

CONTRACT: ID: B-3876

# STATE OF NORTH CAROLINA

## DEPARTMENT OF TRANSPORTATION

### DIVISION OF HIGHWAYS

### GEOTECHNICAL UNIT

# STRUCTURE SUBSURFACE INVESTIGATION

| STATE           | STATE PROJECT REFERENCE NO. | SHEET NO.      | TOTAL SHEETS |
|-----------------|-----------------------------|----------------|--------------|
| N.C.            | 33320.1.1 (B-3876)          | 1              | 17           |
| STATE PROJ. NO. | F.A. PROJ. NO.              | DESCRIPTION    |              |
|                 |                             | P.E.<br>CONST. |              |

#### CONTENTS:

| <u>SHEET</u> | <u>DESCRIPTION</u>      |
|--------------|-------------------------|
| 1            | TITLE SHEET             |
| 2            | LEGEND                  |
| 3            | TEXT REPORT             |
| 4            | SITE PLAN               |
| 5            | PROFILE                 |
| 6, 7         | CROSS SECTIONS          |
| 8-13         | BORE LOG & CORE REPORTS |
| 14           | SOIL TEST RESULTS       |
| 15           | SCOUR REPORT            |
| 16           | CORE PHOTOGRAPHS        |
| 17           | SITE PHOTOGRAPH         |

#### CAUTION NOTICE

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

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

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

STATE PROJECT 33320.1.1 I.D. NO. B-3876

F.A. PROJECT BRZ-1004(9)

COUNTY NASH

PROJECT DESCRIPTION BRIDGE NO. 34

ON -L- (SR 1004) OVER PIG BASKET

CREEK AT -L- STATION 22+03.6

INVESTIGATED BY S. P. BROWN PERSONNEL (TIERRA, INC.)

CHECKED BY D. N. ARGENBRIGHT I. T. CRUZ

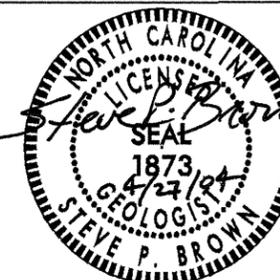
SUBMITTED BY D. N. ARGENBRIGHT S. RIVERA

DATE APRIL 2004

DRAWN BY: S. P. BROWN

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

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

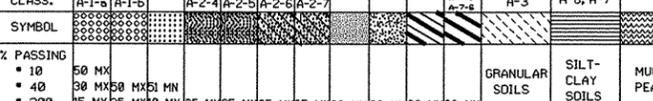
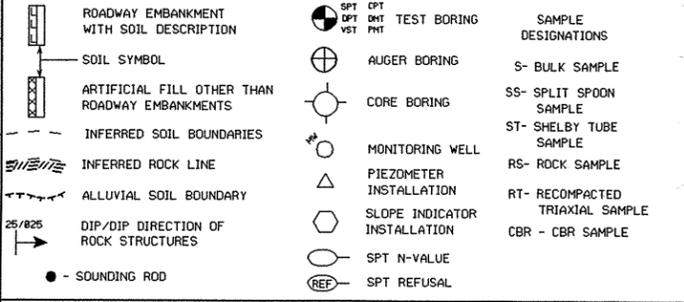


**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**GEOTECHNICAL UNIT**

|        |                   |           |              |
|--------|-------------------|-----------|--------------|
| ID     | STATE PROJECT NO. | SHEET NO. | TOTAL SHEETS |
| B-3876 | 33320.1J          | 2         | 17           |

**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 (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:<br><i>VERY STIFF, GRAY SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGH PLASTIC, A-7-6</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>WELL GRADED</b> - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE<br><b>UNIFORM</b> - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)<br><b>GAP-GRADED</b> - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.<br><br><b>ANGULARITY OF GRAINS</b><br>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS: <b>ANGULAR</b> , <b>SUBANGULAR</b> , <b>SUBROUNDED</b> , OR <b>ROUNDED</b> .                                                                                                                                                                                                    | <b>HARD ROCK</b> 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.<br>ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:<br><br><b>WEATHERED ROCK (WR)</b><br><br><b>CRYSTALLINE ROCK (CR)</b><br><br><b>NON-CRYSTALLINE ROCK (NCR)</b><br><br><b>COASTAL PLAIN SEDIMENTARY ROCK (CPS)</b><br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>ALLUVIUM (ALLUV.)</b> - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER.<br><b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA.<br><b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.<br><b>ARGILLACEOUS</b> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.<br><b>ARTESIAN</b> - 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.<br><b>CALCAREOUS (CALC.)</b> - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.<br><b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.<br><b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.<br><b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.<br><b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.<br><b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.<br><b>FAULT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.<br><b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.<br><b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.<br><b>FLOOD PLAIN (F.P.)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.<br><b>FORMATION (FM.)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.<br><b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.<br><b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.<br><b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.<br><b>MOTTLED (MOT.)</b> - IRRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.<br><b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.<br><b>RESIDUAL SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.<br><b>ROCK QUALITY DESIGNATION (R.Q.D.)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.<br><b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.<br><b>SILL</b> - 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 INTRODUCED ROCKS.<br><b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.<br><b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - NUMBER OF BLOWS (IN 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.<br><b>STRATA CORE RECOVERY (SREC.)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.<br><b>STRATA ROCK QUALITY DESIGNATION (S.R.Q.D.)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 10 CENTIMETERS DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.<br><b>TOPSOIL (T.S.)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER. |
| <b>SOIL LEGEND AND AASHTO CLASSIFICATION</b><br>GENERAL CLASS. GRANULAR MATERIALS (< 75% PASSING #200) SILT-CLAY MATERIALS (> 75% PASSING #200) ORGANIC MATERIALS<br>GROUP CLASS. A-1-a, A-1-b, A-2, A-2-4, A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, A-7-5, A-7-6, A-1, A-2, A-3, A-4, A-5, A-6, A-7<br>SYMBOL <br>% PASSING: 10, 40, 200 (for 60, 100, 200 mesh)<br>LIQUID LIMIT PLASTIC INDEX: 6 MX, N.P., 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100<br>USUAL TYPES OF MAJOR MATERIALS: STONE FRAGS, GRAVEL AND SAND, FINE SAND, SILTY OR CLAYEY GRAVEL AND SAND, SILTY SOILS, CLAYEY SOILS<br>GEN. RATING AS A SUBGRADE: EXCELLENT TO GOOD, FAIR TO POOR, POOR, UNSUITABLE<br>P.I. OF A-7-5 ≤ L.L. - 30 & P.I. OF A-7-6 > L.L. - 30 | <b>MINERALOGICAL COMPOSITION</b><br>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.<br><br><b>COMPRESSIBILITY</b><br>SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 30<br>MODERATELY COMPRESSIBLE LIQUID LIMIT 31-50<br>HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50<br><br><b>PERCENTAGE OF MATERIAL</b><br>ORGANIC MATERIAL GRANULAR SOILS SILT-CLAY SOILS OTHER MATERIAL<br>TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10%<br>LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20%<br>MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35%<br>HIGHLY ORGANIC >10% >20% HIGHLY 35% AND ABOVE | <b>WEATHERING</b><br>FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.<br>VERY SLIGHT (V. SL.) 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.<br>SLIGHT (SL.) 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.<br>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.<br>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><br>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><br>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><br>COMPLETE ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>CONSISTENCY OR DENSENESS</b><br>PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> )<br>GENERALLY GRANULAR MATERIAL (NON-COHESIVE) VERY LOOSE, LOOSE, MEDIUM DENSE, DENSE, VERY DENSE < 4, 4 TO 10, 10 TO 30, 30 TO 50, > 50 N/A<br>GENERALLY SILT-CLAY MATERIAL (COHESIVE) VERY SOFT, SOFT, MEDIUM STIFF, STIFF, VERY STIFF, HARD < 2, 2 TO 4, 4 TO 8, 8 TO 15, 15 TO 30, > 30 < 0.25, 0.25 TO 0.5, 0.5 TO 1, 1 TO 2, 2 TO 4, > 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>MISCELLANEOUS SYMBOLS</b><br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>ROCK HARDNESS</b><br>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.<br>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.<br>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.<br>MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.<br>SOFT CAN BE GROUDED 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.<br>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>TEXTURE OR GRAIN SIZE</b><br>U.S. STD. SIEVE SIZE OPENING (MM) 4, 10, 40, 60, 200, 270<br>BOULDER (BLDR.) COBBLE (COB.) GRAVEL (GR.) COARSE SAND (CSE. SD.) FINE SAND (F. SD.) SILT (SL.) CLAY (CL.)<br>GRAIN SIZE MM 305, 75, 2.0, 0.25, 0.05, 0.005<br>IN. 12", 3", 0.075, 0.010, 0.002                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>ABBREVIATIONS</b><br>AR - AUGER REFUSAL<br>BT - BORING TERMINATED<br>CL - CLAY<br>CPT - CONE PENETRATION TEST<br>CSE. - COARSE<br>DMT - DILATOMETER TEST<br>DPT - DYNAMIC PENETRATION TEST<br>e - VOID RATIO<br>F. - FINE<br>FOSS. - FOSSILIFEROUS<br>FRAC. - FRACTURED<br>FRAGS. - FRAGMENTS<br>MED. - MEDIUM<br>PMT - PRESSUREMETER TEST<br>SD. - SAND, SANDY<br>SL. - SILT, SILTY<br>SLI. - SLIGHTLY<br>TCR - TRICONE REFUSAL<br>T - UNIT WEIGHT<br>W - MOISTURE CONTENT<br>V. - VERY<br>VST - VANE SHEAR TEST                                                                                                                                                                       | <b>ROCK HARDNESS</b><br>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.<br>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.<br>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.<br>MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.<br>SOFT CAN BE GROUDED 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.<br>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>SOIL MOISTURE - CORRELATION OF TERMS</b><br>SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION<br>LL - LIQUID LIMIT - SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE<br>PL - PLASTIC LIMIT - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE<br>OM - OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE<br>SL - SHRINKAGE LIMIT - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>EQUIPMENT USED ON SUBJECT PROJECT</b><br>DRILL UNITS: MOBILE B-____, BK-51, CME-45C, CME-550, PORTABLE HOIST, DIEDRICH D-50 TURBO ON TRACKS, OTHER_____<br>ADVANCING TOOLS: CLAY BITS, 6" CONTINUOUS FLIGHT AUGER, 8" HOLLOW AUGERS, HARD FACED FINGER BITS, TUNG-CARBIDE INSERTS, CASING W/ ADVANCER, TRICONE STEEL TEETH, TRICONE TUNG-CARB., OTHER_____<br>HAMMER TYPE: AUTOMATIC, MANUAL<br>CORE SIZE: B, N-W4, H<br>HAND TOOLS: POST HOLE DIGGER, HAND AUGER, SOUNDING ROD, VANE SHEAR TEST, OTHER_____                                                                                                                                                                            | <b>ROCK HARDNESS</b><br>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.<br>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.<br>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.<br>MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.<br>SOFT CAN BE GROUDED 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.<br>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>PLASTICITY</b><br>NONPLASTIC 0-5 VERY LOW<br>LOW PLASTICITY 6-15 SLIGHT<br>MED. PLASTICITY 16-25 MEDIUM<br>HIGH PLASTICITY 26 OR MORE HIGH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>FRACTURE SPACING</b><br>TERM SPACING<br>VERY WIDE MORE THAN 10 FEET<br>WIDE 3 TO 10 FEET<br>MODERATELY CLOSE 1 TO 3 FEET<br>CLOSE 0.16 TO 1 FEET<br>VERY CLOSE LESS THAN 0.16 FEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>ROCK HARDNESS</b><br>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.<br>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.<br>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.<br>MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.<br>SOFT CAN BE GROUDED 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.<br>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>COLOR</b><br>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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>BEDDING</b><br>TERM THICKNESS<br>VERY THICKLY BEDDED > 4 FEET<br>THICKLY BEDDED 1.5 - 4 FEET<br>THINLY BEDDED 0.16 - 1.5 FEET<br>VERY THINLY BEDDED 0.03 - 0.16 FEET<br>THICKLY LAMINATED 0.008 - 0.03 FEET<br>THINLY LAMINATED < 0.008 FEET                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>ROCK HARDNESS</b><br>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.<br>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.<br>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.<br>MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.<br>SOFT CAN BE GROUDED 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.<br>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>INDURATION</b><br>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.<br>FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.<br>MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.<br>INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.<br>EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.                                                                                                                                            | <b>ROCK HARDNESS</b><br>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.<br>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.<br>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.<br>MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.<br>SOFT CAN BE GROUDED 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.<br>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>FRACTURE SPACING</b><br>TERM SPACING<br>VERY WIDE MORE THAN 10 FEET<br>WIDE 3 TO 10 FEET<br>MODERATELY CLOSE 1 TO 3 FEET<br>CLOSE 0.16 TO 1 FEET<br>VERY CLOSE LESS THAN 0.16 FEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>ROCK HARDNESS</b><br>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.<br>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.<br>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.<br>MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.<br>SOFT CAN BE GROUDED 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.<br>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>BEDDING</b><br>TERM THICKNESS<br>VERY THICKLY BEDDED > 4 FEET<br>THICKLY BEDDED 1.5 - 4 FEET<br>THINLY BEDDED 0.16 - 1.5 FEET<br>VERY THINLY BEDDED 0.03 - 0.16 FEET<br>THICKLY LAMINATED 0.008 - 0.03 FEET<br>THINLY LAMINATED < 0.008 FEET                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>ROCK HARDNESS</b><br>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.<br>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.<br>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.<br>MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.<br>SOFT CAN BE GROUDED 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.<br>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>INDURATION</b><br>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.<br>FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.<br>MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.<br>INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.<br>EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.                                                                                                                                            | <b>ROCK HARDNESS</b><br>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.<br>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.<br>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.<br>MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.<br>SOFT CAN BE GROUDED 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.<br>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>FRACTURE SPACING</b><br>TERM SPACING<br>VERY WIDE MORE THAN 10 FEET<br>WIDE 3 TO 10 FEET<br>MODERATELY CLOSE 1 TO 3 FEET<br>CLOSE 0.16 TO 1 FEET<br>VERY CLOSE LESS THAN 0.16 FEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>ROCK HARDNESS</b><br>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.<br>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.<br>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.<br>MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.<br>SOFT CAN BE GROUDED 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.<br>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>BEDDING</b><br>TERM THICKNESS<br>VERY THICKLY BEDDED > 4 FEET<br>THICKLY BEDDED 1.5 - 4 FEET<br>THINLY BEDDED 0.16 - 1.5 FEET<br>VERY THINLY BEDDED 0.03 - 0.16 FEET<br>THICKLY LAMINATED 0.008 - 0.03 FEET<br>THINLY LAMINATED < 0.008 FEET                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>ROCK HARDNESS</b><br>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.<br>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.<br>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.<br>MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.<br>SOFT CAN BE GROUDED 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.<br>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>INDURATION</b><br>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.<br>FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.<br>MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.<br>INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.<br>EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.                                                                                                                                            | <b>ROCK HARDNESS</b><br>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.<br>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.<br>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.<br>MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.<br>SOFT CAN BE GROUDED 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.<br>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>FRACTURE SPACING</b><br>TERM SPACING<br>VERY WIDE MORE THAN 10 FEET<br>WIDE 3 TO 10 FEET<br>MODERATELY CLOSE 1 TO 3 FEET<br>CLOSE 0.16 TO 1 FEET<br>VERY CLOSE LESS THAN 0.16 FEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>ROCK HARDNESS</b><br>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.<br>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.<br>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.<br>MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.<br>SOFT CAN BE GROUDED 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.<br>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>BEDDING</b><br>TERM THICKNESS<br>VERY THICKLY BEDDED > 4 FEET<br>THICKLY BEDDED 1.5 - 4 FEET<br>THINLY BEDDED 0.16 - 1.5 FEET<br>VERY THINLY BEDDED 0.03 - 0.16 FEET<br>THICKLY LAMINATED 0.008 - 0.03 FEET<br>THINLY LAMINATED < 0.008 FEET                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>ROCK HARDNESS</b><br>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.<br>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.<br>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.<br>MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.<br>SOFT CAN BE GROUDED 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.<br>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>INDURATION</b><br>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.<br>FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.<br>MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.<br>INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |



STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY  
GOVERNOR

P.O. BOX 25201, RALEIGH, N.C. 27611-5201

LYNDO TIPPETT  
SECRETARY

April 22, 2004

STATE PROJECT: 33320.1.1 (B-3876)  
FEDERAL PROJECT: BRZ-1004(9)  
COUNTY: Nash  
DESCRIPTION: Bridge No. 34 on -L- (SR 1004) over Pig Basket Creek  
SUBJECT: Geotechnical Report - Bridge Foundation Investigation for Bridge No. 34 on -L- (SR 1004) over Pig Basket Creek at -L- Station 22+03.6

**Project Description**

Project B-3876 provides for the replacement of an existing bridge on SR 1004 over Pig Basket Creek, approximately 2.5 miles northwest of Nashville. The replacement structure will be constructed approximately 50 feet east (downstream) of the existing alignment. It will consist of three spans with an overall length of 150 feet. Bents are proposed on a 110° skew.

The site was investigated in March 2004, using a Diedrich D-50 Turbo drill with an automatic hammer, mounted on a tracked carrier. Borings were mud drilled through soil, weathered rock, and rock using a tricone bit, N casing, and NWD4 core equipment. Standard Penetration Tests were performed and representative soil and rock samples were submitted to the Materials and Tests Unit laboratory for analysis. Bridge rods were driven to refusal at two locations along the proposed interior bents that were inaccessible to the drill rig.

**Physiography and Geology**

The project is in very gently rolling terrain, in the vicinity of the boundary between the Piedmont and Coastal Plain Physiographic Provinces. Surface water level in Pig Basket Creek varied little during the investigation, with a measured elevation of 148.2 feet. Woodlands surround the project. Metamorphosed mudstone, siltstone, and volcanic rocks of the Eastern Slate Belt underlie the area. Foundation materials at the site include alluvial and residual soils, weathered rock, metavolcanic rock, and artificial fill.

**Foundation Description**

**Soil Properties**

Alluvial deposits consist of 6 to 10 feet of interbedded sandy silt (A-4), silty sand (A-2-4), and gravelly sand (A-1-b). These soils transition at shallow depth from moist to wet, related to a very shallow groundwater table. The sandy silt is very soft to stiff. Sands are very loose to medium dense.

The alluvial deposits rest on residual, very stiff to hard, sandy silt (A-4). All residual soils are below the water table, and are consequently wet. Thickness varies between 5 and 12 feet. Residual soil transitions to weathered rock between elevations 131 and 138 feet.

Several large mounds of artificial fill are present right of -L-, in the vicinity of, and ahead of, End Bent 2. These mounds appear to be waste material placed on the floodplain surface adjacent to the creek bank. Broken blocks of concrete were observed on the mounds' surfaces. Steep and irregular topography prevented rig access to investigate these features.

**Rock Properties**

Weathered rock is present across the site. It is derived from in-place weathering of the underlying metavolcanic rock. Thickness varies from 5 to 20 feet. The weathered rock grades to metavolcanic rock at elevations between 117 and 129 feet. Less than 2 feet of core were cut at each of the two interior bent borings. The metavolcanic rock is very slightly weathered to fresh, and very hard to hard. Core from boring B1-B is very closely to closely fractured, with a recovery of 60% and an RQD of 47%. A single, unfractured piece of core was obtained from boring B2-A, representing a recovery of 94% and an RQD of 94%.

**Groundwater**

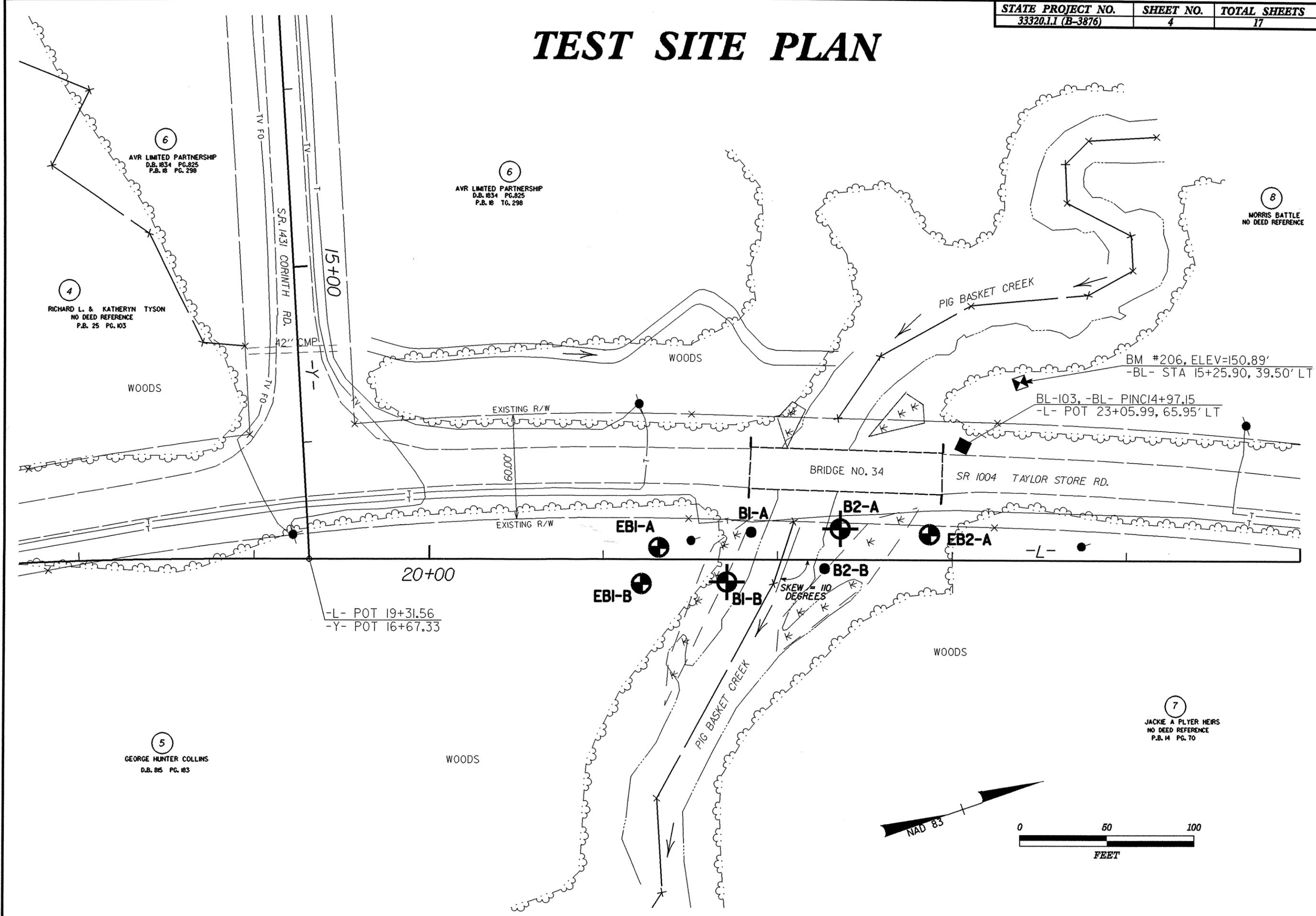
Surface water elevation of Pig Basket Creek was measured at 148.2 feet. Groundwater elevations measured in the five borings varied 0.3 feet or less from the surface water elevation. These elevations indicate that the alluvial soils are highly permeable, and that an equilibrium exists between the water table elevation and the level of Pig Basket Creek.

Respectfully submitted,

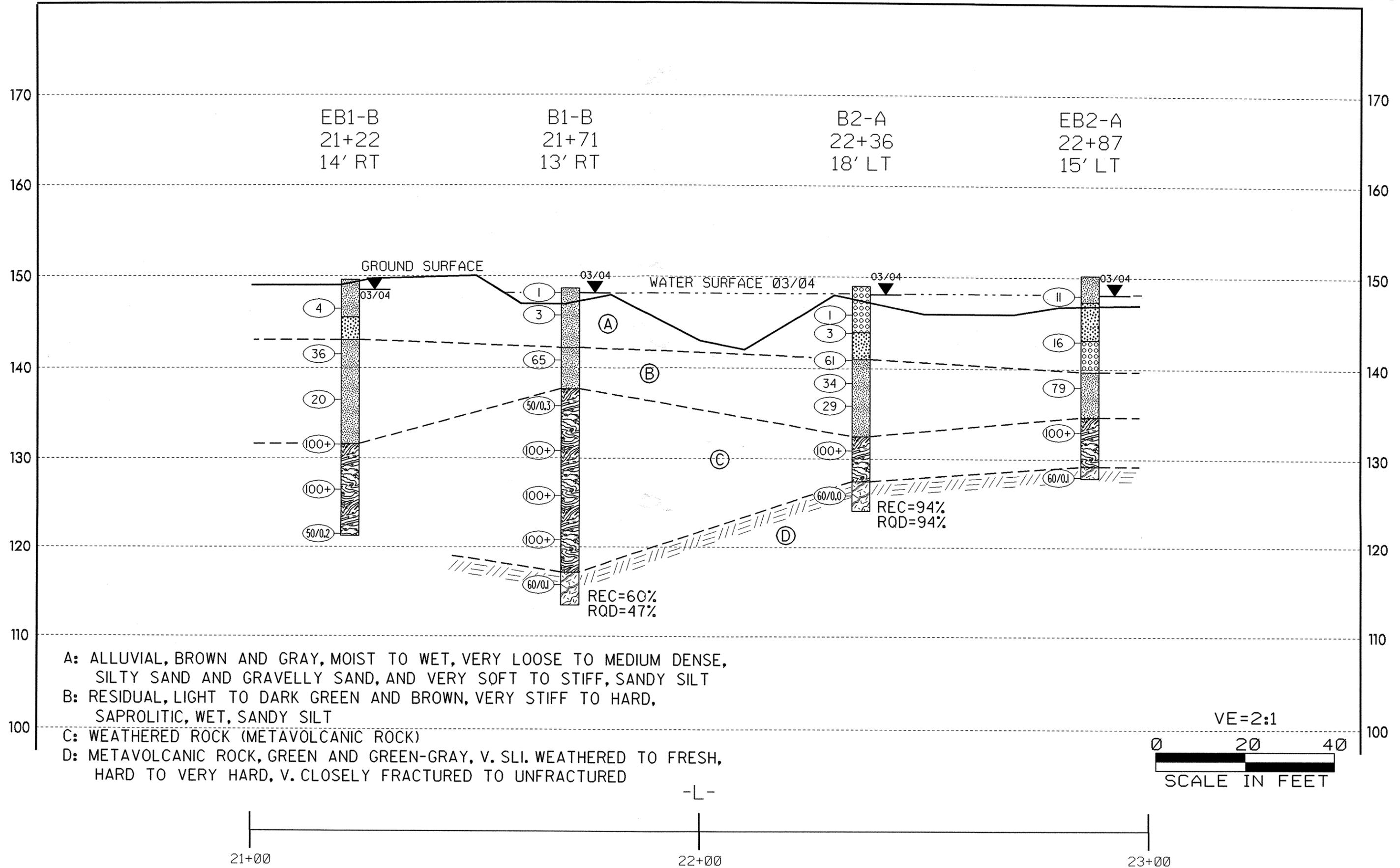
A handwritten signature in black ink that reads "Steve P. Brown".

Steve P. Brown, LG  
Project Engineering Geologist

# TEST SITE PLAN

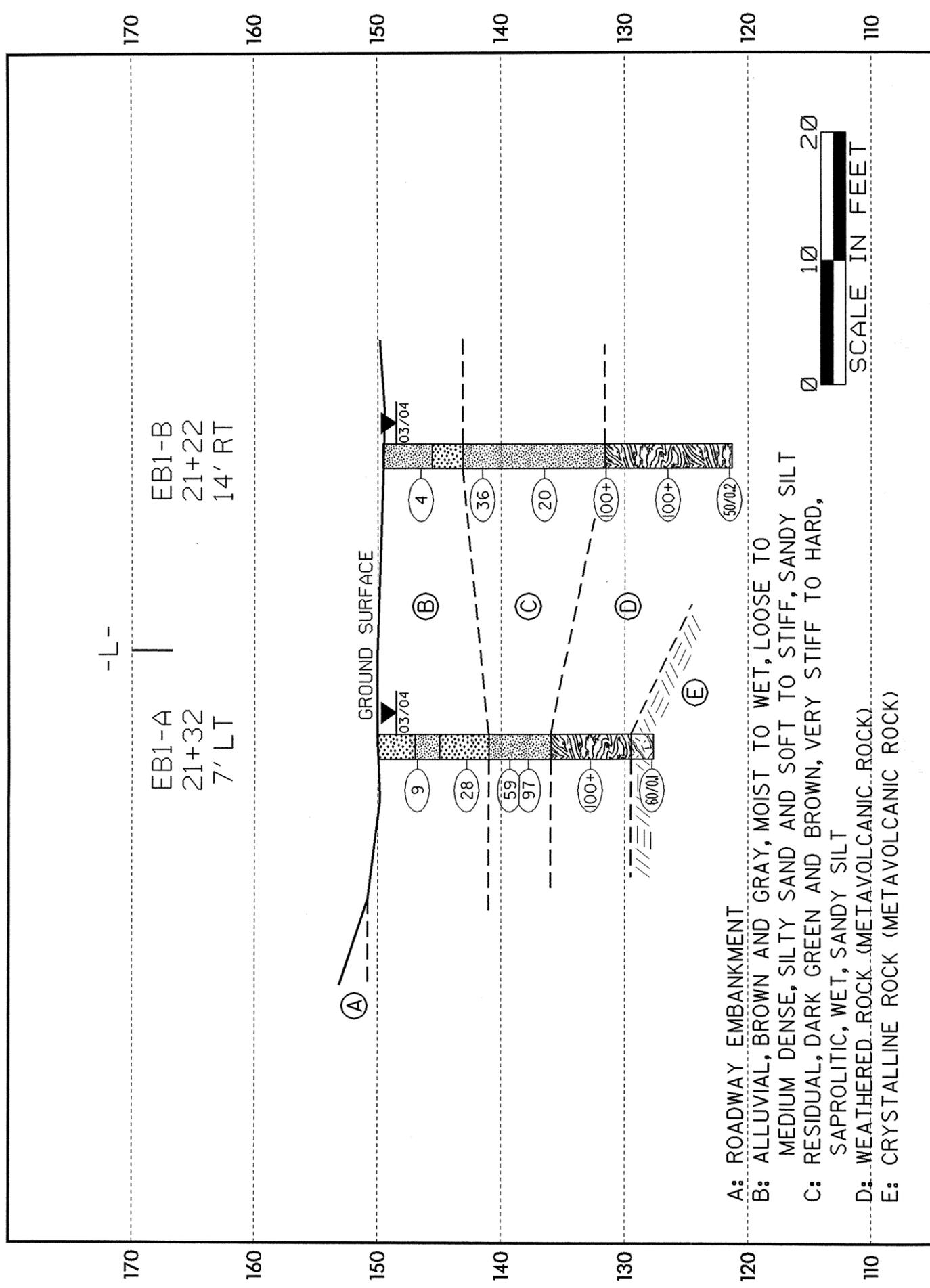


# PROFILE THROUGH BORINGS PROJECTED ALONG -L-



# CROSS SECTION THROUGH END BENT I

BRIDGE NO. 34, 33320.1.1 (B-3876)



A: ROADWAY EMBANKMENT

B: ALLUVIAL, BROWN AND GRAY, MOIST TO WET, LOOSE TO

MEDIUM DENSE, SILTY SAND AND SOFT TO STIFF, SANDY SILT

C: RESIDUAL, DARK GREEN AND BROWN, VERY STIFF TO HARD,

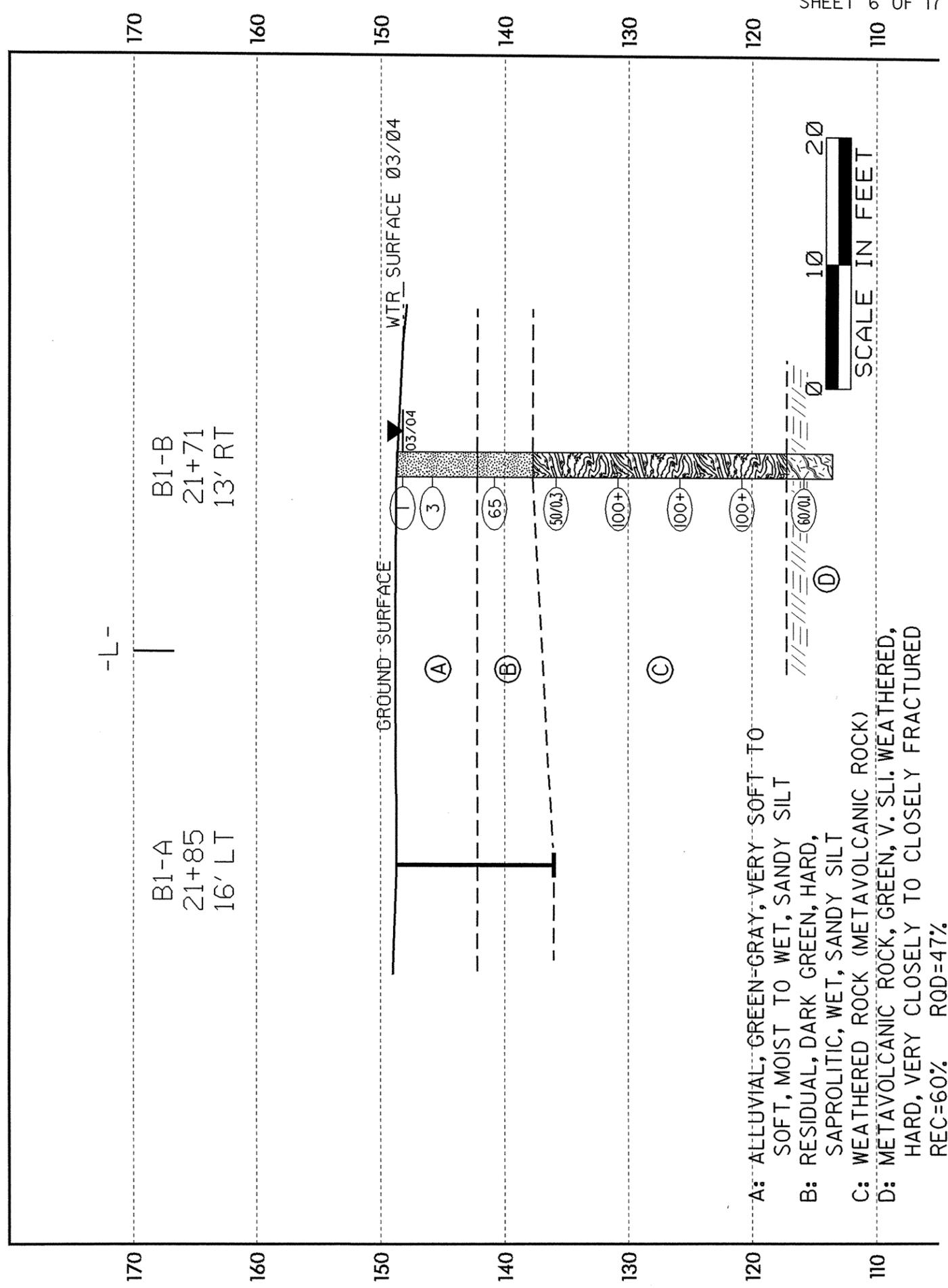
SAPROLITIC, WET, SANDY SILT

D: WEATHERED ROCK (METAVOLCANIC ROCK)

E: CRYSTALLINE ROCK (METAVOLCANIC ROCK)

# CROSS SECTION THROUGH BENT I

BRIDGE NO. 34, 33320.1.1 (B-3876)



A: ALLUVIAL, GREEN-GRAY, VERY SOFT TO

SOFT, MOIST TO WET, SANDY SILT

B: RESIDUAL, DARK GREEN, HARD,

SAPROLITIC, WET, SANDY SILT

C: WEATHERED ROCK (METAVOLCANIC ROCK)

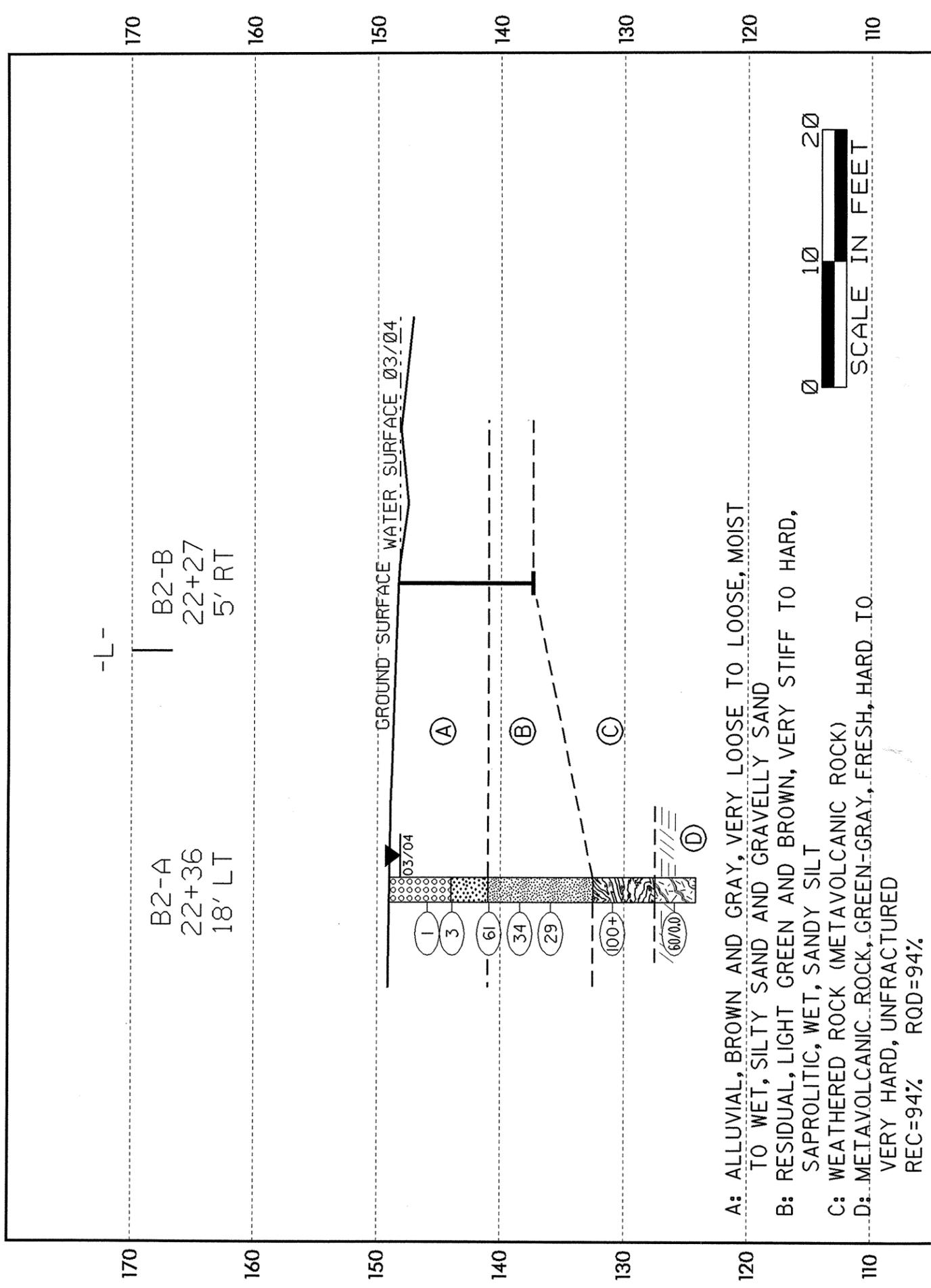
D: METAVOLCANIC ROCK, GREEN, V. SLI. WEATHERED,

HARD, VERY CLOSELY TO CLOSELY FRACTURED

REC=60% RQD=47%

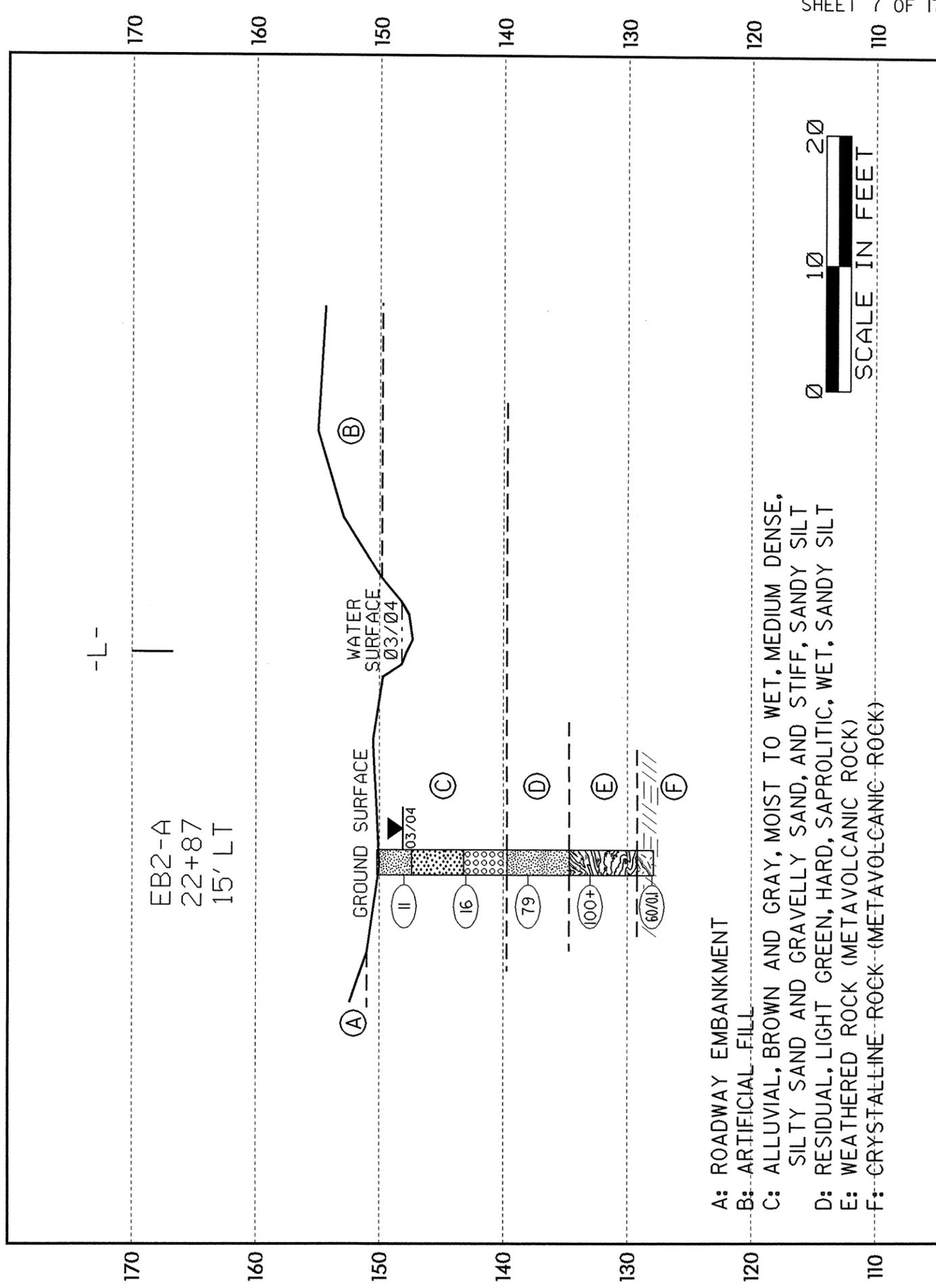
# CROSS SECTION THROUGH BENT 2

BRIDGE NO. 34, 33320.1.1 (B-3876)



# CROSS SECTION THROUGH END BENT 2

BRIDGE NO. 34, 33320.1.1 (B-3876)





NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
 GEOTECHNICAL UNIT ROD SOUNDING LOG

|                                                                       |             |                         |            |                                                                                  |    |                       |              |     |               |     |                           |  |
|-----------------------------------------------------------------------|-------------|-------------------------|------------|----------------------------------------------------------------------------------|----|-----------------------|--------------|-----|---------------|-----|---------------------------|--|
| PROJECT NO. 33320.I.I                                                 |             | ID. B-3876              |            | COUNTY NASH                                                                      |    | GEOLOGIST S. P. BROWN |              |     |               |     |                           |  |
| SITE DESCRIPTION BRIDGE NO. 34 ON -L- (SR 1004) OVER PIG BASKET CREEK |             |                         |            |                                                                                  |    |                       | GROUND WATER |     |               |     |                           |  |
| BORING NO. BI-A                                                       |             | BORING LOCATION 21+85   |            | OFFSET 16' LT                                                                    |    | ALIGNMENT -L-         |              |     |               |     |                           |  |
| COLLAR ELEVATION 148.7'                                               |             | NORTHING 822069         |            | EASTING 2301164                                                                  |    | 0 HR. N/A             |              |     |               |     |                           |  |
| TOTAL DEPTH 12.7'                                                     |             | DRILL MACHINE N/A       |            | DRILL METHOD ROD SOUNDING                                                        |    | HAMMER TYPE MANUAL    |              |     |               |     |                           |  |
| START DATE 3/29/04                                                    |             | COMPLETION DATE 3/29/04 |            | SURFACE WATER DEPTH N/A                                                          |    | DEPTH TO ROCK N/A     |              |     |               |     |                           |  |
| ELEV.                                                                 | DEPTH (FT.) | BLOW COUNT              | PEN. (FT.) | BLOWS PER FOOT                                                                   |    |                       |              |     | SAMPLE NUMBER | LOG | SOIL AND ROCK DESCRIPTION |  |
|                                                                       |             | 0.5' 0.5' 0.5'          |            | 0                                                                                | 25 | 50                    | 75           | 100 |               |     |                           |  |
| 148.7                                                                 | 0.0         | 1                       | 1.0        |                                                                                  |    |                       |              |     |               |     |                           |  |
|                                                                       | 1.0         | 1                       | 1.0        |                                                                                  |    |                       |              |     |               |     |                           |  |
|                                                                       | 2.0         | 4                       | 1.0        |                                                                                  |    |                       |              |     |               |     |                           |  |
| 145.0                                                                 | 3.0         | 3                       | 1.0        |                                                                                  |    |                       |              |     |               |     |                           |  |
|                                                                       | 4.0         | 2                       | 1.0        |                                                                                  |    |                       |              |     |               |     |                           |  |
|                                                                       | 5.0         | 2                       | 1.0        |                                                                                  |    |                       |              |     |               |     |                           |  |
|                                                                       | 6.0         | 7                       | 1.0        |                                                                                  |    |                       |              |     |               |     |                           |  |
|                                                                       | 7.0         | 2                       | 1.0        |                                                                                  |    |                       |              |     |               |     |                           |  |
| 140.0                                                                 | 8.0         | 29                      | 1.0        |                                                                                  |    |                       |              |     |               |     |                           |  |
|                                                                       | 9.0         | 37                      | 1.0        |                                                                                  |    |                       |              |     |               |     |                           |  |
|                                                                       | 10.0        | 41                      | 1.0        |                                                                                  |    |                       |              |     |               |     |                           |  |
|                                                                       | 11.0        | 57                      | 1.0        |                                                                                  |    |                       |              |     |               |     |                           |  |
|                                                                       | 12.0        | 87                      | 1.0        |                                                                                  |    |                       |              |     |               |     |                           |  |
| 135.0                                                                 |             |                         | 0.7        | BRIDGE ROD REFUSAL AT ELEVATION 136.0 FEET ON WEATHERED ROCK (METAVOLCANIC ROCK) |    |                       |              |     |               |     |                           |  |

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
 GEOTECHNICAL UNIT BORING LOG

|                                                                       |             |                             |            |                                                                |    |                       |              |     |               |     |                           |  |
|-----------------------------------------------------------------------|-------------|-----------------------------|------------|----------------------------------------------------------------|----|-----------------------|--------------|-----|---------------|-----|---------------------------|--|
| PROJECT NO. 33320.I.I                                                 |             | ID. B-3876                  |            | COUNTY NASH                                                    |    | GEOLOGIST S. P. BROWN |              |     |               |     |                           |  |
| SITE DESCRIPTION BRIDGE NO. 34 ON -L- (SR 1004) OVER PIG BASKET CREEK |             |                             |            |                                                                |    |                       | GROUND WATER |     |               |     |                           |  |
| BORING NO. BI-B                                                       |             | BORING LOCATION 21+71       |            | OFFSET 13' RT                                                  |    | ALIGNMENT -L-         |              |     |               |     |                           |  |
| COLLAR ELEVATION 148.7'                                               |             | NORTHING 822046             |            | EASTING 2301187                                                |    | 0 HR. N/A             |              |     |               |     |                           |  |
| TOTAL DEPTH 35.2'                                                     |             | DRILL MACHINE DIEDRICH D-50 |            | DRILL METHOD ROTARY W/MUD                                      |    | HAMMER TYPE AUTOMATIC |              |     |               |     |                           |  |
| START DATE 3/24/04                                                    |             | COMPLETION DATE 3/24/04     |            | SURFACE WATER DEPTH N/A                                        |    | DEPTH TO ROCK 31.5'   |              |     |               |     |                           |  |
| ELEV.                                                                 | DEPTH (FT.) | BLOW COUNT                  | PEN. (FT.) | BLOWS PER FOOT                                                 |    |                       |              |     | SAMPLE NUMBER | LOG | SOIL AND ROCK DESCRIPTION |  |
|                                                                       |             | 0.5' 0.5' 0.5'              |            | 0                                                              | 25 | 50                    | 75           | 100 |               |     |                           |  |
| 148.7                                                                 | 0.5         | WOHWOH                      | 1          |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 1.0         |                             | 1.0        |                                                                |    |                       |              |     |               |     |                           |  |
| 145.0                                                                 | 2.9         | WOH                         | 2          |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 3.0         |                             | 1.0        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 4.0         |                             | 1.0        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 5.0         |                             | 1.0        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 6.0         |                             | 1.0        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 7.0         |                             | 1.0        |                                                                |    |                       |              |     |               |     |                           |  |
| 140.0                                                                 | 7.9         | 35                          | 36         |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 8.0         | 29                          | 1.0        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 9.0         |                             | 1.0        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 10.0        |                             | 1.0        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 11.0        |                             | 1.0        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 12.0        |                             | 1.0        |                                                                |    |                       |              |     |               |     |                           |  |
| 135.0                                                                 | 12.9        | 50                          | 0.3        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 13.0        |                             | 0.3        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 14.0        |                             | 0.3        |                                                                |    |                       |              |     |               |     |                           |  |
| 130.0                                                                 | 17.9        | 91                          | 0.6        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 18.0        | 9                           | 0.6        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 19.0        |                             | 0.6        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 20.0        |                             | 0.6        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 21.0        |                             | 0.6        |                                                                |    |                       |              |     |               |     |                           |  |
| 125.0                                                                 | 22.9        | 100                         | 0.4        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 23.0        |                             | 0.4        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 24.0        |                             | 0.4        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 25.0        |                             | 0.4        |                                                                |    |                       |              |     |               |     |                           |  |
| 120.0                                                                 | 27.9        | 100                         | 0.4        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 28.0        |                             | 0.4        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 29.0        |                             | 0.4        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 30.0        |                             | 0.4        |                                                                |    |                       |              |     |               |     |                           |  |
| 115.0                                                                 | 32.9        | 60                          | 0.1        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 33.0        |                             | 0.1        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 34.0        |                             | 0.1        |                                                                |    |                       |              |     |               |     |                           |  |
|                                                                       | 35.0        |                             | 0.1        |                                                                |    |                       |              |     |               |     |                           |  |
| 110.0                                                                 |             |                             |            | BORING TERMINATED AT ELEVATION 113.5 FEET IN METAVOLCANIC ROCK |    |                       |              |     |               |     |                           |  |



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
 GEOTECHNICAL UNIT BORING LOG

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
 GEOTECHNICAL UNIT ROD SOUNDING LOG SHEET 11 OF 17

| PROJECT NO. 33320.1.1                                                 |             | ID. B-3876                  |      | COUNTY NASH               |            | GEOLOGIST S. P. BROWN |              |    |    |               |            |                           |                                                                                    |
|-----------------------------------------------------------------------|-------------|-----------------------------|------|---------------------------|------------|-----------------------|--------------|----|----|---------------|------------|---------------------------|------------------------------------------------------------------------------------|
| SITE DESCRIPTION BRIDGE NO. 34 ON -L- (SR 1004) OVER PIG BASKET CREEK |             |                             |      |                           |            |                       | GROUND WATER |    |    |               |            |                           |                                                                                    |
| BORING NO. B2-A                                                       |             | BORING LOCATION 22+36       |      | OFFSET 18' LT             |            | ALIGNMENT -L-         |              |    |    |               |            |                           |                                                                                    |
| COLLAR ELEVATION 149.0'                                               |             | NORTHING 822118             |      | EASTING 2301179           |            | 0 HR. N/A             |              |    |    |               |            |                           |                                                                                    |
| TOTAL DEPTH 24.8'                                                     |             | DRILL MACHINE DIEDRICH D-50 |      | DRILL METHOD ROTARY W/MUD |            | HAMMER TYPE AUTOMATIC |              |    |    |               |            |                           |                                                                                    |
| START DATE 3/26/04                                                    |             | COMPLETION DATE 3/26/04     |      | SURFACE WATER DEPTH N/A   |            | DEPTH TO ROCK 21.5'   |              |    |    |               |            |                           |                                                                                    |
| ELEV. (FT.)                                                           | DEPTH (FT.) | BLOW COUNT                  |      |                           | PEN. (FT.) | BLOWS PER FOOT        |              |    |    | SAMPLE NUMBER | LOG MOI. G | SOIL AND ROCK DESCRIPTION |                                                                                    |
|                                                                       |             | 0.5'                        | 0.5' | 0.5'                      |            | 0                     | 25           | 50 | 75 |               |            |                           | 100                                                                                |
| 149.0                                                                 |             |                             |      |                           |            |                       |              |    |    |               |            |                           |                                                                                    |
| 145.0                                                                 | 3.1         | 1                           | 0    | 1                         | 1.0        |                       |              |    |    |               |            | SS-12                     | ALLUVIAL, BROWN, GRAVELLY SAND                                                     |
|                                                                       | 5.1         | 1                           | 1    | 2                         | 1.0        |                       |              |    |    |               |            |                           | GRAY, SILTY SAND                                                                   |
| 140.0                                                                 | 8.1         | 44                          | 35   | 26                        | 1.0        |                       |              |    |    |               |            |                           | RESIDUAL, LIGHT GREEN AND BROWN, SAPROLITIC, SANDY SILT                            |
|                                                                       | 10.6        | 13                          | 15   | 19                        | 1.0        |                       |              |    |    |               |            |                           |                                                                                    |
| 135.0                                                                 | 13.1        | 11                          | 15   | 14                        | 1.0        |                       |              |    |    |               |            |                           |                                                                                    |
| 130.0                                                                 | 18.1        | 38                          | 62   |                           | 0.9        |                       |              |    |    |               |            |                           | WEATHERED ROCK (METAVOLCANIC ROCK)                                                 |
| 125.0                                                                 | 23.1        | 60                          |      |                           | 0.0        |                       |              |    |    |               |            |                           | METAVOLCANIC ROCK, GREEN-GRAY, FRESH, HARD TO V. HARD, UNFRACTURED REC=94% ROD=94% |
| BORING TERMINATED AT ELEVATION 124.2 FEET IN METAVOLCANIC ROCK        |             |                             |      |                           |            |                       |              |    |    |               |            |                           |                                                                                    |

| PROJECT NO. 33320.1.1                                                            |             | ID. B-3876              |      | COUNTY NASH               |            | GEOLOGIST S. P. BROWN |              |    |    |               |            |                           |
|----------------------------------------------------------------------------------|-------------|-------------------------|------|---------------------------|------------|-----------------------|--------------|----|----|---------------|------------|---------------------------|
| SITE DESCRIPTION BRIDGE NO. 34 ON -L- (SR 1004) OVER PIG BASKET CREEK            |             |                         |      |                           |            |                       | GROUND WATER |    |    |               |            |                           |
| BORING NO. B2-B                                                                  |             | BORING LOCATION 22+27   |      | OFFSET 5' RT              |            | ALIGNMENT -L-         |              |    |    |               |            |                           |
| COLLAR ELEVATION 148.3'                                                          |             | NORTHING 822102         |      | EASTING 2301198           |            | 0 HR. N/A             |              |    |    |               |            |                           |
| TOTAL DEPTH 10.9'                                                                |             | DRILL MACHINE N/A       |      | DRILL METHOD ROD SOUNDING |            | HAMMER TYPE MANUAL    |              |    |    |               |            |                           |
| START DATE 3/29/04                                                               |             | COMPLETION DATE 3/29/04 |      | SURFACE WATER DEPTH N/A   |            | DEPTH TO ROCK N/A     |              |    |    |               |            |                           |
| ELEV. (FT.)                                                                      | DEPTH (FT.) | BLOW COUNT              |      |                           | PEN. (FT.) | BLOWS PER FOOT        |              |    |    | SAMPLE NUMBER | LOG MOI. G | SOIL AND ROCK DESCRIPTION |
|                                                                                  |             | 0.5'                    | 0.5' | 0.5'                      |            | 0                     | 25           | 50 | 75 |               |            |                           |
| 148.3                                                                            | 0.0         | WOH                     | WOH  |                           | 1.0        |                       |              |    |    |               |            |                           |
|                                                                                  | 1.0         | 1                       | 1    |                           | 1.0        |                       |              |    |    |               |            |                           |
| 145.0                                                                            | 2.0         | 0                       | 1    |                           | 1.0        |                       |              |    |    |               |            |                           |
|                                                                                  | 3.0         | 0                       | 1    |                           | 1.0        |                       |              |    |    |               |            |                           |
|                                                                                  | 4.0         | 1                       | 1    |                           | 1.0        |                       |              |    |    |               |            |                           |
|                                                                                  | 5.0         | 1                       | 1    |                           | 1.0        |                       |              |    |    |               |            |                           |
| 140.0                                                                            | 6.0         | 4                       | 16   |                           | 1.0        |                       |              |    |    |               |            |                           |
|                                                                                  | 7.0         | 33                      | 36   |                           | 1.0        |                       |              |    |    |               |            |                           |
|                                                                                  | 8.0         | 35                      | 47   |                           | 1.0        |                       |              |    |    |               |            |                           |
|                                                                                  | 9.0         | 37                      | 85   |                           | 1.0        |                       |              |    |    |               |            |                           |
|                                                                                  | 10.0        | 87                      | 100  |                           | 0.9        |                       |              |    |    |               |            |                           |
| BRIDGE ROD REFUSAL AT ELEVATION 137.4 FEET ON WEATHERED ROCK (METAVOLCANIC ROCK) |             |                         |      |                           |            |                       |              |    |    |               |            |                           |





**EB1-A**

| <b>SOIL TEST RESULTS</b> |        |         |                |               |      |      |             |        |      |      |                    |     |     |            |           |
|--------------------------|--------|---------|----------------|---------------|------|------|-------------|--------|------|------|--------------------|-----|-----|------------|-----------|
| SAMPLE NO.               | OFFSET | STATION | DEPTH INTERVAL | AASHTO CLASS. | L.L. | P.I. | % BY WEIGHT |        |      |      | % PASSING (SIEVES) |     |     | % MOISTURE | % ORGANIC |
|                          |        |         |                |               |      |      | C.SAND      | F.SAND | SILT | CLAY | 10                 | 40  | 200 |            |           |
| SS-4                     | 7 LT   | 21+32   | 12.2-13.7      | A-4(4)        | 33   | 8    | 19.9        | 15.7   | 42.3 | 22.1 | 96                 | 81  | 66  | -          | -         |
| S-5                      | 7 LT   | 21+32   | 0.5-1.5        | A-2-4(0)      | 18   | NP   | 21.9        | 52.3   | 11.8 | 14.1 | 100                | 95  | 31  | -          | -         |
| SS-6                     | 7 LT   | 21+32   | 3.2-4.7        | A-4(1)        | 24   | 4    | 1.6         | 35.6   | 44.7 | 18.1 | 100                | 100 | 77  | -          | -         |

**EB1-B**

| <b>SOIL TEST RESULTS</b> |        |         |                |               |      |      |             |        |      |      |                    |    |     |            |           |
|--------------------------|--------|---------|----------------|---------------|------|------|-------------|--------|------|------|--------------------|----|-----|------------|-----------|
| SAMPLE NO.               | OFFSET | STATION | DEPTH INTERVAL | AASHTO CLASS. | L.L. | P.I. | % BY WEIGHT |        |      |      | % PASSING (SIEVES) |    |     | % MOISTURE | % ORGANIC |
|                          |        |         |                |               |      |      | C.SAND      | F.SAND | SILT | CLAY | 10                 | 40 | 200 |            |           |
| SS-1                     | 14 RT  | 21+22   | 3.1-4.0        | A-4(3)        | 25   | 8    | 7.6         | 37.4   | 36.9 | 18.1 | 100                | 97 | 67  | -          | -         |
| SS-2                     | 14 RT  | 21+22   | 4.0-4.6        | A-2-4(0)      | 19   | NP   | 40.2        | 47.8   | 5.9  | 6.0  | 97                 | 79 | 15  | -          | -         |
| SS-3                     | 14 RT  | 21+22   | 8.1-9.6        | A-4(0)        | 31   | NP   | 18.5        | 30.6   | 38.9 | 12.1 | 95                 | 85 | 57  | -          | -         |

**B1-B**

| <b>SOIL TEST RESULTS</b> |        |         |                |               |      |      |             |        |      |      |                    |    |     |            |           |
|--------------------------|--------|---------|----------------|---------------|------|------|-------------|--------|------|------|--------------------|----|-----|------------|-----------|
| SAMPLE NO.               | OFFSET | STATION | DEPTH INTERVAL | AASHTO CLASS. | L.L. | P.I. | % BY WEIGHT |        |      |      | % PASSING (SIEVES) |    |     | % MOISTURE | % ORGANIC |
|                          |        |         |                |               |      |      | C.SAND      | F.SAND | SILT | CLAY | 10                 | 40 | 200 |            |           |
| SS-7                     | 13 RT  | 21+71   | 0.5-2.0        | A-4(2)        | 27   | 8    | 20.1        | 28.5   | 31.3 | 20.1 | 100                | 94 | 56  | -          | -         |
| SS-8                     | 13 RT  | 21+71   | 7.9-9.4        | A-4(1)        | 29   | 6    | 32.5        | 23.6   | 35.8 | 8.1  | 100                | 74 | 51  | 15.6       | -         |

**B2-A**

| <b>SOIL TEST RESULTS</b> |        |         |                |               |      |      |             |        |      |      |                    |    |     |            |           |
|--------------------------|--------|---------|----------------|---------------|------|------|-------------|--------|------|------|--------------------|----|-----|------------|-----------|
| SAMPLE NO.               | OFFSET | STATION | DEPTH INTERVAL | AASHTO CLASS. | L.L. | P.I. | % BY WEIGHT |        |      |      | % PASSING (SIEVES) |    |     | % MOISTURE | % ORGANIC |
|                          |        |         |                |               |      |      | C.SAND      | F.SAND | SILT | CLAY | 10                 | 40 | 200 |            |           |
| SS-12                    | 18 LT  | 22+36   | 3.1-4.6        | A-1-b(0)      | 19   | NP   | 78.3        | 14.2   | 3.5  | 4.0  | 86                 | 28 | 7   | -          | -         |

**EB2-A**

| <b>SOIL TEST RESULTS</b> |        |         |                |               |      |      |             |        |      |      |                    |    |     |            |           |
|--------------------------|--------|---------|----------------|---------------|------|------|-------------|--------|------|------|--------------------|----|-----|------------|-----------|
| SAMPLE NO.               | OFFSET | STATION | DEPTH INTERVAL | AASHTO CLASS. | L.L. | P.I. | % BY WEIGHT |        |      |      | % PASSING (SIEVES) |    |     | % MOISTURE | % ORGANIC |
|                          |        |         |                |               |      |      | C.SAND      | F.SAND | SILT | CLAY | 10                 | 40 | 200 |            |           |
| SS-9                     | 15 LT  | 22+87   | 2.2-2.8        | A-4(2)        | 22   | 6    | 4.8         | 21.3   | 45.7 | 28.1 | 100                | 99 | 81  | -          | -         |
| SS-10                    | 15 LT  | 22+87   | 7.2-8.7        | A-1-b(0)      | 18   | NP   | 51.3        | 26.7   | 14.0 | 8.0  | 67                 | 45 | 17  | -          | -         |
| SS-11                    | 15 LT  | 22+87   | 12.2-13.7      | A-4(1)        | 29   | 7    | 24.9        | 18.5   | 38.5 | 18.1 | 83                 | 67 | 52  | -          | -         |



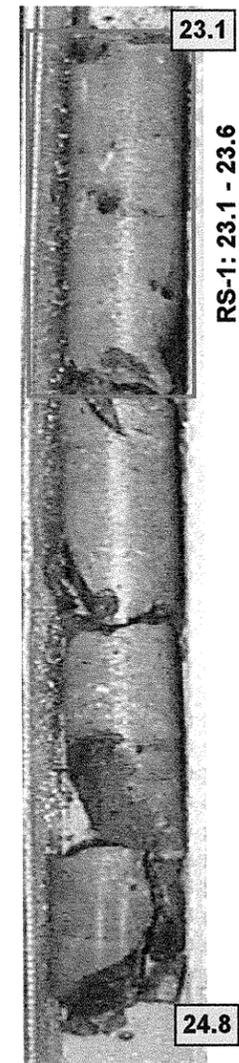
# CORE PHOTOGRAPHS

**B1-B**

BOX 1: 33.7 - 35.2 FT

**B2-A**

BOX 1: 23.1 - 24.8 FT



SITE PHOTOGRAPH

