

REFERENCE: SF-490159

PROJECT: 17BP.14.R.212

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

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	SF-490159	1	9

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2	LEGEND (SOIL & ROCK)
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STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY JACKSON
PROJECT DESCRIPTION REPLACE BRIDGE #159 ON SR 1336
(MONTEITH GAP RD.) OVER CULLOWHEE CREEK

SITE DESCRIPTION _____

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 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

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

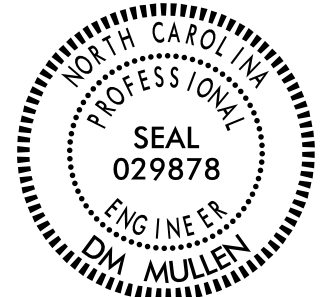
THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE 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.

- NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
 2. 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.

PERSONNEL

CD JOHNSON
DO CHEEK
CJ COFFEY

INVESTIGATED BY DM MULLEN
DRAWN BY DM MULLEN
CHECKED BY JC KUHNE
SUBMITTED BY JC KUHNE
DATE 5/31/2019



DocuSigned by:
D Matt Mullen 6/21/2019
18909BD36B5443C... SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

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									
SOIL IS CONSIDERED 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 THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6										WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.										HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED, 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:										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, SUCH 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 DISLOGGED 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 (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. 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 (SROD) - 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.									
SOIL LEGEND AND AASHTO CLASSIFICATION GENERAL CLASS. GRANULAR MATERIALS (≤ 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS GROUP CLASS. A-1, A-3, A-2, A-4, A-5, A-6, A-7, A-1, A-2, A-3, A-4, A-5, A-6, A-7 SYMBOL [Diagrams showing soil patterns for various groups] % PASSING #10, #40, #200 MATERIAL PASSING #40 LL, PI GROUP INDEX USUAL TYPES OF MAJOR MATERIALS: STONE FRAGS., GRAVEL, AND SAND; FINE SAND; SILTY OR CLAYEY GRAVEL AND SAND; SILTY SOILS; CLAYEY SOILS GEN. RATING AS SUBGRADE: EXCELLENT TO GOOD, FAIR TO POOR, FAIR TO POOR, POOR, UNSUITABLE PI OF A-7-5 SUBGROUP IS ≤ LL - 30; PI OF A-7-6 SUBGROUP IS > LL - 30										ANGULARITY OF GRAINS THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED. MINERALOGICAL COMPOSITION MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE. COMPRESSIBILITY SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50 PERCENTAGE OF MATERIAL ORGANIC MATERIAL: TRACE OF ORGANIC MATTER (2-3%), LITTLE ORGANIC MATTER (3-5%), MODERATELY ORGANIC (5-10%), HIGHLY ORGANIC (>10%) GRANULAR SOILS: 2-3%, 3-5%, 5-12%, 12-20%, >20% SILT-CLAY SOILS: 3-5%, 5-12%, 12-20%, >20% OTHER MATERIAL: TRACE (1-10%), LITTLE (10-20%), SOME (20-35%), HIGHLY (35% AND ABOVE)										WEATHERING FRESH: ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. 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. 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. MODERATE (MOD.): SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK. MODERATELY SEVERE (MOD. SEV.): ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. IF TESTED, WOULD YIELD SPT REFUSAL. 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, WOULD YIELD SPT N VALUES > 100 BPF. VERY SEVERE (V SEV.): ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF. 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.																			
CONSISTENCY OR DENSENESS PRIMARY SOIL TYPE: GENERALLY GRANULAR MATERIAL (NON-COHESSIVE), GENERALLY SILT-CLAY MATERIAL (COHESSIVE) COMPACTNESS OR CONSISTENCY: VERY LOOSE, MEDIUM DENSE, DENSE, VERY DENSE, VERY SOFT, MEDIUM STIFF, STIFF, VERY STIFF, HARD RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE): < 4, 4 TO 10, 10 TO 30, > 30 RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²): N/A, < 0.25, 0.25 TO 0.5, 0.5 TO 1.0, 1 TO 2, 2 TO 4, > 4										MISCELLANEOUS SYMBOLS ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION, SOIL SYMBOL, ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT, INFERRED SOIL BOUNDARY, INFERRED ROCK LINE, ALLUVIAL SOIL BOUNDARY, DIP & DIP DIRECTION OF ROCK STRUCTURES, SPT DMT VST PMT TEST BORING, AUGER BORING, CORE BORING, MONITORING WELL, PIEZOMETER INSTALLATION, SLOPE INDICATOR INSTALLATION, CONE PENETROMETER TEST, SOUNDING ROD, TEST BORING WITH CORE, SPT N-VALUE																													
TEXTURE OR GRAIN SIZE U.S. STD. SIEVE SIZE OPENING (MM): 4, 10, 40, 60, 200, 270 BOULDER (BLDR.), COBBLE (COB.), GRAVEL (GR.), COARSE SAND (CS, 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										RECOMMENDATION SYMBOLS UNDERCUT, SHALLOW UNDERCUT, UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE, UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK, UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL																													
SOIL MOISTURE - CORRELATION OF TERMS SOIL MOISTURE SCALE (ATTERBERG LIMITS), FIELD MOISTURE DESCRIPTION, GUIDE FOR FIELD MOISTURE DESCRIPTION LL - LIQUID LIMIT, PL - PLASTIC LIMIT, OM - OPTIMUM MOISTURE, SL - SHRINKAGE LIMIT - SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE										ABBREVIATIONS AR - AUGER REFUSAL, BT - BORING TERMINATED, CL - CLAY, CPT - CONE PENETRATION TEST, CSE - COARSE, DMT - DILATOMETER TEST, DPT - DYNAMIC PENETRATION TEST, e - VOID RATIO, F - FINE, FOSS. - FOSSILIFEROUS, FRAC. - FRACTURED, FRACTURES FRAGS. - FRAGMENTS, HI. - HIGHLY, MED. - MEDIUM, MICA - MICACEOUS, MOD. - MODERATELY, NP - NON PLASTIC, ORG. - ORGANIC, PMT - PRESSUREMETER TEST, SAP. - SAPROLITIC, SD. - SAND, SANDY, SL. - SILT, SILTY, SLI. - SLIGHTLY, TCR - TRICONE REFUSAL, w - MOISTURE CONTENT, V - VERY, VST - VANE SHEAR TEST, WEA. - WEATHERED, UNIT WEIGHT, DRY UNIT WEIGHT, SAMPLE ABBREVIATIONS: S - BULK, SS - SPLIT SPOON, ST - SHELBY TUBE, RS - ROCK, RT - RECOMPACTED TRIAXIAL, CBR - CALIFORNIA BEARING RATIO																													
PLASTICITY PLASTICITY INDEX (PI), DRY STRENGTH NON PLASTIC, SLIGHTLY PLASTIC, MODERATELY PLASTIC, HIGHLY PLASTIC 0-5, 6-15, 16-25, 26 OR MORE VERY LOW, SLIGHT, MEDIUM, HIGH										EQUIPMENT USED ON SUBJECT PROJECT DRILL UNITS: CME-45C, CME-55, CME-550, VANE SHEAR TEST, PORTABLE HOIST ADVANCING TOOLS: CLAY BITS, 6" CONTINUOUS FLIGHT AUGER, 8" HOLLOW AUGERS, HARD FACED FINGER BITS, TUNG-CARBIDE INSERTS, CASING w/ ADVANCER, TRICONE *STEEL TEETH, TRICONE *TUNG-CARB., CORE BIT HAMMER TYPE: AUTOMATIC, MANUAL CORE SIZE: B, H, N XWL HAND TOOLS: POST HOLE DIGGER, HAND AUGER, SOUNDING ROD, VANE SHEAR TEST																													
COLOR 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.										ROCK HARDNESS VERY HARD: CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. HARD: CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. MODERATELY HARD: CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. MEDIUM HARD: CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. SOFT: CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE. VERY SOFT: CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.																													
FRACTURE SPACING TERM: VERY WIDE, WIDE, MODERATELY CLOSE, CLOSE, VERY CLOSE SPACING: MORE THAN 10 FEET, 3 TO 10 FEET, 1 TO 3 FEET, 0.16 TO 1 FOOT, LESS THAN 0.16 FEET										BEDDING TERM: VERY THICKLY BEDDED, THICKLY BEDDED, THINLY BEDDED, VERY THINLY BEDDED, THICKLY LAMINATED, THINLY LAMINATED THICKNESS: 4 FEET, 1.5 - 4 FEET, 0.16 - 1.5 FEET, 0.03 - 0.16 FEET, 0.008 - 0.03 FEET, < 0.008 FEET																													
INDURATION FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC. FRIABLE: RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. MODERATELY INDURATED: GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. INDURATED: GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. EXTREMELY INDURATED: SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.										BENCH MARK: BM2 ELEVATION: 2062.68 FEET NOTES:																													

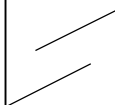
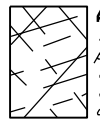
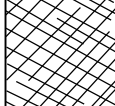
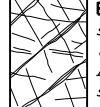



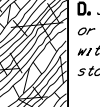

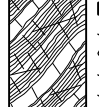


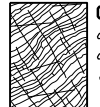
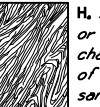
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DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

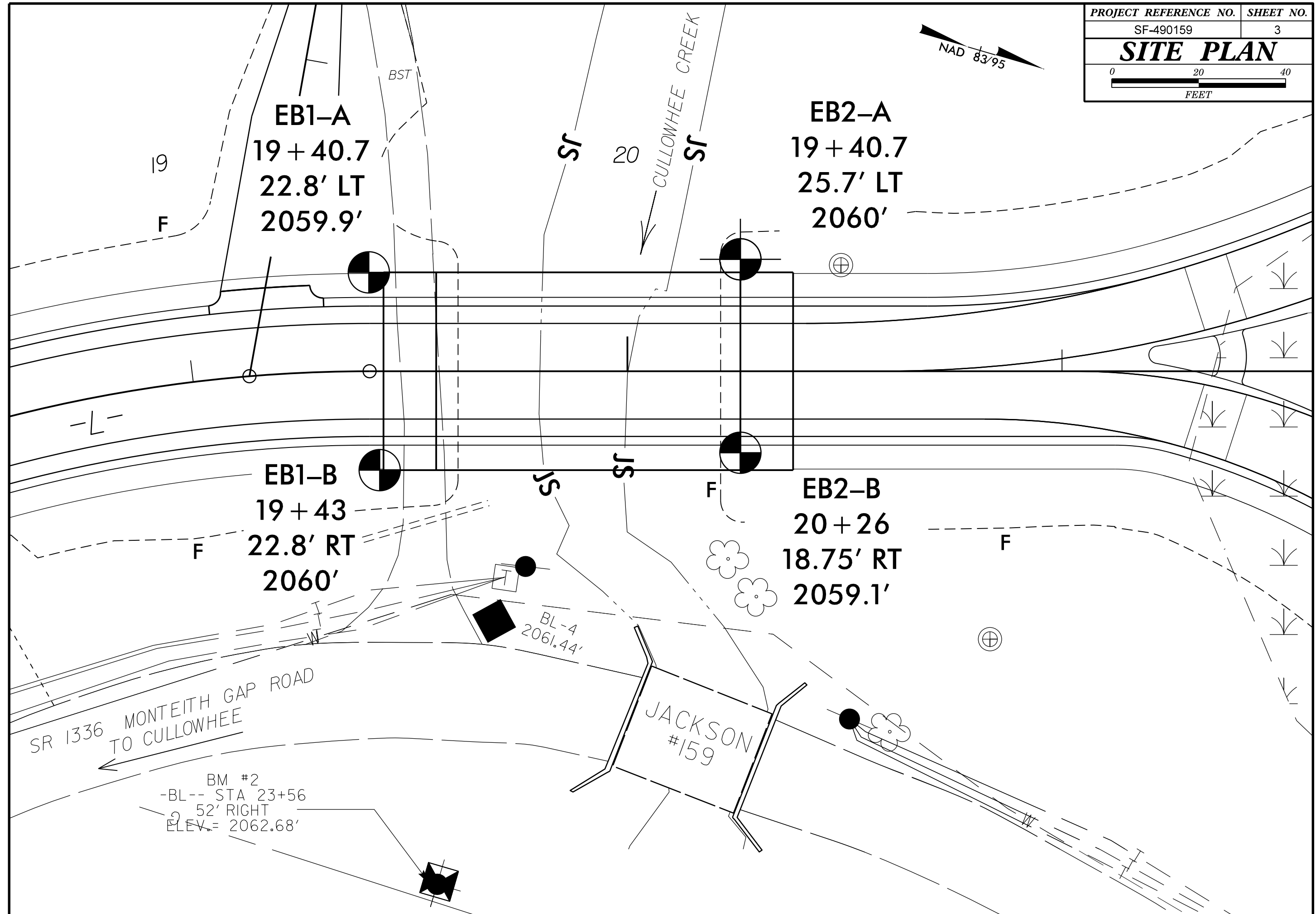
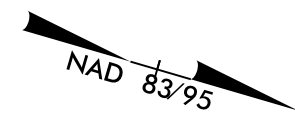
SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)		SURFACE CONDITIONS					GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)		SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)					
From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.		VERY GOOD	GOOD	FAIR	POOR	VERY POOR	From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.		VERY GOOD	GOOD	FAIR	POOR	VERY POOR	
STRUCTURE		DECREASING SURFACE QUALITY →					COMPOSITION AND STRUCTURE							
	INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities	90			N/A	N/A		A. Thick bedded, very blocky sandstone. The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability.	70					
	BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets	80						B. Sandstone with thin inter-layers of siltstone	60					
	VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets		70					C. Sandstone and siltstone in similar amounts	50					
	BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity		60					D. Siltstone or silty shale with sandstone layers	40					
	DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces		50					E. Weak siltstone or clayey shale with sandstone layers	30					
	LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes		40					F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure	20					
			30					G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers	10					
			20					H. Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.						
			10											
			N/A											
			N/A											

→ Means deformation after tectonic disturbance



EB1-A
 19 + 40.7
 22.8' LT
 2059.9'

EB2-A
 19 + 40.7
 25.7' LT
 2060'

EB1-B
 19 + 43
 22.8' RT
 2060'

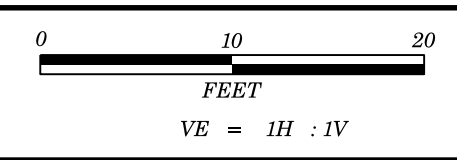
EB2-B
 20 + 26
 18.75' RT
 2059.1'

SR 1336 MONTEITH GAP ROAD
 TO CULLOWHEE

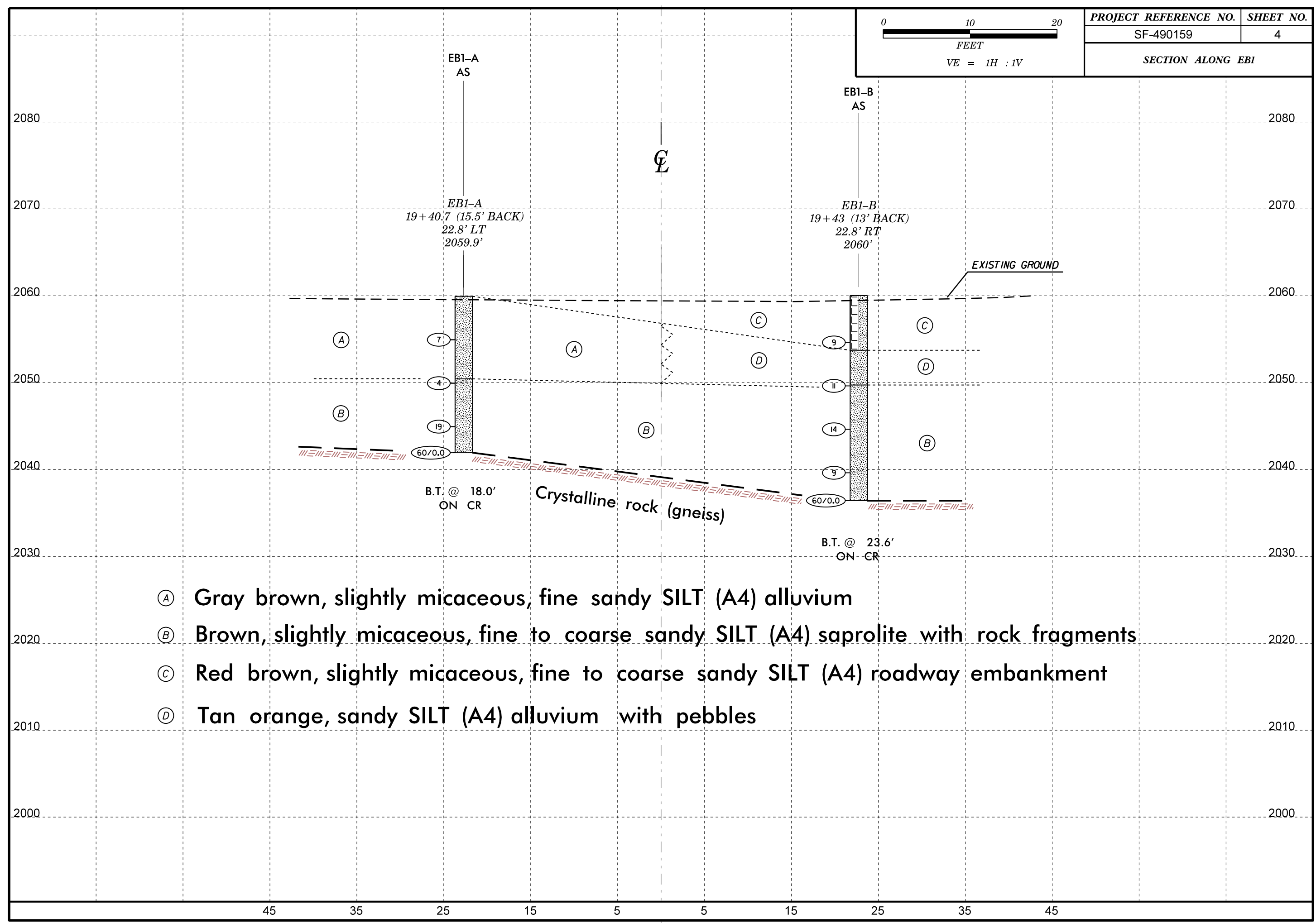
JACKSON
 #159

BM #2
 -BL-- STA 23+56
 52' RIGHT
 ELEV. = 2062.68'

BL-4
 2061.44'



PROJECT REFERENCE NO.	SHEET NO.
SF-490159	4
SECTION ALONG EBI	



EB1-A
AS

EB1-A
19+40.7 (15.5' BACK)
22.8' LT
2059.9'

EB1-B
AS

EB1-B
19+43 (13' BACK)
22.8' RT
2060'

EXISTING GROUND

(A)

(7)

(A)

(C)

(9)

(C)

2050

(B)

(4)

(11)

(D)

2050

2040

B.T. @ 18.0'
ON CR

Crystalline rock (gneiss)

B.T. @ 23.6'
ON CR

(14)

(D)

2040

(60/0.0)

(9)

(B)

2030

2030

- (A) Gray brown, slightly micaceous, fine sandy SILT (A4) alluvium
- (B) Brown, slightly micaceous, fine to coarse sandy SILT (A4) saprolite with rock fragments
- (C) Red brown, slightly micaceous, fine to coarse sandy SILT (A4) roadway embankment
- (D) Tan orange, sandy SILT (A4) alluvium with pebbles

2020

2020

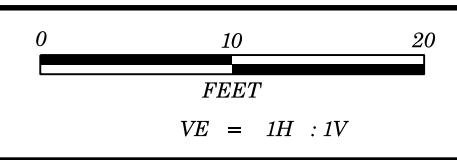
2010

2010

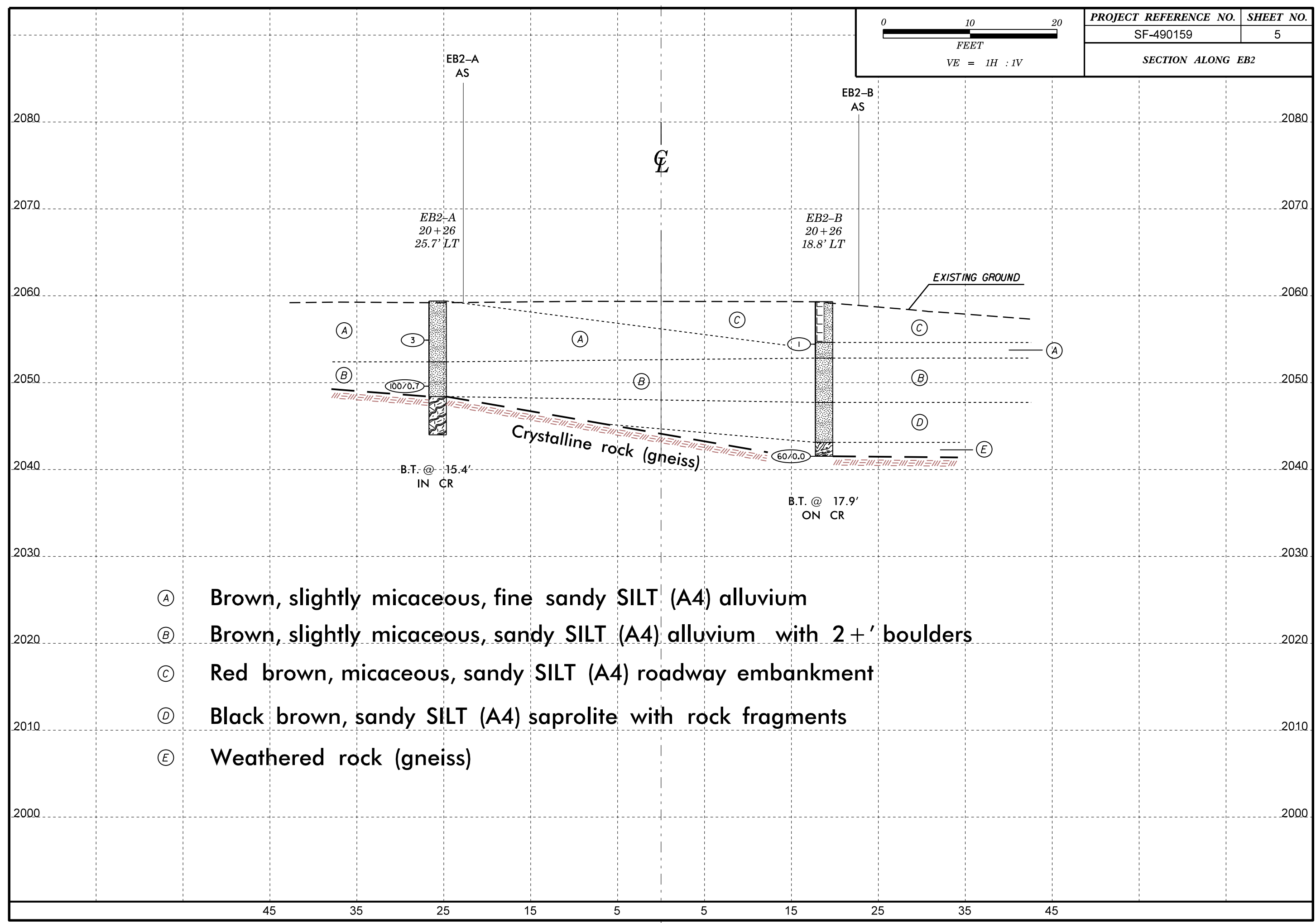
2000

2000

45 35 25 15 5 5 15 25 35 45



PROJECT REFERENCE NO.	SHEET NO.
SF-490159	5
SECTION ALONG EB2	



- Ⓐ Brown, slightly micaceous, fine sandy SILT (A4) alluvium
- Ⓑ Brown, slightly micaceous, sandy SILT (A4) alluvium with 2+' boulders
- Ⓒ Red brown, micaceous, sandy SILT (A4) roadway embankment
- Ⓓ Black brown, sandy SILT (A4) saprolite with rock fragments
- Ⓔ Weathered rock (gneiss)

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.14.R.212		TIP SF-490159		COUNTY JACKSON		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION N/A							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 19+41		OFFSET 23 ft LT		ALIGNMENT L										
COLLAR ELEV. 2,059.9 ft		TOTAL DEPTH 18.0 ft		NORTHING 596,531		EASTING 753,371										
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017		DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic												
DRILLER Cheek, D. O.		START DATE 05/20/19		COMP. DATE 05/20/19		SURFACE WATER DEPTH 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						
2060														2,059.9	0.0	GROUND SURFACE
																ALLUVIAL Gray-brown, slightly micaceous, Fine sandy SILT
2055	2,054.9	5.0	2	2	5											
2050	2,049.9	10.0	2	3	1									2,050.4	9.5	SAPROLITE Brown, slightly micaceous, fine to coarse sandy SILT with rock fragments
2045	2,044.9	15.0	8	11	8									2,041.9	18.0	CRYSTALLINE ROCK Gneiss Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,041.9 ft ON CR
	2,041.9	18.0	60/0.0													

WBS 17BP.14.R.212		TIP SF-490159		COUNTY JACKSON		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION N/A							GROUND WTR (ft)									
BORING NO. EB1-B		STATION 19+43		OFFSET 23 ft RT		ALIGNMENT L										
COLLAR ELEV. 2,060.0 ft		TOTAL DEPTH 23.6 ft		NORTHING 596,547		EASTING 753,414										
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017		DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic												
DRILLER Cheek, D. O.		START DATE 05/20/19		COMP. DATE 05/20/19		SURFACE WATER DEPTH 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						
2065																GROUND SURFACE
																ROADWAY EMBANKMENT Red-brown, Slightly micaceous, sandy SILT
2060														2,060.0	0.0	
																ALLUVIAL Tan-orange, sandy SILT w/ pebbles
2055	2,054.6	5.4	1	1	8									2,053.7	6.3	SAPROLITE Brown-black, sandy SILT with a few rock (gneiss) fragments
2050	2,049.6	10.4	6	6	5									2,049.7	10.3	
2045	2,044.6	15.4	3	8	6											
2040	2,039.6	20.4	5	5	4											
	2,036.4	23.6	60/0.0													
																CRYSTALLINE ROCK Gneiss Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,036.4 ft ON CR

GEOTECHNICAL BORING REPORT BORE LOG

GEOTECHNICAL BORING REPORT CORE LOG

WBS 17BP.14.R.212		TIP SF-490159		COUNTY JACKSON		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION N/A							GROUND WTR (ft)									
BORING NO. EB2-A		STATION 20+26		OFFSET 26 ft LT		ALIGNMENT L										
COLLAR ELEV. 2,059.4 ft		TOTAL DEPTH 15.4 ft		NORTHING 596,613		EASTING 753,344										
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017		DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic												
DRILLER Cheek, D. O.		START DATE 05/21/19		COMP. DATE 05/21/19		SURFACE WATER DEPTH 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						
2060														2,059.4	GROUND SURFACE	0.0
															ALLUVIAL Brown, slightly micaceous, sandy SILT	
2055	2,054.6	4.8														
			1	1	2									2,052.4	ALLUVIAL As above with 2+' boulders	7.0
2050																
														2,048.4	CRYSTALLINE ROCK Gneiss	11.0
2045														2,044.0	GSI : 80 - 90	15.4
															Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,044.0 ft ON CR	

WBS 17BP.14.R.212		TIP SF-490159		COUNTY JACKSON		GEOLOGIST Johnson, C. D.							
SITE DESCRIPTION N/A							GROUND WTR (ft)						
BORING NO. EB2-A		STATION 20+26		OFFSET 26 ft LT		ALIGNMENT L							
COLLAR ELEV. 2,059.4 ft		TOTAL DEPTH 15.4 ft		NORTHING 596,613		EASTING 753,344							
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017		DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic									
DRILLER Cheek, D. O.		START DATE 05/21/19		COMP. DATE 05/21/19		SURFACE WATER DEPTH N/A							
CORE SIZE NXWL		TOTAL RUN 4.4 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. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %				
2048.4	2,048.4	11.0	4.4		(4.4) 100%	(4.4) 100%					2,048.4	Begin Coring @ 11.0 ft CRYSTALLINE ROCK	11.0
2045	2,044.0	15.4									2,044.0	GSI : 80 - 90	15.4
												Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,044.0 ft ON CR	

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.14.R.212		TIP SF-490159		COUNTY JACKSON		GEOLOGIST Johnson, C. D.								
SITE DESCRIPTION N/A							GROUND WTR (ft)							
BORING NO. EB2-B		STATION 20+26		OFFSET 19 ft RT		ALIGNMENT L								
COLLAR ELEV. 2,059.1 ft		TOTAL DEPTH 17.9 ft		NORTHING 596,625		EASTING 753,387								
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017				DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic								
DRILLER Cheek, D. O.		START DATE 05/21/19		COMP. DATE 05/21/19		SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
2060														2,059.1 GROUND SURFACE 0.0
														ROADWAY EMBANKMENT Red-brown, sandy micaceous SILT
2055	2,054.2	4.9												2,054.4 4.7
			1	0	1									2,052.6 ALLUVIAL Tan-orange, sandy SILT 6.5
2050														ALLUVIAL As above with cobbles and boulders
														2,047.5 11.6
2045														SAPROLITE Black-brown, sandy SILT with rock fragments
														2,042.9 16.2
	2,041.3	17.8												WEATHERED ROCK 2,041.3 17.8
			60/0.0											CRYSTALLINE ROCK Gneiss Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,041.2 ft ON CR

CORE PHOTOGRAPH

EB2-A
BOX 1 OF 1: 11 - 15.4 FEET
GSI 80 - 90

