1.5 FEET IN DIAMETER) WITH BROWN SILTY FINE TO COARSE SAND (A-1-a)

**RESIDIUM:**  
HARD DARK GRAY FINE SANDY SILT (A-4)

**CRYSTALLINE ROCK:**  
SOFT TO VERY SOFT, SEVERE WEATHERING, DARK GRAY META SILTSTONE, VERY CLOSE TO CLOSE FRACTURE SPACING AND WITH A COMPLETELY WEATHERED ZONE BETWEEN 14.4 AND 14.7 FEET.  
10 JOINTS @ 0° TO 10°  
6 JOINTS @ 30° TO 45°

**CRYSTALLINE ROCK:**  
MEDIUM HARD TO HARD, SEVERE TO MODERATE WEATHERING, BROWN, GRAY AND WHITE GRANITIC GNEISS CLOSE TO VERY CLOSE FRACTURE SPACING  
2 JOINTS @ 30° TO 45°  
3 JOINTS @ 0° TO 10°

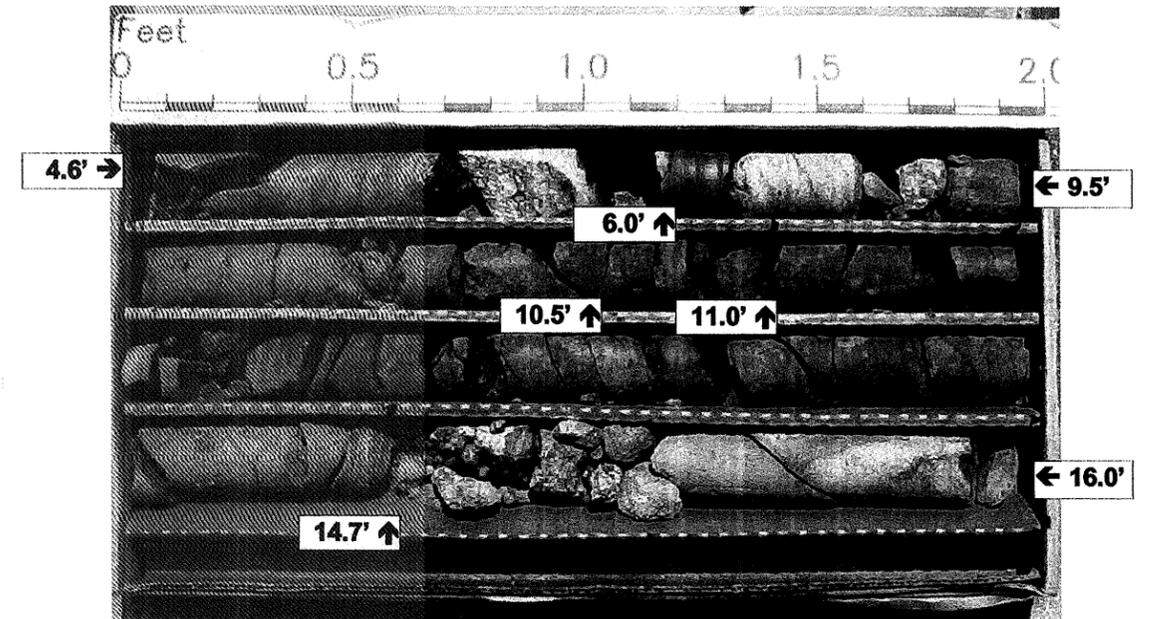
- 1) ADVANCED 2-1/4" HSA TO 4.6 FEET.
- 2) SET NW CASING TO 4.6 FEET.
- 3) ADVANCED NQ-2 CORE BARREL FROM 4.6 TO 16.0 FEET.
- 4) CREEK WATER USED AS DRILLING FLUID.
- 5) APPROXIMATE DRILLING FLUID DENSITY 62.4 PCF.
- 6) NO DRILLING FLUID LOSS OBSERVED.
- 7) \*BLOW COUNTS INFLATED DUE TO COBBLES AND BOULDERS.

NCDOT BORE SINGLE 51-023.GPJ NCDOT.GDT 5/25/06

PROJECT NO. 33037.1.1	ID. B-3406	COUNTY Avery	GEOLOGIST S. Laney
SITE DESCRIPTION Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)			GROUND WATER (ft)
BORING NO. EB1-A Detour	BORING LOCATION 12+21	OFFSET 5.0 ft LT	ALIGNMENT -DET-
COLLAR ELEV. 3,034.3 ft	NORTHING 894,255.1	EASTING 1,131,498.1	0 HR. N/A
TOTAL DEPTH 16.0 ft	DRILL MACHINE Diedrich D-50	DRILL METHOD 2-1/4" HSA/NQ-2 Core Barrel	24 HR. N/M
DATE STARTED 4/28/06	COMPLETED 4/28/06	SURFACE WATER DEPTH N/A	
CORE SIZE NQ-2	TOTAL RUN 11.4 ft	DRILLER L. Shrader	

WBS No: 33037.1.1	ID: B-3406	County: Avery	Boring No.: EB1-A (Detour)
Site Description: Bridge No. 28 over Curtis Creek on SR 1321 (Curtis Creek Rd.) Detour			Driller: L. Shrader
Collar Elev.: 3034.3 ft.	Core Size: NQ-2	Equipment: Diedrich D-50	Geologist: S. Laney
Elev. at T.D.: 3018.3 ft.	Total Depth: 16.0 ft.	Total Run: 11.4 ft.	Date: 4/28/06

ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (ft)	RQD (%)	SAMP. NO.	STRATA REC. (%)	RQD (%)	L O G	DESCRIPTION AND REMARKS
										3,029.7 Begin Coring @ 4.6 ft 4.6
3,029.7	4.6	1.4	3:00	(1.0)	(N/A)					ALLUVIUM/COLLUVIUM: MEDIUM DENSE BROWN, GRAY AND WHITE COBBLES TO BOULDERS (0.5 TO 1.5 FEET IN DIAMETER) WITH BROWN SILTY FINE TO COARSE SAND (A-1-a)
3,028.3	6.0	5.0	1:00/0.4	71%	(N/A)					
			1:00	(2.2)	(N/A)					RESIDUUM: HARD DARK GRAY FINE SANDY SILT (A-4)
			3:30	44%						
3,023.3	11.0	5.0	0:50				(3.8)	(0.0)		CRYSTALLINE ROCK: SOFT TO VERY SOFT, SEVERE WEATHERING, DARK GRAY META SILTSTONE, VERY CLOSE TO CLOSE FRACTURE SPACING AND WITH A COMPLETELY WEATHERED ZONE BETWEEN 14.4 AND 14.7 FEET. 10 JOINTS @ 0° TO 10° 6 JOINTS @ 30° TO 45°
			1:20				90%	0%		
3,018.3	16.0		2:40	(4.7)	(0.0)					CRYSTALLINE ROCK: MEDIUM HARD TO HARD, SEVERE TO MODERATE WEATHERING, BROWN, GRAY AND WHITE GRANITIC GNEISS CLOSE TO VERY CLOSE FRACTURE SPACING 2 JOINTS @ 30° TO 45° 3 JOINTS @ 0° TO 10° BORING TERMINATED AT ELEV. 3018.3 FEET IN CRYSTALLINE ROCK: MEDIUM HARD BROWN GRAY AND WHITE GRANITIC GNEISS.
			1:10	94%	0%					
			1:30				(1.3)	(0.0)		
			1:00				100%	0%		
			1:00							



Box 1 of 1  
Top of Box @ 4.6 feet; Bottom of Box @ 16.0 feet



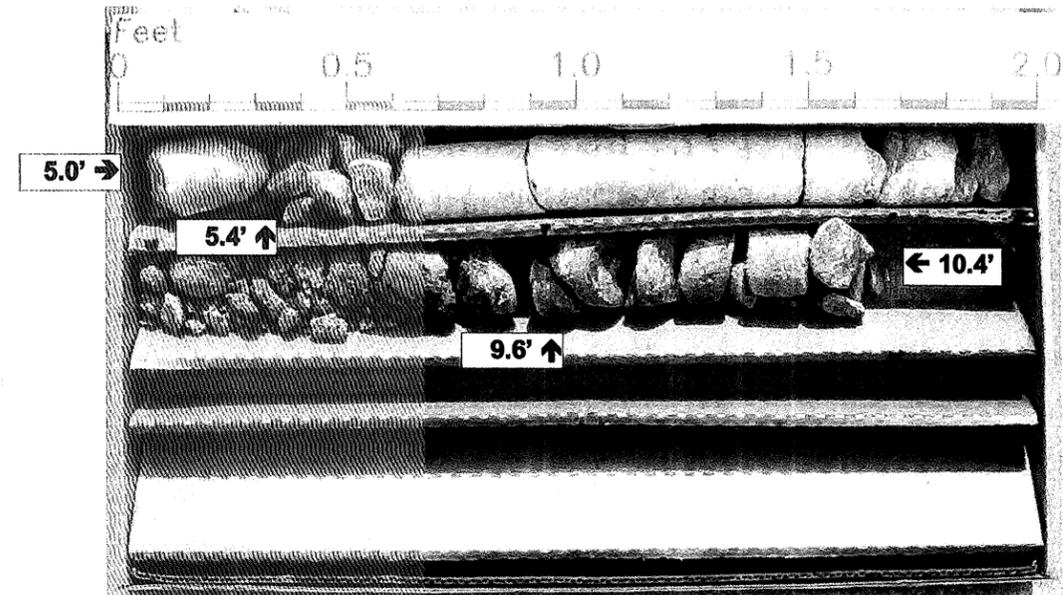
PROJECT NO. 33037.1.1		ID. B-3406		COUNTY Avery		GEOLOGIST S. Laney								
SITE DESCRIPTION Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)							GROUND WATER (ft)							
BORING NO. EB1-B Detour		BORING LOCATION 12+35		OFFSET 14.0 ft RT	ALIGNMENT -DET-	0 HR. N/A	24 HR. N/M							
COLLAR ELEV. 3,034.4 ft		NORTHING 894,232.6		EASTING 1,131,503.0										
TOTAL DEPTH 10.4 ft		DRILL MACHINE Diedrich D-50		DRILL METHOD 2-1/4" HSA/NQ-2 Core Barrel		HAMMER TYPE MANUAL								
DATE STARTED 4/28/06		COMPLETED 4/28/06		SURFACE WATER DEPTH N/A										
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION		
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100	
3,034.4													GROUND SURFACE	0.00
3,033.4	1.0													
3,030.9	3.5	2	1	4								M	ALLUVIUM MEDIUM STIFF BROWN FINE TO COARSE SANDY SILT (A-4)	3.5
		20	30	22									ALLUVIUM/COLLUVIUM DENSE BROWN GRAY AND WHITE COBBLES TO BOULDERS (0.5 TO 1.5 FEET IN DIAMETER) WITH BROWN SILTY FINE TO COARSE SAND (A-1-a)	8.6
													RESIDUUM: DENSE GRAY SILTY FINE TO COARSE SAND (A-2-4)	9.6
													CRYSTALLINE ROCK: SOFT TO MEDIUM HARD, SEVERE WEATHERING, GRAY AND WHITE GRANITIC GNEISS VERY CLOSE TO CLOSE FRACTURE SPACING 2 JOINTS @ 0° TO 10° 1 JOINT @ 45°	10.4
					BORING TERMINATED AT ELEV. 3024.0 FEET IN CRYSTALLINE ROCK: VERY SOFT GRAY AND WHITE GRANITIC GNEISS.									
													1) ADVANCED 2-1/4" HSA TO 4.3 FEET. 2) SET NW CASING TO 4.3 FEET. 3) ADVANCED NQ-2 CORE BARREL FROM 5.0 TO 10.4 FEET. 4) CREEK WATER USED AS DRILLING FLUID. 5) APPROXIMATE DRILLING FLUID DENSITY 62.4 PCF. 6) NO DRILLING FLUID LOSS OBSERVED. 7) *BLOW COUNTS INFLATED DUE TO COBBLES AND BOULDERS.	

NCDOT BORE SINGLE 51-023 GPJ NCDOT GDT 5/25/06

PROJECT NO. 33037.1.1	ID. B-3406	COUNTY Avery	GEOLOGIST S. Laney
SITE DESCRIPTION Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)			GROUND WATER (ft)
BORING NO. EB1-B Detour	BORING LOCATION 12+35	OFFSET 14.0 ft RT	ALIGNMENT -DET-
COLLAR ELEV. 3,034.4 ft	NORTHING 894,232.6	EASTING 1,131,503.0	0 HR. N/A
TOTAL DEPTH 10.4 ft	DRILL MACHINE Diedrich D-50	DRILL METHOD 2-1/4" HSA/NQ-2 Core Barrel	24 HR. N/M
DATE STARTED 4/28/06	COMPLETED 4/28/06	SURFACE WATER DEPTH N/A	
CORE SIZE NQ-2	TOTAL RUN 5.4 ft	DRILLER L. Shrader	

WBS No: 33037.1.1	ID: B-3406	County: Avery	Boring No.: EB1-B (Detour)
Site Description: Bridge No. 28 over Curtis Creek on SR 1321 (Curtis Creek Rd.) Detour			Driller: L. Shrader
Collar Elev.: 3034.4 ft.	Core Size: NQ-2	Equipment: Diedrich D-50	Geologist: S. Laney
Elev. at T.D.: 3024.0 ft.	Total Depth: 10.4 ft.	Total Run: 5.4 ft.	Date: 4/28/06

ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS
				REC. (%)	RQD (%)		REC. (%)	RQD (%)		
										3,029.4 Begin Coring @ 5.0 ft 5.0
3,029.4	5.0	0.4	0:10/0.4	(0.4)	(N/A)					ALLUVIUM/COLLUVIUM DENSE BROWN GRAY AND WHITE COBBLES TO BOULDERS (0.5 TO 1.5 FEET IN DIAMETER) WITH BROWN SILTY FINE TO COARSE SAND (A-1-a) RESIDUUM: DENSE GRAY SILTY FINE TO COARSE SAND (A-2-4) CRYSTALLINE ROCK: SOFT TO MEDIUM HARD, SEVERE WEATHERING, GRAY AND WHITE GRANITIC GNEISS VERY CLOSE TO CLOSE FRACTURE SPACING 2 JOINTS @ 0° TO 10° 1 JOINT @ 45° BORING TERMINATED AT ELEV. 3024.0 FEET IN CRYSTALLINE ROCK: VERY SOFT GRAY AND WHITE GRANITIC GNEISS.
3,029.0	5.4	5.0	0:50	100%	(N/A)					
			1:00	(3.5)						
			0:30	70%						
3,024.0	10.4		0:30	(0.8)	(0.0)					3,024.8 8.6 3,024.8 9.6 3,024.0 10.4

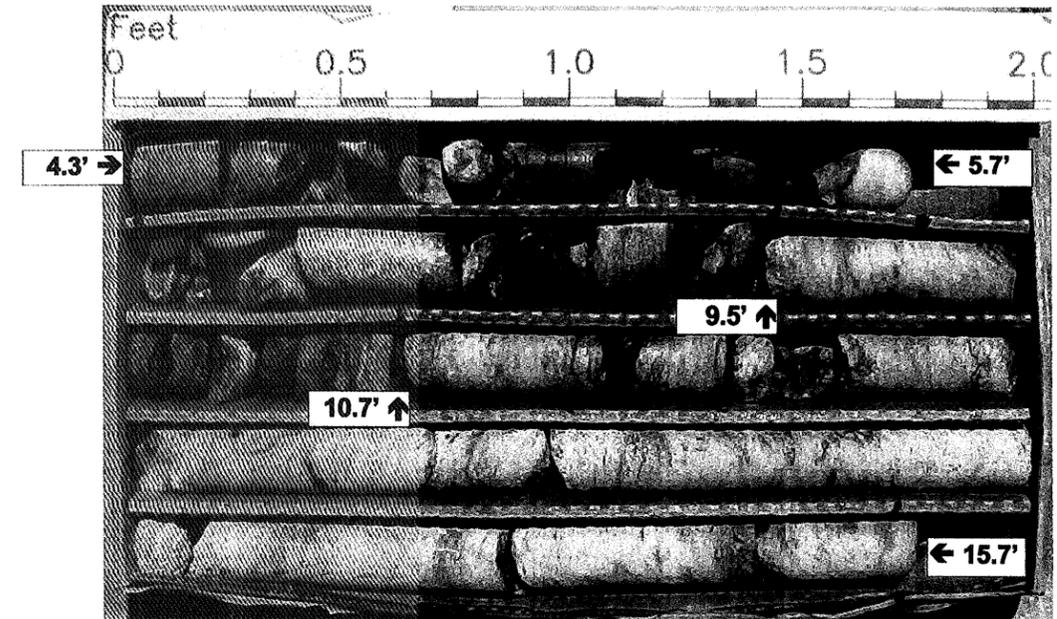


Box 1 of 1  
Top of Box @ 5.0 feet; Bottom of Box @ 10.4 feet



PROJECT NO. 33037.1.1		ID. B-3406		COUNTY Avery		GEOLOGIST S. Laney					
SITE DESCRIPTION Bridge No. 28 over Curtis Creek on S.R. 1321 (Curtis Creek Road)						GROUND WATER (ft)					
BORING NO. EB2-B Detour		BORING LOCATION 13+11		OFFSET 15.0 ft RT		ALIGNMENT -DET-					
COLLAR ELEV. 3,037.2 ft		NORTHING 894,202.7		EASTING 1,131,575.1		0 HR. N/A					
TOTAL DEPTH 15.7 ft		DRILL MACHINE Diedrich D-50		DRILL METHOD 2-1/4" HSA/NQ-2 Core Barrel		24 HR. 1.0 on 04-26-06					
DATE STARTED 4/25/06		COMPLETED 4/25/06		SURFACE WATER DEPTH N/A		HAMMER TYPE MANUAL					
CORE SIZE NQ-2		TOTAL RUN 11.4 ft		DRILLER L. Shrader							
ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS	
										3,032.9 Begin Coring @ 4.3 ft 4.3	
3,032.9	4.3	1.4	1:00	(1.4)	(N/A)					ALLUVIUM/COLLUVIUM: DENSE DARK GRAY COBBLES AND BOULDERS (0.5 TO 1.5 FEET IN DIAMETER) WITH BROWN SILTY FINE TO COARSE SAND (A-1-a)	
3,031.5	5.7	5.0	0:30/0.4	100%	(N/A)						
			1:30	(2.6)						CRYSTALLINE ROCK: MEDIUM HARD TO HARD MODERATELY SEVERE TO SLIGHT WEATHERING BROWN, GRAY AND WHITE GRANITIC GNEISS WITH VERY CLOSE TO CLOSE FRACTURE SPACING	
			1:00	52%							
3,026.5	10.7	5.0	1:00	(6.1)	(4.3)		98%	69%		9.5	
			1:00	(4.9)	(3.8)					CRYSTALLINE ROCK: MEDIUM HARD TO HARD MODERATELY SEVERE TO SLIGHT WEATHERING BROWN, GRAY AND WHITE GRANITIC GNEISS WITH VERY CLOSE TO CLOSE FRACTURE SPACING 9 JOINTS @ 0° TO 10° 3 JOINTS @ 30° TO 45° BORING TERMINATED AT ELEV. 3021.5 FEET IN CRYSTALLINE ROCK: HARD BROWN GRAY AND WHITE GRANITIC GNEISS.	
			1:00	98%	76%						
3,021.5	15.7		1:30								15.7
			1:30								

WBS No: 33037.1.1	ID: B-3406	County: Avery	Boring No.: EB2-B (Detour)
Site Description: Bridge No. 28 over Curtis Creek on SR 1321 (Curtis Creek Rd.) Detour			Driller: L. Shrader
Collar Elev.: 3037.2 ft.	Core Size: NQ-2	Equipment: Diedrich D-50	Geologist: S. Laney
Elev. At T.D.: 3021.5 ft.	Total Depth: 15.7 ft.	Total Run: 11.4 ft.	Date: 4/26/06



Box 1 of 1  
Top of Box @ 4.3 feet; Bottom of Box @ 15.7 feet

**SUMMARY OF LABORATORY TEST DATA**

Soil Classification and Gradation

Boring No.	Sample No.	Sample Depth Feet	AASHTO Classification		% Passing Sieve #				Coarse	Fine	Silt	Clay	LL	PL	PI	Organic Content %	Moisture Content %
					10	40	60	200	Sand	Sand							
EB2-A	SS-1	1.0-2.5	A-2-4	(0)	44	30	25	18	43	19	20	18	30	23	7	N.A.	N.A.

N.A.: Not Analyzed  
 N.P.: Non Plastic

Project Name: Bridge No. 28 over Curtis Creek on SR 1321 (Detour)

S&ME Project No.: 1051-06-023

State Project No. 33037.1.1

County: Avery

Federal ID No.: BRZ-1321 (1)

TIP No.: B-3406

Checked By: JSJ & AFR

### Particle Size Analysis of Soils

AASHTO T 88 as Modified by NCDOT



S&ME Project #: **1051-06-023** Report Date: 5/8/06  
 Project Name: **BRIDGE 28 OVER CURTIS CREEK ON S.R.1321 DET.** Test Date(s): 5/3-8/06  
 Client Name: NCDOT  
 Client Address: RALEIGH, NC  
 State Project #: 33037.1.1 F.A. Project No: BRZ-1321 (1) TIP NO: B-3406

Boring #: EB2-A (DETOUR) Sample #: SS-1 Sample Date: 4/24-28/06  
 Location: STA. 12+96 Offset: 14' LT Depth: 1.0-2.5'  
 Sample Description: BROWN CLAYEY SILTY FINE TO COURSE SAND (A-2-4)



As Defined by NCDOT		Fine Sand	
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.25 mm and > 0.05 mm
Coarse Sand	< 2.00 mm and > 0.25 mm	Clay	< 0.05 and > 0.005 mm
			< 0.005 mm

Maximum Particle Size	1.5"	Coarse Sand	19.0%	Silt	9%
Gravel	55.9%	Fine Sand	8.3%	Clay	8%
Apparent Relative Density	2.650	Moisture Content		% Passing #200	18.2%
Liquid Limit	30	Plastic Limit	23	Plastic Index	7

Soil Mortar (-#10 Sieve)					
Coarse Sand	43.1%	Fine Sand	18.8%	Silt	20%
				Clay	18%

Description of Sand & Gravel Particles: Rounded  Angular  Hard & Durable  Soft  Weathered & Friable   
 Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g/ Liter

References: AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT  
 AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test AASHTO T265: Laboratory Determination of Moisture Content of Soils  
 AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils  
 AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Stewart Laney \_\_\_\_\_  
 Signature Signature



**Photograph No. 1:**  
This photograph was taken from the proposed west approach of the detour bridge, along the -Detour- alignment, looking east.



**Photograph No. 3:**  
This photograph was taken from the right side of the detour alignment, looking north, across proposed End Bent No. 1 of the detour bridge.



**Photograph No. 2:**  
This photograph was taken from the left side of the detour alignment, looking south, across proposed End Bent No. 1 of the detour bridge.



**Photograph No. 4:**  
This photograph was taken from the left side of the detour alignment, looking south, across proposed End Bent No. 2 of the detour bridge.



**Photograph No. 5:**  
This photograph was taken from the right side of the detour alignment, looking north, across proposed End Bent No. 2 of the detour bridge.



**Photograph No. 7:**  
This photograph was taken from the proposed detour bridge location, looking south (upstream) at Curtis Creek.



**Photograph No. 6:**  
This photograph was taken from the proposed detour bridge location, looking north (downstream) at Curtis Creek.



**Photograph No. 8:**  
This photograph was taken from the proposed east approach of the detour bridge, along the -Detour- alignment, looking west.