

| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|-------|-----------------------------|-----------|--------------|
| N.C.  | 38501.1.1 (B-4728)          | 1         | 15           |

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 38501.1.1(B-4728) F.A. PROJ. BRZ-1102(4)  
COUNTY CHATHAM  
PROJECT DESCRIPTION BRIDGE NO. 251 -L- SR 1102 (COLERIDGE RD.)  
OVER BRUSH CREEK

**INVENTORY**

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**CAUTION NOTICE**

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

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

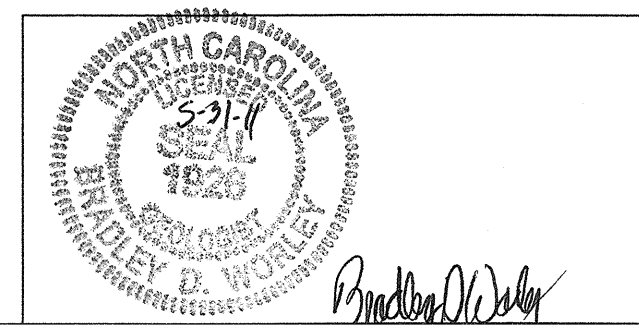
THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, OR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THIS PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

**PROJECT: 38501.1.1 ID: B-4728**

PERSONNEL

J.K. STICKNEY  
M.L. SMITH  
C.L. SMITH

INVESTIGATED BY B.D. WORLEY  
CHECKED BY C.A. YOUNGBLOOD  
SUBMITTED BY K.B. MILLER  
DATE MAY 2011



DRAWN BY: T.T. WALKER and B.D. WORLEY
























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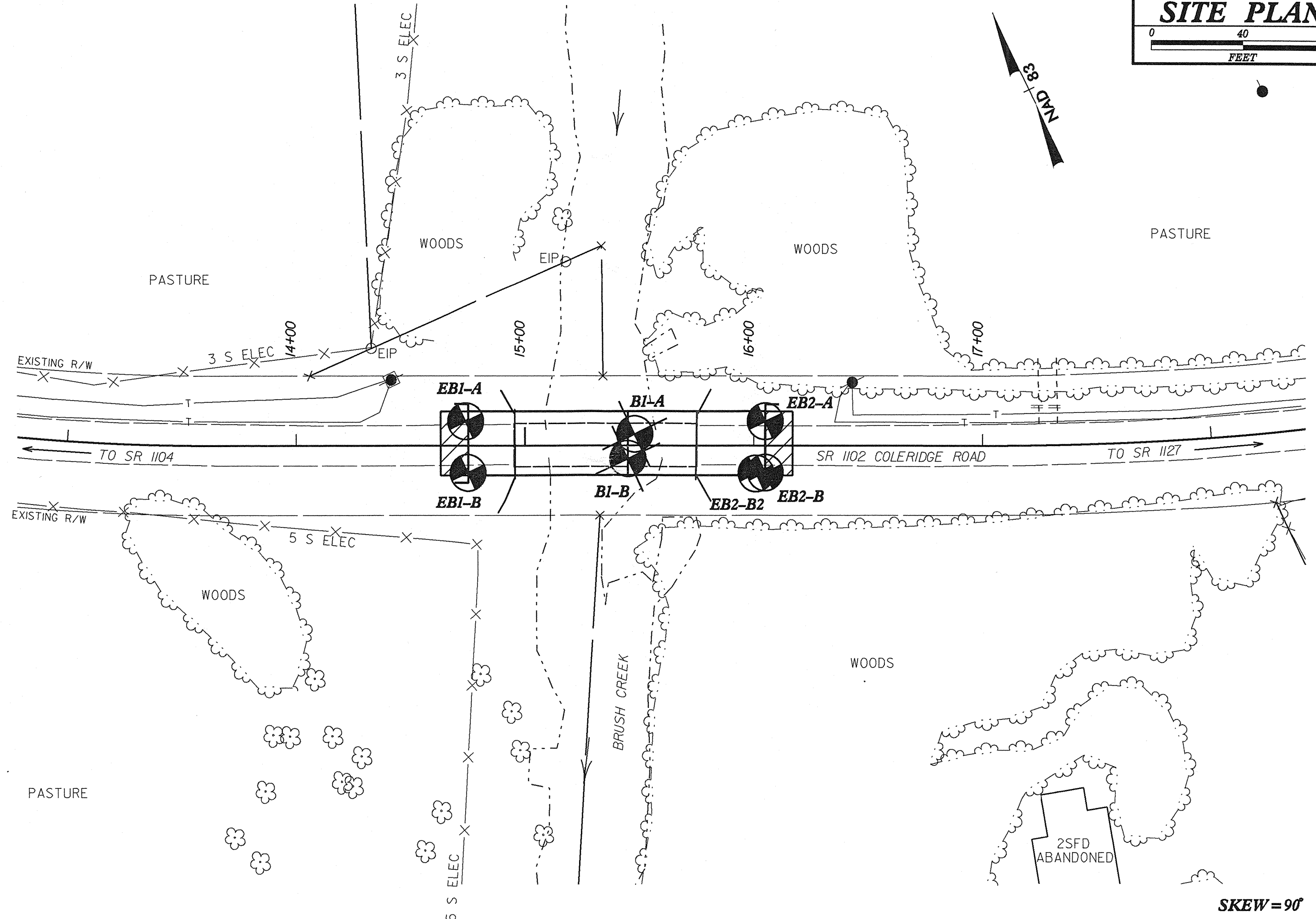
NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT

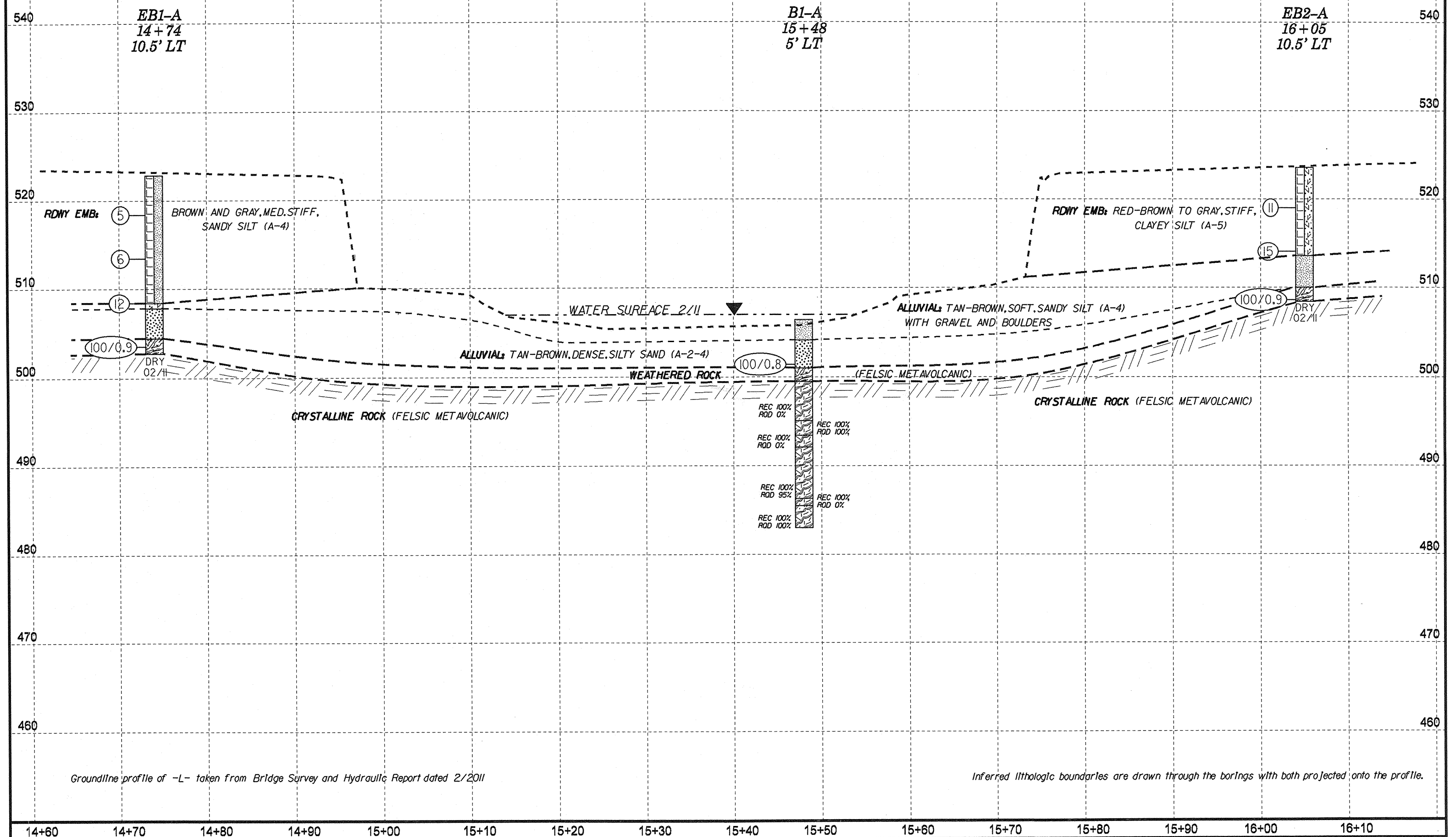
# SUBSURFACE INVESTIGATION

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

| SOIL DESCRIPTION   | GRADATION  | ROCK DESCRIPTION   | TERMS AND DEFINITIONS   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
|--|--|--|---|--|---|--|--|------------|---|--|--|---|--|--|--------------------|---------------|-----------------------|------------------------|------------------|-----------------|-----------|-------------------|-----------------|-----------------------------|------------------|----------------------------------|--------------|----------------|----------------------|------------------------|--------------------------|----------|--------------------------------|-------------------|------------------|----------------|-------------------|------------------|----------|-------------------|--|-----------------------|-----------------|---------------------------|------------------------------|-----------------------|--------------------------------|--------------------|----------------------|-------|----------------|------------|---------------------|------|-----------|---------------------|----------|----------------|--------------|---------------|-----------------|--------------------|------------------|----------------------------|-------------------|------------------|--------------|----|----|----|----|----|----|--|--|--|-------------|---|--|--|---|---|--|----------------------------|--------------------------------------|--------------------------------|-----------------------------------|---|---------------------------|---|------------------------------|--------------------------------|------------------------------------|-----------------------------|--|-------------|------|------|------|--|--|--|---------------------------|-------------------|--|--|--------------|--|--|--------------|------|-------------|--|--|--|---|------------------|----------------|-------------------|----------------|-------------------------|--------|--------|---------------|-----------------------|--------|----------|-----------------|--------------------|---------|------|---------------|----------------|------|------|----------------------|--|
| <p>SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T208, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:</p> <p style="text-align: center;"><i>VERY STIFF, GRAY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i></p>  | <p><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.</p> <p style="text-align: center;"><b>ANGULARITY OF GRAINS</b></p> <p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: <b>ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</b></p>  | <p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL, AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS, IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.<br/>ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p> <p><b>WEATHERED ROCK (WR)</b>  NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</p> <p><b>CRYSTALLINE ROCK (CR)</b>  FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p> <p><b>NON-CRYSTALLINE ROCK (NCR)</b>  FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p> <p><b>COASTAL PLAIN SEDIMENTARY ROCK (CP)</b>  COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p> | <p><b>ALLUVIUM (ALLUV.)</b> - SOILS THAT 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 IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.<br/><b>CALCAREOUS (CALC.)</b> - SOILS THAT 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 (FP)</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> - IRREGULARLY 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 (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.<br/><b>ROCK QUALITY DESIGNATION (RQD)</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 THAT 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, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR COMPACTIVITY OF THE INTRUDED 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 BPF OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.<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 (SROD)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.<br/><b>TOPSOIL (TS.)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p> |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| <p style="text-align: center;"><b>SOIL LEGEND AND AASHTO CLASSIFICATION</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th rowspan="2">GENERAL CLASS.</th> <th colspan="4">GRANULAR MATERIALS (≤ 35% PASSING #200)</th> <th colspan="4">SILT-CLAY MATERIALS (&gt; 35% PASSING #200)</th> <th colspan="3">ORGANIC MATERIALS</th> </tr> <tr> <th>A-1</th> <th>A-3</th> <th>A-2</th> <th>A-4</th> <th>A-5</th> <th>A-6</th> <th>A-7</th> <th>A-1, A-2</th> <th>A-4, A-5</th> <th>A-6, A-7</th> <th></th> <th></th> </tr> <tr> <td>GROUP CLASS.</td> <td>A-1-a</td> <td>A-1-b</td> <td>A-2-4</td> <td>A-2-5</td> <td>A-2-6</td> <td>A-2-7</td> <td>A-7-5</td> <td>A-7-6</td> <td>A-3</td> <td></td> <td></td> <td></td> </tr> <tr> <td>SYMBOL</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>% PASSING</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td></td> <td></td> <td></td> </tr> <tr> <td>LIQUID LIMIT PLASTIC INDEX</td> <td>6</td> <td>6</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td></td> <td></td> <td></td> </tr> <tr> <td>GROUP INDEX</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td></td> <td></td> <td></td> </tr> <tr> <td>USUAL TYPES OF MAJOR MATERIALS</td> <td>STONE FRAGS. GRAVEL AND SAND</td> <td>FINE SAND</td> <td>SILTY OR CLAYEY GRAVEL AND SAND</td> <td>SILTY GRAVEL</td> <td>SILTY SAND</td> <td>CLAYEY SAND</td> <td>SAND</td> <td>SAND</td> <td>SAND</td> <td></td> <td></td> <td></td> </tr> <tr> <td>GEN. RATING AS A SUBGRADE</td> <td colspan="3">EXCELLENT TO GOOD</td> <td colspan="3">FAIR TO POOR</td> <td>FAIR TO POOR</td> <td>POOR</td> <td>UNSATURABLE</td> <td></td> <td></td> <td></td> </tr> </table> <p>PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS &gt; LL - 30</p> | GENERAL CLASS.   | GRANULAR MATERIALS (≤ 35% PASSING #200)  |   |  |   | SILT-CLAY MATERIALS (> 35% PASSING #200)                   |  |            |   | ORGANIC MATERIALS  |  |   | A-1  | A-3  | A-2                | A-4           | A-5                   | A-6                    | A-7              | A-1, A-2        | A-4, A-5  | A-6, A-7          |                 |                             | GROUP CLASS.     | A-1-a                            | A-1-b        | A-2-4          | A-2-5                | A-2-6                  | A-2-7                    | A-7-5    | A-7-6                          | A-3               |                  |                |                   | SYMBOL           |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       | % PASSING      | 10         | 10                  | 10   | 10        | 10                  | 10       | 10             | 10           | 10            |                 |                    |                  | LIQUID LIMIT PLASTIC INDEX | 6                 | 6                | 10           | 10 | 10 | 10 | 10 | 10 | 10 |  |  |  | GROUP INDEX | 0   | 0  | 0  | 0   | 0   | 0                                      | 0                          | 0                                    | 0                              |                                   |   |                           | USUAL TYPES OF MAJOR MATERIALS                        | STONE FRAGS. GRAVEL AND SAND | FINE SAND                      | SILTY OR CLAYEY GRAVEL AND SAND    | SILTY GRAVEL                | SILTY SAND   | CLAYEY SAND | SAND | SAND | SAND |  |  |  | GEN. RATING AS A SUBGRADE | EXCELLENT TO GOOD |  |  | FAIR TO POOR |  |  | FAIR TO POOR | POOR | UNSATURABLE |  |  |  | <p style="text-align: center;"><b>MINERALOGICAL COMPOSITION</b></p> <p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.</p> <p style="text-align: center;"><b>COMPRESSIBILITY</b></p> <p>SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31<br/>MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50<br/>HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50</p> <p style="text-align: center;"><b>PERCENTAGE OF MATERIAL</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>ORGANIC MATERIAL</th> <th>GRANULAR SOILS</th> <th>SILT - CLAY SOILS</th> <th>OTHER MATERIAL</th> </tr> <tr> <td>TRACE OF ORGANIC MATTER</td> <td>2 - 3%</td> <td>3 - 5%</td> <td>TRACE 1 - 10%</td> </tr> <tr> <td>LITTLE ORGANIC MATTER</td> <td>3 - 5%</td> <td>12 - 20%</td> <td>LITTLE 10 - 20%</td> </tr> <tr> <td>MODERATELY ORGANIC</td> <td>5 - 10%</td> <td>&gt;20%</td> <td>SOME 20 - 35%</td> </tr> <tr> <td>HIGHLY ORGANIC</td> <td>&gt;10%</td> <td>&gt;20%</td> <td>HIGHLY 35% AND ABOVE</td> </tr> </table> <p style="text-align: center;"><b>GROUND WATER</b></p> <p> WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING</p> <p> STATIC WATER LEVEL AFTER 24 HOURS</p> <p> PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA</p> <p> SPRING OR SEEP</p> | ORGANIC MATERIAL | GRANULAR SOILS | SILT - CLAY SOILS | OTHER MATERIAL | TRACE OF ORGANIC MATTER | 2 - 3% | 3 - 5% | TRACE 1 - 10% | LITTLE ORGANIC MATTER | 3 - 5% | 12 - 20% | LITTLE 10 - 20% | MODERATELY ORGANIC | 5 - 10% | >20% | SOME 20 - 35% | HIGHLY ORGANIC | >10% | >20% | HIGHLY 35% AND ABOVE | <p style="text-align: center;"><b>WEATHERING</b></p> <p><b>FRESH</b> ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p> <p><b>VERY SLIGHT (V SLI.)</b> ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.</p> <p><b>SLIGHT (SLI.)</b> ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.</p> <p><b>MODERATE (MOD.)</b> SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.</p> <p><b>MODERATELY SEVERE (MOD. SEV.)</b> 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.<br/><i>IF TESTED, WOULD YIELD SPT REFUSAL</i></p> <p><b>SEVERE (SEV.)</b> ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN.<br/><i>IF TESTED, YIELDS SPT N VALUES &gt; 100 BPF</i></p> <p><b>VERY SEVERE (V SEV.)</b> ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS SPT N VALUES &lt; 100 BPF</i></p> <p><b>COMPLETE</b> ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.</p> <p style="text-align: center;"><b>ROCK HARDNESS</b></p> <p><b>VERY HARD</b> CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.</p> <p><b>HARD</b> CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.</p> <p><b>MODERATELY HARD</b> CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.</p> <p><b>MEDIUM HARD</b> CAN BE GROVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.</p> <p><b>SOFT</b> CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.</p> <p><b>VERY SOFT</b> CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.</p> |
| GENERAL CLASS.   |  | GRANULAR MATERIALS (≤ 35% PASSING #200)  |   |  |   | SILT-CLAY MATERIALS (> 35% PASSING #200)                   |  |            |   | ORGANIC MATERIALS  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
|  | A-1  | A-3  | A-2   | A-4  | A-5   | A-6  | A-7  | A-1, A-2   | A-4, A-5                                | A-6, A-7   |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| GROUP CLASS.   | A-1-a  | A-1-b  | A-2-4   | A-2-5  | A-2-6                                       | A-2-7  | A-7-5  | A-7-6      | A-3                                     |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| SYMBOL   |  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| % PASSING  | 10   | 10   | 10  | 10   | 10  | 10   | 10   | 10         | 10                                      |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| LIQUID LIMIT PLASTIC INDEX   | 6  | 6  | 10  | 10   | 10  | 10   | 10   | 10         | 10                                      |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| GROUP INDEX  | 0  | 0  | 0   | 0  | 0   | 0  | 0  | 0          | 0                                       |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| USUAL TYPES OF MAJOR MATERIALS   | STONE FRAGS. GRAVEL AND SAND   | FINE SAND  | SILTY OR CLAYEY GRAVEL AND SAND   | SILTY GRAVEL   | SILTY SAND                                  | CLAYEY SAND  | SAND   | SAND       | SAND                                    |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| GEN. RATING AS A SUBGRADE  | EXCELLENT TO GOOD  |  |   | FAIR TO POOR   |   |  | FAIR TO POOR                                   | POOR       | UNSATURABLE                             |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| ORGANIC MATERIAL   | GRANULAR SOILS   | SILT - CLAY SOILS  | OTHER MATERIAL  |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| TRACE OF ORGANIC MATTER  | 2 - 3%   | 3 - 5%   | TRACE 1 - 10%   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| LITTLE ORGANIC MATTER  | 3 - 5%   | 12 - 20%   | LITTLE 10 - 20%   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| MODERATELY ORGANIC   | 5 - 10%  | >20%   | SOME 20 - 35%   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| HIGHLY ORGANIC   | >10%   | >20%   | HIGHLY 35% AND ABOVE  |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| <p style="text-align: center;"><b>CONSISTENCY OR DENSENESS</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>PRIMARY SOIL TYPE</th> <th>COMPACTNESS OR CONSISTENCY</th> <th>RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)</th> <th>RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT<sup>2</sup>)</th> </tr> <tr> <td>GENERALLY GRANULAR MATERIAL (NON-COHESSIVE)</td> <td>VERY LOOSE<br/>LOOSE<br/>MEDIUM DENSE<br/>DENSE<br/>VERY DENSE</td> <td>&lt; 4<br/>4 TO 10<br/>10 TO 30<br/>30 TO 50<br/>&gt; 50</td> <td>N/A</td> </tr> <tr> <td>GENERALLY SILT-CLAY MATERIAL (COHESIVE)</td> <td>VERY SOFT<br/>SOFT<br/>MEDIUM STIFF<br/>STIFF<br/>VERY STIFF<br/>HARD</td> <td>&lt; 2<br/>2 TO 4<br/>4 TO 8<br/>8 TO 15<br/>15 TO 30<br/>&gt; 30</td> <td>&lt; 0.25<br/>0.25 TO 0.50<br/>0.5 TO 1.0<br/>1 TO 2<br/>2 TO 4<br/>&gt; 4</td> </tr> </table>  | PRIMARY SOIL TYPE  | COMPACTNESS OR CONSISTENCY   | RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)  | RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> ) | GENERALLY GRANULAR MATERIAL (NON-COHESSIVE) | VERY LOOSE<br>LOOSE<br>MEDIUM DENSE<br>DENSE<br>VERY DENSE | < 4<br>4 TO 10<br>10 TO 30<br>30 TO 50<br>> 50 | N/A        | GENERALLY SILT-CLAY MATERIAL (COHESIVE) | VERY SOFT<br>SOFT<br>MEDIUM STIFF<br>STIFF<br>VERY STIFF<br>HARD | < 2<br>2 TO 4<br>4 TO 8<br>8 TO 15<br>15 TO 30<br>> 30 | < 0.25<br>0.25 TO 0.50<br>0.5 TO 1.0<br>1 TO 2<br>2 TO 4<br>> 4 | <p style="text-align: center;"><b>MISCELLANEOUS SYMBOLS</b></p> <p> ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION</p> <p> SOIL SYMBOL</p> <p> ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT</p> <p> INFERRED SOIL BOUNDARY</p> <p> INFERRED ROCK LINE</p> <p> ALLUVIAL SOIL BOUNDARY</p> <p> DIP &amp; DIP DIRECTION OF ROCK STRUCTURES</p> <p> TEST BORING WITH CORE</p> <p> AUGER BORING</p> <p> CORE BORING</p> <p> MONITORING WELL</p> <p> PIEZOMETER INSTALLATION</p> <p> SLOPE INDICATOR INSTALLATION</p> <p> CONE PENETROMETER TEST</p> <p> SOUNDING ROD</p> | <p style="text-align: center;"><b>ABBREVIATIONS</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>AR - AUGER REFUSAL</td> <td>MED. - MEDIUM</td> <td>VST - VANE SHEAR TEST</td> </tr> <tr> <td>BT - BORING TERMINATED</td> <td>MICA - MICACEOUS</td> <td>WEA - WEATHERED</td> </tr> <tr> <td>CL - CLAY</td> <td>MOD. - MODERATELY</td> <td>W - UNIT WEIGHT</td> </tr> <tr> <td>CPT - CONE PENETRATION TEST</td> <td>NP - NON PLASTIC</td> <td>W<sub>u</sub> - DRY UNIT WEIGHT</td> </tr> <tr> <td>CSE - COARSE</td> <td>ORG. - ORGANIC</td> <td>SAMPLE ABBREVIATIONS</td> </tr> <tr> <td>DMT - DILATOMETER TEST</td> <td>PMT - PRESSUREMETER TEST</td> <td>S - BULK</td> </tr> <tr> <td>DPT - DYNAMIC PENETRATION TEST</td> <td>SAP. - SAPROLITIC</td> <td>SS - SPLIT SPOON</td> </tr> <tr> <td>e - VOID RATIO</td> <td>SD. - SAND, SANDY</td> <td>ST - SHELBY TUBE</td> </tr> <tr> <td>F - FINE</td> <td>SL. - SILT, SILTY</td> <td>RS - ROCK</td> </tr> <tr> <td>FOSS. - FOSSILIFEROUS</td> <td>SLI. - SLIGHTLY</td> <td>RT - RECOMPACTED TRIAXIAL</td> </tr> <tr> <td>FRAC. - FRACTURED, FRACTURES</td> <td>TCR - TRICONE REFUSAL</td> <td>CBR - CALIFORNIA BEARING RATIO</td> </tr> <tr> <td>FRAGS. - FRAGMENTS</td> <td>W - MOISTURE CONTENT</td> <td></td> </tr> <tr> <td>HI. - HIGHLY</td> <td>V - VERY</td> <td></td> </tr> </table> | AR - AUGER REFUSAL | MED. - MEDIUM | VST - VANE SHEAR TEST | BT - BORING TERMINATED | MICA - MICACEOUS | WEA - WEATHERED | CL - CLAY | MOD. - MODERATELY | W - UNIT WEIGHT | CPT - CONE PENETRATION TEST | NP - NON PLASTIC | W <sub>u</sub> - DRY UNIT WEIGHT | CSE - COARSE | ORG. - ORGANIC | SAMPLE ABBREVIATIONS | DMT - DILATOMETER TEST | PMT - PRESSUREMETER TEST | S - BULK | DPT - DYNAMIC PENETRATION TEST | SAP. - SAPROLITIC | SS - SPLIT SPOON | e - VOID RATIO | SD. - SAND, SANDY | ST - SHELBY TUBE | F - FINE | SL. - SILT, SILTY | RS - ROCK  | FOSS. - FOSSILIFEROUS | SLI. - SLIGHTLY | RT - RECOMPACTED TRIAXIAL | FRAC. - FRACTURED, FRACTURES | TCR - TRICONE REFUSAL | CBR - CALIFORNIA BEARING RATIO | FRAGS. - FRAGMENTS | W - MOISTURE CONTENT |       | HI. - HIGHLY   | V - VERY   |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| PRIMARY SOIL TYPE  | COMPACTNESS OR CONSISTENCY   | RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)   | RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> )  |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| GENERALLY GRANULAR MATERIAL (NON-COHESSIVE)  | VERY LOOSE<br>LOOSE<br>MEDIUM DENSE<br>DENSE<br>VERY DENSE   | < 4<br>4 TO 10<br>10 TO 30<br>30 TO 50<br>> 50   | N/A   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
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| AR - AUGER REFUSAL   | MED. - MEDIUM  | VST - VANE SHEAR TEST  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| BT - BORING TERMINATED   | MICA - MICACEOUS   | WEA - WEATHERED  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| CL - CLAY  | MOD. - MODERATELY  | W - UNIT WEIGHT  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| CPT - CONE PENETRATION TEST  | NP - NON PLASTIC   | W <sub>u</sub> - DRY UNIT WEIGHT   |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| CSE - COARSE   | ORG. - ORGANIC   | SAMPLE ABBREVIATIONS   |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| DMT - DILATOMETER TEST   | PMT - PRESSUREMETER TEST   | S - BULK   |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| DPT - DYNAMIC PENETRATION TEST   | SAP. - SAPROLITIC  | SS - SPLIT SPOON   |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| e - VOID RATIO   | SD. - SAND, SANDY  | ST - SHELBY TUBE   |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| F - FINE   | SL. - SILT, SILTY  | RS - ROCK  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| FOSS. - FOSSILIFEROUS  | SLI. - SLIGHTLY  | RT - RECOMPACTED TRIAXIAL  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| FRAC. - FRACTURED, FRACTURES   | TCR - TRICONE REFUSAL  | CBR - CALIFORNIA BEARING RATIO   |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| FRAGS. - FRAGMENTS   | W - MOISTURE CONTENT   |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| HI. - HIGHLY   | V - VERY   |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| <p style="text-align: center;"><b>TEXTURE OR GRAIN SIZE</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>U.S. STD. 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SIEVE SIZE OPENING (MM)  | 4  | 10  | 40   | 60  | 200  | 270  |            | 4.75                                    | 2.00   | 0.42   | 0.25  | 0.075  | 0.053  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             | <p style="text-align: center;"><b>EQUIPMENT USED ON SUBJECT PROJECT</b></p> <table border="1" style="width: 100%; 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AT OR NEAR OPTIMUM MOISTURE | SHRINKAGE LIMIT - DRY - (D) | REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| U.S. STD. SIEVE SIZE OPENING (MM)  | 4  | 10   | 40  | 60   | 200   | 270  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
|  | 4.75   | 2.00   | 0.42  | 0.25   | 0.075                                       | 0.053  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
|  |  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
|  |  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
|  |  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
|  |  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
|  |  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
|  |  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
|  |  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
|  |  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
|  |  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
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| SOIL MOISTURE SCALE (ATTERBERG LIMITS)   | FIELD MOISTURE DESCRIPTION   | GUIDE FOR FIELD MOISTURE DESCRIPTION   |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| LL<br>PLASTIC RANGE (PI)<br>PL   | LIQUID LIMIT - SATURATED - (SAT.)  | USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
|  | PLASTIC LIMIT - WET - (W)  | SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| OM<br>SL   | OPTIMUM MOISTURE - MOIST - (M)   | SOLID; AT OR NEAR OPTIMUM MOISTURE   |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
|  | SHRINKAGE LIMIT - DRY - (D)  | REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE   |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| <p style="text-align: center;"><b>PLASTICITY</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>NONPLASTIC</th> <th>LOW PLASTICITY</th> <th>MED. PLASTICITY</th> <th>HIGH PLASTICITY</th> </tr> <tr> <td>0-5</td> <td>6-15</td> <td>16-25</td> <td>26 OR MORE</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </table>   | NONPLASTIC   | LOW PLASTICITY   | MED. PLASTICITY   | HIGH PLASTICITY  | 0-5   | 6-15   | 16-25  | 26 OR MORE |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   | <p style="text-align: center;"><b>FRACTURE SPACING</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>TERM</th> <th>SPACING</th> </tr> <tr> <td>VERY WIDE</td> <td>MORE THAN 10 FEET</td> </tr> <tr> <td>WIDE</td> <td>3 TO 10 FEET</td> </tr> <tr> <td>MODERATELY CLOSE</td> <td>1 TO 3 FEET</td> </tr> <tr> <td>CLOSE</td> <td>0.16 TO 1 FEET</td> </tr> <tr> <td>VERY CLOSE</td> <td>LESS THAN 0.16 FEET</td> </tr> </table> <p style="text-align: center;"><b>BEDDING</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>TERM</th> <th>THICKNESS</th> </tr> <tr> <td>VERY THICKLY BEDDED</td> <td>&gt; 4 FEET</td> </tr> <tr> <td>THICKLY BEDDED</td> <td>1.5 - 4 FEET</td> </tr> <tr> <td>THINLY BEDDED</td> <td>0.16 - 1.5 FEET</td> </tr> <tr> <td>VERY THINLY BEDDED</td> <td>0.03 - 0.16 FEET</td> </tr> <tr> <td>THICKLY LAMINATED</td> <td>0.008 - 0.03 FEET</td> </tr> <tr> <td>THINLY LAMINATED</td> <td>&lt; 0.008 FEET</td> </tr> </table> <p style="text-align: center;"><b>INDURATION</b></p> <p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</p> <p><b>FRIABLE</b> RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</p> <p><b>MODERATELY INDURATED</b> GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</p> <p><b>INDURATED</b> GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</p> <p><b>EXTREMELY INDURATED</b> SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p> | TERM                  | SPACING         | VERY WIDE                 | MORE THAN 10 FEET            | WIDE                  | 3 TO 10 FEET                   | MODERATELY CLOSE   | 1 TO 3 FEET          | CLOSE | 0.16 TO 1 FEET | VERY CLOSE | LESS THAN 0.16 FEET | TERM | THICKNESS | VERY THICKLY BEDDED | > 4 FEET | THICKLY BEDDED | 1.5 - 4 FEET | THINLY BEDDED | 0.16 - 1.5 FEET | VERY THINLY BEDDED | 0.03 - 0.16 FEET | THICKLY LAMINATED          | 0.008 - 0.03 FEET | THINLY LAMINATED | < 0.008 FEET |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| NONPLASTIC   | LOW PLASTICITY   | MED. PLASTICITY  | HIGH PLASTICITY   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| 0-5  | 6-15   | 16-25  | 26 OR MORE  |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
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|  |  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
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|  |  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| TERM   | SPACING  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| VERY WIDE  | MORE THAN 10 FEET  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| WIDE   | 3 TO 10 FEET   |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| MODERATELY CLOSE   | 1 TO 3 FEET  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| CLOSE  | 0.16 TO 1 FEET   |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| VERY CLOSE   | LESS THAN 0.16 FEET  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| TERM   | THICKNESS  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| VERY THICKLY BEDDED  | > 4 FEET   |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| THICKLY BEDDED   | 1.5 - 4 FEET   |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| THINLY BEDDED  | 0.16 - 1.5 FEET  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| VERY THINLY BEDDED   | 0.03 - 0.16 FEET   |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| THICKLY LAMINATED  | 0.008 - 0.03 FEET  |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| THINLY LAMINATED   | < 0.008 FEET   |  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |
| <p>DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.</p>  | <p style="text-align: center;"><b>INDURATION</b></p> <p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</p> <p><b>FRIABLE</b> RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</p> <p><b>MODERATELY INDURATED</b> GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</p> <p><b>INDURATED</b> GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</p> <p><b>EXTREMELY INDURATED</b> SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p> | <p><b>BENCH MARK:</b> BL-101<br/>N 713559.7<br/>E 1839628.7<br/>ELEVATION: 521.76 FT.</p> <p>NOTES:</p>  |   |  |   |  |  |            |   |  |  |   |  |  |                    |               |                       |                        |                  |                 |           |                   |                 |                             |                  |                                  |              |                |                      |                        |                          |          |                                |                   |                  |                |                   |                  |          |                   |  |                       |                 |                           |                              |                       |                                |                    |                      |       |                |            |                     |      |           |                     |          |                |              |               |                 |                    |                  |                            |                   |                  |              |    |    |    |    |    |    |  |  |  |             |   |  |  |   |   |  |                            |                                      |                                |                                   |   |                           |   |                              |                                |                                    |                             |  |             |      |      |      |  |  |  |                           |                   |  |  |              |  |  |              |      |             |  |  |  |   |                  |                |                   |                |                         |        |        |               |                       |        |          |                 |                    |         |      |               |                |      |      |                      |  |



**SKEW = 90°**



Groundline profile of -L- taken from Bridge Survey and Hydraulic Report dated 2/2011

Inferred lithologic boundaries are drawn through the borings with both projected onto the profile.

540

E1-A  
14+74  
10.5' LT

E1-B  
14+75  
11.7' RT



530

520

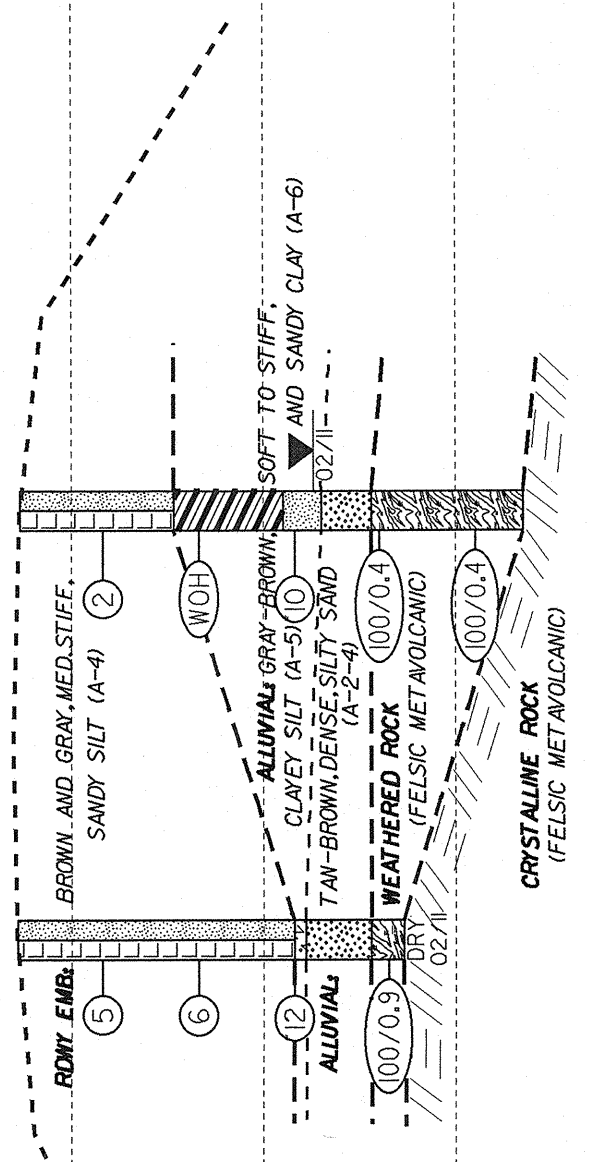
510

500

490

480

470



HORIZ. SCALE 0 10 20 (FEET)

VE = 1:1

CROSS SECTION THROUGH END BENT 1

HORIZ. SCALE 0 10 20 (FEET)

VE = 1:1

CROSS SECTION THROUGH BENT 1

E1-A  
15+48  
5' LT

E1-B  
15+45  
5.7' RT



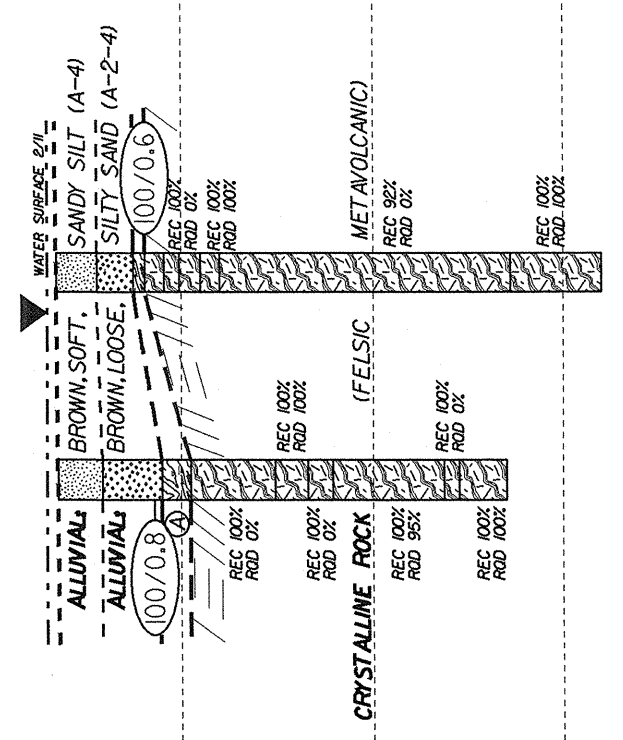
520

510

500

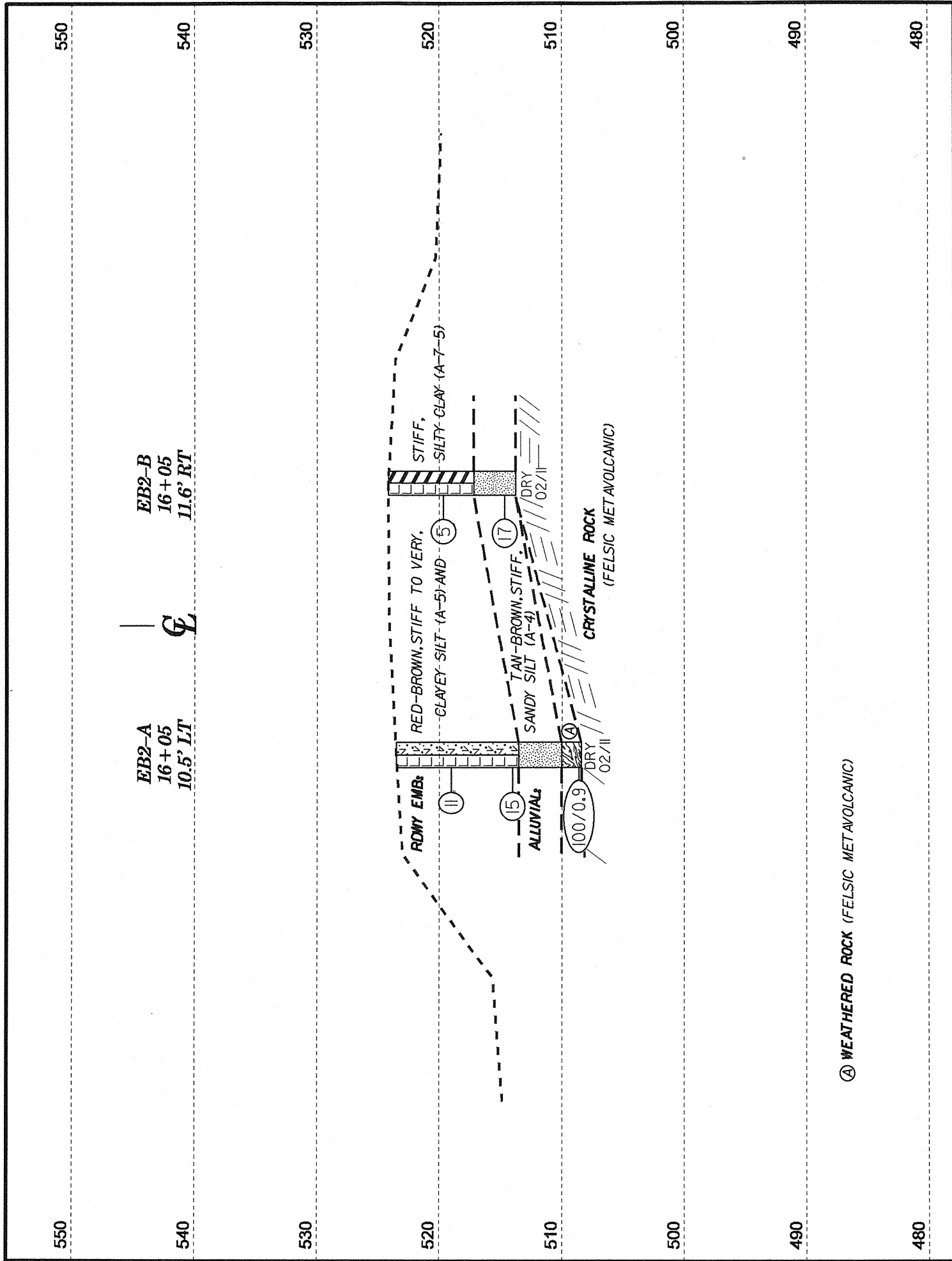
490

480



Ⓐ WEATHERED ROCK (FELSIC METAVOLCANIC)

460



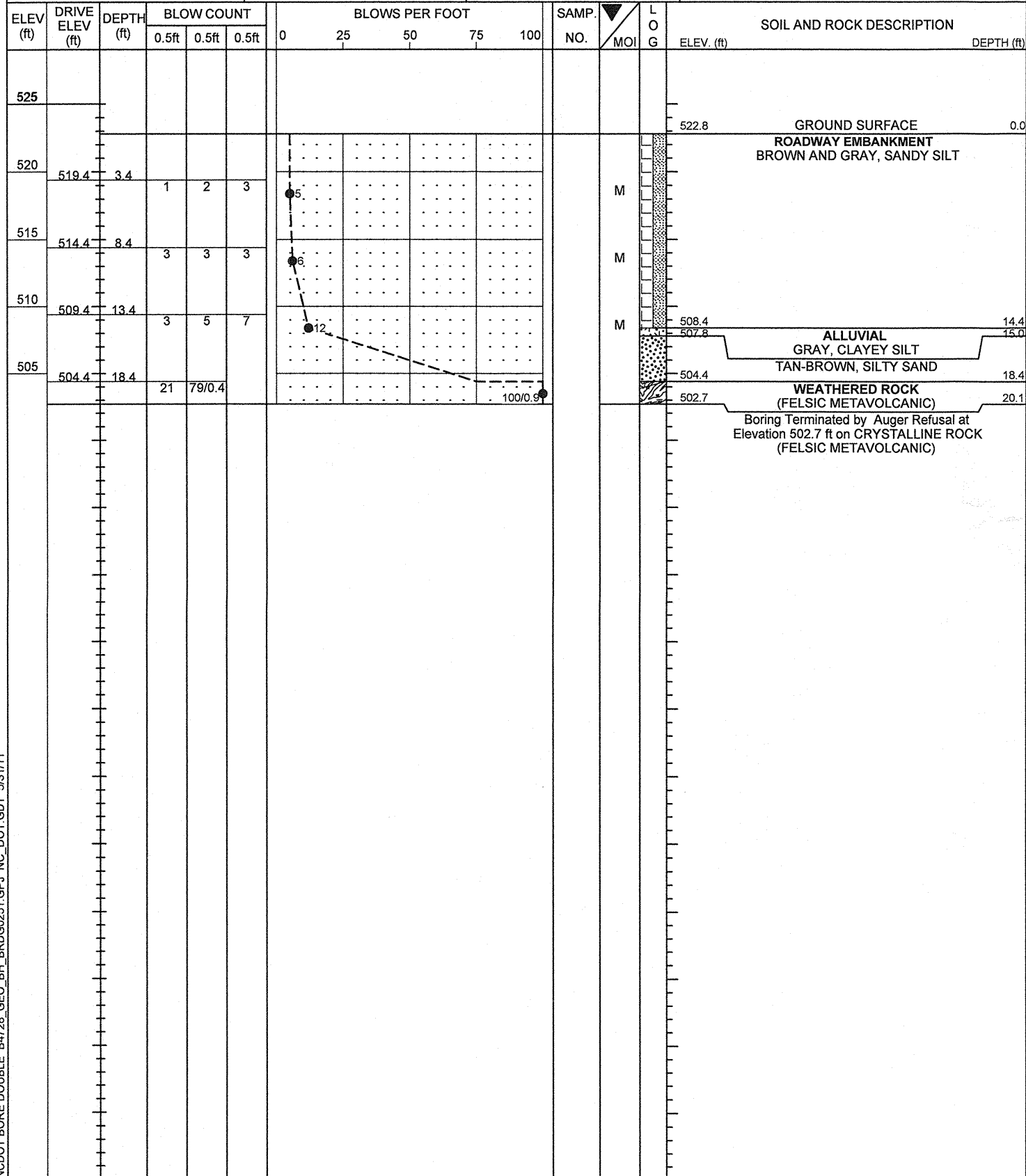
HORIZ. SCALE 0 10 20 (FEET)

VE = 1:1

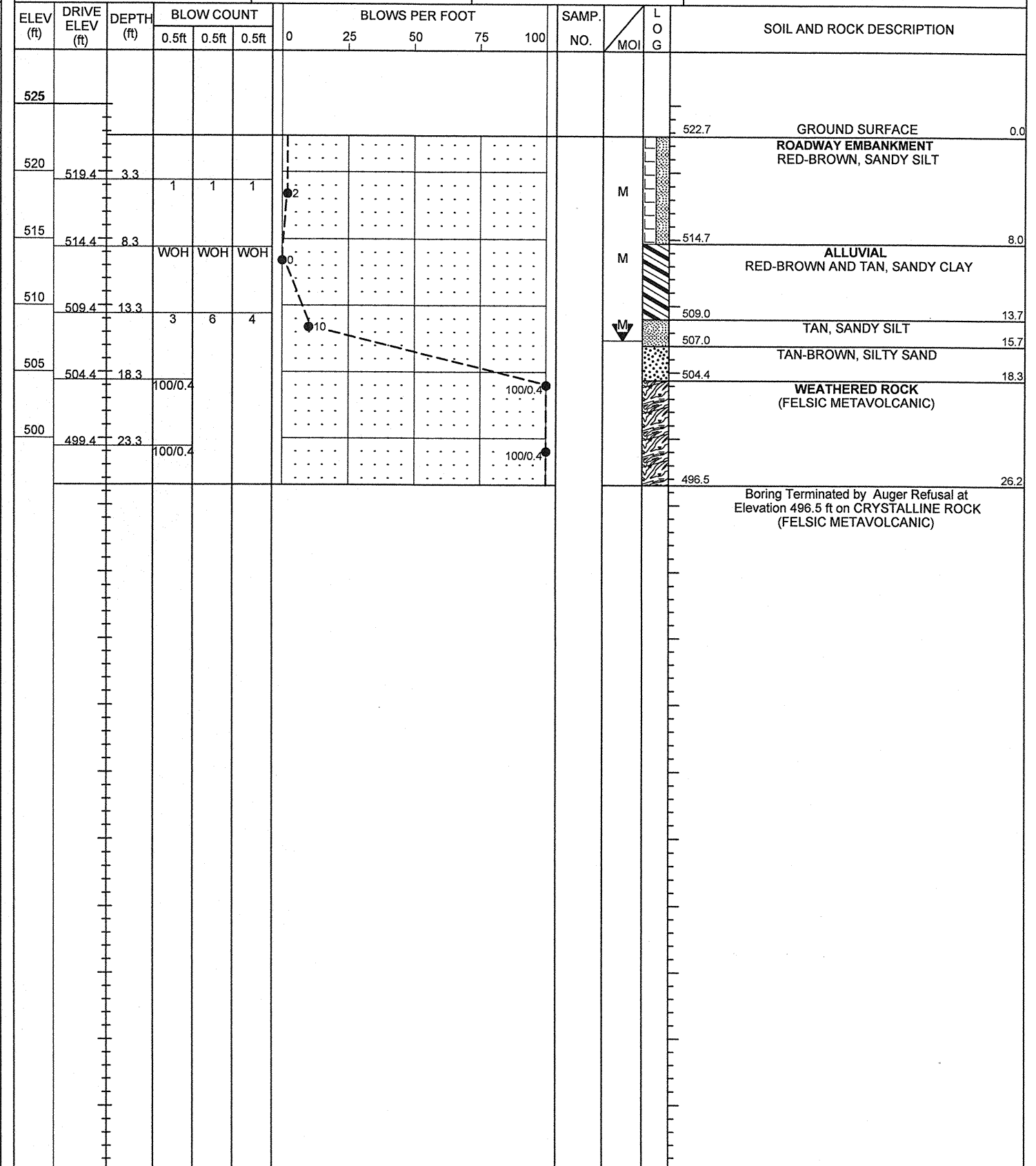
CROSS SECTION THROUGH END BENT 2



|  |                     |                          |                           |
|--|---------------------|--------------------------|---------------------------|
| WBS 38501.1.1  | TIP B-4728          | COUNTY CHATHAM           | GEOLOGIST Stickney, J. K. |
| SITE DESCRIPTION BRIDGE NO. 251 ON -L- SR 1102 (COLERIDGE ROAD) OVER BRUSH CREEK |                     |                          | GROUND WTR (ft)           |
| BORING NO. EB1-A   | STATION 14+74       | OFFSET 11 ft LT          | ALIGNMENT -L-             |
| COLLAR ELEV. 522.8 ft  | TOTAL DEPTH 20.1 ft | NORTHING 713,591         | EASTING 1,839,627         |
| DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009                        |                     | DRILL METHOD H.S. Augers | HAMMER TYPE Automatic     |
| DRILLER Smith, M. L.   | START DATE 02/09/11 | COMP. DATE 02/09/11      | SURFACE WATER DEPTH N/A   |



|  |                     |                          |                           |
|--|---------------------|--------------------------|---------------------------|
| WBS 38501.1.1  | TIP B-4728          | COUNTY CHATHAM           | GEOLOGIST Stickney, J. K. |
| SITE DESCRIPTION BRIDGE NO. 251 ON -L- SR 1102 (COLERIDGE ROAD) OVER BRUSH CREEK |                     |                          | GROUND WTR (ft)           |
| BORING NO. EB1-B   | STATION 14+75       | OFFSET 12 ft RT          | ALIGNMENT -L-             |
| COLLAR ELEV. 522.7 ft  | TOTAL DEPTH 26.2 ft | NORTHING 713,570         | EASTING 1,839,618         |
| DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009                        |                     | DRILL METHOD H.S. Augers | HAMMER TYPE Automatic     |
| DRILLER Smith, M. L.   | START DATE 02/09/11 | COMP. DATE 02/09/11      | SURFACE WATER DEPTH N/A   |



| WBS 38501.1.1  |                 | TIP B-4728                          |            | COUNTY CHATHAM        |        | GEOLOGIST Stickney, J. K. |                 |    |    |           |         |                           |            |
|--|-----------------|-------------------------------------|------------|-----------------------|--------|---------------------------|-----------------|----|----|-----------|---------|---------------------------|------------|
| SITE DESCRIPTION BRIDGE NO. 251 ON -L- SR 1102 (COLERIDGE ROAD) OVER BRUSH CREEK |                 |                                     |            |                       |        |                           | GROUND WTR (ft) |    |    |           |         |                           |            |
| BORING NO. B1-A  |                 | STATION 15+48                       |            | OFFSET 5 ft LT        |        | ALIGNMENT -L-             |                 |    |    |           |         |                           |            |
| COLLAR ELEV. 506.4 ft  |                 | TOTAL DEPTH 23.4 ft                 |            | NORTHING 713,554      |        | EASTING 1,839,691         |                 |    |    |           |         |                           |            |
| DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009                        |                 | DRILL METHOD NW Casing W/SPT & Core |            | HAMMER TYPE Automatic |        |                           |                 |    |    |           |         |                           |            |
| DRILLER Smith, M. L.   |                 | START DATE 02/15/11                 |            | COMP. DATE 02/15/11   |        | SURFACE WATER DEPTH 0.5ft |                 |    |    |           |         |                           |            |
| ELEV (ft)  | DRIVE ELEV (ft) | DEPTH (ft)                          | BLOW COUNT |                       |        | BLOWS PER FOOT            |                 |    |    | SAMP. NO. | LOG MOI | SOIL AND ROCK DESCRIPTION | DEPTH (ft) |
|  |                 |                                     | 0.5ft      | 0.5ft                 | 0.5ft  | 0                         | 25              | 50 | 75 |           |         |                           |            |
| 510  |                 |                                     |            |                       |        |                           |                 |    |    |           |         |                           |            |
|  |                 |                                     |            |                       |        |                           |                 |    |    |           |         |                           |            |
| 505  |                 |                                     |            |                       |        |                           |                 |    |    |           |         |                           |            |
|  | 502.7           | 3.7                                 |            |                       |        |                           |                 |    |    |           |         |                           |            |
| 500  |                 |                                     | 8          | 24                    | 76/0.3 |                           |                 |    |    |           |         |                           |            |
|  |                 |                                     |            |                       |        |                           |                 |    |    |           |         |                           |            |
| 495  |                 |                                     |            |                       |        |                           |                 |    |    |           |         |                           |            |
|  |                 |                                     |            |                       |        |                           |                 |    |    |           |         |                           |            |
| 490  |                 |                                     |            |                       |        |                           |                 |    |    |           |         |                           |            |
|  |                 |                                     |            |                       |        |                           |                 |    |    |           |         |                           |            |
| 485  |                 |                                     |            |                       |        |                           |                 |    |    |           |         |                           |            |

| WBS 38501.1.1  |               | TIP B-4728                          |                   | COUNTY CHATHAM        |          | GEOLOGIST Stickney, J. K. |                 |          |         |     |  |            |
|--|---------------|-------------------------------------|-------------------|-----------------------|----------|---------------------------|-----------------|----------|---------|-----|--|------------|
| SITE DESCRIPTION BRIDGE NO. 251 ON -L- SR 1102 (COLERIDGE ROAD) OVER BRUSH CREEK |               |                                     |                   |                       |          |                           | GROUND WTR (ft) |          |         |     |  |            |
| BORING NO. B1-A  |               | STATION 15+48                       |                   | OFFSET 5 ft LT        |          | ALIGNMENT -L-             |                 |          |         |     |  |            |
| COLLAR ELEV. 506.4 ft  |               | TOTAL DEPTH 23.4 ft                 |                   | NORTHING 713,554      |          | EASTING 1,839,691         |                 |          |         |     |  |            |
| DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009                        |               | DRILL METHOD NW Casing W/SPT & Core |                   | HAMMER TYPE Automatic |          |                           |                 |          |         |     |  |            |
| DRILLER Smith, M. L.   |               | START DATE 02/15/11                 |                   | COMP. DATE 02/15/11   |          | SURFACE WATER DEPTH 0.5ft |                 |          |         |     |  |            |
| CORE SIZE NWXL   |               |                                     | TOTAL RUN 18.0 ft |                       |          |                           |                 |          |         |     |  |            |
| ELEV (ft)  | RUN ELEV (ft) | DEPTH (ft)                          | RUN (ft)          | DRILL RATE (Min/ft)   | RUN      |                           | SAMP. NO.       | STRATA   |         | LOG | DESCRIPTION AND REMARKS  | DEPTH (ft) |
|  |               |                                     |                   |                       | REC. (%) | RQD (%)                   |                 | REC. (%) | RQD (%) |     |  |            |
| 501  |               |                                     |                   |                       |          |                           |                 |          |         |     |  |            |
| 500  | 501.0         | 5.4                                 | 3.0               | 3:10/1.0              | (3.0)    | (1.9)                     |                 | (1.5)    | (1.5)   |     | Begin Coring @ 5.4 ft  |            |
|  | 498.0         | 8.4                                 |                   | 3:30/1.0              | 100%     | 63%                       |                 | 100%     | 100%    |     | WEATHERED ROCK   | 5.4        |
|  |               |                                     | 4.8               | 3:40/1.0              |          |                           |                 | (4.4)    | (0.0)   |     | FRESH, HARD, MODERATELY CLOSELY FRACTURED, GREEN-GRAY, FELSIC METAVOLCANIC   | 6.9        |
| 495  |               |                                     |                   | 2:45/1.0              | (4.8)    | (1.1)                     |                 | 100%     | 0%      |     | CRYSTALLINE ROCK   |            |
|  |               |                                     |                   | 2:49/1.0              |          |                           |                 |          |         |     | VERY SLIGHTLY WEATHERED, HARD, CLOSELY FRACTURED, GREEN-GRAY, FELSIC METAVOLCANIC WITH QUARTZITE VEINS                                     | 11.3       |
|  |               |                                     |                   | 2:50/1.0              |          |                           |                 |          |         |     |  |            |
|  | 493.2         | 13.2                                |                   | 2:47/1.0              |          |                           |                 | (1.7)    | (1.7)   |     | FRESH, HARD, MODERATELY CLOSE FRACTURED, GREEN-GRAY, FELSIC METAVOLCANIC   | 13.0       |
|  |               |                                     | 4.8               | 2:50/0.8              |          |                           |                 | (1.3)    | (0.0)   |     |  | 14.3       |
| 490  |               |                                     |                   | 3:25/1.0              | (4.8)    | (3.0)                     |                 | 100%     | 63%     |     | R1=7, R2=8, R3=10, R4=12, R5=7, RMR=44   |            |
|  |               |                                     |                   | 3:20/1.0              |          |                           |                 |          |         |     | ROCK TYPE = D  |            |
|  | 488.4         | 18.0                                |                   | 3:24/1.0              |          |                           |                 | (5.8)    | (5.5)   |     | VERY SLIGHTLY WEATHERED, HARD, CLOSELY FRACTURED, GREEN-GRAY, FELSIC METAVOLCANIC  | 20.1       |
|  |               |                                     | 5.4               | 3:30/0.8              |          |                           |                 |          |         |     |  | 20.9       |
| 485  |               |                                     |                   | 3:40/1.0              | (5.4)    | (3.7)                     |                 | (0.8)    | (0.0)   |     | FRESH TO VERY SLIGHTLY WEATHERED, HARD, MODERATELY CLOSELY FRACTURED, GREEN-GRAY, WITH A ZONE OF VERY CLOSELY FRACTURED BETWEEN 16.5-16.8' |            |
|  |               |                                     |                   | 3:35/1.0              | 100%     | 69%                       |                 |          |         |     |  | 23.4       |
|  |               |                                     |                   | 3:37/1.0              |          |                           |                 | (2.5)    | (2.5)   |     | VERY SLIGHTLY WEATHERED, HARD, VERY CLOSELY FRACTURED, GREEN-GRAY, FELSIC METAVOLCANIC   |            |
|  | 483.0         | 23.4                                |                   | 3:39/1.0              |          |                           |                 | 100%     | 100%    |     | FRESH, HARD, MODERATELY CLOSELY FRACTURED, GREEN-GRAY, FELSIC METAVOLCANIC   |            |
|  |               |                                     |                   | 3:33/1.4              |          |                           |                 |          |         |     | Boring Terminated at Elevation 483.0 ft in Crystalline Rock (felsic metavolcanic)  |            |



| WBS 38501.1.1  |                 | TIP B-4728          |            | COUNTY CHATHAM           |       | GEOLOGIST Stickney, J. K. |    |    |    |     |           |     |                           |            |  |
|--|-----------------|---------------------|------------|--------------------------|-------|---------------------------|----|----|----|-----|-----------|-----|---------------------------|------------|--|
| SITE DESCRIPTION BRIDGE NO. 251 ON -L- SR 1102 (COLERIDGE ROAD) OVER BRUSH CREEK |                 |                     |            |                          |       |                           |    |    |    |     |           |     |                           |            |  |
| BORING NO. B1-B  |                 | STATION 15+45       |            | OFFSET. 6 ft RT          |       | ALIGNMENT -L-             |    |    |    |     |           |     |                           |            |  |
| COLLAR ELEV. 506.5 ft  |                 | TOTAL DEPTH 28.5 ft |            | NORTHING 713,545         |       | EASTING 1,839,684         |    |    |    |     |           |     |                           |            |  |
| DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009                        |                 |                     |            | DRILL METHOD H.S. Augers |       | HAMMER TYPE Automatic     |    |    |    |     |           |     |                           |            |  |
| DRILLER Smith, M. L.   |                 | START DATE 02/16/11 |            | COMP. DATE 02/16/11      |       | SURFACE WATER DEPTH 0.5ft |    |    |    |     |           |     |                           |            |  |
| ELEV (ft)  | DRIVE ELEV (ft) | DEPTH (ft)          | BLOW COUNT |                          |       | BLOWS PER FOOT            |    |    |    |     | SAMP. NO. | LOG | SOIL AND ROCK DESCRIPTION | DEPTH (ft) |  |
|  |                 |                     | 0.5ft      | 0.5ft                    | 0.5ft | 0                         | 25 | 50 | 75 | 100 |           |     |                           |            |  |
| 510  |                 |                     |            |                          |       |                           |    |    |    |     |           |     |                           |            |  |
|  |                 |                     |            |                          |       |                           |    |    |    |     |           |     |                           |            |  |
| 505  |                 |                     |            |                          |       |                           |    |    |    |     |           |     |                           |            |  |
|  | 502.5           | 4.0                 | 39         | 61/0.1                   |       |                           |    |    |    |     |           |     |                           |            |  |
| 500  |                 |                     |            |                          |       |                           |    |    |    |     |           |     |                           |            |  |
|  |                 |                     |            |                          |       |                           |    |    |    |     |           |     |                           |            |  |
| 495  |                 |                     |            |                          |       |                           |    |    |    |     |           |     |                           |            |  |
|  |                 |                     |            |                          |       |                           |    |    |    |     |           |     |                           |            |  |
| 490  |                 |                     |            |                          |       |                           |    |    |    |     |           |     |                           |            |  |
|  |                 |                     |            |                          |       |                           |    |    |    |     |           |     |                           |            |  |
| 485  |                 |                     |            |                          |       |                           |    |    |    |     |           |     |                           |            |  |
|  |                 |                     |            |                          |       |                           |    |    |    |     |           |     |                           |            |  |
| 480  |                 |                     |            |                          |       |                           |    |    |    |     |           |     |                           |            |  |
|  |                 |                     |            |                          |       |                           |    |    |    |     |           |     |                           |            |  |

| WBS 38501.1.1  |               | TIP B-4728          |          | COUNTY CHATHAM           |          | GEOLOGIST Stickney, J. K. |           |          |         |     |                         |            |
|--|---------------|---------------------|----------|--------------------------|----------|---------------------------|-----------|----------|---------|-----|-------------------------|------------|
| SITE DESCRIPTION BRIDGE NO. 251 ON -L- SR 1102 (COLERIDGE ROAD) OVER BRUSH CREEK |               |                     |          |                          |          |                           |           |          |         |     |                         |            |
| BORING NO. B1-B  |               | STATION 15+45       |          | OFFSET 6 ft RT           |          | ALIGNMENT -L-             |           |          |         |     |                         |            |
| COLLAR ELEV. 506.5 ft  |               | TOTAL DEPTH 28.5 ft |          | NORTHING 713,545         |          | EASTING 1,839,684         |           |          |         |     |                         |            |
| DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009                        |               |                     |          | DRILL METHOD H.S. Augers |          | HAMMER TYPE Automatic     |           |          |         |     |                         |            |
| DRILLER Smith, M. L.   |               | START DATE 02/16/11 |          | COMP. DATE 02/16/11      |          | SURFACE WATER DEPTH 0.5ft |           |          |         |     |                         |            |
| ELEV (ft)  | RUN ELEV (ft) | DEPTH (ft)          | RUN (ft) | DRILL RATE (Min/ft)      | RUN      |                           | SAMP. NO. | STRATA   |         | LOG | DESCRIPTION AND REMARKS | DEPTH (ft) |
|  |               |                     |          |                          | REC. (%) | RQD (%)                   |           | REC. (%) | RQD (%) |     |                         |            |
| 501.9  |               |                     |          |                          |          |                           |           |          |         |     |                         |            |
| 500  | 501.9         | 4.6                 | 4.1      | 3:07/1.0                 | (3.8)    | (1.2)                     |           | (1.0)    | (0.0)   |     |                         |            |
|  |               |                     |          | 3:11/1.0                 | 93%      | 29%                       |           | 100%     | 0%      |     |                         |            |
|  | 497.8         | 8.7                 |          | 3:10/1.0                 |          |                           |           | (0.8)    | (0.8)   |     |                         |            |
|  |               |                     |          | 3:12/1.1                 |          |                           |           | 100%     | 100%    |     |                         |            |
| 495  |               |                     | 5.0      | 1:50/1.0                 | (3.8)    | (0.0)                     |           | (0.5)    | (0.0)   |     |                         |            |
|  |               |                     |          | 2:00/1.0                 | 76%      | 0%                        |           | 45%      | 0%      |     |                         |            |
|  |               |                     |          | 1:40/1.0                 |          |                           |           | (1.0)    | (1.0)   |     |                         |            |
|  | 492.8         | 13.7                |          | 1:20/1.0                 |          |                           |           | 100%     | 100%    |     |                         |            |
| 490  |               |                     | 5.0      | 1:01/1.0                 | (5.0)    | (0.5)                     | RS-1      | (14.0)   | (5.5)   |     |                         |            |
|  |               |                     |          | 1:04/1.0                 | 100%     | 10%                       |           | 92%      | 36%     |     |                         |            |
|  |               |                     |          | 1:02/1.0                 |          |                           |           |          |         |     |                         |            |
|  |               |                     |          | 0:57/1.0                 |          |                           |           |          |         |     |                         |            |
|  | 487.8         | 18.7                |          | 0:50/1.0                 |          |                           |           |          |         |     |                         |            |
| 485  |               |                     | 5.0      | 1:23/1.0                 | (5.0)    | (0.8)                     |           |          |         |     |                         |            |
|  |               |                     |          | 1:11/1.0                 | 100%     | 16%                       |           |          |         |     |                         |            |
|  |               |                     |          | 1:24/1.0                 |          |                           |           |          |         |     |                         |            |
|  |               |                     |          | 1:30/1.0                 |          |                           |           |          |         |     |                         |            |
|  | 482.8         | 23.7                |          | 1:26/1.0                 |          |                           |           |          |         |     |                         |            |
| 480  |               |                     | 4.8      | 3:10/1.0                 | (4.8)    | (4.8)                     |           | (5.0)    | (5.0)   |     |                         |            |
|  |               |                     |          | 3:0/1.0                  | 100%     | 100%                      |           | 104%     | 104%    |     |                         |            |
|  |               |                     |          | 3:0/1.0                  |          |                           |           |          |         |     |                         |            |
|  | 478.0         | 28.5                |          | 3:0/1.0                  |          |                           |           |          |         |     |                         |            |
|  |               |                     |          | 2:40/0.8                 |          |                           |           |          |         |     |                         |            |

NCDOT BORE SINGLE B4728 GEO BH BRD0251.GPJ NC\_DOT.GDT 5/31/11

NCDOT BORE SINGLE B4728 GEO BH BRD0251.GPJ NC\_DOT.GDT 5/31/11

| WBS 38501.1.1  |                 | TIP B-4728               |            | COUNTY CHATHAM        |        | GEOLOGIST Stickney, J. K. |                 |    |    |     |           |         |       |                           |            |      |
|--|-----------------|--------------------------|------------|-----------------------|--------|---------------------------|-----------------|----|----|-----|-----------|---------|-------|---------------------------|------------|------|
| SITE DESCRIPTION BRIDGE NO. 251 ON -L- SR 1102 (COLERIDGE ROAD) OVER BRUSH CREEK   |                 |                          |            |                       |        |                           | GROUND WTR (ft) |    |    |     |           |         |       |                           |            |      |
| BORING NO. EB2-A   |                 | STATION 16+05            |            | OFFSET 11 ft LT       |        | ALIGNMENT -L-             |                 |    |    |     |           |         |       |                           |            |      |
| COLLAR ELEV. 523.5 ft  |                 | TOTAL DEPTH 15.1 ft      |            | NORTHING 713,534      |        | EASTING 1,839,745         |                 |    |    |     |           |         |       |                           |            |      |
| DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009  |                 | DRILL METHOD H.S. Augers |            | HAMMER TYPE Automatic |        |                           |                 |    |    |     |           |         |       |                           |            |      |
| DRILLER Smith, M. L.   |                 | START DATE 02/11/11      |            | COMP. DATE 02/11/11   |        | SURFACE WATER DEPTH N/A   |                 |    |    |     |           |         |       |                           |            |      |
| ELEV (ft)  | DRIVE ELEV (ft) | DEPTH (ft)               | BLOW COUNT |                       |        | BLOWS PER FOOT            |                 |    |    |     | SAMP. NO. | LOG MOI | LOG G | SOIL AND ROCK DESCRIPTION | DEPTH (ft) |      |
|  |                 |                          | 0.5ft      | 0.5ft                 | 0.5ft  | 0                         | 25              | 50 | 75 | 100 |           |         |       |                           |            |      |
| 525  |                 |                          |            |                       |        |                           |                 |    |    |     |           |         |       |                           | 523.5      | 0.0  |
|  |                 |                          |            |                       |        |                           |                 |    |    |     |           |         |       |                           |            |      |
| 520  | 520.0           | 3.5                      | 1          | 8                     | 3      |                           |                 |    |    |     |           |         |       | M                         |            |      |
| 515  | 515.0           | 8.5                      | 4          | 7                     | 8      |                           |                 |    |    |     |           |         |       | M                         |            |      |
| 510  | 510.0           | 13.5                     | 4          | 31                    | 69/0.4 |                           |                 |    |    |     |           |         |       | D                         |            |      |
|  |                 |                          |            |                       |        |                           |                 |    |    |     |           |         |       |                           | 508.4      | 15.1 |
| WEATHERED ROCK (FELSIC METAVOLCANIC)<br>Boring Terminated by Auger Refusal at Elevation 508.4 ft on CRYSTALLINE ROCK (FELSIC METAVOLCANIC) |                 |                          |            |                       |        |                           |                 |    |    |     |           |         |       |                           |            |      |

| WBS 38501.1.1  |                 | TIP B-4728               |            | COUNTY CHATHAM        |       | GEOLOGIST Stickney, J. K. |                 |    |    |     |           |         |       |                           |            |      |
|--|-----------------|--------------------------|------------|-----------------------|-------|---------------------------|-----------------|----|----|-----|-----------|---------|-------|---------------------------|------------|------|
| SITE DESCRIPTION BRIDGE NO. 251 ON -L- SR 1102 (COLERIDGE ROAD) OVER BRUSH CREEK   |                 |                          |            |                       |       |                           | GROUND WTR (ft) |    |    |     |           |         |       |                           |            |      |
| BORING NO. EB2-B   |                 | STATION 16+05            |            | OFFSET 12 ft RT       |       | ALIGNMENT -L-             |                 |    |    |     |           |         |       |                           |            |      |
| COLLAR ELEV. 524.2 ft  |                 | TOTAL DEPTH 10.4 ft      |            | NORTHING 713,514      |       | EASTING 1,839,735         |                 |    |    |     |           |         |       |                           |            |      |
| DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009  |                 | DRILL METHOD H.S. Augers |            | HAMMER TYPE Automatic |       |                           |                 |    |    |     |           |         |       |                           |            |      |
| DRILLER Smith, M. L.   |                 | START DATE 02/11/11      |            | COMP. DATE 02/11/11   |       | SURFACE WATER DEPTH N/A   |                 |    |    |     |           |         |       |                           |            |      |
| ELEV (ft)  | DRIVE ELEV (ft) | DEPTH (ft)               | BLOW COUNT |                       |       | BLOWS PER FOOT            |                 |    |    |     | SAMP. NO. | LOG MOI | LOG G | SOIL AND ROCK DESCRIPTION | DEPTH (ft) |      |
|  |                 |                          | 0.5ft      | 0.5ft                 | 0.5ft | 0                         | 25              | 50 | 75 | 100 |           |         |       |                           |            |      |
| 525  |                 |                          |            |                       |       |                           |                 |    |    |     |           |         |       |                           | 524.2      | 0.0  |
|  |                 |                          |            |                       |       |                           |                 |    |    |     |           |         |       |                           |            |      |
| 520  | 520.7           | 3.5                      | 2          | 2                     | 3     |                           |                 |    |    |     |           |         |       | M                         |            |      |
|  |                 |                          |            |                       |       |                           |                 |    |    |     |           |         |       |                           |            |      |
| 515  | 515.7           | 8.5                      | 5          | 8                     | 9     |                           |                 |    |    |     |           |         |       | M                         |            |      |
|  |                 |                          |            |                       |       |                           |                 |    |    |     |           |         |       |                           | 513.8      | 10.4 |
| RESIDUAL TAN-BROWN, SANDY SILT<br>Boring Terminated by Auger Refusal at Elevation 513.8 ft on CRYSTALLINE ROCK (FELSIC METAVOLCANIC) |                 |                          |            |                       |       |                           |                 |    |    |     |           |         |       |                           |            |      |

NCDOT BORE DOUBLE B4728\_GEO\_BH\_BRDG0251.GPJ NC\_DOT\_GDT 6/1/11



|  |                     |                          |                           |
|--|---------------------|--------------------------|---------------------------|
| WBS 38501.1.1  | TIP B-4728          | COUNTY CHATHAM           | GEOLOGIST Stickney, J. K. |
| SITE DESCRIPTION BRIDGE NO. 251 ON -L- SR 1102 (COLERIDGE ROAD) OVER BRUSH CREEK |                     |                          | GROUND WTR (ft)           |
| BORING NO. EB2-B2  | STATION 16+01       | OFFSET 12 ft RT          | ALIGNMENT -L-             |
| COLLAR ELEV. 524.2 ft  | TOTAL DEPTH 10.4 ft | NORTHING 713,515         | EASTING 1,839,732         |
| DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009                        |                     | DRILL METHOD H.S. Augers | HAMMER TYPE Automatic     |
| DRILLER Smith, M. L.   | START DATE 02/11/11 | COMP. DATE 02/11/11      | SURFACE WATER DEPTH N/A   |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT |       |        | BLOWS PER FOOT |    |    |    |     | SAMP. NO. | LOG MOI | SOIL AND ROCK DESCRIPTION | DEPTH (ft) |  |      |
|-----------|-----------------|------------|------------|-------|--------|----------------|----|----|----|-----|-----------|---------|---------------------------|------------|--|------|
|           |                 |            | 0.5ft      | 0.5ft | 0.5ft  | 0              | 25 | 50 | 75 | 100 |           |         |                           |            |  |      |
| 525       |                 |            |            |       |        |                |    |    |    |     |           |         |                           |            |  |      |
|           |                 |            |            |       |        |                |    |    |    |     |           |         |                           | 524.2      | GROUND SURFACE   | 0.0  |
|           |                 |            |            |       |        |                |    |    |    |     |           |         |                           |            | ROADWAY EMBANKMENT<br>RED-BROWN, SILTY CLAY  |      |
| 520       |                 |            |            |       |        |                |    |    |    |     |           |         |                           |            |  |      |
|           |                 |            |            |       |        |                |    |    |    |     |           |         |                           | 516.8      | RESIDUAL   | 7.4  |
|           |                 |            |            |       |        |                |    |    |    |     |           |         |                           |            | TAN-BROWN, SANDY SILT  | 9.9  |
| 515       | 515.2           | 9.0        | 7          | 8     | 92/0.4 |                |    |    |    |     |           |         |                           | 514.3      | WEATHERED ROCK<br>(FELSIC METAVOLCANIC)  | 10.4 |
|           |                 |            |            |       |        |                |    |    |    |     |           |         |                           | 513.8      | WEATHERED ROCK<br>(FELSIC METAVOLCANIC)  |      |
|           |                 |            |            |       |        |                |    |    |    |     |           |         |                           |            | Boring Terminated by Auger Refusal at<br>Elevation 513.8 ft on CRYSTALLINE ROCK<br>(FELSIC METAVOLCANIC) |      |

NCDOT BORE SINGLE B4728 GEO\_BH\_BRDG0251.GPJ NC DOT.GDT 5/31/11

**North Carolina Dept. of Transportation  
Division of Highways  
Materials and Tests  
Physical Testing Laboratory**

**Rock Compression**

Lab Number:  
Project #:  
County:  
Tip ID:

366285  
38501.1.1  
Chatham  
B-4728

Structure Description:  
Test Date:

felsic tuff  
05/17/2011

| Lab Number | Sample No. | Diameter<br>in | Area<br>in <sup>2</sup> | Depth  | Specimen<br>Height<br>in | H/D Ratio | Weight<br>lbf | Unit Weight<br>lbf/ft <sup>3</sup> | Ultimate<br>lbf | Ultimate<br>ksi | Ultimate<br>(corrected)<br>ksi | 40% Ut.<br>Load<br>lbf | Sec Mod @<br>40%<br>Mpsi |
|------------|------------|----------------|-------------------------|--------|--------------------------|-----------|---------------|------------------------------------|-----------------|-----------------|--------------------------------|------------------------|--------------------------|
| 366285     | RS-1       | 1.8680         | 2.7406                  | 0.0000 | 3.79                     | 2.03      | 1.0300        | 171.2                              | 21700           | 7.92            | 7.93                           | 8680                   | -0.0371                  |



**FIELD  
SCOUR REPORT**

WBS: 38501.1.1 TIP: B-4728 COUNTY: Chatham

DESCRIPTION(1): Bridge No. 251 over Brush Creek on SR 1102 (Coleridge Rd.)

**EXISTING BRIDGE**

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

Bridge No.: 251 Length: 80'10" Total Bents: 3 Bents in Channel: 0 Bents in Floodplain: 3  
Foundation Type: Concrete footing on B-1, Timber pile and vertical timber abutment and wingwalls at end bents.

**EVIDENCE OF SCOUR(2)**

Abutments or End Bent Slopes: None observed

Interior Bents: None observed

Channel Bed: None observed

Channel Bank: Non observed

**EXISTING SCOUR PROTECTION**

Type(3): Rip Rap

Extent(4): Fill slopes up stream and downstream at 15 to 20 ft.

Effectiveness(5): Good

Obstructions(6): Tree trunk and limbs (existing B-1) and limbs downstream

**INSTRUCTIONS**

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

**DESIGN INFORMATION**

Channel Bed Material(7): silt, sand, gravel and boulders (see borings B1-A and B1-B)

Channel Bank Material(8): silt and sand

Channel Bank Cover(9): trees, shrubs, grass and brush

Floodplain Width(10): approximately 200 ft.

Floodplain Cover(11): trees, shrubs, grass and brush

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

Channel Migration Tendency(13): n/a

Observations and Other Comments: End bents repaired and replaced (wood) recently, boulders in approach fill

**DESIGN SCOUR ELEVATIONS(14)**

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

|              | BENTS  |        |  |  |  |  |  |  |  |  |  |
|--------------|--------|--------|--|--|--|--|--|--|--|--|--|
|              | B1-A   | B1-B   |  |  |  |  |  |  |  |  |  |
| 100 yr. GASE | 501.0' | 502.5' |  |  |  |  |  |  |  |  |  |
|              |        |        |  |  |  |  |  |  |  |  |  |
|              |        |        |  |  |  |  |  |  |  |  |  |
|              |        |        |  |  |  |  |  |  |  |  |  |
|              |        |        |  |  |  |  |  |  |  |  |  |

Comparison of DSE to Hydraulics Unit theoretical scour:  
The Geotechnical Engineering Unit is going to raise the DSE from 496.0 ft. (as shown on the BSR dated 2/2011) to 501.0 ft., to the top of weathered rock at the location of the proposed interior bent.

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

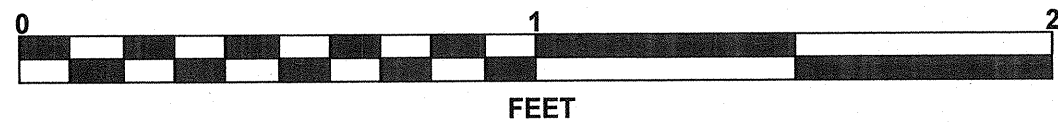
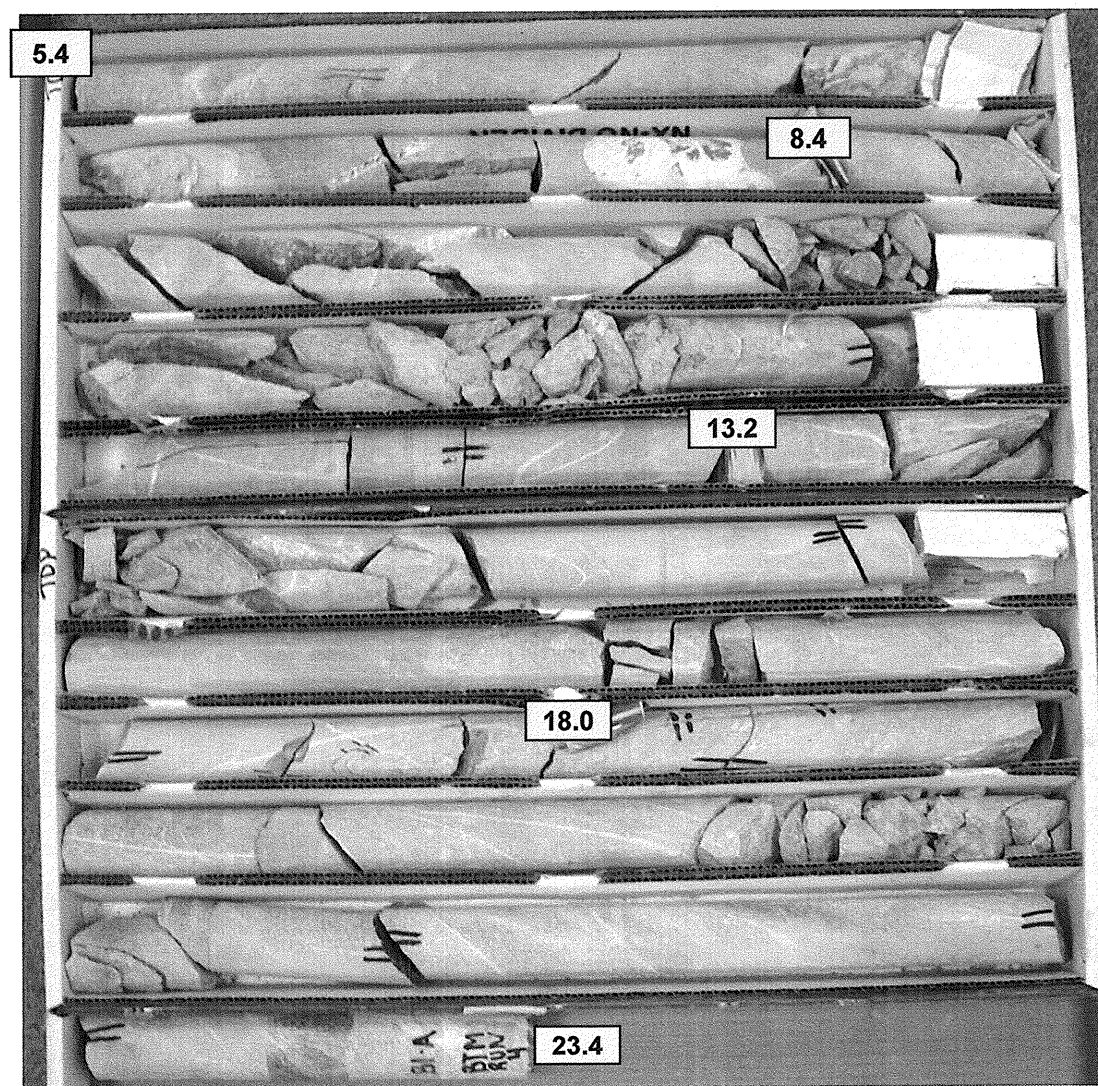
|             |  |  |  |  |  |  |  |  |  |  |
|-------------|--|--|--|--|--|--|--|--|--|--|
| Bed or Bank |  |  |  |  |  |  |  |  |  |  |
| Sample No.  |  |  |  |  |  |  |  |  |  |  |
| Retained #4 | No soil samples were lab tested during this investigation. Samples were classified visually in the field and office. |  |  |  |  |  |  |  |  |  |
| Passed #10  |  |  |  |  |  |  |  |  |  |  |
| Passed #40  |  |  |  |  |  |  |  |  |  |  |
| Passed #200 |  |  |  |  |  |  |  |  |  |  |
| Coarse Sand |  |  |  |  |  |  |  |  |  |  |
| Fine Sand   |  |  |  |  |  |  |  |  |  |  |
| Silt        |  |  |  |  |  |  |  |  |  |  |
| Clay        |  |  |  |  |  |  |  |  |  |  |
| LL          |  |  |  |  |  |  |  |  |  |  |
| PI          |  |  |  |  |  |  |  |  |  |  |
| AASHTO      |  |  |  |  |  |  |  |  |  |  |
| Station     |  |  |  |  |  |  |  |  |  |  |
| Offset      |  |  |  |  |  |  |  |  |  |  |
| Depth       |  |  |  |  |  |  |  |  |  |  |

Reported by:  Date: 5-31-11

# CORE PHOTOGRAPHS

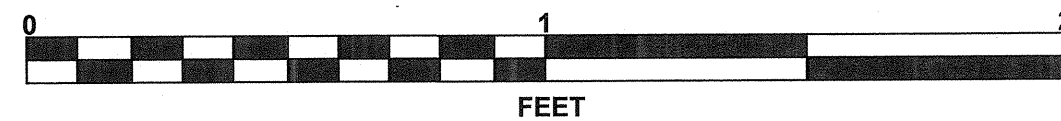
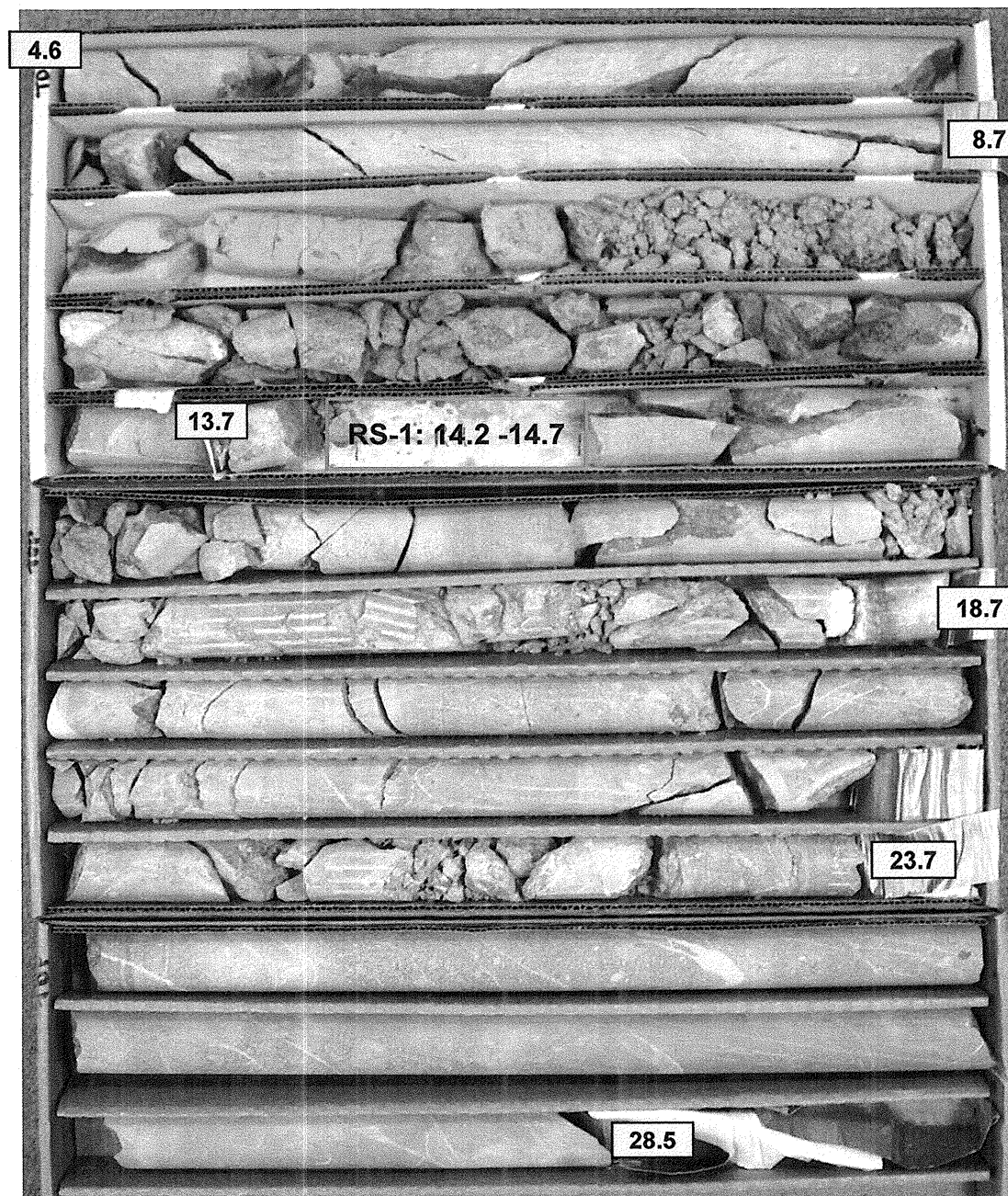
## B1-A

BOXES 1 & 2: 5.4 - 23.4 FEET



## B1-B

BOXES 1 & 2: 4.6 - 28.5 FEET



# Site Photographs



View facing West



View facing south from creek bank



View upstream, north



View downstream, south