

REFERENCE: B-3186/B-5898

PROJECT: 38332/48030

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

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-3186/B-5898	1	17

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND
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STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY HAYWOOD
PROJECT DESCRIPTION US 23/US 74/US 19 (GREAT SMOKY MOUNTAIN HWY) FROM WEST OF NC 209 (CRABTREE RD.) TO EAST OF RUSS AVE.
SITE DESCRIPTION BRIDGE NO. 168 ON -YIRT- (US 19) OVER -L-, -L LT- AND -L RT- (US 74 /US 23) BETWEEN US 276 AND NC 209

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) 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

C. SWAFFORD

R. DUGGER

L. WANSRATH

K. BOONE

INVESTIGATED BY C. SWAFFORD

DRAWN BY T. LYNN

CHECKED BY K. BUSSEY

SUBMITTED BY HDR

DATE NOVEMBER 2021



SIGNATURE _____ DATE _____

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

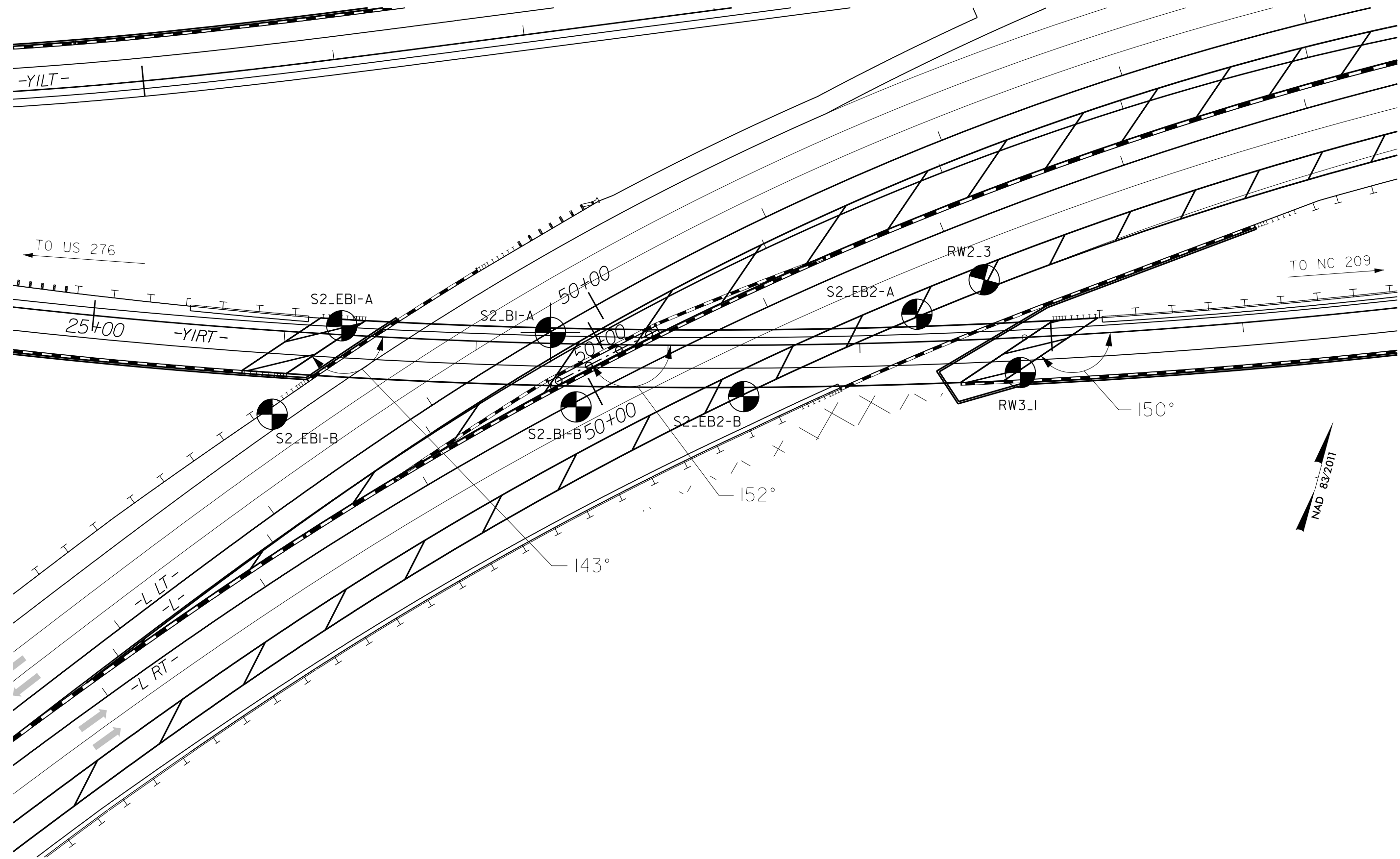
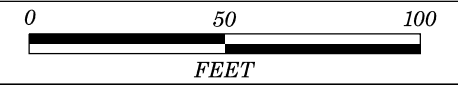
SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

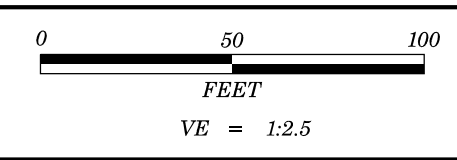
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

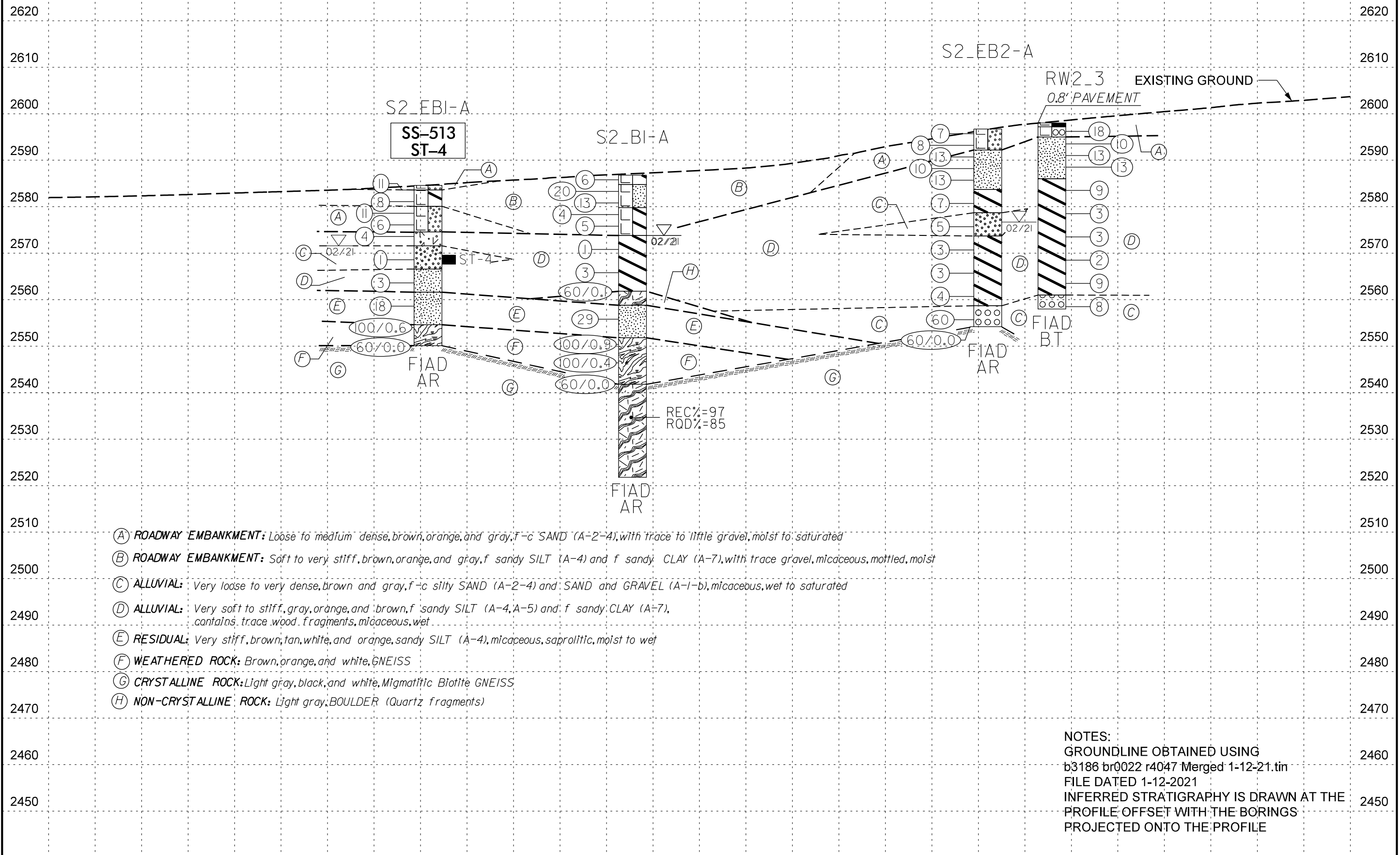
<p>GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)</p> <p>From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. 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.</p> <p>STRUCTURE</p>	<p>SURFACE CONDITIONS</p> <p>VERY GOOD Very rough, fresh unweathered surfaces</p> <p>GOOD Rough, slightly weathered, iron stained surfaces</p> <p>FAIR Smooth, moderately weathered and altered surfaces</p> <p>POOR Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments</p> <p>VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings</p> <p>DECREASING SURFACE QUALITY →</p>	<p>GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)</p> <p>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.</p> <p>SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)</p> <p>VERY GOOD - Very Rough, fresh unweathered surfaces</p> <p>GOOD - Rough, slightly weathered surfaces</p> <p>FAIR - Smooth, moderately weathered and altered surfaces</p> <p>POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments</p> <p>VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings</p>	
<p>INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities</p> <p>BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets</p> <p>VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets</p> <p>BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity</p> <p>DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces</p> <p>LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes</p> <p>DECREASING INTERLOCKING OF ROCK PIECES ↓</p>	<p>90</p> <p>80</p> <p>70</p> <p>60</p> <p>50</p> <p>40</p> <p>30</p> <p>20</p> <p>10</p> <p>N/A</p> <p>N/A</p>	<p>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.</p> <p>B. Sandstone with thin inter-layers of siltstone</p> <p>C. Sandstone and siltstone in similar amounts</p> <p>D. Siltstone or silty shale with sandstone layers</p> <p>E. Weak siltstone or clayey shale with sandstone layers</p> <p>F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</p> <p>G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers</p> <p>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.</p> <p>→ Means deformation after tectonic disturbance</p>	<p>70</p> <p>60</p> <p>50</p> <p>40</p> <p>30</p> <p>20</p> <p>10</p> <p>A</p> <p>B</p> <p>C</p> <p>D</p> <p>E</p> <p>F</p> <p>G</p> <p>H</p>

SITE PLAN



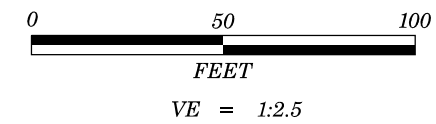


SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-513	5' LT	26+29	10.0' - 11.5'	A-5 (9)	48	10	4.1	32.5	49.9	13.5	100.0	98.0	74.1	51	-
ST-4	5' LT	26+29	15.0' - 17.0'	A-2-4	27	6	41.2	30.8	7.0	21.0	94.4	66.3	31.2	28	-



- (A) ROADWAY EMBANKMENT: Loose to medium dense, brown, orange, and gray, f-c SAND (A-2-4), with trace to little gravel, moist to saturated
- (B) ROADWAY EMBANKMENT: Soft to very stiff, brown, orange, and gray, f sandy SILT (A-4) and f sandy CLAY (A-7), with trace gravel, micaceous, mottled, moist
- (C) ALLUVIAL: Very loose to very dense, brown and gray, f-c silty SAND (A-2-4) and SAND and GRAVEL (A-1-b), micaceous, wet to saturated
- (D) ALLUVIAL: Very soft to stiff, gray, orange, and brown, f sandy SILT (A-4, A-5) and f sandy CLAY (A-7), contains trace wood fragments, micaceous, wet
- (E) RESIDUAL: Very stiff, brown, tan, white, and orange, sandy SILT (A-4), micaceous, saprolitic, moist to wet
- (F) WEATHERED ROCK: Brown, orange, and white, GNEISS
- (G) CRYSTALLINE ROCK: Light gray, black, and white, Migmatitic Blotite GNEISS
- (H) NON-CRYSTALLINE ROCK: Light gray, BOULDER (Quartz fragments)

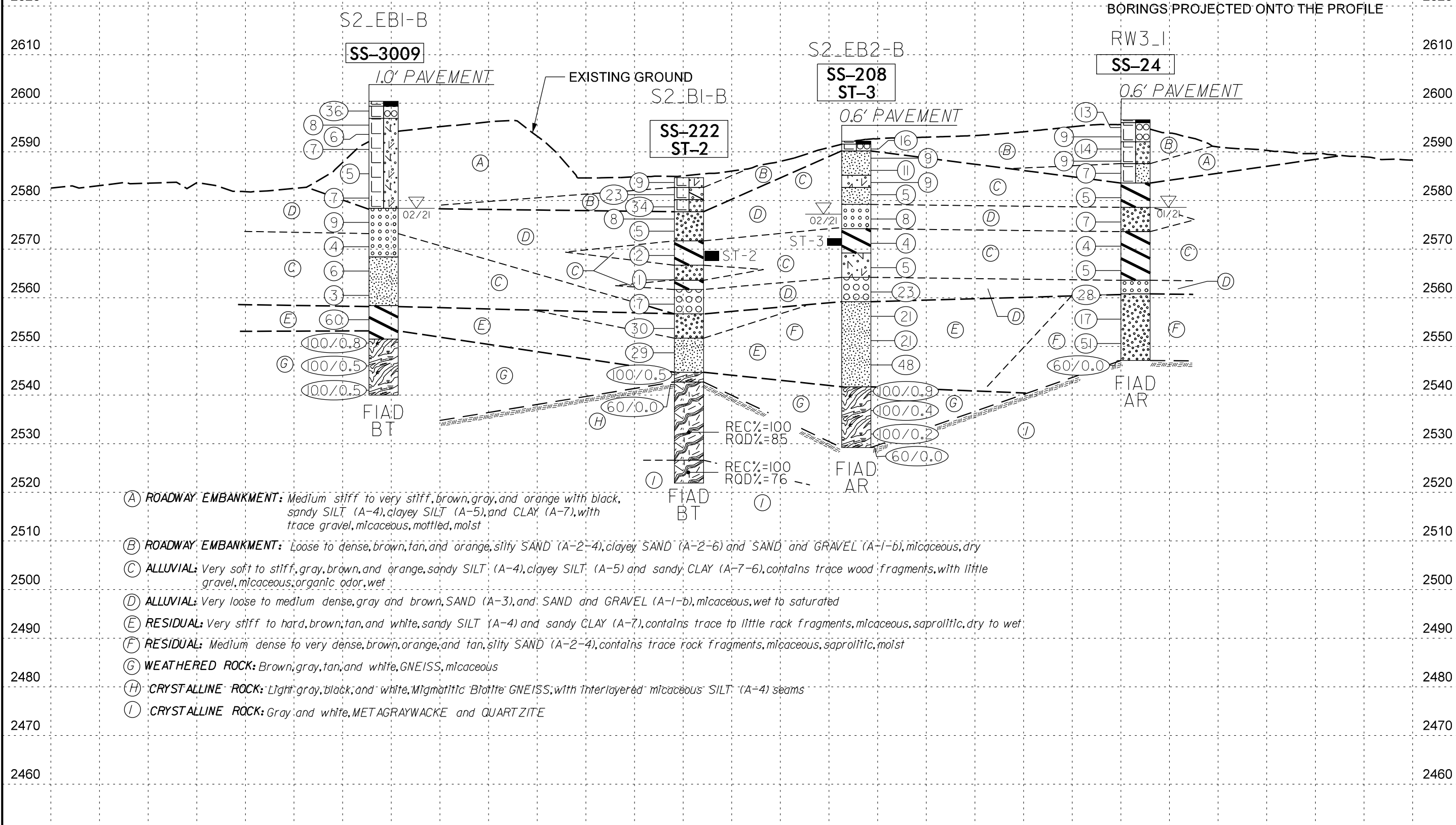
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FILE DATED 1-12-2021
INFERRRED STRATIGRAPHY IS DRAWN AT THE
PROFILE OFFSET WITH THE BORINGS
PROJECTED ONTO THE PROFILE



SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-3009	44' RT	25+96	38.9' - 40.4'	A-4	37	8	26.8	36.0	25.4	11.8	86.6	72.3	36.7	43	-
SS-222	33' RT	27+53	15.0' - 16.5'	A-5 (13)	51	10	1.1	21.2	59.5	18.2	100.0	99.5	85.8	62	-
ST-2	33' RT	27+53	15.0' - 17.0'	A-7-5 (16)	57	11	1.3	14.3	66.8	17.6	100.0	99.6	87.3	68	-
SS-208	27' RT	28+39	20.0' - 21.5'	A-7-5 (29)	77	21	2.5	13.1	70.9	13.5	100.0	98.9	89.2	73	-
ST-3	27' RT	28+39	20.0' - 21.5'	A-4	NP	NP	6.7	33.0	38.9	21.4	100	97.2	69.0	46	-
SS-24	7' LT	29+84	15.0' - 16.1'	A-7-6 (11)	47	23	20.8	20.5	23.6	35.1	92.0	79.1	58.5	26	-

NOTES:
GROUNDLINE OBTAINED USING b3186 br0022
r4047 Merged 1-12-21.tin FILE DATED
1-12-2021 INFERRED STRATIGRAPHY IS
DRAWN AT THE PROFILE OFFSET WITH THE
BORINGS PROJECTED ONTO THE PROFILE

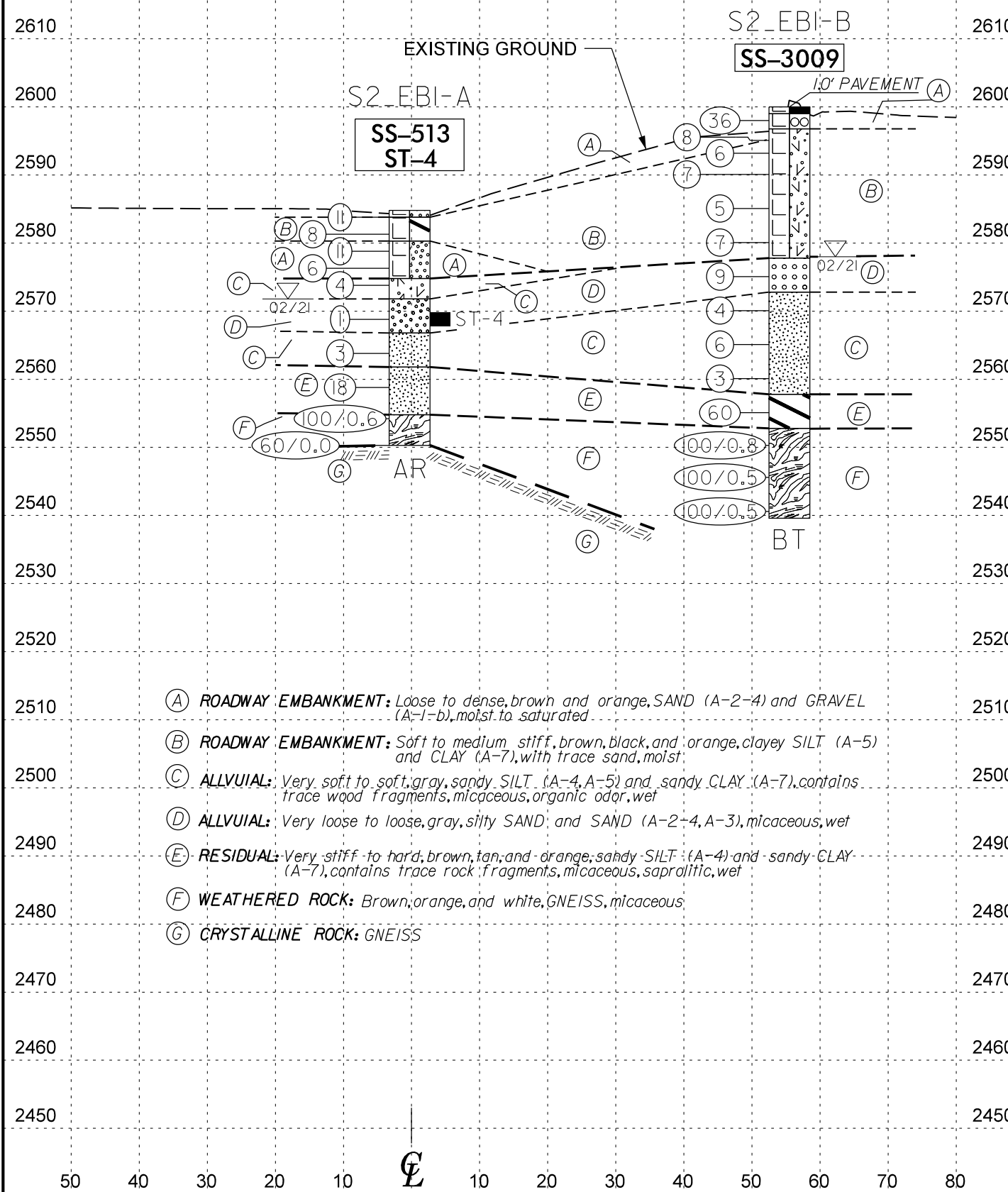


- (A) ROADWAY EMBANKMENT: Medium stiff to very stiff, brown, gray, and orange with black, sandy SILT (A-4), clayey SILT (A-5), and CLAY (A-7), with trace gravel, micaceous, mottled, moist
- (B) ROADWAY EMBANKMENT: Loose to dense, brown, tan, and orange, silty SAND (A-2-4), clayey SAND (A-2-6) and SAND and GRAVEL (A-1-b), micaceous, dry
- (C) ALLUVIAL: Very soft to stiff, gray, brown, and orange, sandy SILT (A-4), clayey SILT (A-5) and sandy CLAY (A-7-6), contains trace wood fragments, with little gravel, micaceous, organic odor, wet
- (D) ALLUVIAL: Very loose to medium dense, gray and brown, SAND (A-3), and SAND and GRAVEL (A-1-b), micaceous, wet to saturated
- (E) RESIDUAL: Very stiff to hard, brown, tan, and white, sandy SILT (A-4) and sandy CLAY (A-7), contains trace to little rock fragments, micaceous, saprolitic, dry to wet
- (F) RESIDUAL: Medium dense to very dense, brown, orange, and tan, silty SAND (A-2-4), contains trace rock fragments, micaceous, saprolitic, moist
- (G) WEATHERED ROCK: Brown, gray, tan, and white, GNEISS, micaceous
- (H) CRYSTALLINE ROCK: Light gray, black, and white, Migmatitic Biotite GNEISS, with interlayered micaceous SILT (A-4) seams
- (I) CRYSTALLINE ROCK: Gray and white, METAGRAYWACKE and QUARTZITE

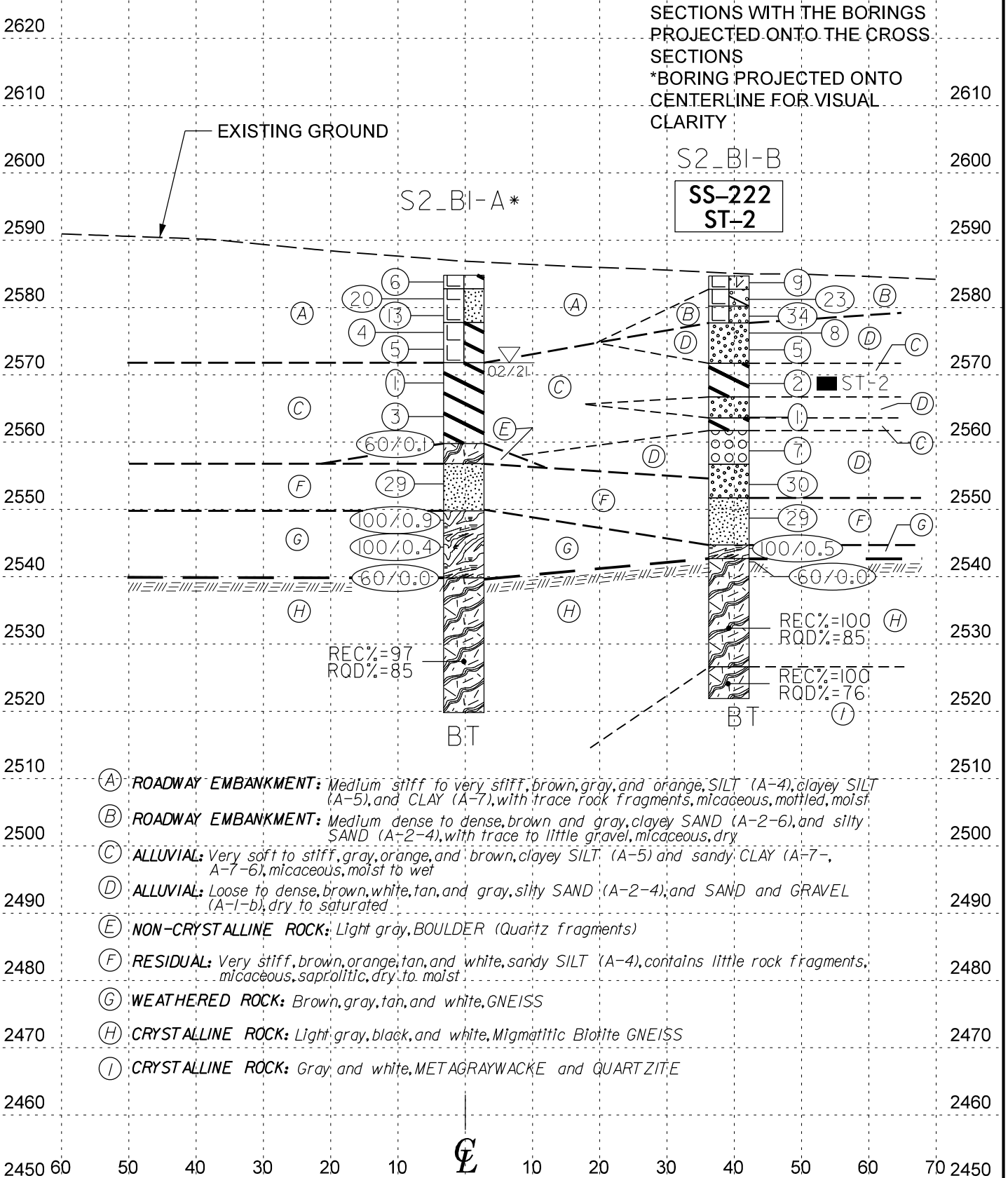
SOIL TEST RESULTS

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							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-513	5' LT	26+29	10.0' - 11.5'	A-5 (9)	48	10	4.1	32.5	49.9	13.5	100.0	98.0	74.1	51	-
ST-4	5' LT	26+29	15.0' - 17.0'	A-2-4	27	6	41.2	30.8	7.0	21.0	94.4	66.3	31.2	28	-
SS-3009	44' RT	25+96	38.9' - 40.4	A-4	37	8	26.8	36.0	25.4	11.8	86.6	72.3	36.7	43	-
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ST-2	33' RT	27+53	15.0' - 17.0'	A-7-5 (16)	57	11	1.3	14.3	66.8	17.6	100.0	99.6	87.3	68	-

NOTES:
 GROUNDLINE OBTAINED USING b3186 br0022 r4047 Merged 1-12-21.tin
 FILE DATED 1-12-2021
 INFERRED STRATIGRAPHY IS DRAWN AT THE CROSS SECTIONS WITH THE BORINGS PROJECTED ONTO THE CROSS SECTIONS
 *BORING PROJECTED ONTO CENTERLINE FOR VISUAL CLARITY



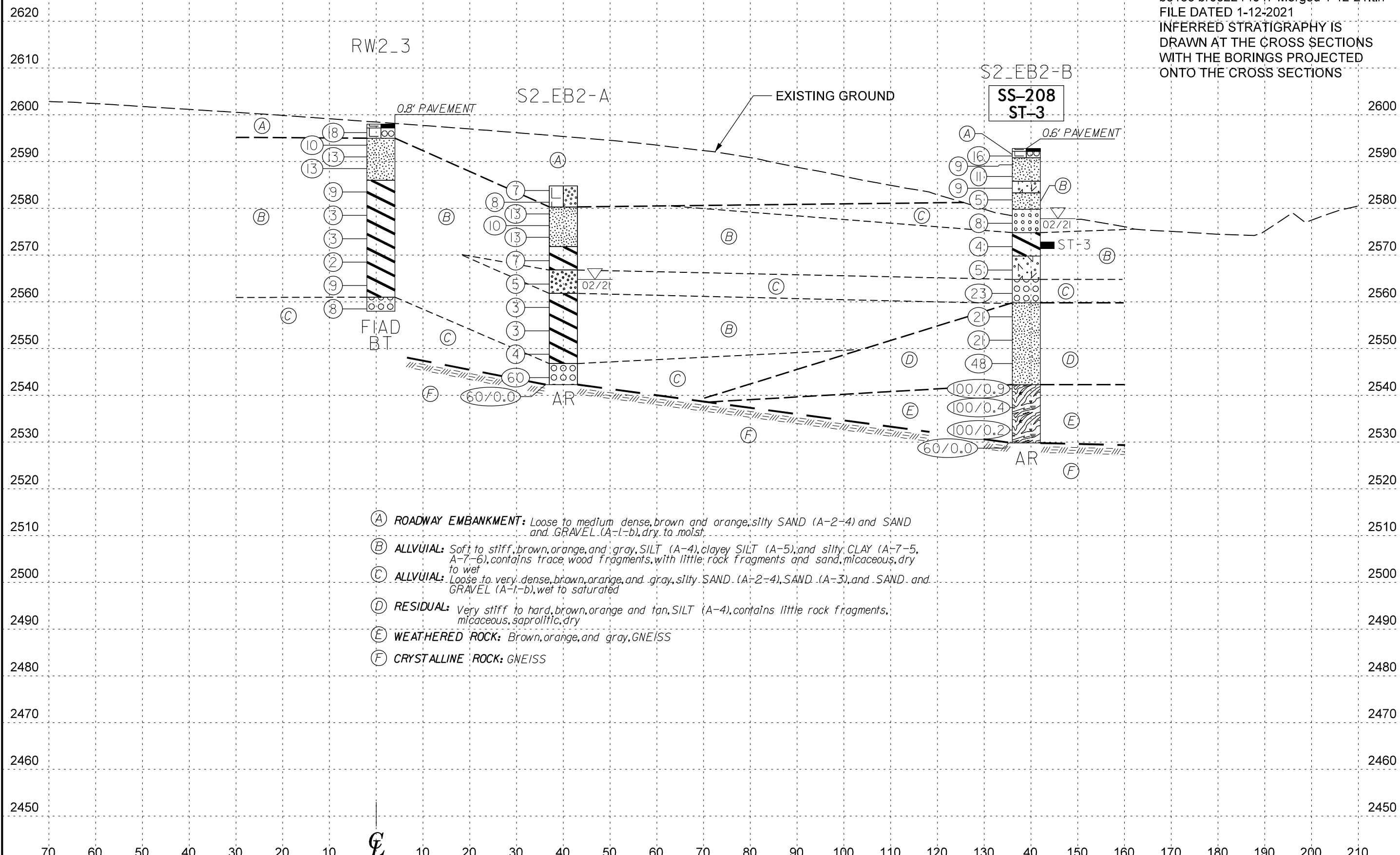
- (A) ROADWAY EMBANKMENT: Loose to dense, brown and orange, SAND (A-2-4) and GRAVEL (A-1-b), moist to saturated
- (B) ROADWAY EMBANKMENT: Soft to medium stiff, brown, black, and orange, clayey SILT (A-5) and CLAY (A-7), with trace sand, moist
- (C) ALLUVIAL: Very soft to soft, gray, sandy SILT (A-4, A-5) and sandy CLAY (A-7), contains trace wood fragments, micaceous, organic odor, wet
- (D) ALLUVIAL: Very loose to loose, gray, silty SAND and SAND (A-2-4, A-3), micaceous, wet
- (E) RESIDUAL: Very stiff to hard, brown, tan, and orange, sandy SILT (A-4) and sandy CLAY (A-7), contains trace rock fragments, micaceous, saprolitic, wet
- (F) WEATHERED ROCK: Brown, orange, and white, GNEISS, micaceous
- (G) CRYSTALLINE ROCK: GNEISS



- (A) ROADWAY EMBANKMENT: Medium stiff to very stiff, brown, gray, and orange, SILT (A-4), clayey SILT (A-5), and CLAY (A-7), with trace rock fragments, micaceous, mottled, moist
- (B) ROADWAY EMBANKMENT: Medium dense to dense, brown and gray, clayey SAND (A-2-6), and silty SAND (A-2-4), with trace to little gravel, micaceous, dry
- (C) ALLUVIAL: Very soft to stiff, gray, orange, and brown, clayey SILT (A-5) and sandy CLAY (A-7, A-7-6), micaceous, moist to wet
- (D) ALLUVIAL: Loose to dense, brown, white, tan, and gray, silty SAND (A-2-4), and SAND and GRAVEL (A-1-b), dry to saturated
- (E) NON-CRYSTALLINE ROCK: Light gray, BOULDER (Quartz fragments)
- (F) RESIDUAL: Very stiff, brown, orange, tan, and white, sandy SILT (A-4), contains little rock fragments, micaceous, saprolitic, dry to moist
- (G) WEATHERED ROCK: Brown, gray, tan, and white, GNEISS
- (H) CRYSTALLINE ROCK: Light gray, black, and white, Migmatitic Biotite GNEISS
- (I) CRYSTALLINE ROCK: Gray and white, METAGRAYWACKE and QUARTZITE

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-208	27' RT	28+39	20.0' - 21.5'	A-7-5 (29)	77	21	2.5	13.1	70.9	13.5	100.0	98.9	89.2	73	-
ST-3	27' RT	28+39	20.0' - 21.5'	A-4	NP	NP	6.7	33.0	38.9	21.4	100	97.2	69.0	46	-

NOTES:
 GROUNDLINE OBTAINED USING:
 b3186 br0022 r4047 Merged 1-12-21.tin
 FILE DATED 1-12-2021
 INFERRED STRATIGRAPHY IS
 DRAWN AT THE CROSS SECTIONS
 WITH THE BORINGS PROJECTED
 ONTO THE CROSS SECTIONS



- (A) ROADWAY EMBANKMENT: Loose to medium dense, brown and orange, silty SAND (A-2-4) and SAND and GRAVEL (A-1-b), dry to moist.
- (B) ALLUVIAL: Soft to stiff, brown, orange, and gray, SILT (A-4), clayey SILT (A-5), and silty CLAY (A-7-5, A-7-6), contains trace wood fragments, with little rock fragments and sand, micaceous, dry to wet.
- (C) ALLUVIAL: Loose to very dense, brown, orange, and gray, silty SAND (A-2-4), SAND (A-3), and SAND and GRAVEL (A-1-b), wet to saturated.
- (D) RESIDUAL: Very stiff to hard, brown, orange and tan, SILT (A-4), contains little rock fragments, micaceous, saprolitic, dry.
- (E) WEATHERED ROCK: Brown, orange, and gray, GNEISS.
- (F) CRYSTALLINE ROCK: GNEISS.

HORIZ. SCALE 0 20 40 (FEET)

VE = 1:1

BRIDGE NO. 2 - END BENT 2 - -YIRT- STA. 29+86.05 149° SKEW

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 38332.1.FS1		TIP B-3186 / B-5898		COUNTY HAYWOOD		GEOLOGIST C. Swafford								
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)							GROUND WTR (ft)							
BORING NO. S2_EB1-A		STATION 26+29		OFFSET 5 ft LT		ALIGNMENT -Y1RT-								
COLLAR ELEV. 2,584.6 ft		TOTAL DEPTH 34.5 ft		NORTHING 666,917		EASTING 819,274								
DRILL RIGHAMMER EFF./DATE GTC9083 CME-550X 80%(11/24/2020)			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic								
DRILLER L. Wanstrath		START DATE 02/25/21		COMP. DATE 02/25/21		SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
2585	2,584.6	0.0	5	7	4									2,584.6 GROUND SURFACE 0.0
	2,582.1	2.5	3	4	4									2,583.6 ROADWAY EMBANKMENT 1.0
	2,579.6	5.0	6	5	6									2,580.1 Medium dense, brown, f SAND (A-2-4), with trace gravel 4.5
	2,577.1	7.5	3	3	3									2,580.1 Soft, brown and orange, CLAY (A-7) 4.5
	2,574.6	10.0	3	2	2									2,574.6 Loose to medium dense, gray, f-c SAND (A-2-4) 10.0
	2,571.6	13.0												2,571.6 ALLUVIAL 13.0
	2,569.6	15.0	1	WOH	1									2,571.6 Soft, gray, SILT (A-5)(9), micaceous 13.0
	2,566.6	18.0												2,566.6 Very loose, gray, f silty SAND (A-2-4), micaceous 18.0
	2,564.6	20.0	1	1	2									2,566.6 Soft, gray, f sandy SILT (A-4), micaceous 18.0
	2,559.6	25.0	4	7	11									2,561.6 RESIDUAL 23.0
	2,554.6	30.0	90	10/0.1										2,554.6 Very stiff, brown and orange, f sandy SILT (A-4), micaceous, saprolitic 23.0
	2,550.1	34.5	60/0.0											2,550.1 WEATHERED ROCK 30.0
														2,554.6 Brown, orange, and white, GNEISS 30.0
														2,550.1 Boring Terminated with Standard Penetration Test Refusal at Elevation 2,550.1 ft on Crystalline Rock (GNEISS) 34.5
														Other Samples: ST-4 (15.0 - 17.0)

WBS 38332.1.FS1		TIP B-3186 / B-5898		COUNTY HAYWOOD		GEOLOGIST C. Swafford								
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)							GROUND WTR (ft)							
BORING NO. S2_EB1-B		STATION 25+96		OFFSET 44 ft RT		ALIGNMENT -Y1RT-								
COLLAR ELEV. 2,600.4 ft		TOTAL DEPTH 60.4 ft		NORTHING 666,863		EASTING 819,251								
DRILL RIGHAMMER EFF./DATE GTC3277 CME-75 83%(09/15/2020)			DRILL METHOD Mud Rotary			HAMMER TYPE Automatic								
DRILLER K. Boone		START DATE 02/27/21		COMP. DATE 02/27/21		SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
2605														2,600.4 GROUND SURFACE 0.0
														2,599.4 ROADWAY EMBANKMENT 1.0
														2,596.9 ROADWAY EMBANKMENT 3.5
														2,596.9 Dense, brown, GRAVEL (A-1-b) 3.5
														2,594.6 Medium stiff, orange and brown with black, clayey SILT (A-5), with trace sand 10.0
														2,594.6 ALLUVIAL 10.0
														2,591.5 Soft, gray, SILT (A-5)(9), micaceous 13.0
														2,586.5 Very loose, gray, f silty SAND (A-2-4), micaceous 18.0
														2,581.5 Soft, gray, f sandy SILT (A-4), micaceous 18.0
														2,576.5 RESIDUAL 23.0
														2,571.5 Very stiff, brown and orange, f sandy SILT (A-4), micaceous, saprolitic 23.0
														2,573.4 ALLUVIAL 22.0
														2,573.4 Very loose to loose, gray, SAND (A-3), micaceous 22.0
														2,573.4 Soft to medium stiff, gray, sandy SILT (A-4), contains trace wood fragments, micaceous, organic odor 27.0
														2,566.5 WEATHERED ROCK 30.0
														2,561.5 Brown, orange, and white, GNEISS 30.0
														2,558.4 RESIDUAL 42.0
														2,558.4 Hard, tan and brown, sandy CLAY (A-7), contains trace rock fragments, micaceous, saprolitic 42.0
														2,551.5 WEATHERED ROCK 48.9
														2,551.5 Brown, GNEISS, micaceous 48.9
														2,546.5 WEATHERED ROCK 53.9
														2,541.5 Brown, GNEISS, micaceous 58.9
														2,540.0 Boring Terminated at Elevation 2,540.0 ft in Weathered Rock (GNEISS) 60.4

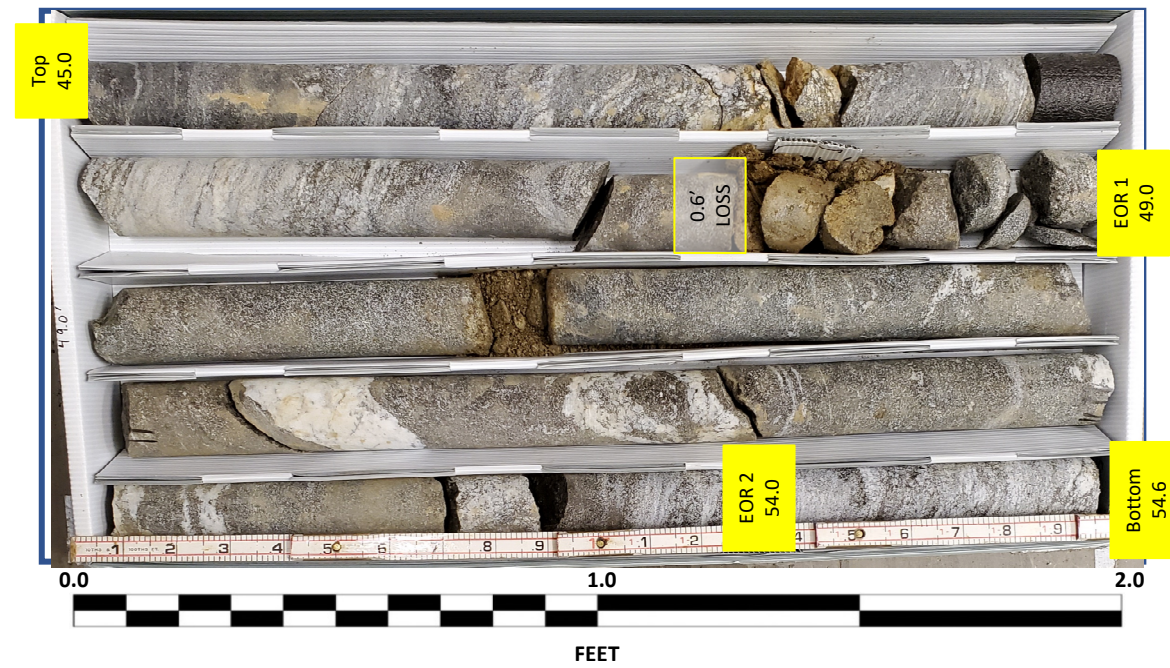
NCDOT BORE DOUBLE B3186_GEO_SITE 2.GPJ NC_DOT.GDT 11/23/21

CORE PHOTOGRAPHIC RECORD

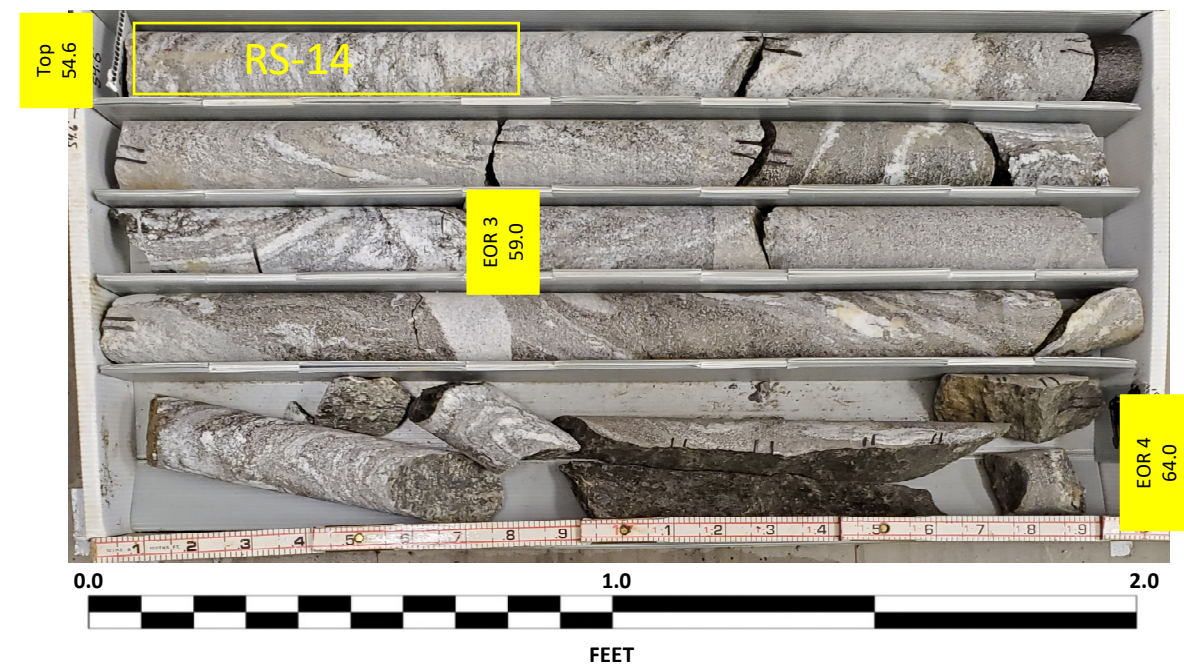
38330.1.FS1 (B-3186/B-5898)

US 23/ US 74 Great Smokey Mountain Highway

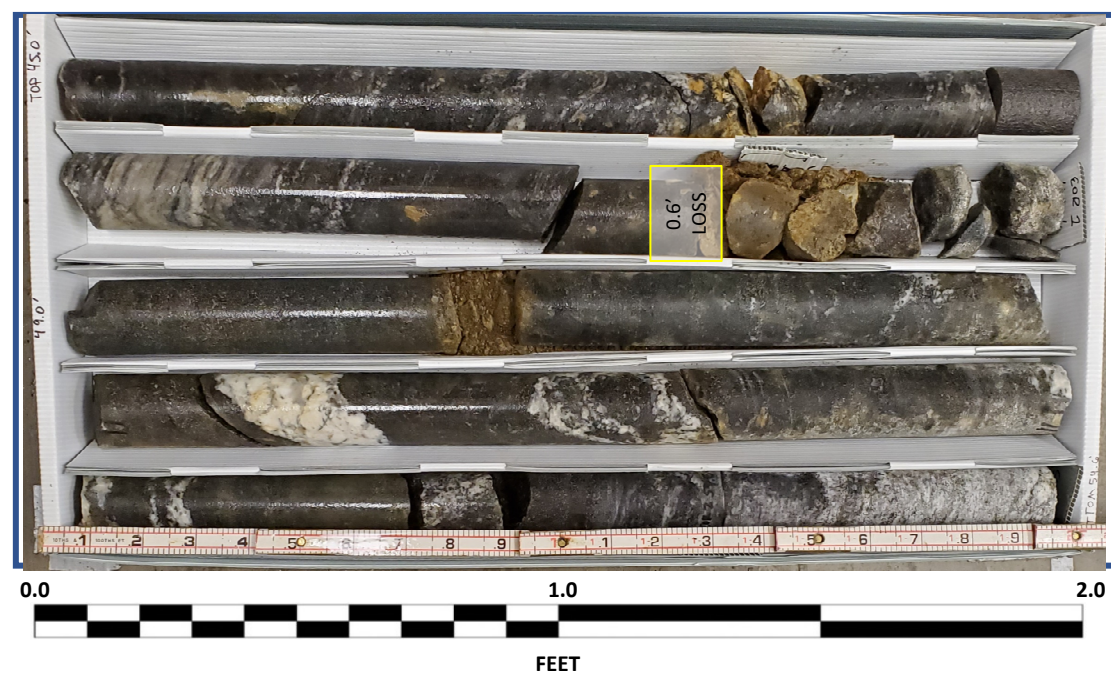
S2_B1-A
Box 1 of 3: 45.0 – 54.6 FEET
DRY



S2_B1-A
Box 2 of 3: 54.6 – 64.0 FEET
DRY



S2_B1-A
Box 1 of 3: 45.0 – 54.6 FEET
WET

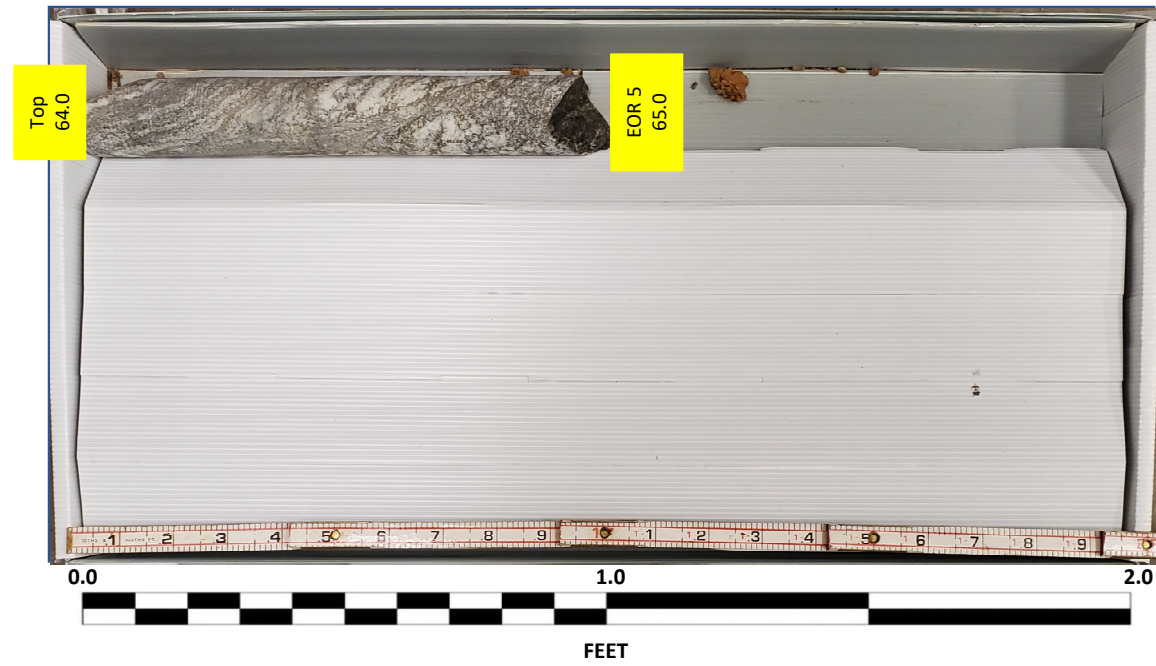


S2_B1-A
Box 2 of 3: 54.6 – 64.0 FEET
WET

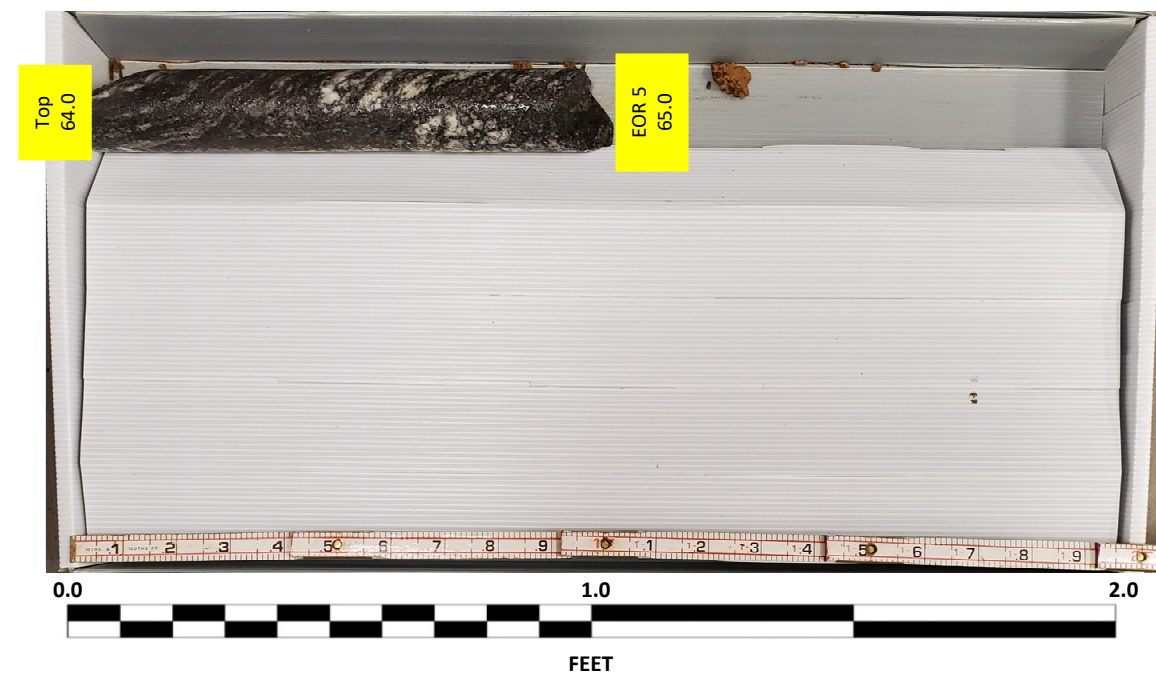


CORE PHOTOGRAPHIC RECORD
38330.1.FS1 (B-3186/B-5898)
US 23/ US 74 Great Smokey Mountain Highway

S2_B1-A
Box 3 of 3: 64.0 – 65.0 FEET
DRY



S2_B1-A
Box 3 of 3: 64.0 – 65.0 FEET
WET



GEOTECHNICAL BORING REPORT BORE LOG

GEOTECHNICAL BORING REPORT CORE LOG

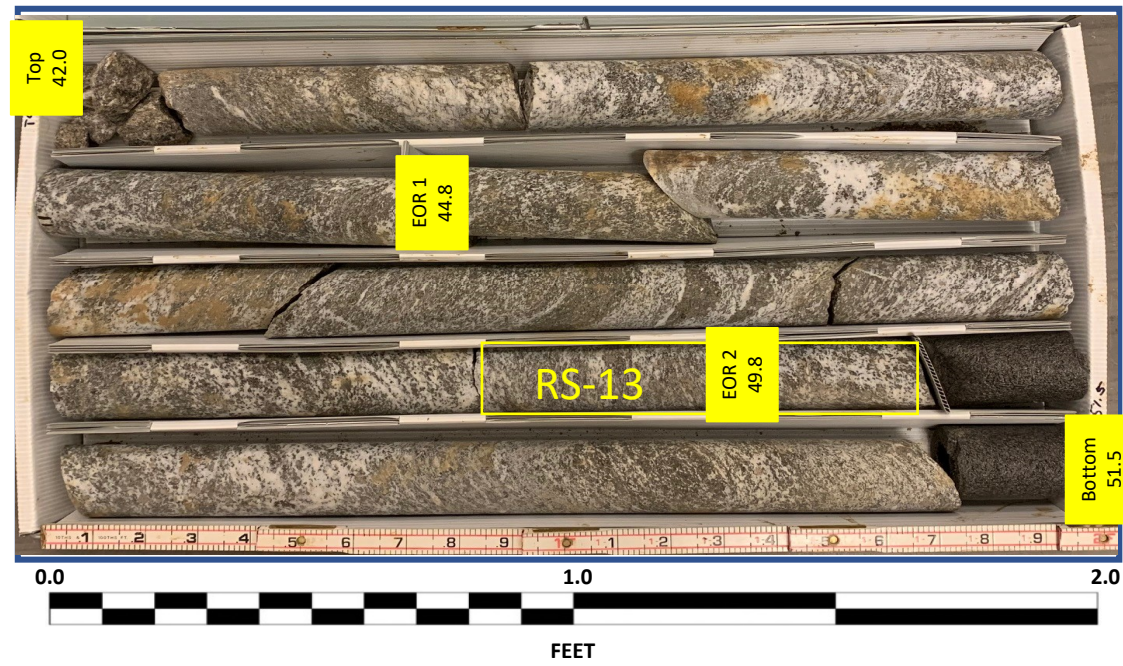
WBS 38332.1.FS1		TIP B-3186 / B-5898		COUNTY HAYWOOD		GEOLOGIST R. Dugger									
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)							GROUND WTR (ft)								
BORING NO. S2_B1-B		STATION 27+53		OFFSET 33 ft RT		ALIGNMENT -Y1RT-									
COLLAR ELEV. 2,584.7 ft		TOTAL DEPTH 62.8 ft		NORTHING 666,908		EASTING 819,403									
DRILL RIGHAMMER EFF./DATE GTC9083 CME-550X 80%(11/24/2020)		DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic											
DRILLER L. Wanstrath		START DATE 02/10/21		COMP. DATE 02/27/21		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					
2585	2,584.7	0.0	2	4	5								2,584.7	GROUND SURFACE	0.0
	2,582.2	2.5	7	12	11								2,582.7	ROADWAY EMBANKMENT Stiff, brown and orange, clayey SILT (A-5), micaceous	2.9
2580	2,579.7	5.0	18	18	16								2,580.2	Medium dense, brown, clayey SAND (A-2-6) with trace gravel	4.5
	2,577.2	7.5	4	4	4								2,577.7	Dense, brown and gray, silty SAND (A-2-4) with little gravel, micaceous	7.0
2575	2,574.7	10.0	2	2	3									ALLUVIAL Loose, brown and gray, silty SAND (A-2-4), micaceous	
2570	2,569.7	15.0	1	1	1								2,571.7	Very soft, gray, silty CLAY (A-7-5)(16) and SILT (A-5)(13), micaceous	13.0
	2,566.7	18.0									SS-222	62% 68%			
2565	2,564.7	20.0	WOH	WOH	1								2,563.6	Very loose, brown and gray, silty SAND (A-2-4)	21.1
2560	2,559.7	25.0	7	5	2								2,561.7	Very soft, brown and gray, CLAY (A-7-6)	23.0
	2,556.7	28.0											2,556.7	Loose, gray, SAND and GRAVEL (A-1-b)	28.0
2555	2,554.7	30.0	9	16	14									RESIDUAL Medium dense to dense, brown, white, and tan, silty SAND (A-2-4) with little rock fragments	30.0
2550	2,549.7	35.0	15	15	14								2,551.7	Very stiff, brown, orange, and tan, sandy SILT (A-4) with little rock fragments, micaceous, saprolitic	33.0
2545	2,544.7	40.0	100/0.5										2,544.7	WEATHERED ROCK	40.0
	2,542.2	42.5	60/0.0										2,542.7	Brown, gray, and white, GNEISS	42.0
2540														CRYSTALLINE ROCK No Recovery, begin rock coring at 42.0' Light to dark gray and white with trace pink, Migmatitic Biotite GNEISS	
2535															
2530															
2525													2,526.6	Grey and white, METAGRAYWACKE and QUARTZITE	58.1
													2,521.9	Boring Terminated at Elevation 2,521.9 ft in Crystalline Rock (METAGRAYWACKE and QUARTZITE)	62.8
<p style="text-align: center;">NOTES</p> <p>15.0- 17.0': ST-2 lab classified as (A-7-5)(16) in offset hole ~3' upstation 15.0 - 16.5': SS-222 lab classified as (A-5)(13)</p> <p>Other Samples: ST-2 (15.0 - 17.0)</p>															

WBS 38332.1.FS1		TIP B-3186 / B-5898		COUNTY HAYWOOD		GEOLOGIST R. Dugger						
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)							GROUND WTR (ft)					
BORING NO. S2_B1-B		STATION 27+53		OFFSET 33 ft RT		ALIGNMENT -Y1RT-						
COLLAR ELEV. 2,584.7 ft		TOTAL DEPTH 62.8 ft		NORTHING 666,908		EASTING 819,403						
DRILL RIGHAMMER EFF./DATE GTC9083 CME-550X 80%(11/24/2020)		DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic								
DRILLER L. Wanstrath		START DATE 02/10/21		COMP. DATE 02/27/21		SURFACE WATER DEPTH N/A						
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	TOTAL RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (%)	RQD (%)		REC. (%)	RQD (%)			
2542.7	2,542.7	42.0	2.8	0:36/0.8 1:43/1.0 2:21/1.0	(2.8)	(2.6)		(16.1)	(13.7)		Begin Coring @ 42.0 ft	
2540	2,539.9	44.8	5.0	1:41/1.0 1:30/1.0 1:39/1.0 1:29/1.0 2:20/1.0	(5.0)	(5.0)		100%	93%		CRYSTALLINE ROCK Light to dark grey and white with trace pink, Migmatitic Biotite GNEISS, with trace garnet porphyroblasts, slight to very slight weathering, hard, moderately close to close fracture spacing	42.0
2535	2,534.9	49.8	5.0	1:55/1.0 1:52/1.0 1:45/1.0 2:14/1.0 2:20/1.0	(5.0)	(2.8)	RS-13	100%	56%		RS-13 49.5' - 50.2' GSI= 75 - 85 Qu= 17,889 psi	
2530	2,529.9	54.8	5.0	1:44/1.0 2:04/1.0 2:22/1.0 2:38/1.0 2:46/1.0	(5.0)	(4.5)		100%	90%		Moderately severe to severe weathering, very close fracture spacing (80-90° joint), with trace epidote along fracture plane Very slight to slight weathering, wide fracture spacing	
2525	2,524.9	59.8	3.0	3:16/1.0 3:15/1.0 2:30/1.0	(3.0)	(2.4)		(4.5) 100%	(3.4) 76%		Grey and white, METAGRAYWACKE and QUARTZITE (eye fold), slight weathering, hard, close to moderately close fracture spacing, with few healed fractures (variable orientations), foliations oriented 55-65°	58.1
	2,521.9	62.8									Boring Terminated at Elevation 2,521.9 ft in Crystalline Rock (METAGRAYWACKE and QUARTZITE)	62.8
<p style="text-align: center;">NOTES</p> <p>15.0- 17.0': ST-2 lab classified as (A-7-5)(16) in offset hole ~3' upstation 15.0 - 16.5': SS-222 lab classified as (A-5)(13)</p> <p>Other Samples: ST-2 (15.0 - 17.0)</p>												

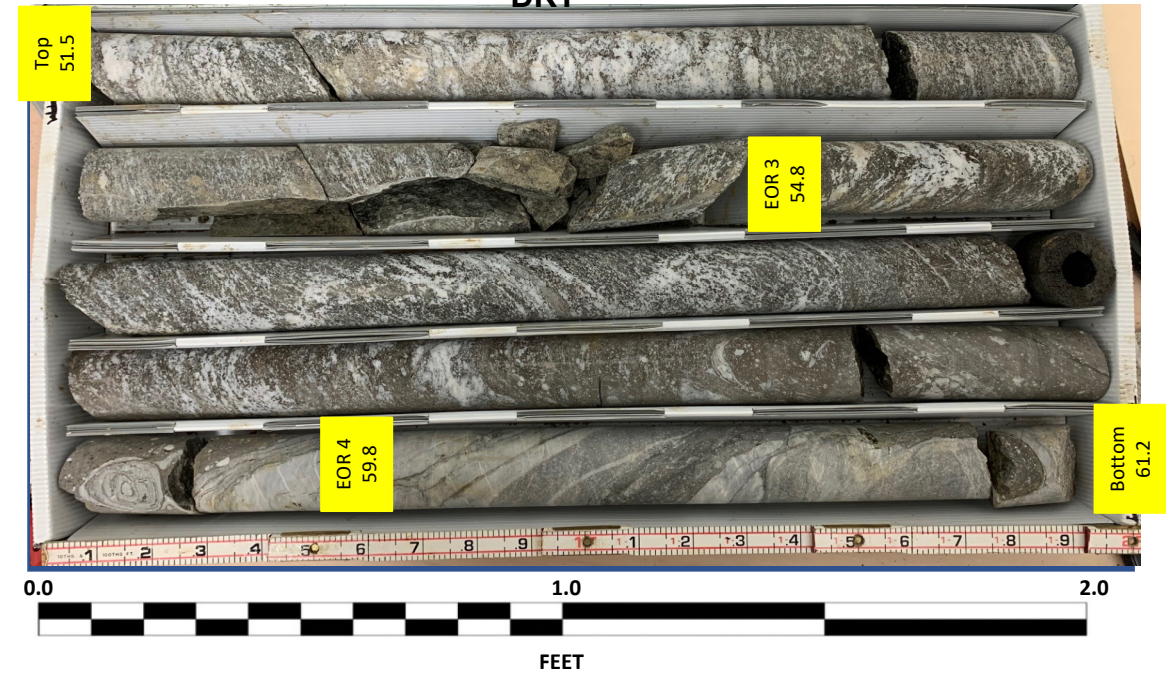
NCDOT BORE DOUBLE B3186_GEO_SITE 2.GPJ NC_DOT.GDT 11/23/21

CORE PHOTOGRAPHIC RECORD
38330.1.FS1 (B-3186/B-5898)
US 23/ US 74 Great Smokey Mountain Highway

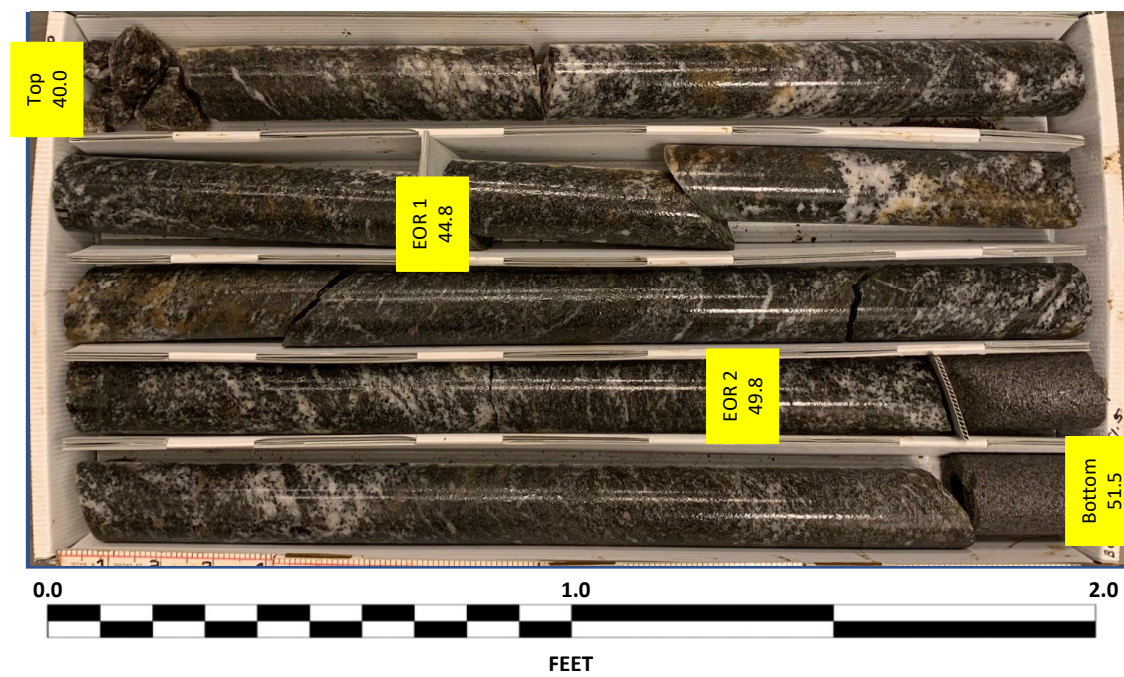
S2_B1-B
Box 1 of 3: 42.0 – 51.5 FEET
DRY



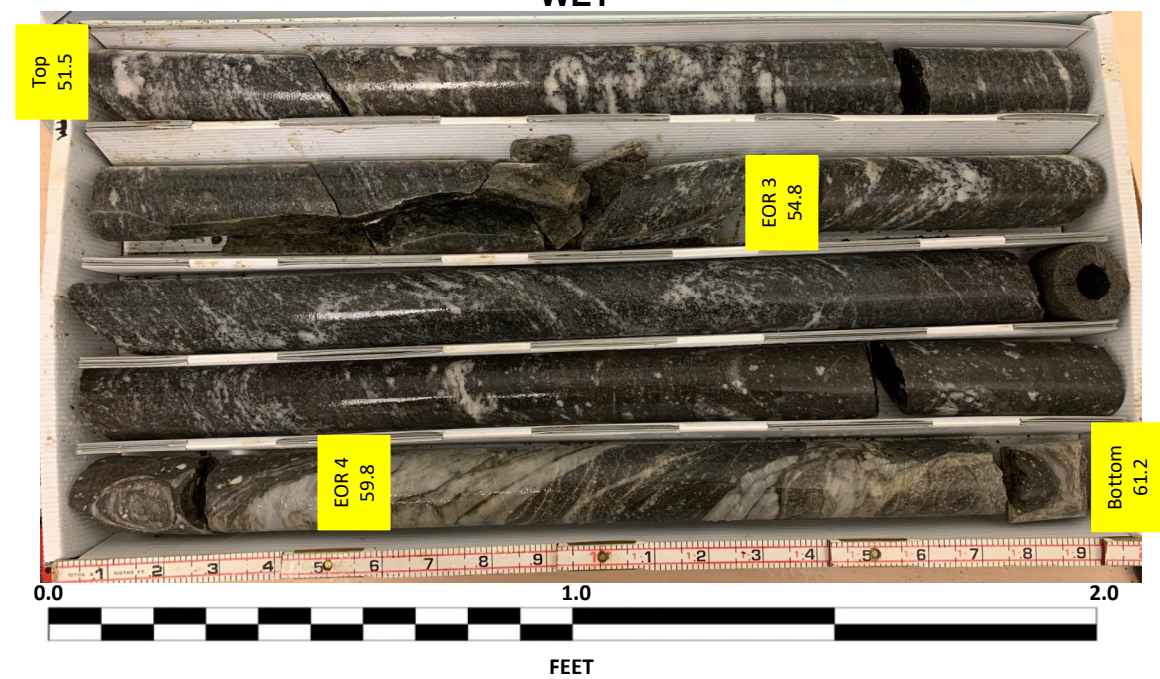
S2_B1-B
Box 2 of 3: 51.5 – 61.2 FEET
DRY



S2_B1-B
Box 1 of 3: 42.0 – 51.5 FEET
WET



S2_B1-B
Box 2 of 3: 51.5 – 61.2 FEET
WET

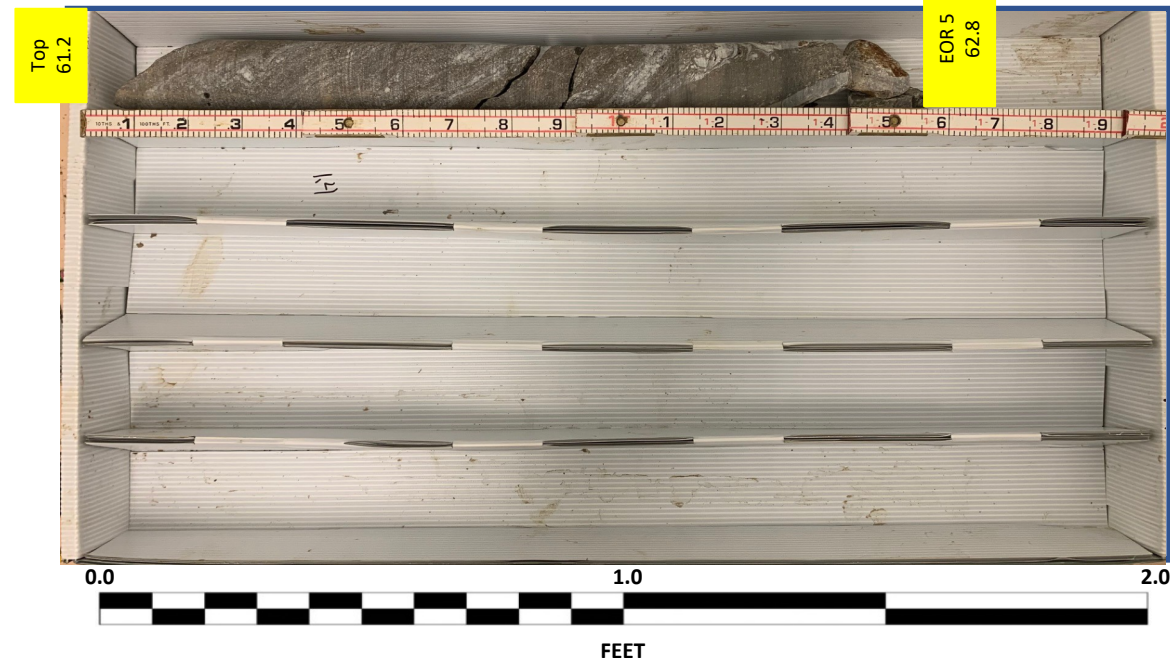


CORE PHOTOGRAPHIC RECORD

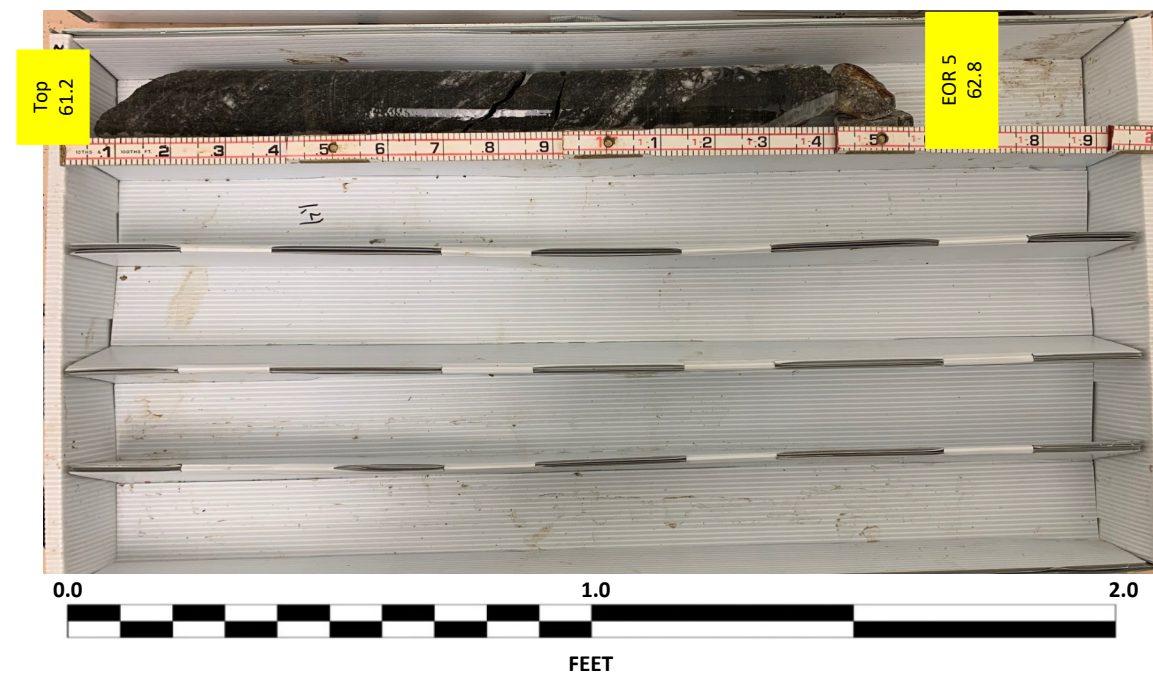
38330.1.FS1 (B-3186/B-5898)

US 23/ US 74 Great Smokey Mountain Highway

S2_B1-B
Box 3 of 3: 61.2 – 62.8 FEET
DRY



S2_B1-B
Box 3 of 3: 61.2 – 62.8 FEET
WET



GEOTECHNICAL BORING REPORT

BORE LOG

WBS 38332.1.FS1		TIP B-3186 / B-5898		COUNTY HAYWOOD		GEOLOGIST R. Dugger									
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)							GROUND WTR (ft)								
BORING NO. S2_EB2-A		STATION 29+30		OFFSET 14 ft LT		ALIGNMENT -Y1RT-									
COLLAR ELEV. 2,596.7 ft		TOTAL DEPTH 42.5 ft		NORTHING 667,001		EASTING 819,562									
DRILL RIGHAMMER EFF./DATE GTC9083 CME-550X 80%(11/24/2020)			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic									
DRILLER L. Wanstrath		START DATE 02/10/21		COMP. DATE 02/10/21		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
2600	2,596.7	0.0												2,596.7	0.0
2595	2,594.2	2.5	2	3	4								M	ROADWAY EMBANKMENT Loose, brown and orange, f-c silty SAND (A-2-4), with little gravel	4.5
2590	2,591.7	5.0	3	6	7								D	ALLUVIAL Stiff, brown and orange, SILT (A-4), micaceous	7.0
2585	2,586.7	10.0	4	4	6								D		10.0
2580	2,581.7	15.0	7	6	7								D	Medium stiff, brown and gray, f silty CLAY (A-7-6), micaceous	13.0
2575	2,576.7	20.0	3	3	2								M	Loose, brown and gray, f-c silty SAND (A-2-4), micaceous	18.0
2570	2,571.7	25.0	3	3	2								M	Soft to medium stiff, gray, CLAY (A-7-6), contains trace wood fragments, micaceous	23.0
2565	2,566.7	30.0	1	1	2								M		30.0
2560	2,561.7	35.0	1	2	2								M		35.0
2555	2,556.7	40.0	9	25	35								W	Very dense, gray, SAND and GRAVEL (A-1-b)	38.0
	2,554.2	42.5													42.5
Boring Terminated with Standard Penetration Test Refusal at Elevation 2,554.2 ft on Crystalline Rock (GNEISS). A.R. at a depth of 42.5'.															

WBS 38332.1.FS1		TIP B-3186 / B-5898		COUNTY HAYWOOD		GEOLOGIST R. Dugger									
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)							GROUND WTR (ft)								
BORING NO. S2_EB2-B		STATION 28+39		OFFSET 27 ft RT		ALIGNMENT -Y1RT-									
COLLAR ELEV. 2,592.2 ft		TOTAL DEPTH 63.0 ft		NORTHING 666,936		EASTING 819,486									
DRILL RIGHAMMER EFF./DATE GTC9083 CME-550X 80%(11/24/2020)			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic									
DRILLER L. Wanstrath		START DATE 02/09/21		COMP. DATE 02/09/21		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
2595	2,592.2	0.0												2,592.2	0.0
2590	2,589.7	2.5	12	10	6								D	GROUND SURFACE 0.6' PAVEMENT	0.6
2585	2,587.2	5.0	3	5	4								D	ROADWAY EMBANKMENT Medium dense, brown and orange, SAND and GRAVEL (A-1-b)	2.0
2580	2,584.7	7.5	3	5	6								D	ALLUVIAL Stiff, brown and orange, SILT (A-4), micaceous	7.0
2575	2,582.2	10.0	2	4	5								D	Stiff, brown and orange, clayey SILT (A-5) with little gravel, micaceous	9.5
2570	2,579.2	13.0	2	2	3								D	Medium stiff, brown, orange and white, SILT (A-4) with little gravel and sand, micaceous	13.0
2565	2,577.2	15.0	2	4	4								W	Loose, gray, SAND (A-3)	18.0
2560	2,572.2	20.0	1	2	2								SS-208	Soft, gray, CLAY (A-7-5)(29), micaceous	23.0
2555	2,569.2	25.0	1	2	3								W	Medium stiff, gray and brown, clayey SILT (A-5), micaceous	28.0
2550	2,567.2	30.0	2	2	3								W	Medium dense, brown and gray, SAND and GRAVEL (A-1-b)	33.0
2545	2,564.2	35.0	13	12	11								Sat.	RESIDUAL Very stiff to hard, brown, orange and tan, SILT (A-4) with little rock fragments, micaceous, saprolitic	38.0
2540	2,559.2	40.0	5	9	12								D		43.0
2535	2,557.2	45.0	11	10	11								D		48.0
2530	2,552.2	50.0	12	13	35								D		53.0
	2,547.2	55.0	37	48	52/0.4								D		58.0
	2,542.2	60.0											SS-214	WEATHERED ROCK Brown, orange, and gray, GNEISS	63.0
	2,537.2	65.0													68.0
	2,532.2	70.0													73.0
	2,529.2	75.0													78.0
	2,529.2	63.0													63.0
Boring Terminated by Auger Refusal at Elevation 2,529.2 ft on Crystalline Rock (GNEISS)															
NOTES ST-3 was classified as gray, sandy SILT (A-4) Other Samples: ST-3 (20.0 - 21.5)															

NCDOT BORE DOUBLE B3186_GEO_SITE 2.GPJ NC_DOT.GDT 11/23/21

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 38332.1.FS1		TIP B-3186 / B-5898		COUNTY HAYWOOD		GEOLOGIST N. Yacobi										
SITE DESCRIPTION Retaining Wall No. 2 from -L_RT- STA 51+63 to 53+56							GROUND WTR (ft)									
BORING NO. RW2_3		STATION 54+92		OFFSET 28 ft RT		ALIGNMENT -RW2-										
COLLAR ELEV. 2,598.0 ft		TOTAL DEPTH 40.0 ft		NORTHING 667,028		EASTING 819,591										
DRILL RIGHAMMER EFF./DATE GTC3277 CME-75 83%(09/15/2020)			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic										
DRILLER K. Boone		START DATE 02/10/21		COMP. DATE 02/10/21		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						
2600																
	2,597.2	0.8	9	12	6											
2595	2,594.5	3.5	5	5	5											
	2,592.0	6.0	5	6	7											
2590	2,589.5	8.5	7	6	7											
	2,586.0	12.0														
2585	2,584.5	13.5	4	4	5											
	2,579.5	18.5	2	1	2											
2580	2,574.5	23.5	1	1	2											
	2,569.5	28.5	1	1	1											
2575	2,564.5	33.5	0	4	5											
	2,559.5	38.5	0	3	5											
2560																

WBS 38332.1.FS1		TIP B-3186 / B-5898		COUNTY HAYWOOD		GEOLOGIST R. Dugger										
SITE DESCRIPTION Retaining Wall No. 3 from -Y1RT- STA 29+35 to 40+54							GROUND WTR (ft)									
BORING NO. RW3_1		STATION 29+84		OFFSET 7 ft LT		ALIGNMENT -RW3-										
COLLAR ELEV. 2,596.6 ft		TOTAL DEPTH 49.5 ft		NORTHING 666,986		EASTING 819,622										
DRILL RIGHAMMER EFF./DATE GTC9083 CME-550X 80%(11/24/2020)			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic										
DRILLER L. Wanstrath		START DATE 01/28/21		COMP. DATE 01/28/21		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						
2600																
	2,596.6	0.6	8	7	6											
2595	2,594.1	2.5	3	4	5											
	2,591.6	5.0	7	7	7											
2590	2,589.1	7.5	6	5	4											
	2,586.6	10.0	3	3	4											
2585	2,581.6	15.0	3	2	3											
	2,576.6	20.0	3	3	4											
2580	2,571.6	25.0	1	2	2											
	2,566.6	30.0	WOH	2	3											
2575	2,561.6	35.0	4	15	13											
	2,556.6	40.0	5	7	10											
2570	2,551.6	45.0	18	19	32											
	2,547.1	49.5	60/0.0													

NCDOT BORE DOUBLE B3186_GEO_RWAL_GPJ_NC_DOT.GDT 11/23/21



REPORT ON SAMPLES OF: Rock For Quality

PROJECT: B-3186 / B-5898
DATE SAMPLED: 05/11/2021
SAMPLED FROM: Test Borings
SUBMITTED BY: HDR

COUNTY: Haywood
RECEIVED: 5/11/2021
REPORTED: 5/12/2021
BY / CERT NO: Kevin E. Walker

BORING NO	SAMPLE NO	DEPTH (FT)	ROCK TYPE	LENGTH (IN)	DIAMETER (IN)	UNIT WEIGHT (PCF)	UNCONFINED COMPRESSIVE STRENGTH (PSI)
S2_B1-A	RS-13	49.5-50.2	Migmatitic Biotite Gneiss	4.20	1.86	177.20	17,889
S2_B1-B	RS-14	54.6-55.2	Migmatitic Biotite Gneiss	4.22	1.86	171.90	16,778