

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

STRUCTURE
SUBSURFACE INVESTIGATION

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PROJ. REFERENCE NO. 33741.1.1 (B-4517) F.A. PROJ. BRSTP-1103(15)
COUNTY GASTON
PROJECT DESCRIPTION BRIDGE 49 ON SR 1103 OVER CROWDER'S CREEK

SITE DESCRIPTION CROWDER'S CREEK RD. (SR 1103) BETWEEN LINWOOD RD. (SR 1131) AND CRAWFORD RD. (SR 1108)

CAUTION NOTICE

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

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

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

PROJECT: 33741.1.1 ID: B-4517

PERSONNEL

R. W. TODD

M. L. SMITH

A. C. SMITH

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C. L. SMITH

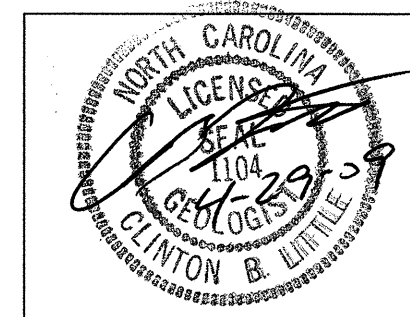
M. D. MAULDIN

INVESTIGATED BY **J. P. ROGERS**

CHECKED BY **C. B. LITTLE**

SUBMITTED BY **C. B. LITTLE**

DATE **APRIL 2009**



DRAWN BY: **C. E. BURRIS**

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

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

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

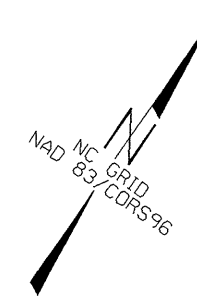
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

| SOIL DESCRIPTION | | GRADATION | | ROCK DESCRIPTION | | TERMS AND DEFINITIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| <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 (ASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE ASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, ASHTO CLASSIFICATION AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLES:</p> <p>VERY STIFF, GRAY, SOFT CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HEAVY PLASTIC, A-7-6</p> | | <p>WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED) GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.</p> <p>ANGULARITY OF GRAINS</p> <p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p> | | <p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL, AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p> <p>WEATHERED ROCK (WR)</p> <p>CRYSTALLINE ROCK (CR)</p> <p>NON-CRYSTALLINE ROCK (NCR)</p> <p>COASTAL PLAIN SEDIMENTARY ROCK (CP)</p> | | <p>ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR 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. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>SOIL LEGEND AND ASHTO CLASSIFICATION</p> <table border="1"> <tr> <th>GENERAL CLASS.</th> <th colspan="5">GRANULAR MATERIALS (≤ 35% PASSING #200)</th> <th colspan="5">SILT-CLAY MATERIALS (> 35% PASSING #200)</th> <th colspan="3">ORGANIC MATERIALS</th> </tr> <tr> <td>GROUP CLASS.</td> <td>A-1</td> <td>A-3</td> <td colspan="3">A-2</td> <td>A-4</td> <td>A-5</td> <td>A-6</td> <td>A-7</td> <td>A-1, A-2</td> <td>A-4, A-5</td> <td colspan="3">A-7</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> <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>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> </tr> <tr> <td>LIQUID LIMIT</td> <td>≤ 5</td> <td>≤ 10</td> <td>≤ 15</td> <td>≤ 20</td> <td>≤ 25</td> <td>≤ 30</td> <td>≤ 35</td> <td>≤ 40</td> <td>≤ 45</td> <td>≤ 50</td> <td>≤ 55</td> <td>≤ 60</td> <td>≤ 65</td> <td>≤ 70</td> </tr> <tr> <td>PLASTIC INDEX</td> <td>≤ 4</td> <td>≤ 7</td> <td>≤ 10</td> <td>≤ 15</td> <td>≤ 20</td> <td>≤ 25</td> <td>≤ 30</td> <td>≤ 35</td> <td>≤ 40</td> <td>≤ 45</td> <td>≤ 50</td> <td>≤ 55</td> <td>≤ 60</td> <td>≤ 65</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>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>USUAL TYPES OF MAJOR MATERIALS</td> <td>STONE FRAGS. OF MAJOR GRAVEL AND SAND</td> <td>FINE SAND</td> <td colspan="3">SILTY OR CLAYEY GRAVEL AND SAND</td> <td colspan="3">SILTY SOILS</td> <td colspan="3">CLAYEY SOILS</td> <td colspan="3">SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER</td> </tr> <tr> <td>GENERALITY AS A SUBGRADE</td> <td colspan="5">EXCELLENT TO GOOD</td> <td colspan="5">FAIR TO POOR</td> <td>FAIR TO POOR</td> <td>POOR</td> <td>UNSUITABLE</td> </tr> </table> <p>PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30</p> | | GENERAL CLASS. | GRANULAR MATERIALS (≤ 35% PASSING #200) | | | | | SILT-CLAY MATERIALS (> 35% PASSING #200) | | | | | ORGANIC MATERIALS | | | GROUP CLASS. | A-1 | A-3 | A-2 | | | A-4 | A-5 | A-6 | A-7 | A-1, A-2 | A-4, A-5 | A-7 | | | SYMBOL | | | | | | | | | | | | | | | % PASSING | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | LIQUID LIMIT | ≤ 5 | ≤ 10 | ≤ 15 | ≤ 20 | ≤ 25 | ≤ 30 | ≤ 35 | ≤ 40 | ≤ 45 | ≤ 50 | ≤ 55 | ≤ 60 | ≤ 65 | ≤ 70 | PLASTIC INDEX | ≤ 4 | ≤ 7 | ≤ 10 | ≤ 15 | ≤ 20 | ≤ 25 | ≤ 30 | ≤ 35 | ≤ 40 | ≤ 45 | ≤ 50 | ≤ 55 | ≤ 60 | ≤ 65 | GROUP INDEX | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | USUAL TYPES OF MAJOR MATERIALS | STONE FRAGS. OF MAJOR GRAVEL AND SAND | FINE SAND | SILTY OR CLAYEY GRAVEL AND SAND | | | SILTY SOILS | | | CLAYEY SOILS | | | SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER | | | GENERALITY AS A SUBGRADE | EXCELLENT TO GOOD | | | | | FAIR TO POOR | | | | | FAIR TO POOR | POOR | UNSUITABLE | <p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.</p> <p>COMPRESSIBILITY</p> <p>SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31</p> <p>MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50</p> <p>HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50</p> <p>PERCENTAGE OF MATERIAL</p> <table border="1"> <tr> <th>ORGANIC MATERIAL</th> <th>GRANULAR SOILS</th> <th>SILT - CLAY SOILS</th> <th>OTHER MATERIAL</th> </tr> <tr> <td>TRACE OF ORGANIC MATTER</td> <td>2 - 3%</td> <td>3 - 5%</td> <td>TRACE</td> </tr> <tr> <td>LITTLE ORGANIC MATTER</td> <td>3 - 5%</td> <td>5 - 12%</td> <td>LITTLE</td> </tr> <tr> <td>MODERATELY ORGANIC</td> <td>5 - 10%</td> <td>12 - 20%</td> <td>SOME</td> </tr> <tr> <td>HIGHLY ORGANIC</td> <td>>10%</td> <td>>20%</td> <td>HIGHLY</td> </tr> </table> <p>GROUND WATER</p> <p>▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING</p> <p>▽. STATIC WATER LEVEL AFTER 24 HOURS</p> <p>▽. PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA</p> <p>○ SPRING OR SEEP</p> | | ORGANIC MATERIAL | GRANULAR SOILS | SILT - CLAY SOILS | OTHER MATERIAL | TRACE OF ORGANIC MATTER | 2 - 3% | 3 - 5% | TRACE | LITTLE ORGANIC MATTER | 3 - 5% | 5 - 12% | LITTLE | MODERATELY ORGANIC | 5 - 10% | 12 - 20% | SOME | HIGHLY ORGANIC | >10% | >20% | HIGHLY | <p>WEATHERING</p> <p>FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p> <p>VERY SLIGHT (V SL.) ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY, ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.</p> <p>SLIGHT (SL.) ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED, CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.</p> <p>MODERATE (MOD.) SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.</p> <p>MODERATELY SEVERE (MOD. SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. IF TESTED, WOULD YIELD SPT REFUSAL</p> <p>SEVERE (SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT, SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. IF TESTED, YIELDS SPT N VALUES > 100 BPF</p> <p>VERY SEVERE (V SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. IF TESTED, YIELDS SPT N VALUES < 100 BPF</p> <p>COMPLETE ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.</p> | |
| GENERAL CLASS. | GRANULAR MATERIALS (≤ 35% PASSING #200) | | | | | SILT-CLAY MATERIALS (> 35% PASSING #200) | | | | | ORGANIC MATERIALS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GROUP CLASS. | A-1 | A-3 | A-2 | | | A-4 | A-5 | A-6 | A-7 | A-1, A-2 | A-4, A-5 | A-7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SYMBOL | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| % PASSING | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LIQUID LIMIT | ≤ 5 | ≤ 10 | ≤ 15 | ≤ 20 | ≤ 25 | ≤ 30 | ≤ 35 | ≤ 40 | ≤ 45 | ≤ 50 | ≤ 55 | ≤ 60 | ≤ 65 | ≤ 70 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PLASTIC INDEX | ≤ 4 | ≤ 7 | ≤ 10 | ≤ 15 | ≤ 20 | ≤ 25 | ≤ 30 | ≤ 35 | ≤ 40 | ≤ 45 | ≤ 50 | ≤ 55 | ≤ 60 | ≤ 65 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GROUP INDEX | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USUAL TYPES OF MAJOR MATERIALS | STONE FRAGS. OF MAJOR GRAVEL AND SAND | FINE SAND | SILTY OR CLAYEY GRAVEL AND SAND | | | SILTY SOILS | | | CLAYEY SOILS | | | SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GENERALITY AS A SUBGRADE | EXCELLENT TO GOOD | | | | | FAIR TO POOR | | | | | FAIR TO POOR | POOR | UNSUITABLE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ORGANIC MATERIAL | GRANULAR SOILS | SILT - CLAY SOILS | OTHER MATERIAL | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TRACE OF ORGANIC MATTER | 2 - 3% | 3 - 5% | TRACE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LITTLE ORGANIC MATTER | 3 - 5% | 5 - 12% | LITTLE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MODERATELY ORGANIC | 5 - 10% | 12 - 20% | SOME | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HIGHLY ORGANIC | >10% | >20% | HIGHLY | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>CONSISTENCY OR DENSENESS</p> <table border="1"> <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/FT²)</th> </tr> <tr> <td>GENERALLY GRANULAR MATERIAL (NON-COHESIVE)</td> <td>VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE</td> <td>≤ 4 4 TO 10 10 TO 30 30 TO 50 ≥ 50</td> <td>N/A</td> </tr> <tr> <td>GENERALLY SILT-CLAY MATERIAL (COHESIVE)</td> <td>VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD</td> <td>≤ 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 ≥ 30</td> <td>< 0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 > 4</td> </tr> </table> | | PRIMARY SOIL TYPE | COMPACTNESS OR CONSISTENCY | RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) | RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²) | GENERALLY GRANULAR MATERIAL (NON-COHESIVE) | VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE | ≤ 4 4 TO 10 10 TO 30 30 TO 50 ≥ 50 | N/A | GENERALLY SILT-CLAY MATERIAL (COHESIVE) | VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD | ≤ 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 ≥ 30 | < 0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 > 4 | <p>MISCELLANEOUS SYMBOLS</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 & DIP DIRECTION OF ROCK STRUCTURES</p> <p>SOUNDING ROD</p> <p>SPT DPT DMT VST TEST BORING</p> <p>AUGER BORING</p> <p>CORE BORING</p> <p>MONITORING WELL</p> <p>PIEZOMETER INSTALLATION</p> <p>SLOPE INDICATOR INSTALLATION</p> <p>SPT N-VALUE</p> <p>SPT REFUSAL</p> <p>SAMPLE DESIGNATIONS</p> <p>S - BULK SAMPLE</p> <p>SS - SPLIT SPOON SAMPLE</p> <p>ST - SHELBY TUBE SAMPLE</p> <p>RS - ROCK SAMPLE</p> <p>RT - RECOMPACTED TRIAXIAL SAMPLE</p> <p>CBR - CALIFORNIA BEARING RATIO SAMPLE</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY SOIL TYPE | COMPACTNESS OR CONSISTENCY | RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) | RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GENERALLY GRANULAR MATERIAL (NON-COHESIVE) | VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE | ≤ 4 4 TO 10 10 TO 30 30 TO 50 ≥ 50 | N/A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GENERALLY SILT-CLAY MATERIAL (COHESIVE) | VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD | ≤ 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 ≥ 30 | < 0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 > 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>TEXTURE OR GRAIN SIZE</p> <table border="1"> <tr> <th>U.S. STD. SIEVE SIZE OPENING (MM)</th> <th>4</th> <th>10</th> <th>40</th> <th>60</th> <th>200</th> <th>270</th> </tr> <tr> <td></td> <td>4.76</td> <td>2.00</td> <td>0.42</td> <td>0.25</td> <td>0.075</td> <td>0.053</td> </tr> </table> <table border="1"> <tr> <th>BOULDER (BLDR.)</th> <th>COBBLE (COB.)</th> <th>GRAVEL (GR.)</th> <th>COARSE SAND (CSE. SD.)</th> <th>FINE SAND (F. SD.)</th> <th>SILT (SL.)</th> <th>CLAY (CL.)</th> </tr> <tr> <td>GRAIN SIZE MM</td> <td>305</td> <td>75</td> <td>2.0</td> <td>0.25</td> <td>0.05</td> <td>0.005</td> </tr> <tr> <td>IN.</td> <td>12</td> <td>3</td> <td></td> <td></td> <td></td> <td></td> </tr> </table> | | U.S. STD. SIEVE SIZE OPENING (MM) | 4 | 10 | 40 | 60 | 200 | 270 | | 4.76 | 2.00 | 0.42 | 0.25 | 0.075 | 0.053 | BOULDER (BLDR.) | COBBLE (COB.) | GRAVEL (GR.) | COARSE SAND (CSE. SD.) | FINE SAND (F. SD.) | SILT (SL.) | CLAY (CL.) | GRAIN SIZE MM | 305 | 75 | 2.0 | 0.25 | 0.05 | 0.005 | IN. | 12 | 3 | | | | | <p>ABBREVIATIONS</p> <p>AR - AUGER REFUSAL</p> <p>BT - BORING TERMINATED</p> <p>CL - CLAY</p> <p>CPT - CONE PENETRATION TEST</p> <p>CSE. - COARSE</p> <p>DMT - DILATOMETER TEST</p> <p>DPT - DYNAMIC PENETRATION TEST</p> <p>o - VOID RATIO</p> <p>F - FINE</p> <p>FOSS. - FOSSILIFEROUS</p> <p>FRAC. - FRACTURED, FRACTURES</p> <p>FRAGS. - FRAGMENTS</p> <p>HI. - HIGHLY</p> <p>MD. - MEDIUM</p> <p>MICA. - MICACEOUS</p> <p>MOD. - MODERATELY</p> <p>NP - NON PLASTIC</p> <p>ORG. - ORGANIC</p> <p>PMT - PRESSUREMETER TEST</p> <p>SAP. - SAPROLITIC</p> <p>SD. - SAND, SANDY</p> <p>SL. - SILT, SILTY</p> <p>SLI. - SLIGHTLY</p> <p>TCR - TRICONE REFUSAL</p> <p>% - MOISTURE CONTENT</p> <p>V - VERY</p> <p>VST - VANE SHEAR TEST</p> <p>WEA. - WEATHERED</p> <p>γ - UNIT WEIGHT</p> <p>γ_d - DRY UNIT WEIGHT</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| U.S. STD. SIEVE SIZE OPENING (MM) | 4 | 10 | 40 | 60 | 200 | 270 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4.76 | 2.00 | 0.42 | 0.25 | 0.075 | 0.053 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BOULDER (BLDR.) | COBBLE (COB.) | GRAVEL (GR.) | COARSE SAND (CSE. SD.) | FINE SAND (F. SD.) | SILT (SL.) | CLAY (CL.) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GRAIN SIZE MM | 305 | 75 | 2.0 | 0.25 | 0.05 | 0.005 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| IN. | 12 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>SOIL MOISTURE - CORRELATION OF TERMS</p> <table border="1"> <tr> <th>SOIL MOISTURE SCALE (ATTERBERG LIMITS)</th> <th>FIELD MOISTURE DESCRIPTION</th> <th>GUIDE FOR FIELD MOISTURE DESCRIPTION</th> </tr> <tr> <td>LL</td> <td>LIQUID LIMIT</td> <td>- SATURATED - (SAT.)</td> </tr> <tr> <td>PL</td> <td>PLASTIC LIMIT</td> <td>- WET - (W)</td> </tr> <tr> <td>OM</td> <td>OPTIMUM MOISTURE</td> <td>- MOIST - (M)</td> </tr> <tr> <td>SL</td> <td>SHRINKAGE LIMIT</td> <td>- DRY - (D)</td> </tr> </table> <p>USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE</p> <p>SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE</p> <p>SOLID; AT OR NEAR OPTIMUM MOISTURE</p> <p>REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE</p> | | SOIL MOISTURE SCALE (ATTERBERG LIMITS) | FIELD MOISTURE DESCRIPTION | GUIDE FOR FIELD MOISTURE DESCRIPTION | LL | LIQUID LIMIT | - SATURATED - (SAT.) | PL | PLASTIC LIMIT | - WET - (W) | OM | OPTIMUM MOISTURE | - MOIST - (M) | SL | SHRINKAGE LIMIT | - DRY - (D) | <p>EQUIPMENT USED ON SUBJECT PROJECT</p> <p>DRILL UNITS:</p> <p><input type="checkbox"/> MOBILE B-</p> <p><input type="checkbox"/> BK-51</p> <p><input type="checkbox"/> CME-45C</p> <p><input checked="" type="checkbox"/> CME-550</p> <p><input type="checkbox"/> PORTABLE HOIST</p> <p>ADVANCING TOOLS:</p> <p><input type="checkbox"/> CLAY BITS</p> <p><input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER</p> <p><input checked="" type="checkbox"/> 8" HOLLOW AUGERS</p> <p><input type="checkbox"/> HARD FACED FINGER BITS</p> <p><input type="checkbox"/> TUNG-CARBIDE INSERTS</p> <p><input checked="" type="checkbox"/> CASING <input checked="" type="checkbox"/> W/ ADVANCER</p> <p><input type="checkbox"/> TRICONE <input type="checkbox"/> STEEL TEETH</p> <p><input checked="" type="checkbox"/> TRICONE 2 1/16" <input type="checkbox"/> TUNG-CARB.</p> <p><input type="checkbox"/> CORE BIT</p> <p>HAMMER TYPE:</p> <p><input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL</p> <p>CORE SIZE:</p> <p><input type="checkbox"/> -B-</p> <p><input type="checkbox"/> -N-</p> <p><input type="checkbox"/> -H-</p> <p>HAND TOOLS:</p> <p><input type="checkbox"/> POST HOLE DIGGER</p> <p><input type="checkbox"/> HAND AUGER</p> <p><input type="checkbox"/> SOUNDING ROD</p> <p><input type="checkbox"/> VANE SHEAR TEST</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SOIL MOISTURE SCALE (ATTERBERG LIMITS) | FIELD MOISTURE DESCRIPTION | GUIDE FOR FIELD MOISTURE DESCRIPTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LL | LIQUID LIMIT | - SATURATED - (SAT.) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PL | PLASTIC LIMIT | - WET - (W) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| OM | OPTIMUM MOISTURE | - MOIST - (M) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SL | SHRINKAGE LIMIT | - DRY - (D) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>PLASTICITY</p> <table border="1"> <tr> <th>NONPLASTIC</th> <th>LOW PLASTICITY</th> <th>MED. PLASTICITY</th> <th>HIGH PLASTICITY</th> </tr> <tr> <td>PLASTICITY INDEX (PI)</td> <td>0-5</td> <td>6-15</td> <td>16-25</td> </tr> <tr> <td>DRY STRENGTH</td> <td>VERY LOW</td> <td>SLIGHT</td> <td>MEDIUM</td> </tr> <tr> <td></td> <td></td> <td></td> <td>HIGH</td> </tr> </table> <p>DESCRIPTORS 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> | | NONPLASTIC | LOW PLASTICITY | MED. PLASTICITY | HIGH PLASTICITY | PLASTICITY INDEX (PI) | 0-5 | 6-15 | 16-25 | DRY STRENGTH | VERY LOW | SLIGHT | MEDIUM | | | | HIGH | <p>FRACTURE SPACING</p> <table border="1"> <tr> <th>TERM</th> <th>SPACING</th> <th>THICKNESS</th> </tr> <tr> <td>VERY WIDE</td> <td>MORE THAN 10 FEET</td> <td>> 4 FEET</td> </tr> <tr> <td>WIDE</td> <td>3 TO 10 FEET</td> <td>1.5 - 4 FEET</td> </tr> <tr> <td>MODERATELY CLOSE</td> <td>1 TO 3 FEET</td> <td>0.16 - 1.5 FEET</td> </tr> <tr> <td>CLOSE</td> <td>0.16 TO 1 FEET</td> <td>0.03 - 0.16 FEET</td> </tr> <tr> <td>VERY CLOSE</td> <td>LESS THAN 0.16 FEET</td> <td>0.008 - 0.03 FEET</td> </tr> </table> <p>INDURATION</p> <p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</p> <p>FRAGILE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</p> <p>MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</p> <p>INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</p> <p>EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p> | | TERM | SPACING | THICKNESS | VERY WIDE | MORE THAN 10 FEET | > 4 FEET | WIDE | 3 TO 10 FEET | 1.5 - 4 FEET | MODERATELY CLOSE | 1 TO 3 FEET | 0.16 - 1.5 FEET | CLOSE | 0.16 TO 1 FEET | 0.03 - 0.16 FEET | VERY CLOSE | LESS THAN 0.16 FEET | 0.008 - 0.03 FEET | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NONPLASTIC | LOW PLASTICITY | MED. PLASTICITY | HIGH PLASTICITY | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PLASTICITY INDEX (PI) | 0-5 | 6-15 | 16-25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DRY STRENGTH | VERY LOW | SLIGHT | MEDIUM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | HIGH | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TERM | SPACING | THICKNESS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VERY WIDE | MORE THAN 10 FEET | > 4 FEET | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WIDE | 3 TO 10 FEET | 1.5 - 4 FEET | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MODERATELY CLOSE | 1 TO 3 FEET | 0.16 - 1.5 FEET | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CLOSE | 0.16 TO 1 FEET | 0.03 - 0.16 FEET | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VERY CLOSE | LESS THAN 0.16 FEET | 0.008 - 0.03 FEET | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>BENCH MARK: BENCHMARK #2 -BL- STA. 21+52.52 LT 204.42'</p> <p>STA. -L- 19+07.96 LT 196.42'</p> <p>ELEVATION: 647.93 FT.</p> <p>NOTES:</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

15



C.F. BOYD HEIRS
DB 115 PG 147

ALLUVIUM

ALLUVIUM

ARTIFICIAL
FILL

ROADWAY EMBANKMENT

ROADWAY EMBANKMENT

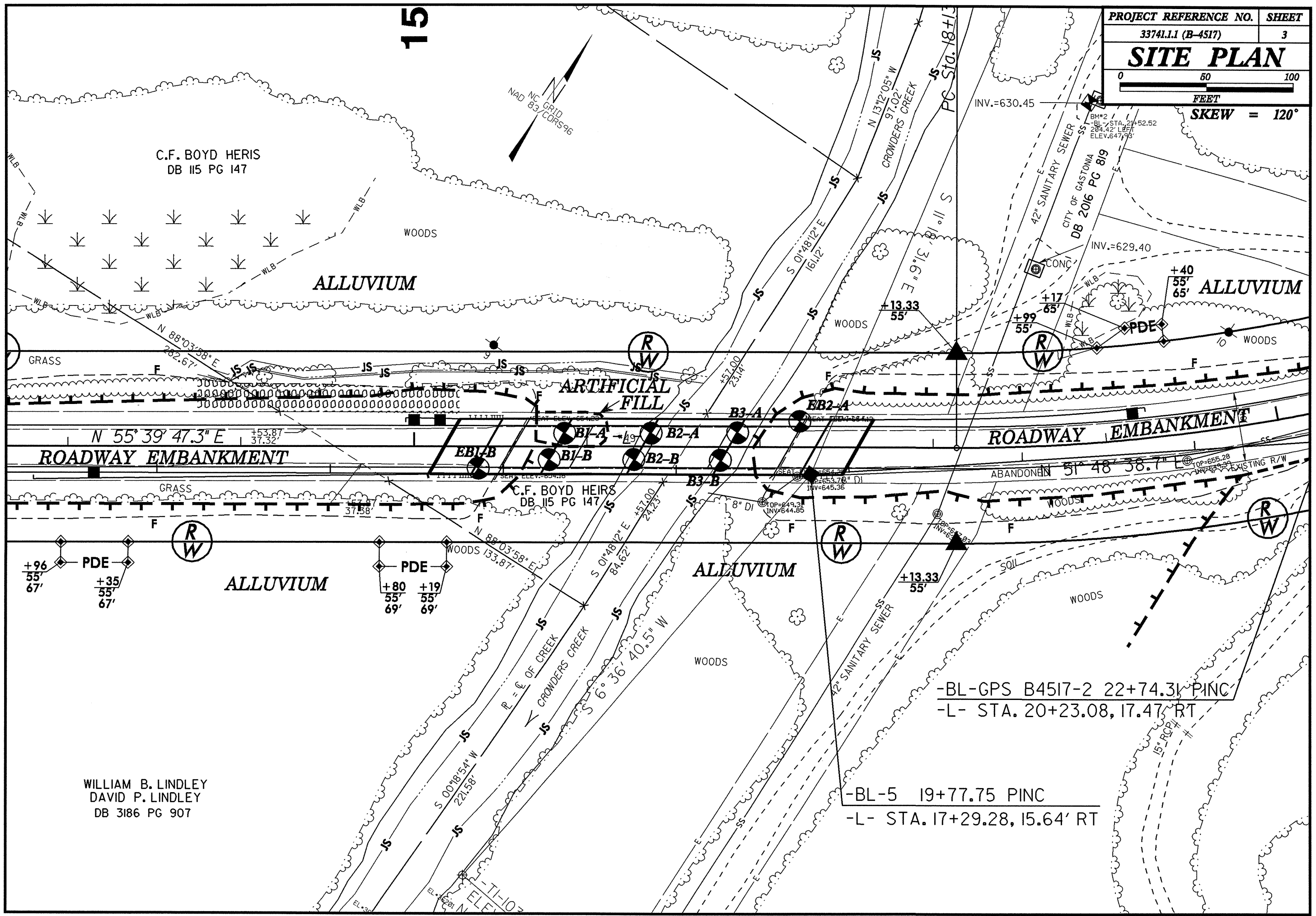
ALLUVIUM

ALLUVIUM

WILLIAM B. LINDLEY
DAVID P. LINDLEY
DB 3186 PG 907

-BL-GPS B4517-2 22+74.31 PINC
-L- STA. 20+23.08, 17.47 RT

-BL-5 19+77.75 PINC
-L- STA. 17+29.28, 15.64 RT



5/14/99

| | |
|--|---------------------|
| PROJECT REFERENCE NO. 33741JJ (B-4517) | SHEET NO. 4 |
| ROADWAY DESIGN ENGINEER | HYDRAULICS ENGINEER |
| INCOMPLETE PLANS DO NOT USE FOR A/W ACQUISITION | |
| PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION | |

-L-

UNCLASSIFIED STRUCTURE EXCAVATION
(STRUCTURE PAY ITEM, SEE STRUCTURE PLANS)

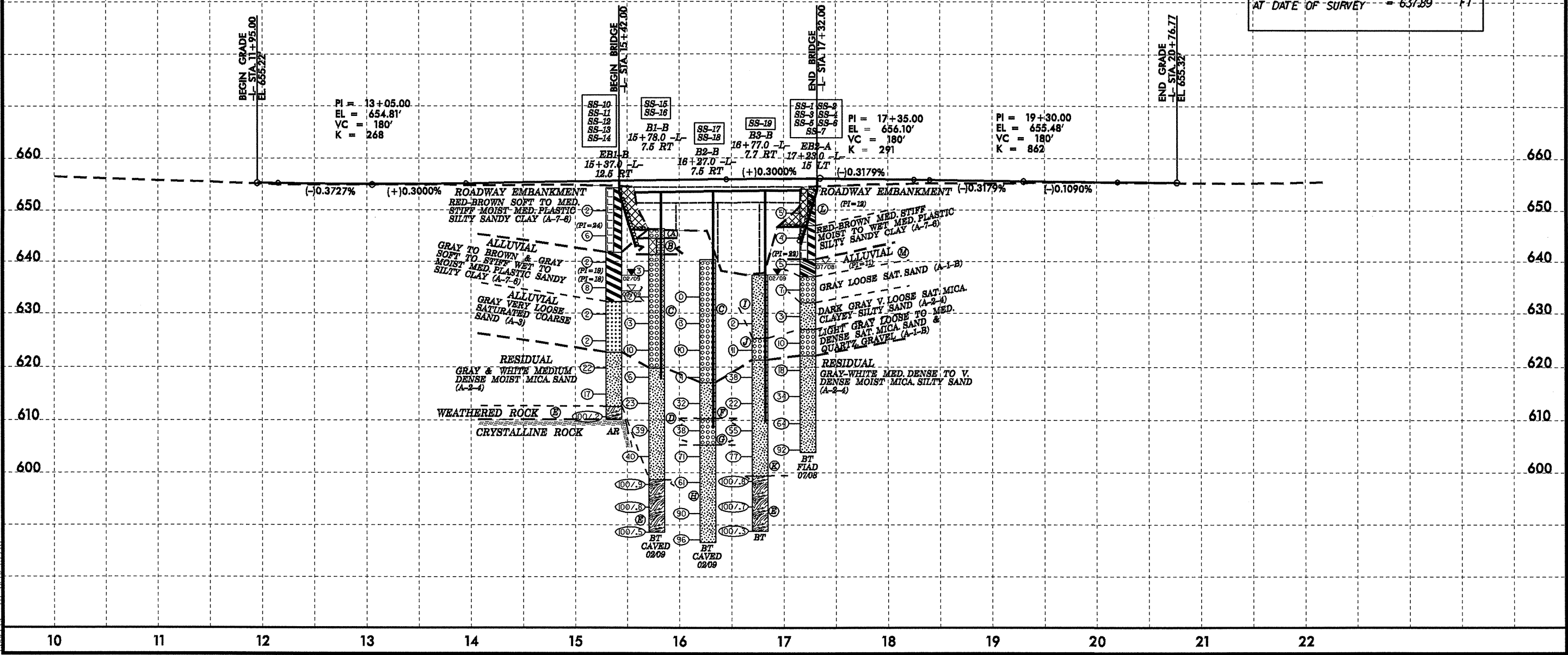
BM #1 8" SPIKE IN BASE OF POWER POLE
OUTSIDE PROJECT LIMITS
ELEV. = 668.88'

BM #2 CHISELED SQUARE IN S.W. CORNER
ON TOP OF CONC. FORCED SEWER BOX
197' LEFT OF L- STA. 19+08
ELEV. = 647.93'

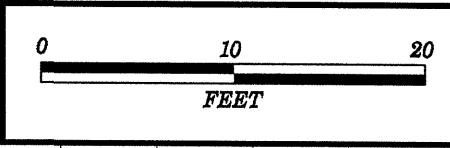
BM #3 CHISELED SQUARE IN S.W. CORNER
OF CONC. FOUNDATION OF A POWER BOX
OUTSIDE PROJECT LIMITS
ELEV. = 663.75'

| BORING DESCRIPTIONS | |
|--|---|
| <p>(A) ALLUVIAL, GRAY VERY LOOSE WET COARSE SAND (A-1-b)</p> <p>(B) ARTIFICIAL FILL, GRAY VERY LOOSE WET SAND WITH PIECES OF CONCRETE (A-1-b)</p> <p>(C) ALLUVIAL, GRAY VERY LOOSE TO MEDIUM-DENSE WET TO SAT. COARSE SAND (A-1-b)</p> <p>(D) RESIDUAL, GRAY & WHITE LOOSE TO DENSE MOIST VERY MICA SILTY SAND (A-2-4)</p> <p>(E) WEATHERED ROCK, SEVERELY WEATHERED CRYSTALLINE ROCK</p> <p>(F) RESIDUAL, BROWN-TAN-GRAY-WHITE DENSE MOIST SILTY SAND (A-2-4)</p> <p>(G) RESIDUAL, BROWN-DENSE-MOIST-SILTY SAND (A-1-b)</p> <p>(H) RESIDUAL, BROWN-TAN-GRAY-WHITE VERY DENSE MOIST SILTY SAND (A-2-4)</p> | <p>(I) ALLUVIAL, GRAY & BROWN VERY LOOSE WET SAND (A-2-4)</p> <p>(J) ALLUVIAL, BROWN MED. DENSE WET SAND & GRAVEL (A-1-b)</p> <p>(K) RESIDUAL, GRAY & WHITE MED. DENSE TO VERY DENSE DRY TO MOIST SILTY SAND (A-2-4)</p> <p>(L) ROADWAY EMBANKMENT, TAN-RED-BROWN MED. STIFF MOIST LOW PLASTIC SILTY SANDY CLAY (A-6)</p> <p>(M) ALLUVIAL, GRAY MED. STIFF MOIST LOW PLASTIC SILTY SANDY CLAY (A-6)</p> |

| BRIDGE HYDRAULIC DATA | |
|----------------------------------|-----------------|
| DESIGN DISCHARGE | = 8300 CFS |
| DESIGN FREQUENCY | = 50 YRS |
| DESIGN HW ELEVATION | = 653.3 FT |
| BASE DISCHARGE | = 9100 CFS |
| BASE FREQUENCY | = 100 YRS |
| BASE HW ELEVATION | = 653.9 FT |
| OVERTOPPING DISCHARGE | = 15000 +/- CFS |
| OVERTOPPING FREQUENCY | = 500 +/- YRS |
| OVERTOPPING ELEVATION | = 655.0 FT |
| EST. NORM. W.S. ELEV. | = 637.89 FT |
| DATE OF SURVEY | = Sept. 3, 2008 |
| W.S. ELEVATION AT DATE OF SURVEY | = 637.89 FT |

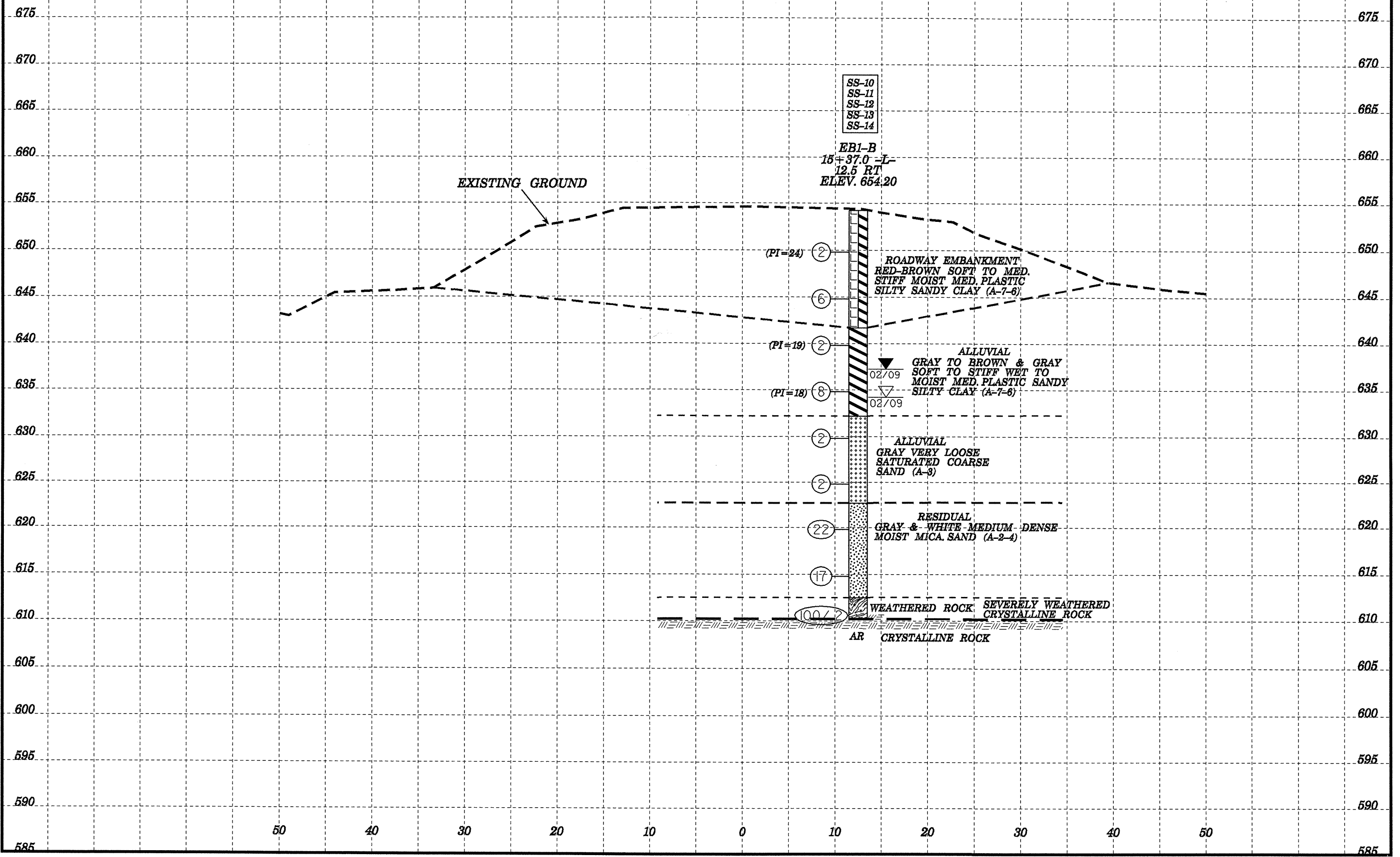


24-APR-2009 09:25
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| | |
|--------------------------------|-------|
| PROJECT REFERENCE NO. | SHEET |
| 33741.1.1 (B-4517) | 5 |
| CROSS SECTION THRU END BENT 1 | |
| STA. 15+42.0 -L- WORK POINT #1 | |
| SKEW = 120° | |

-L-



SS-10
SS-11
SS-12
SS-13
SS-14

EB1-B
15+37.0 -L-
12.5 RT
ELEV. 654.20

EXISTING GROUND

(PI=24)

ROADWAY EMBANKMENT
RED-BROWN SOFT TO MED.
STIFF MOIST MED. PLASTIC
SILTY SANDY CLAY (A-7-6)

(PI=19)

ALLUVIAL
GRAY TO BROWN & GRAY
SOFT TO STIFF WET TO
MOIST MED. PLASTIC SANDY
SILTY CLAY (A-7-6)

(PI=18)

ALLUVIAL
GRAY VERY LOOSE
SATURATED COARSE
SAND (A-3)

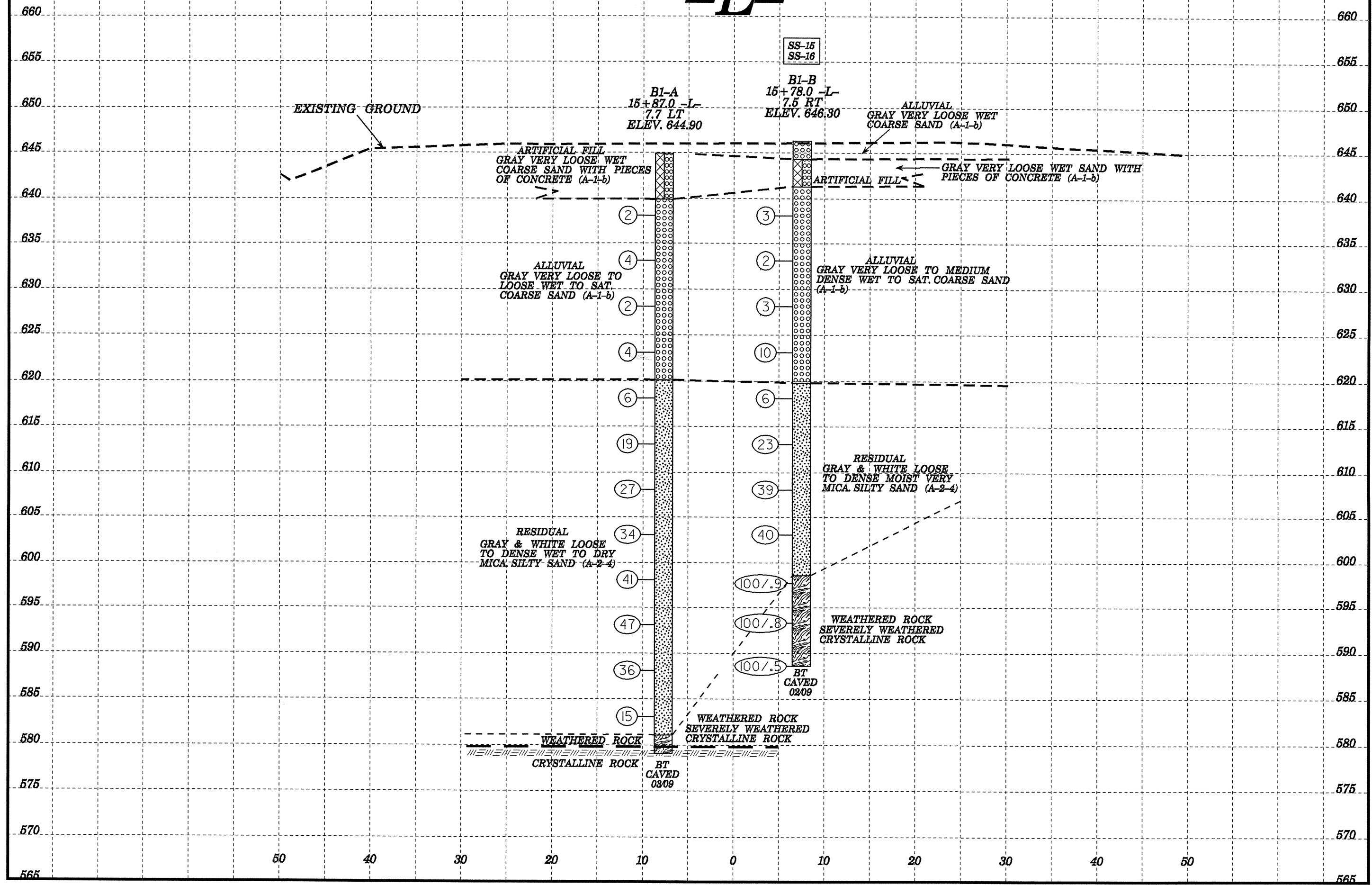
RESIDUAL
GRAY & WHITE MEDIUM-DENSE
MOIST MICA SAND (A-2-4)

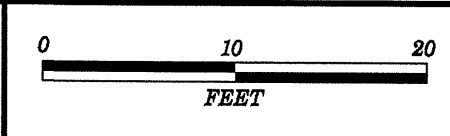
WEATHERED ROCK SEVERELY WEATHERED
CRYSTALLINE ROCK
AR CRYSTALLINE ROCK

02/09
02/09

- (2)
- (6)
- (2)
- (8)
- (2)
- (2)
- (22)
- (17)
- (100/2)

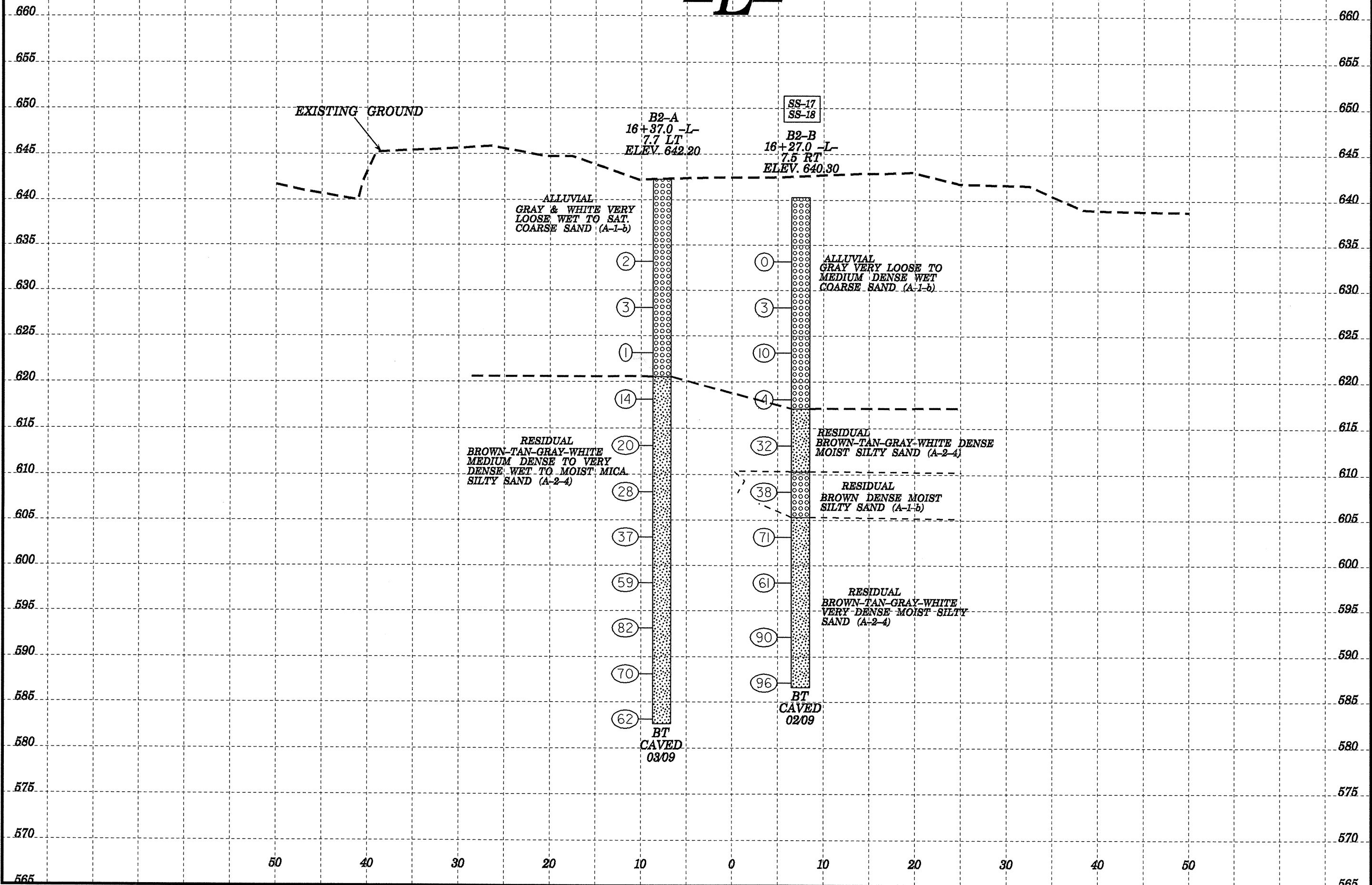
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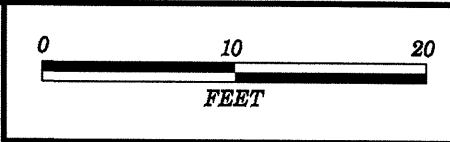




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|--------------------------------|-------|
| PROJECT REFERENCE NO. | SHEET |
| 33741.1.1 (B-4517) | 7 |
| CROSS SECTION THRU BENT 2 | |
| STA. 16+32.0 -L- WORK POINT #3 | |
| SKEW = 120° | |

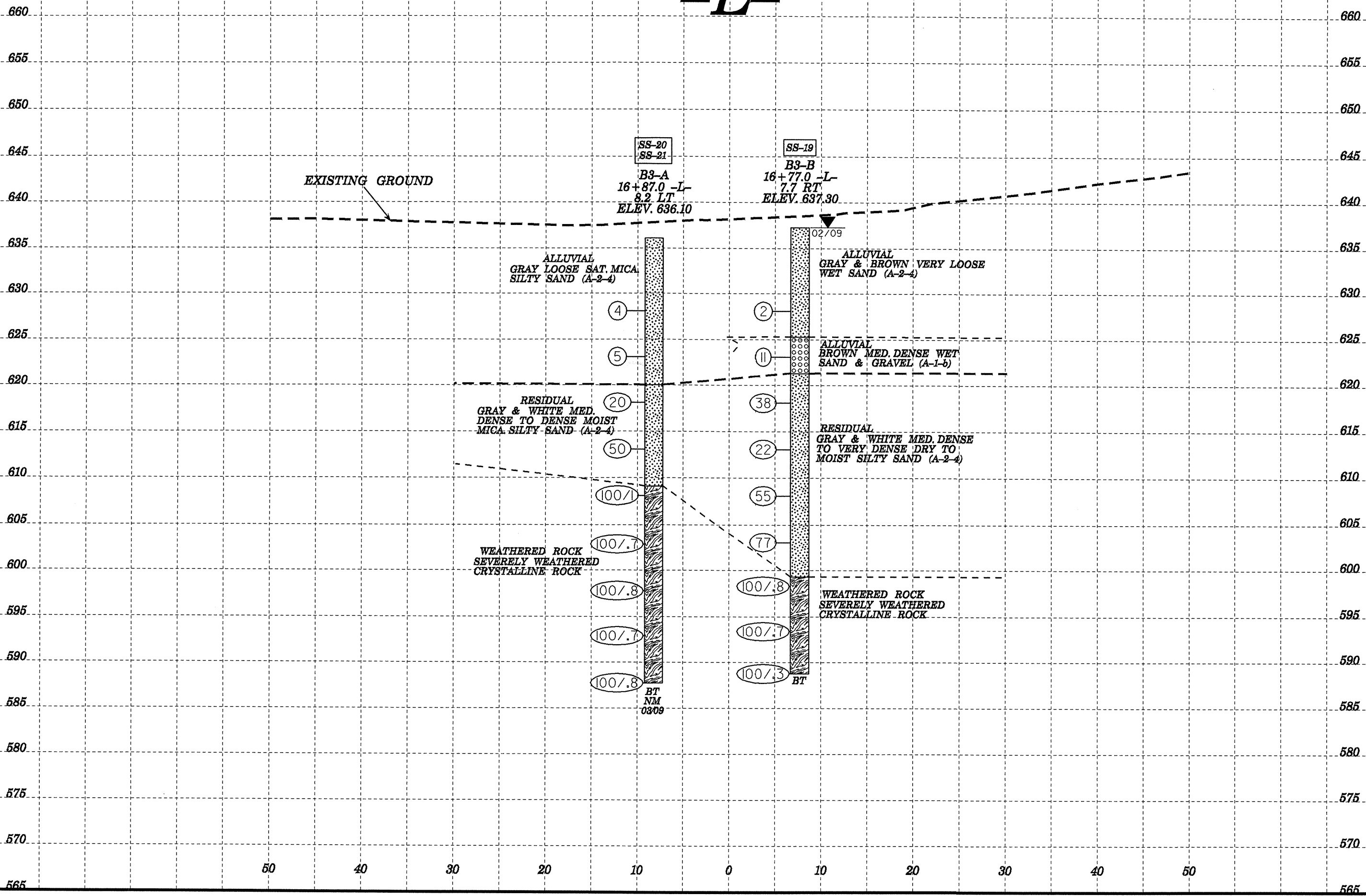
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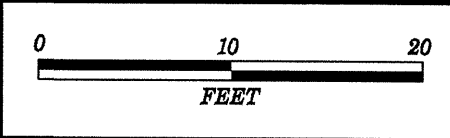




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|--------------------------------|-------|
| PROJECT REFERENCE NO. | SHEET |
| 33741.1.1 (B-4517) | 8 |
| CROSS SECTION THRU BENT 3 | |
| STA. 16+82.0 -L- WORK POINT #4 | |
| SKEW = 120° | |

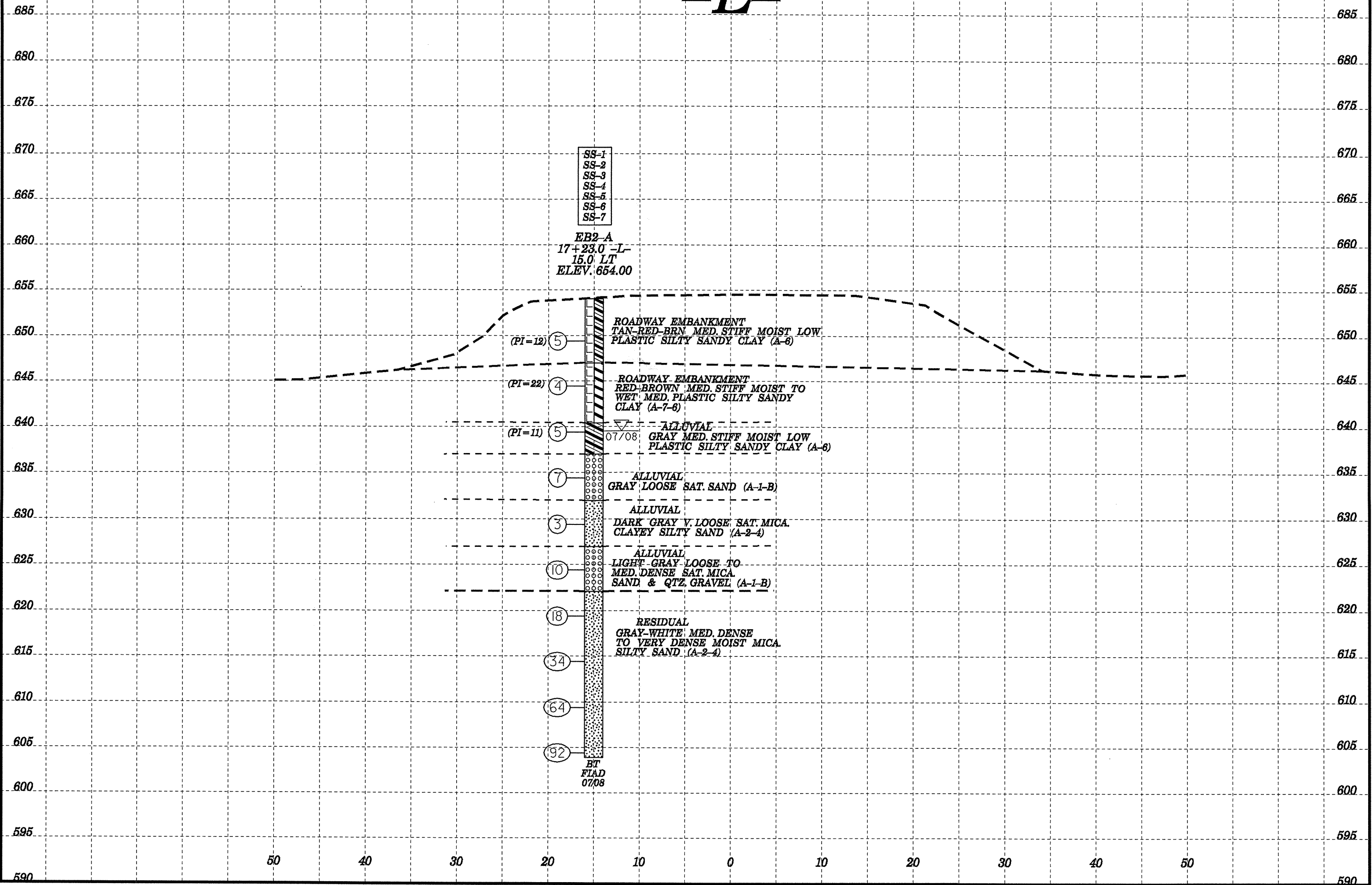
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| | |
|--------------------------------|-------|
| PROJECT REFERENCE NO. | SHEET |
| 33741.1.1 (B-4517) | 9 |
| CROSS SECTION THRU END BENT 2 | |
| STA. 17+32.0 -L- WORK POINT #5 | |
| SKEW = 120° | |

-L-



- SS-1
- SS-2
- SS-3
- SS-4
- SS-5
- SS-6
- SS-7

EB2-A
17+23.0 -L-
15.0 LT
ELEV. 654.00

(PI=12) 5
ROADWAY EMBANKMENT
TAN-RED-BRN MED. STIFF MOIST LOW
PLASTIC SILTY SANDY CLAY (A-6)

(PI=22) 4
ROADWAY EMBANKMENT
RED-BROWN MED. STIFF MOIST TO
WET MED. PLASTIC SILTY SANDY
CLAY (A-7-6)

(PI=11) 5
ALLUVIAL
07/08
GRAY MED. STIFF MOIST LOW
PLASTIC SILTY SANDY CLAY (A-6)

7
ALLUVIAL
GRAY LOOSE SAT. SAND (A-1-B)

3
ALLUVIAL
DARK GRAY V. LOOSE SAT. MICA
CLAYEY SILTY SAND (A-2-4)

10
ALLUVIAL
LIGHT GRAY LOOSE TO
MED. DENSE SAT. MICA
SAND & QTZ GRAVEL (A-1-B)

18
RESIDUAL
GRAY-WHITE MED. DENSE
TO VERY DENSE MOIST MICA
SILTY SAND (A-2-4)

34

64

92

BT
FIAD
07/08



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

SHEET

| PROJECT NO. 33741.1.1 | | ID. B-4517 | | COUNTY GASTON | | GEOLOGIST Todd, R. W. | | | | | | | | | | | |
|---|-----------------|--------------------------|------------|-------------------------|-------|-----------------------|-----------------|----|----|-----|-----------|-------|------|---------------------------|------------|------|---|
| SITE DESCRIPTION BRIDGE NO. 49 OVER CROWDERS CREEK ON SR 1103 | | | | | | | GROUND WTR (ft) | | | | | | | | | | |
| BORING NO. EB1-B | | STATION 15+37 | | OFFSET 13ft RT | | ALIGNMENT -L- | | | | | | | | | | | |
| COLLAR ELEV. 654.2 ft | | TOTAL DEPTH 44.0 ft | | NORTHING 533,444 | | EASTING 1,335,845 | | | | | | | | | | | |
| DRILL MACHINE CME-550X | | DRILL METHOD H.S. Augers | | | | HAMMER TYPE Automatic | | | | | | | | | | | |
| START DATE 02/23/09 | | COMP. DATE 02/23/09 | | SURFACE WATER DEPTH N/A | | DEPTH TO ROCK 44.0 ft | | | | | | | | | | | |
| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | | | |
| | | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | ELEV. (ft) | DEPTH (ft) | | |
| 655 | | | | | | | | | | | | | | | | | |
| 650 | 650.8 | 3.4 | 1 | 1 | 1 | | | | | | | SS-10 | M | | 654.2 | 0.0 | GROUND SURFACE ROADWAY EMBANKMENT RED-BROWN SOFT TO MED. STIFF MOIST MED. PLASTIC (PI=24) SILTY SANDY CLAY (A-7-6) |
| 645 | 645.8 | 8.4 | 3 | 3 | 3 | | | | | | | | M | | | | |
| 640 | 640.8 | 13.4 | 1 | 1 | 1 | | | | | | | SS-11 | W | | 641.7 | 12.5 | ALLUVIAL GRAY TO BROWN & GRAY SOFT TO STIFF WET TO MOIST MED. PLASTIC (PI=19, PI=18) SANDY SILTY CLAY (A-7-6) |
| 635 | 635.8 | 18.4 | 3 | 3 | 5 | | | | | | | SS-12 | W | | | | |
| 630 | 630.8 | 23.4 | 1 | 1 | 1 | | | | | | | SS-13 | Sat. | | 632.2 | 22.0 | ALLUVIAL GRAY VERY LOOSE SATURATED COARSE SAND (A-3) |
| 625 | 625.8 | 28.4 | 1 | 1 | 1 | | | | | | | | Sat. | | | | |
| 620 | 620.8 | 33.4 | 7 | 9 | 13 | | | | | | | SS-14 | M | | 622.7 | 31.5 | RESIDUAL GRAY & WHITE MEDIUM DENSE MOIST MICA. SAND (A-2-4) |
| 615 | 615.8 | 38.4 | 11 | 7 | 10 | | | | | | | | M | | 612.5 | 41.7 | |
| 610 | 610.8 | 43.4 | 100/2 | | | | | | | | | | M | | 610.2 | 44.0 | WEATHERED ROCK SEVERELY WEATHERED CRYSTALLINE ROCK Boring Terminated BY AUGER REFUSAL at Elevation 610.2 ft ON CRYSTALLINE ROCK |
| 605 | | | | | | | | | | | | | | | | | |
| 600 | | | | | | | | | | | | | | | | | |
| 595 | | | | | | | | | | | | | | | | | |
| 590 | | | | | | | | | | | | | | | | | |
| 585 | | | | | | | | | | | | | | | | | |
| 580 | | | | | | | | | | | | | | | | | |
| 575 | | | | | | | | | | | | | | | | | |

NCDOT BORE SINGLE B4517_GEO_BH_BRD0049_GASTON.GPJ_NC_DOT.GDT_04/22/09

| | | | |
|---|------------------------------------|-------------------------|-----------------------|
| PROJECT NO. 33741.1.1 | ID. B-4517 | COUNTY GASTON | GEOLOGIST Todd, R. W. |
| SITE DESCRIPTION BRIDGE NO. 49 OVER CROWDERS CREEK ON SR 1103 | | | GROUND WTR (ft) |
| BORING NO. B1-A | STATION 15+87 | OFFSET 8ft LT | ALIGNMENT -L- |
| COLLAR ELEV. 644.9 ft | TOTAL DEPTH 65.0 ft | NORTHING 533,489 | EASTING 1,335,875 |
| DRILL MACHINE CME-550X | DRILL METHOD NW Casing w/ Advancer | HAMMER TYPE Automatic | |
| START DATE 03/11/09 | COMP. DATE 03/11/09 | SURFACE WATER DEPTH N/A | DEPTH TO ROCK 65.0 ft |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | LOG | SOIL AND ROCK DESCRIPTION | DEPTH (ft) |
|-----------|-----------------|------------|------------|-------|-------|----------------|----|----|----|-----|-----------|-----|--|------------|
| | | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | |
| 645 | | | | | | | | | | | | | 644.9 GROUND SURFACE | 0.0 |
| 640 | 639.1 | 5.8 | 1 | 1 | 1 | | | | | | W | | 639.9 GRAY VERY LOOSE WET COARSE SAND WITH PIECES OF CONCRETE (A-1-b) | 5.0 |
| 635 | 634.1 | 10.8 | 1 | 2 | 2 | | | | | | W | | ALLUVIAL GRAY VERY LOOSE TO LOOSE WET TO SAT. COARSE SAND (A-1-b) | |
| 630 | 629.1 | 15.8 | 1 | 1 | 1 | | | | | | Sat. | | | |
| 625 | 624.1 | 20.8 | 2 | 2 | 2 | | | | | | Sat. | | | |
| 620 | 619.1 | 25.8 | 2 | 3 | 3 | | | | | | W | | 620.1 RESIDUAL GRAY & WHITE LOOSE TO DENSE WET TO DRY MICA. SILTY SAND (A-2-4) | 24.8 |
| 615 | 614.1 | 30.8 | 4 | 8 | 11 | | | | | | M | | | |
| 610 | 609.1 | 35.8 | 6 | 10 | 17 | | | | | | D | | | |
| 605 | 604.1 | 40.8 | 9 | 15 | 19 | | | | | | D | | | |
| 600 | 599.1 | 45.8 | 11 | 18 | 23 | | | | | | D | | | |
| 595 | 594.1 | 50.8 | 15 | 20 | 27 | | | | | | D | | | |
| 590 | 589.1 | 55.8 | 11 | 17 | 19 | | | | | | D | | | |
| 585 | 584.1 | 60.8 | 7 | 7 | 8 | | | | | | W | | | |
| 580 | | | | | | | | | | | | | 581.1 WEATHERED ROCK | 63.8 |
| | | | | | | | | | | | | | 579.9 SEVERELY WEATHERED CRYSTALLINE ROCK | 65.0 |
| | | | | | | | | | | | | | 579.1 CRYSTALLINE ROCK | 65.8 |
| 575 | | | | | | | | | | | | | Boring Terminated at Elevation 579.9 ft IN CRYSTALLINE ROCK | |
| 570 | | | | | | | | | | | | | | |
| 565 | | | | | | | | | | | | | | |

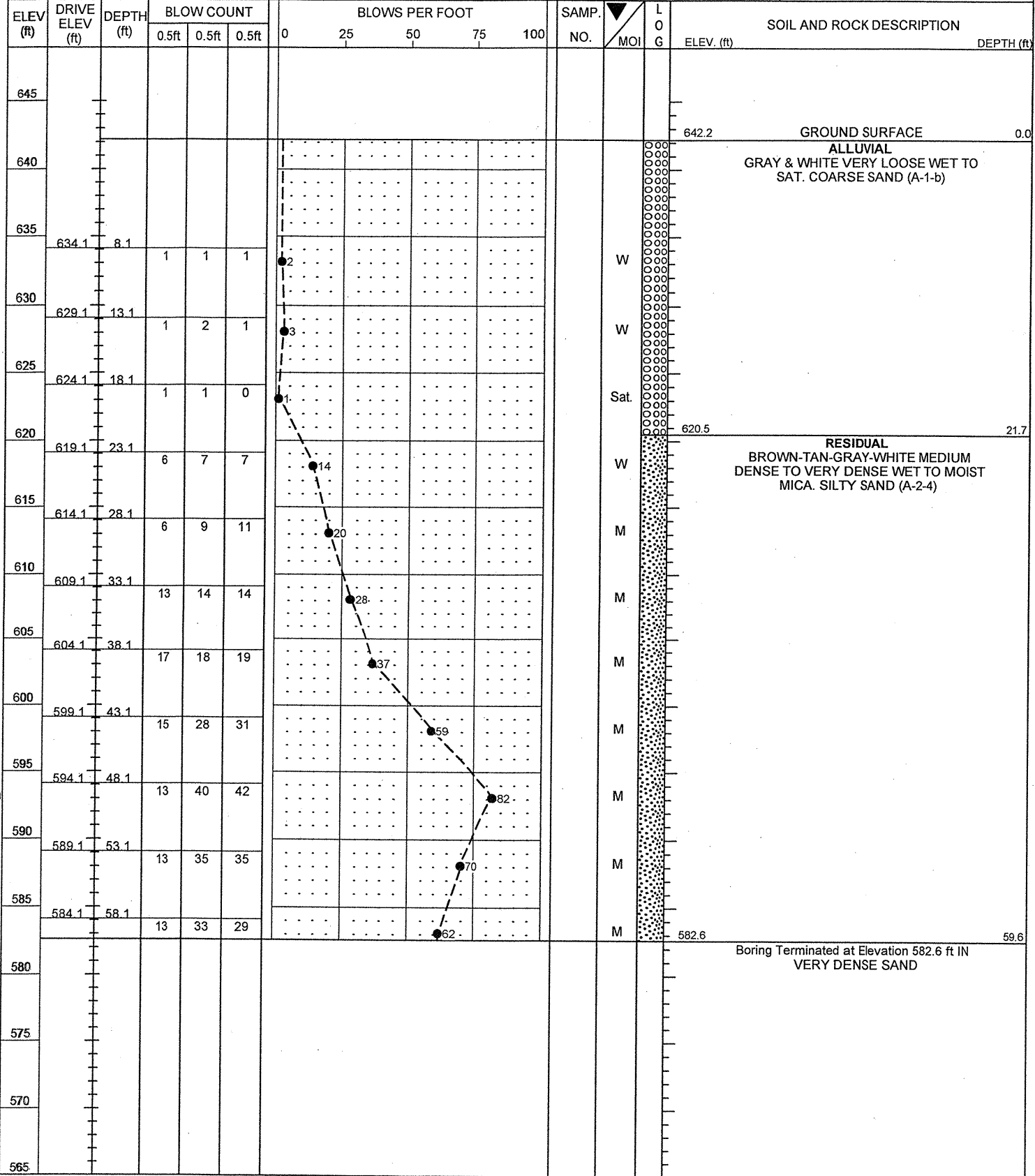
NCDOT BORE SINGLE B4517_GEO_BH_BRD0049_GASTON.GPJ NC_DOT.GDT 04/22/09

| | | | |
|---|------------------------------------|-------------------------|-----------------------|
| PROJECT NO. 33741.1.1 | ID. B-4517 | COUNTY GASTON | GEOLOGIST Todd, R. W. |
| SITE DESCRIPTION BRIDGE NO. 49 OVER CROWDERS CREEK ON SR 1103 | | | GROUND WTR (ft) |
| BORING NO. B1-B | STATION 15+78 | OFFSET 8ft RT | ALIGNMENT -L- |
| COLLAR ELEV. 646.3 ft | TOTAL DEPTH 57.7 ft | NORTHING 533,472 | EASTING 1,335,876 |
| DRILL MACHINE CME-550X | DRILL METHOD NW Casing w/ Advancer | HAMMER TYPE Automatic | |
| START DATE 02/25/09 | COMP. DATE 02/25/09 | SURFACE WATER DEPTH N/A | DEPTH TO ROCK N/A |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | LOG | SOIL AND ROCK DESCRIPTION | DEPTH (ft) |
|-----------|-----------------|------------|------------|-------|-------|----------------|----|----|----|-----|-----------|-----|--|------------|
| | | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | |
| 650 | | | | | | | | | | | | | 646.3 GROUND SURFACE | 0.0 |
| 645 | | | | | | | | | | | | | 644.3 ALLUVIAL GRAY VERY LOOSE WET COARSE SAND (A-1-b) | 2.0 |
| 640 | 639.1 | 7.2 | 1 | 2 | 1 | | | | | | SS-15 W | | 641.3 ARTIFICIAL FILL GRAY VERY LOOSE WET SAND WITH PIECES OF CONCRETE (A-1-b) | 5.0 |
| 635 | 634.1 | 12.2 | 1 | 1 | 1 | | | | | | Sat. | | ALLUVIAL GRAY VERY LOOSE TO MEDIUM DENSE WET TO SAT. COARSE SAND (A-1-b) | |
| 630 | 629.1 | 17.2 | 2 | 1 | 2 | | | | | | Sat. | | | |
| 625 | 624.1 | 22.2 | 4 | 6 | 4 | | | | | | W | | | |
| 620 | 619.1 | 27.2 | 2 | 2 | 4 | | | | | | SS-16 M | | 619.8 RESIDUAL GRAY & WHITE LOOSE TO DENSE MOIST VERY MICA. SILTY SAND (A-2-4) | 28.5 |
| 615 | 614.1 | 32.2 | 5 | 9 | 14 | | | | | | M | | | |
| 610 | 609.1 | 37.2 | 9 | 15 | 24 | | | | | | M | | | |
| 605 | 604.1 | 42.2 | 10 | 15 | 25 | | | | | | M | | | |
| 600 | 599.1 | 47.2 | 26 | 45 | 55/4 | | | | | | M | | | |
| 595 | 594.1 | 52.2 | 29 | 71/3 | | | | | | | M | | 598.6 WEATHERED ROCK SEVERELY WEATHERED CRYSTALLINE ROCK | 47.7 |
| 590 | 589.1 | 57.2 | | | | | | | | | M | | | |
| 585 | | | | | | | | | | | | | Boring Terminated at Elevation 588.6 ft IN SEVERELY WEATHERED CRYSTALLINE ROCK | |
| 580 | | | | | | | | | | | | | | |
| 575 | | | | | | | | | | | | | | |
| 570 | | | | | | | | | | | | | | |

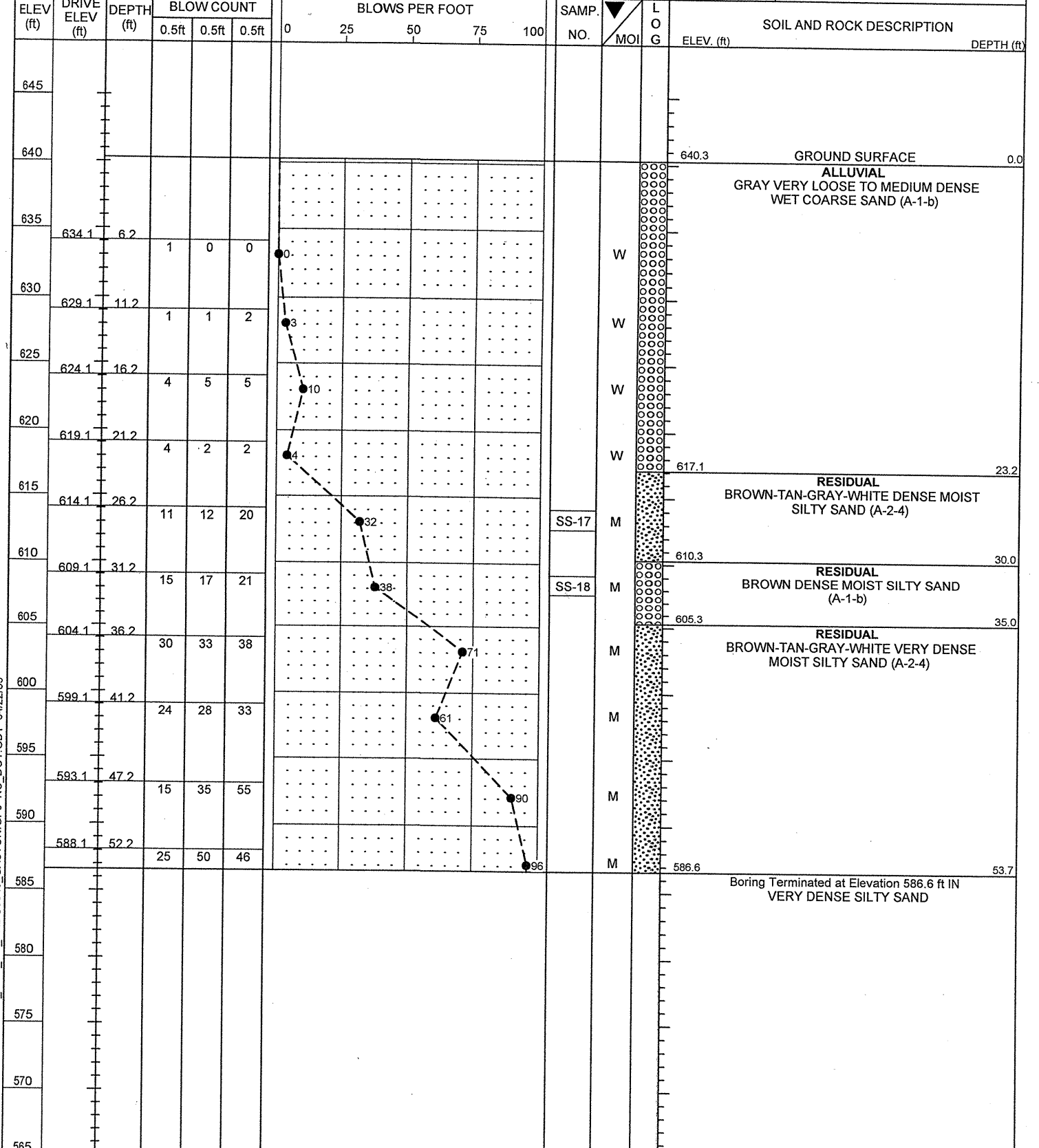
NCDOT BORE SINGLE B4517_GEO_BH_BRD0049_GASTON.GPJ NC_DOT.GDT 04/22/09

| | | | |
|---|------------------------------------|-------------------------|-----------------------|
| PROJECT NO. 33741.1.1 | ID. B-4517 | COUNTY GASTON | GEOLOGIST Todd, R. W. |
| SITE DESCRIPTION BRIDGE NO. 49 OVER CROWDERS CREEK ON SR 1103 | | | GROUND WTR (ft) |
| BORING NO. B2-A | STATION 16+37 | OFFSET 8ft LT | ALIGNMENT -L- |
| COLLAR ELEV. 642.2 ft | TOTAL DEPTH 59.6 ft | NORTHING 533,518 | EASTING 1,335,916 |
| DRILL MACHINE CME-550X | DRILL METHOD NW Casing w/ Advancer | HAMMER TYPE Automatic | |
| START DATE 03/10/09 | COMP. DATE 03/10/09 | SURFACE WATER DEPTH N/A | DEPTH TO ROCK N/A |



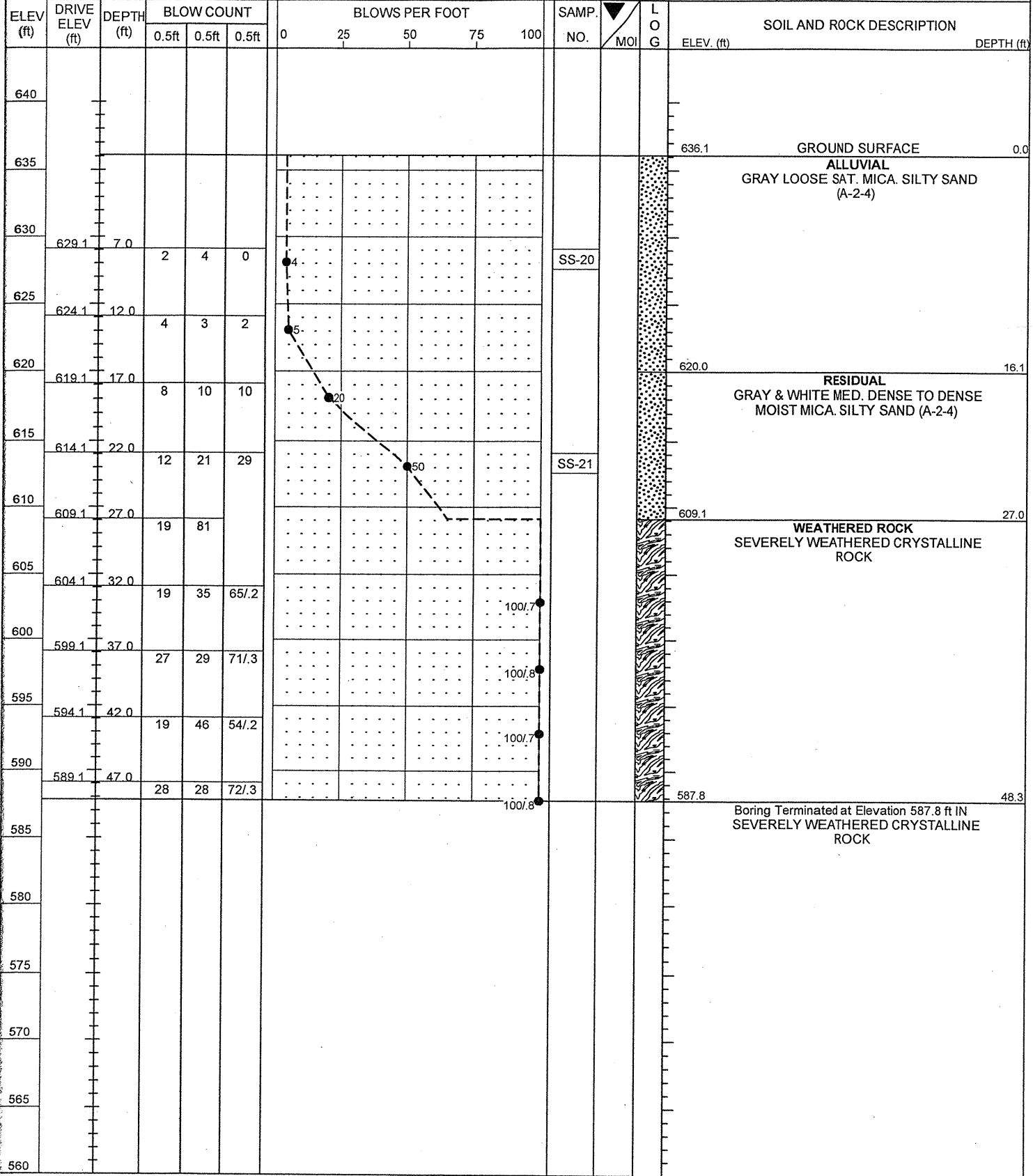
NCDOT BORE SINGLE B4517_GEO_BH_BRD0049_GASTON.GPJ NC_DOT_GDT 04/22/09

| | | | |
|---|------------------------------------|-------------------------|-----------------------|
| PROJECT NO. 33741.1.1 | ID. B-4517 | COUNTY GASTON | GEOLOGIST Todd, R. W. |
| SITE DESCRIPTION BRIDGE NO. 49 OVER CROWDERS CREEK ON SR 1103 | | | GROUND WTR (ft) |
| BORING NO. B2-B | STATION 16+27 | OFFSET 8ft RT | ALIGNMENT -L- |
| COLLAR ELEV. 640.3 ft | TOTAL DEPTH 53.7 ft | NORTHING 533,499 | EASTING 1,335,917 |
| DRILL MACHINE CME-550X | DRILL METHOD NW Casing w/ Advancer | HAMMER TYPE Automatic | |
| START DATE 02/26/09 | COMP. DATE 02/26/09 | SURFACE WATER DEPTH N/A | DEPTH TO ROCK N/A |

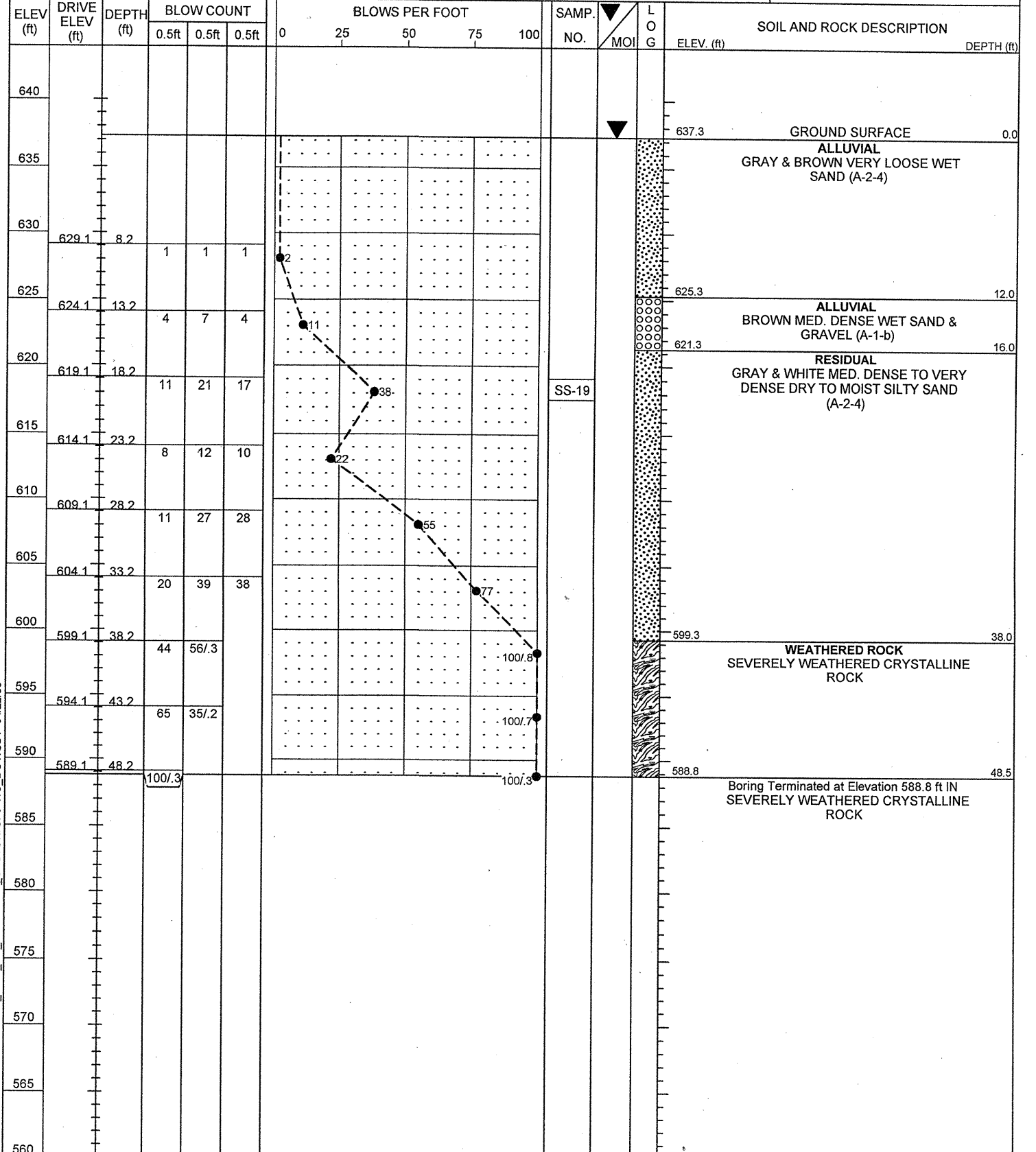


NCDOT BORE SINGLE B4517_GEO_BH_BRD0049_GASTON.GPJ NC_DOT_GDT 04/22/09

| | | | |
|---|------------------------------------|-------------------------|-----------------------|
| PROJECT NO. 33741.1.1 | ID. B-4517 | COUNTY GASTON | GEOLOGIST Todd, R. W. |
| SITE DESCRIPTION BRIDGE NO. 49 OVER CROWDERS CREEK ON SR 1103 | | | GROUND WTR (ft) |
| BORING NO. B3-A | STATION 16+87 | OFFSET 8ft LT | ALIGNMENT -L- |
| COLLAR ELEV. 636.1 ft | TOTAL DEPTH 48.3 ft | NORTHING 533,546 | EASTING 1,335,957 |
| DRILL MACHINE CME-550X | DRILL METHOD NW Casing w/ Advancer | HAMMER TYPE Automatic | |
| START DATE 03/09/09 | COMP. DATE 03/09/09 | SURFACE WATER DEPTH N/A | DEPTH TO ROCK N/A |



| | | | |
|---|------------------------------------|-------------------------|-----------------------|
| PROJECT NO. 33741.1.1 | ID. B-4517 | COUNTY GASTON | GEOLOGIST Todd, R. W. |
| SITE DESCRIPTION BRIDGE NO. 49 OVER CROWDERS CREEK ON SR 1103 | | | GROUND WTR (ft) |
| BORING NO. B3-B | STATION 16+77 | OFFSET 8ft RT | ALIGNMENT -L- |
| COLLAR ELEV. 637.3 ft | TOTAL DEPTH 48.5 ft | NORTHING 533,527 | EASTING 1,335,958 |
| DRILL MACHINE CME-550X | DRILL METHOD NW Casing w/ Advancer | HAMMER TYPE Automatic | |
| START DATE 02/27/09 | COMP. DATE 02/27/09 | SURFACE WATER DEPTH N/A | DEPTH TO ROCK N/A |



NCDOT BORE SINGLE B4517_GEO_PH_BRD0049_GASTON.GPJ NC_DOT.GDT 04/22/09

NCDOT BORE SINGLE B4517_GEO_PH_BRD0049_GASTON.GPJ NC_DOT.GDT 04/22/09



NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

SHEET

14

| | | | |
|---|--------------------------|-------------------------|---------------------------|
| PROJECT NO. 33741.1.1 | ID. B-4517 | COUNTY GASTON | GEOLOGIST Stickney, J. K. |
| SITE DESCRIPTION BRIDGE NO. 49 OVER CROWDERS CREEK ON SR 1103 | | | GROUND WTR (ft) |
| BORING NO. EB2-A | STATION 17+23 | OFFSET 15ft LT | ALIGNMENT -L- |
| COLLAR ELEV. 654.0 ft | TOTAL DEPTH 50.1 ft | NORTHING 533,572 | EASTING 1,335,983 |
| DRILL MACHINE CME-550X | DRILL METHOD H.S. Augers | HAMMER TYPE Automatic | |
| START DATE 07/21/08 | COMP. DATE 07/21/08 | SURFACE WATER DEPTH N/A | DEPTH TO ROCK N/A |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | MOI | L O G | SOIL AND ROCK DESCRIPTION | DEPTH (ft) |
|-----------|-----------------|------------|------------|-------|-------|----------------|----|----|----|-----|-----------|------|-------|---|------------|
| | | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | | |
| 655 | | | | | | | | | | | | | | GROUND SURFACE | 0.0 |
| 650 | 650.4 | 3.6 | 1 | 2 | 3 | | | | | | SS-1 | M | | ROADWAY EMBANKMENT TAN-RED-BRN MED. STIFF MOIST LOW (PI=12) PLASTIC SILTY SANDY CLAY (A-6) | 7.0 |
| 645 | 645.4 | 8.6 | 2 | 2 | 2 | | | | | | SS-2 | W | | ROADWAY EMBANKMENT RED-BRN MED. STIFF MOIST TO WET MED. (PI=22) PLASTIC SILTY SANDY CLAY (A-7-6) | 13.6 |
| 640 | 640.4 | 13.6 | 1 | 2 | 3 | | | | | | SS-3 | M | | ALLUVIAL GRAY MED. STIFF MOIST LOW (PI=11) PLASTIC SILTY SANDY CLAY (A-6) | 17.0 |
| 635 | 635.4 | 18.6 | 1 | 4 | 3 | | | | | | SS-4 | Sat. | | ALLUVIAL GRAY LOOSE SAT. SAND (A-1-B) | 22.0 |
| 630 | 630.4 | 23.6 | 1 | 1 | 2 | | | | | | SS-5 | Sat. | | ALLUVIAL DARK GRAY V. LOOSE SAT. MICA. CLAYEY SILTY SAND (A-2-4) | 27.0 |
| 625 | 625.4 | 28.6 | 7 | 5 | 5 | | | | | | SS-6 | Sat. | | ALLUVIAL LIGHT GRAY LOOSE TO MED. DENSE SAT. MICA. SAND & QTZ. GRAVEL (A-1-B) | 31.9 |
| 620 | 620.4 | 33.6 | 4 | 7 | 11 | | | | | | SS-7 | M | | RESIDUAL GRAY-WHITE MED. DENSE TO V. DENSE MOIST MICA. SILTY SAND (A-2-4) | |
| 615 | 615.4 | 38.6 | 10 | 15 | 19 | | | | | | | M | | | |
| 610 | 610.4 | 43.6 | 12 | 21 | 43 | | | | | | | M | | | |
| 605 | 605.4 | 48.6 | 31 | 48 | 44 | | | | | | | M | | | |
| 600 | | | | | | | | | | | | | | Boring Terminated at Elevation 603.9 ft IN V. DENSE MOIST SILTY SAND (A-2-4) | 50.1 |
| 595 | | | | | | | | | | | | | | | |
| 590 | | | | | | | | | | | | | | | |
| 585 | | | | | | | | | | | | | | | |
| 580 | | | | | | | | | | | | | | | |
| 575 | | | | | | | | | | | | | | | |

NCDOT BORE SINGLE B4517_GEO_BH_BRD00049_GASTON.GPJ_NC_DOT_GDT_04/22/09

TEST RESULTS

PROJECT: 33741.1.1 B-4517

COUNTY: GASTON

SITE DESCRIPTION: BRIDGE NO. 0049 ON SR 1103 OVER CROWDER'S CREEK

SOIL SAMPLE RESULTS

| SAMPLE NO. | OFFSET | STATION | DEPTH INTERVAL | AASHTO CLASS | N | L.L. | P.I. | % BY WEIGHT | | | | % PASSING SIEVES | | | % MOISTURE | % ORGANIC | UNIT WT. (d) | VOID RATIO |
|--------------|----------|---------|-------------------|-----------------|----|------|------|-------------|---------|------|------|------------------|----|-----|---------------|--------------|-----------------|---------------|
| | | | | | | | | C. SAND | F. SAND | SILT | CLAY | 10 | 40 | 200 | | | | |
| EB1-B | | | | | | | | | | | | | | | | | | |
| SS-10 | 12.5 RT. | 15+37 | 3.40-5.90 | A-7-6(9) | 2 | 48 | 24 | 28.8 | 21.5 | 13.3 | 36.5 | 98 | 81 | 52 | | | | |
| SS-11 | 12.5 RT. | 15+37 | 13.40-14.90 | A-7-6(15) | 2 | 44 | 19 | 10.5 | 16.6 | 34.3 | 38.5 | 100 | 94 | 78 | | | | |
| SS-12 | 12.5 RT. | 15+37 | 18.40-19.90 | A-7-6(15) | 8 | 44 | 18 | 8.9 | 17.0 | 37.6 | 36.5 | 100 | 95 | 80 | | | | |
| SS-13 | 12.5 RT. | 15+37 | 23.40-24.90 | A-3(0) | 2 | 11 | NP | 72.1 | 24.5 | 1.3 | 2.0 | 97 | 63 | 4 | | | | |
| SS-14 | 12.5 RT. | 15+37 | 33.40-34.90 | A-2-4(0) | 22 | 10 | NP | 32.6 | 49.4 | 15.9 | 2.0 | 97 | 84 | 24 | | | | |
| B1-B | | | | | | | | | | | | | | | | | | |
| SS-15 | 7.5 RT. | 15+78 | 7.20-8.70 | A-1-b(0) | 3 | 12 | NP | 64.8 | 25.7 | 7.4 | 2.0 | 67 | 36 | 9 | | | | |
| SS-16 | 7.5 RT. | 15+78 | 27.20-28.70 | A-2-4(0) | 6 | 13 | NP | 41.1 | 43.8 | 13.1 | 2.0 | 96 | 77 | 20 | | | | |
| B2-B | | | | | | | | | | | | | | | | | | |
| SS-17 | 7.5 RT. | 16+27 | 26.20-27.70 | A-2-4(0) | 32 | 12 | NP | 38.5 | 46.6 | 12.9 | 2.0 | 95 | 77 | 20 | | | | |
| SS-18 | 7.5 RT. | 16+27 | 31.20-32.70 | A-1-b(0) | 38 | 12 | NP | 58.8 | 28.0 | 11.2 | 2.0 | 67 | 38 | 12 | | | | |
| B3-A | | | | | | | | | | | | | | | | | | |
| SS-20 | 8.2 LT. | 16+87 | 7.00-8.50 | A-2-4(0) | 4 | 29 | NP | 34.1 | 47.1 | 12.8 | 6.0 | 69 | 54 | 18 | | | | |
| SS-21 | 8.2 LT. | 16+87 | 22.0-23.50 | A-2-4(0) | 50 | 32 | NP | 40.3 | 41.3 | 14.3 | 4.0 | 87 | 69 | 21 | | | | |
| B3-B | | | | | | | | | | | | | | | | | | |
| SS-19 | 7.7 RT | 16+77 | 18.20-19.70 | A-2-4(0) | 38 | 18 | NP | 53.3 | 32.6 | 12.1 | 2.0 | 95 | 60 | 18 | | | | |
| EB2-A | | | | | | | | | | | | | | | | | | |
| SS-1 | 15.0 LT | 17+23 | 4.10-5.10 | A-6(3) | 5 | 30 | 12 | 34.5 | 19.3 | 13.7 | 32.5 | 98 | 75 | 48 | | | | |
| SS-2 | 15.0 LT | 17+23 | 9.10-10.10 | A-7-6(5) | 4 | 41 | 22 | 37.6 | 19.1 | 12.8 | 30.5 | 96 | 71 | 44 | | | | |
| SS-3 | 15.0 LT | 17+23 | 14.10-15.10 | A-6(6) | 5 | 34 | 11 | 8.3 | 30.7 | 24.5 | 36.5 | 100 | 96 | 69 | | | | |
| SS-4 | 15.0 LT | 17+23 | 19.10-20.10 | A-1-b(0) | 7 | 24 | NP | 77.0 | 17.5 | 3.6 | 2.0 | 87 | 39 | 6 | | | | |
| SS-5 | 15.0 LT | 17+23 | 24.10-25.10 | A-2-4(0) | 3 | 27 | NP | 17.7 | 56.9 | 15.3 | 10.2 | 100 | 97 | 33 | | | | |
| SS-6 | 15.0 LT | 17+23 | 29.10-30.10 | A-1-b(0) | 10 | 24 | NP | 50.2 | 40.2 | 3.6 | 6.1 | 58 | 41 | 7 | | | | |
| SS-7 | 15.0 LT | 17+23 | 34.10-35.10 | A-2-4(0) | 18 | 33 | NP | 36.1 | 43.0 | 14.7 | 6.1 | 97 | 79 | 26 | | | | |



FIELD SCOUR REPORT

WBS: 33741.1.1 TIP: B-4517 COUNTY: GASTON

DESCRIPTION(1): BRIDGE NO. 49 ON SR 1103 OVER CROWDER'S CREEK.

EXISTING BRIDGE

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

Bridge No.: 49 Length: 160' Total Bents: 5 Bents in Channel: 2 Bents in Floodplain: 5
 Foundation Type: _____

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: NONE

Interior Bents: NONE

Channel Bed: NONE

Channel Bank: MODERATE EROSION OF CHANNEL BANKS THROUGHOUT SITE.

EXISTING SCOUR PROTECTION

Type(3): CONCRETE SLABS - POSSIBLY OLD DECK MATERIAL

Extent(4): BOTH END BENT ABUTMENTS & APP. 50' BACK OF ABUTMENTS ON SIDE SLOPES.

Effectiveness(5): OK

Obstructions(6): SEVERAL LARGE TREES FELL ACROSS CREEK DURING RECENT STORM EVENT (3/09).

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): BROWN, SILTY, COARSE SAND (A-1-b) AS SS-15.

Channel Bank Material(8): BROWN & GRAY, SILTY, FINE SAND (A-2-4) AS SS-20.

Channel Bank Cover(9): TREES. MANY LEANING TOWARDS CREEK. SEE #6.

Floodplain Width(10): APP. 1000'.

Floodplain Cover(11): TREES

Stream is(12): Aggrading _____ Degrading _____ Static

Channel Migration Tendency(13): NO OBSERVABLE TENDENCY.

Observations and Other Comments: TREES MENTIONED AT #6 CAUSING DEBRIS TO COLLECT APP. 50' EITHER SIDE OF BRIDGE. VERY SANDY CREEK W/ LOW NORMAL FLOW.

DESIGN SCOUR ELEVATIONS(14)

Feet Meters _____

| | BENTS | | | | | | | | | | |
|---------|-------|-------|-------|--|--|--|--|--|--|--|--|
| | B1 | B2 | B3 | | | | | | | | |
| 100 yr. | 631.9 | 623.5 | 623.8 | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Comparison of DSE to Hydraulics Unit theoretical scour:

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

| Bed or Bank Sample No. | Retained #4 | Passed #10 | Passed #40 | Passed #200 | Coarse Sand | Fine Sand | Silt | Clay | LL | PI | AASHTO | Station | Offset | Depth |
|------------------------|-------------|------------|------------|-------------|-------------|-----------|------|------|----|----|--------|---------|--------|-------|
| | SEE | SAMPLE | RESULTS | SHEET 15 | | | | | | | | | | |
| | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | |

Reported by: RW TODD

Date: 3/12/2009