

REFERENCE: SF-910216

PROJECT: 17BP.5.R.79

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY WAKE
 PROJECT DESCRIPTION BRIDGE NO. 216 ON SR 2366
(OLD BATTLE BRIDGE ROAD) OVER BUFFALO
CREEK

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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	SF-910216	1	12

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.

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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

<u>S. WOODS, GIT</u>	<u>F&R DRILLING</u>
<u>C.T. TANG, PE</u>	<u>S. DAVIS</u>
<u>CAROLINA DRILLING</u>	<u>T. BENRD</u>
<u>G. EISTER</u>	
<u>T. POGGIE</u>	

INVESTIGATED BY S. WOODS, GIT
 DRAWN BY C.T. TANG, PE
 CHECKED BY D. BROWN, PE
 SUBMITTED BY C.T. TANG, PE
 DATE NOVEMBER 2019



STEWART

12/11/2019

NORTH CAROLINA
PROFESSIONAL
SEAL
047389
ENGINEER
CHIEN-TING TANG

Signed by:
Chien-Ting Tang
806B9478DA4C46E...

SIGNATURE _____ DATE _____

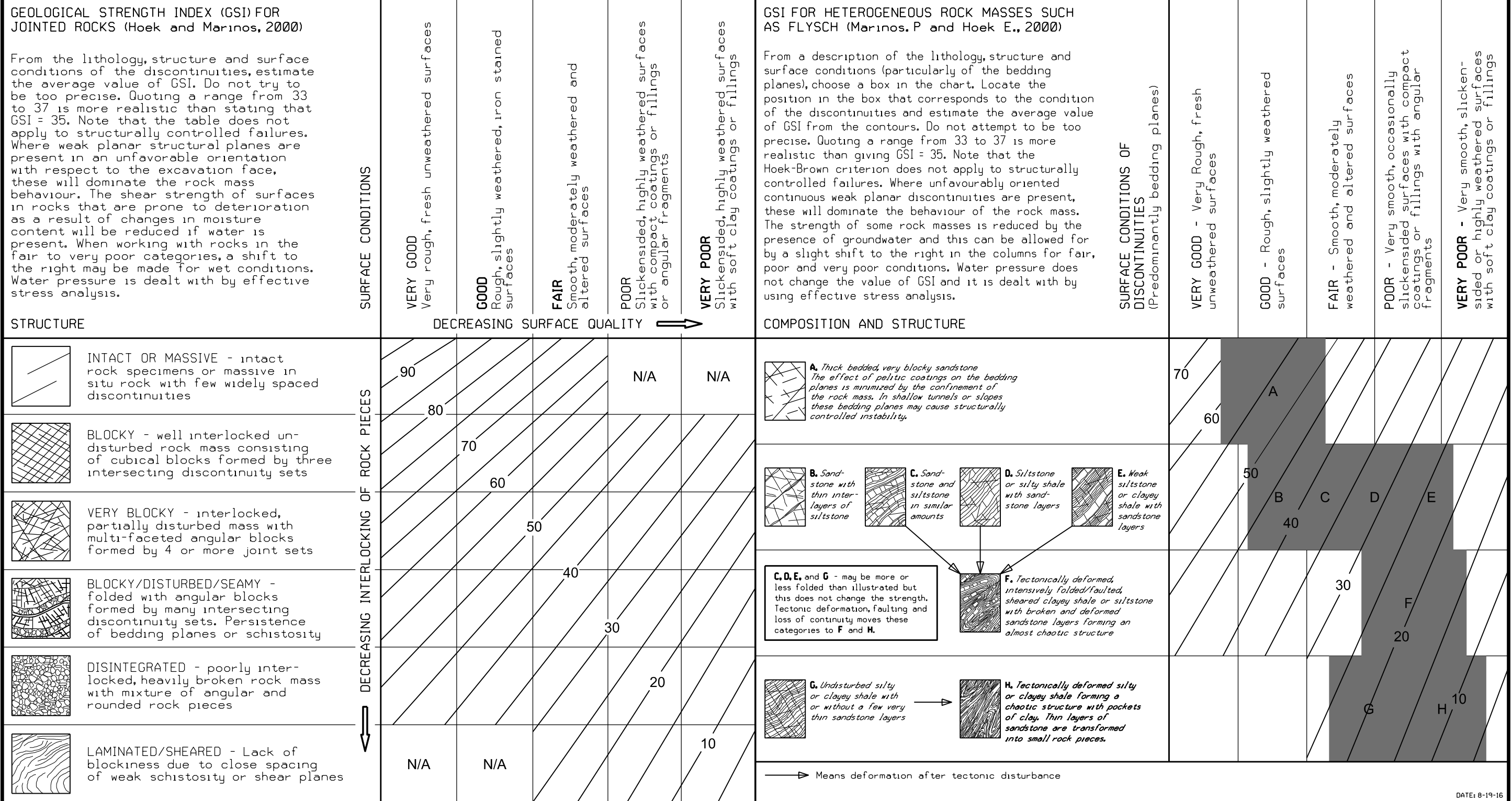
DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SUBSURFACE INVESTIGATION

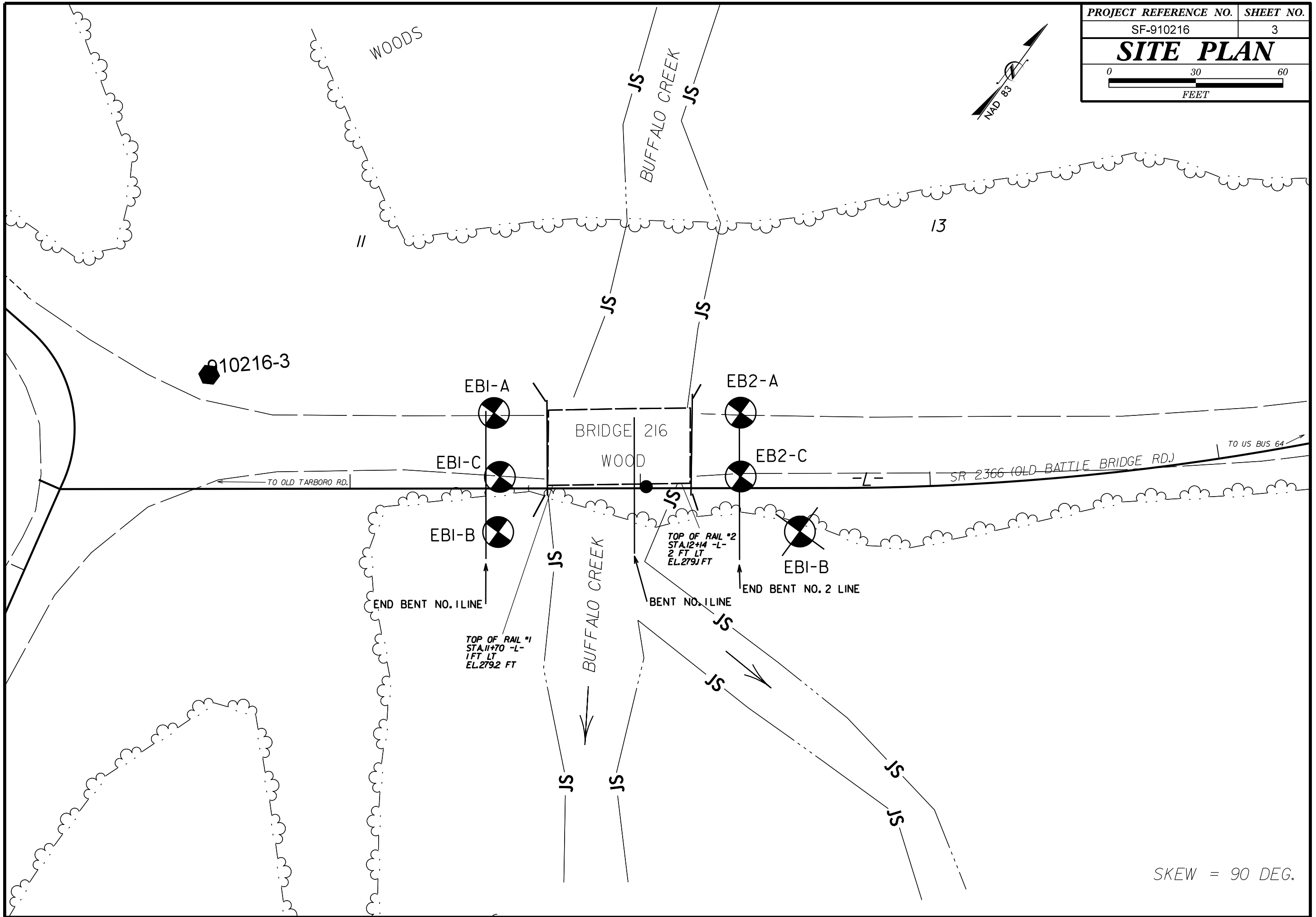
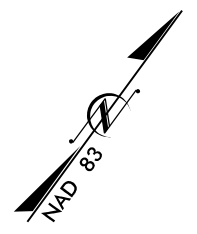
**SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES
 FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS**

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

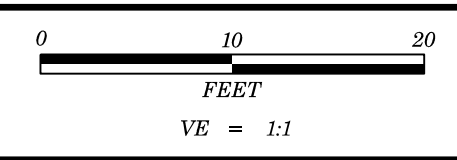
AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)



PROJECT REFERENCE NO.	SHEET NO.
SF-910216	3
SITE PLAN	
 0 30 60 FEET	

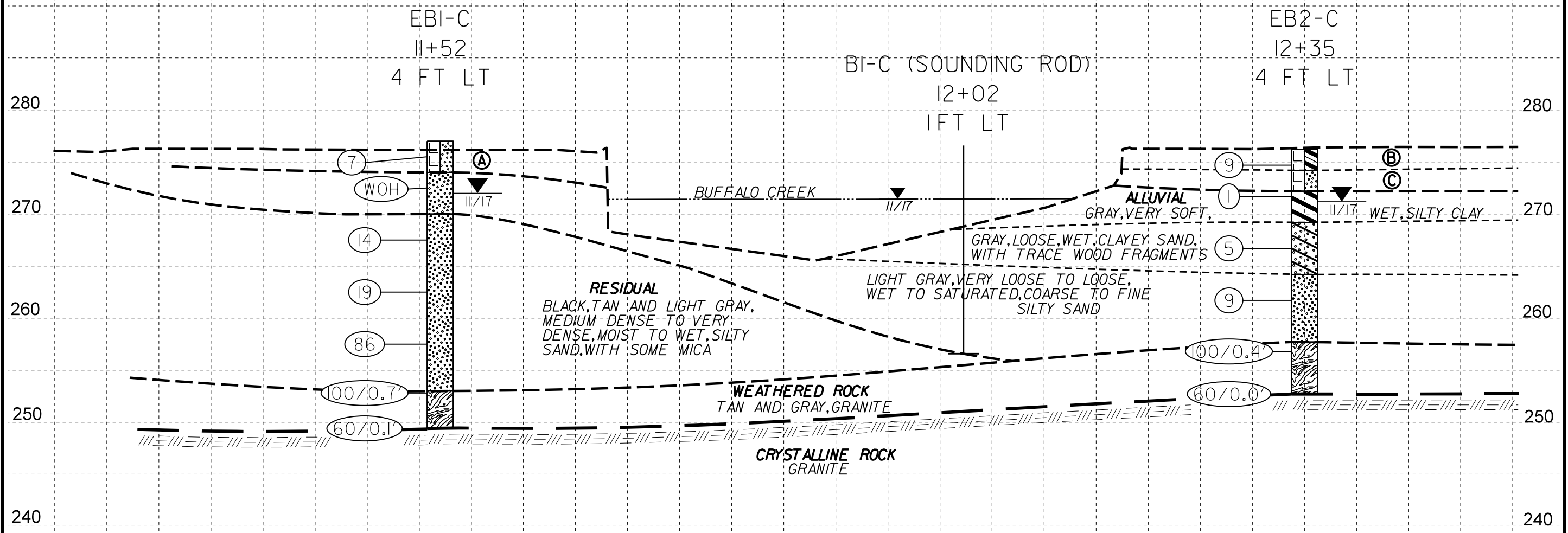


SKEW = 90 DEG.



PROJECT REFERENCE NO.	SHEET NO.
SF-910216	4
PROFILE ALONG -L- CENTERLINE	

- Ⓐ ROADWAY EMBANKMENT BROWN, LOOSE, MOIST, SILTY SAND
- Ⓑ ROADWAY EMBANKMENT BROWN, STIFF, MOIST, SANDY CLAY
- Ⓒ ROADWAY EMBANKMENT BROWN, LOOSE, MOIST TO WET, SILTY SAND



NOTE: EXISTING GROUND SURFACE SHOWN WAS TAKEN FROM ELECTRONIC TIN FILE (DATED DECEMBER 2016). INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE -L- PROFILE.

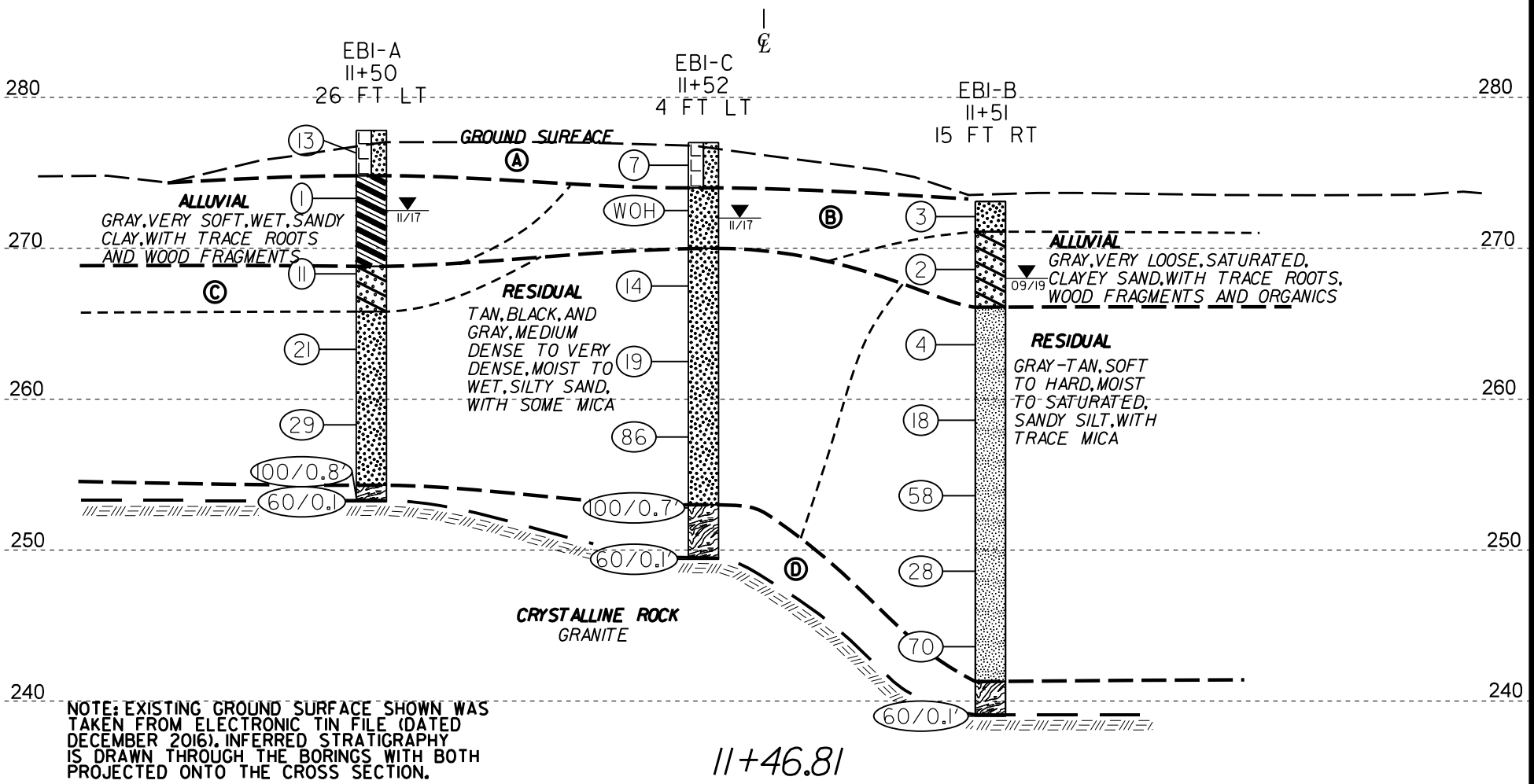
HORIZ. SCALE
(FEET)



VE = 1:1

CROSS SECTION AT END BENT NO. 1

- (A) ROADWAY EMBANKMENT BROWN, LOOSE TO MEDIUM DENSE, MOIST, SILTY SAND
- (B) ALLUVIAL GRAY AND BROWN, VERY LOOSE, MOIST TO SATURATED, SILTY SAND, WITH TRACE ROOTS
- (C) RESIDUAL BLACK AND LIGHT GRAY, MEDIUM DENSE, MOIST, CLAYEY SAND
- (D) WEATHERED ROCK TAN AND GRAY, GRANITE



11+46.81
-L-

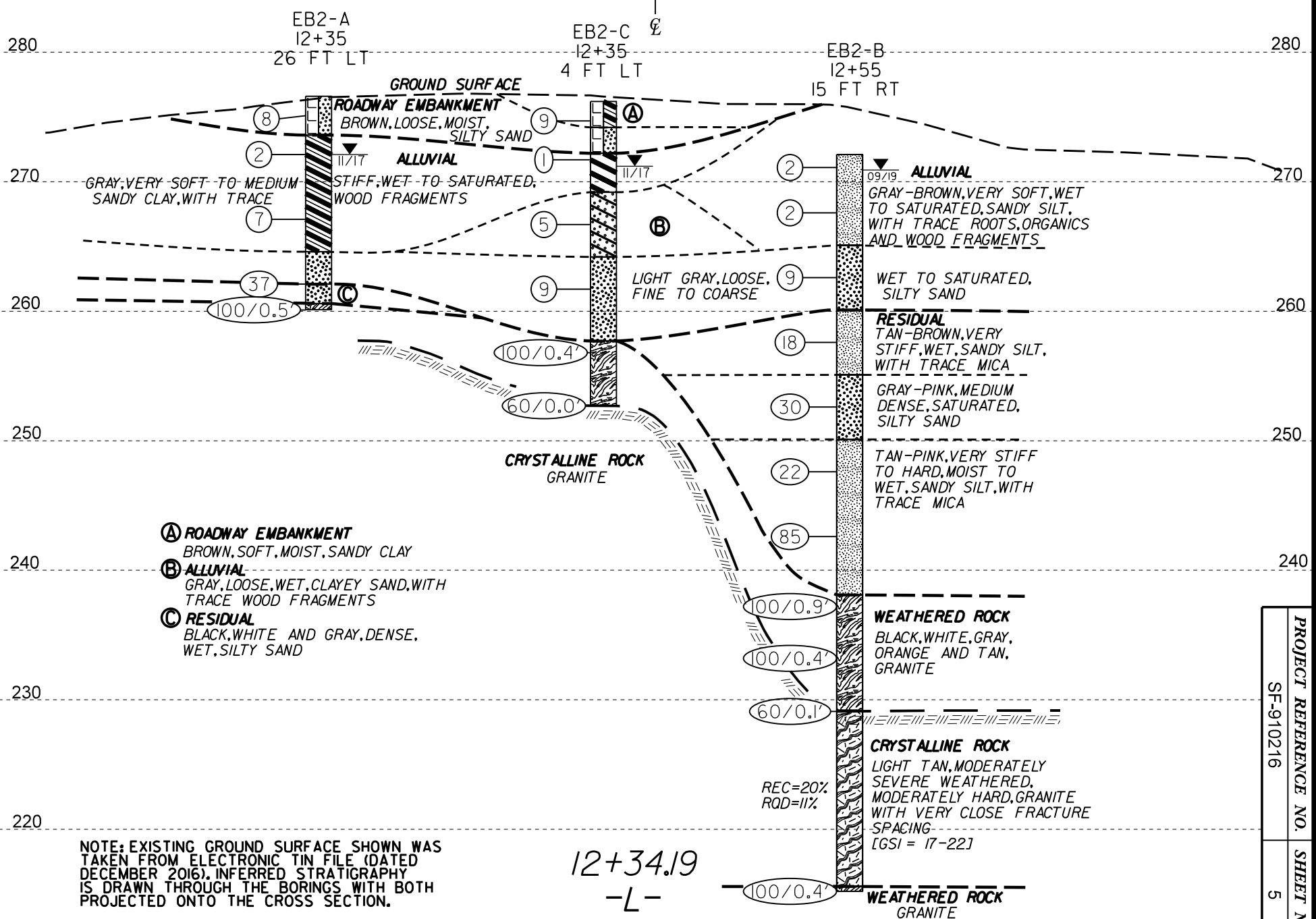
HORIZ. SCALE
(FEET)



VE = 1:1

CROSS SECTION AT END BENT NO. 2

- (A) ROADWAY EMBANKMENT BROWN, SOFT, MOIST, SANDY CLAY
- (B) ALLUVIAL GRAY, LOOSE, WET, CLAYEY SAND, WITH TRACE WOOD FRAGMENTS
- (C) RESIDUAL BLACK, WHITE AND GRAY, DENSE, WET, SILTY SAND



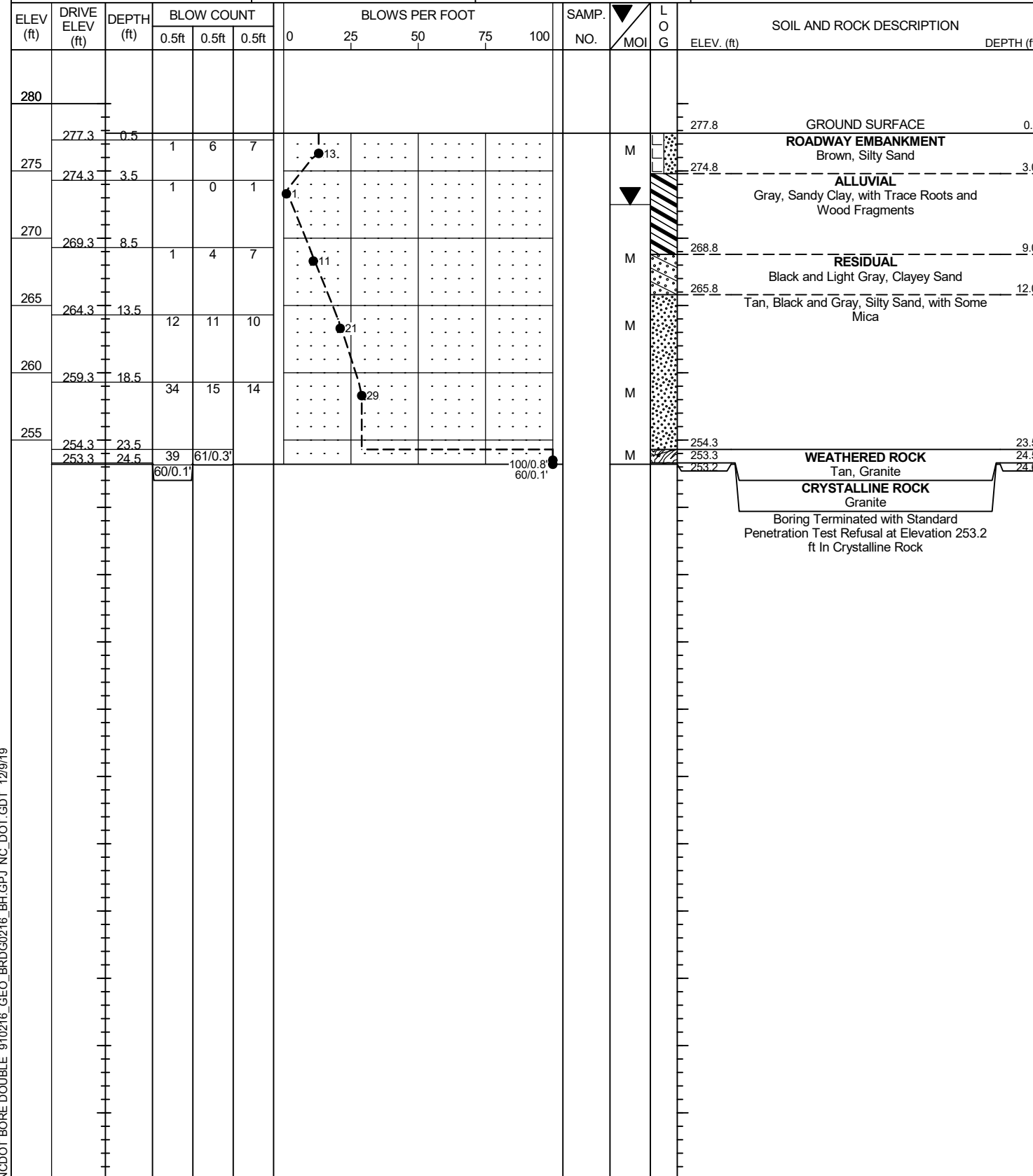
12+34.19
-L-

PROJECT REFERENCE NO.	SF-910216
SHEET NO.	5

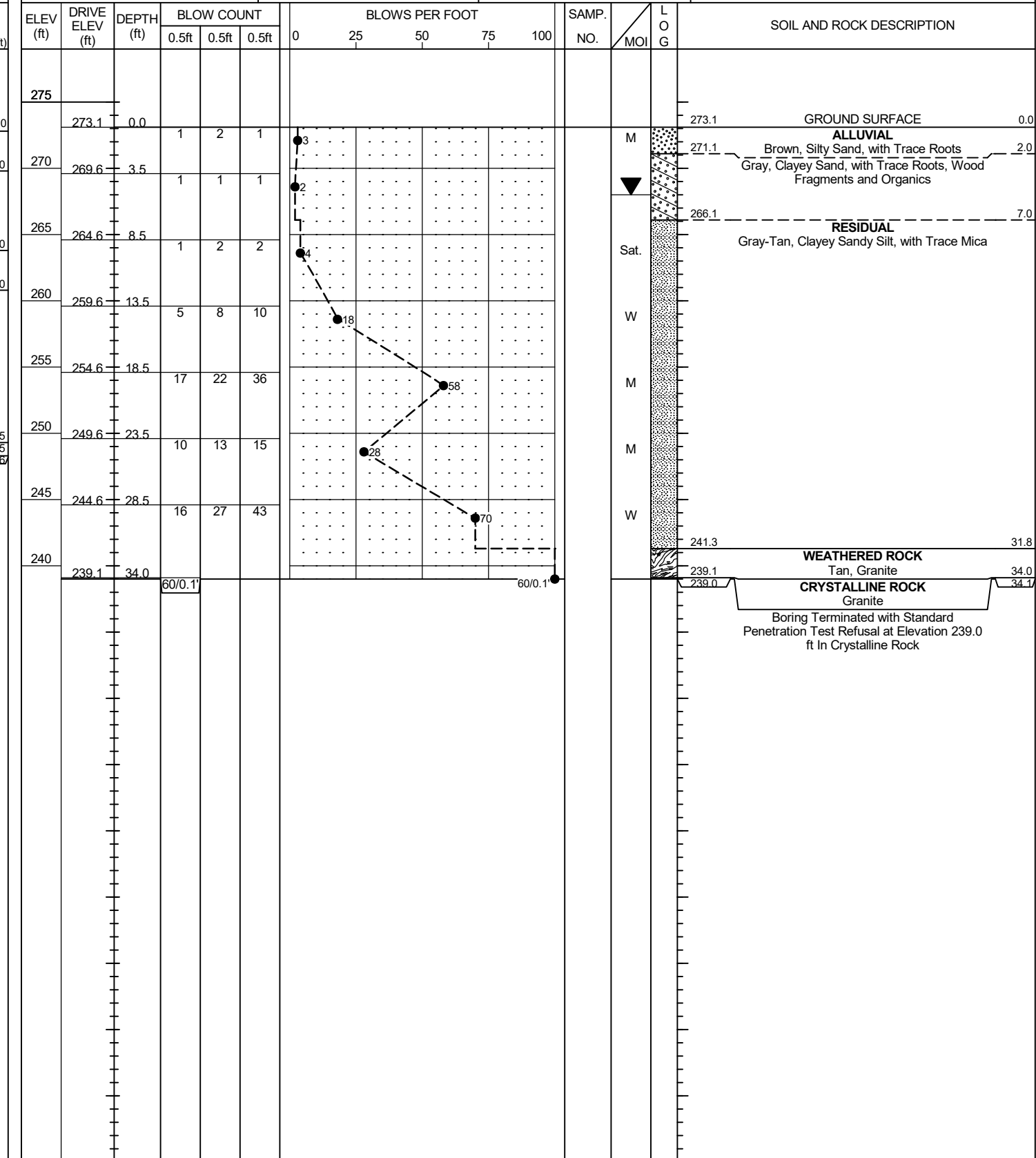
GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.5.R.79		TIP SF-910216		COUNTY WAKE		GEOLOGIST C.T. TANG	
SITE DESCRIPTION Bridge No. 216 on SR 2366 (Old Battle Bridge Road) over Buffalo Creek							GROUND WTR (ft)
BORING NO. EB1-A		STATION 11+50		OFFSET 26 ft LT		ALIGNMENT -L-	
COLLAR ELEV. 277.8 ft		TOTAL DEPTH 24.6 ft		NORTHING 746,234		EASTING 2,176,511	
DRILL RIG/HAMMER EFF./DATE BRI9103 BK-51 82% 02/23/2017			DRILL METHOD Mud Rotary			HAMMER TYPE Automatic	
DRILLER G. EISTER		START DATE 11/15/17		COMP. DATE 11/15/17		SURFACE WATER DEPTH N/A	



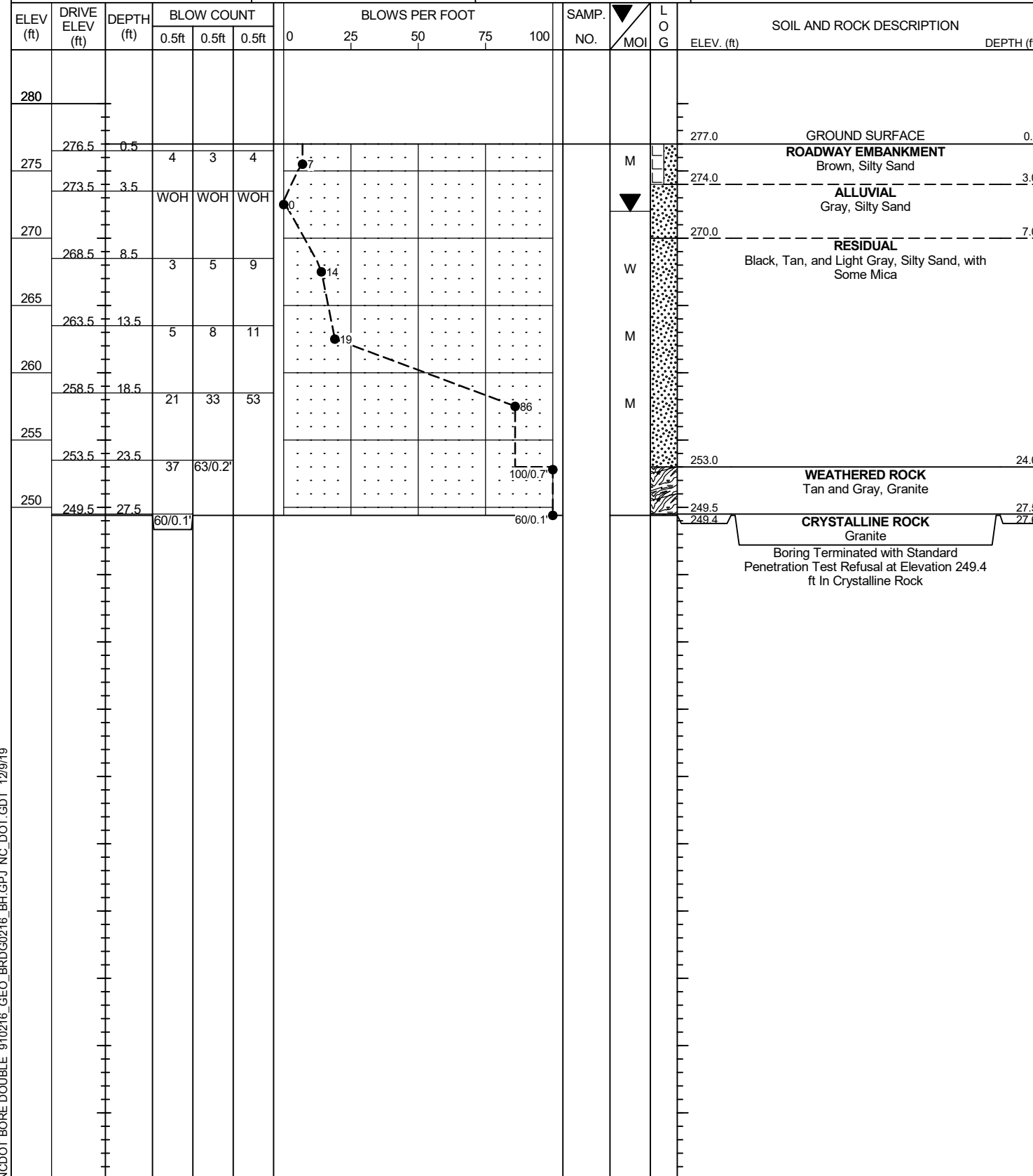
WBS 17BP.5.R.79		TIP SF-910216		COUNTY WAKE		GEOLOGIST S. Woods	
SITE DESCRIPTION Bridge No. 216 on SR 2366 (Old Battle Bridge Road) over Buffalo Creek							GROUND WTR (ft)
BORING NO. EB1-B		STATION 11+51		OFFSET 15 ft RT		ALIGNMENT -L-	
COLLAR ELEV. 273.1 ft		TOTAL DEPTH 34.1 ft		NORTHING 746,201		EASTING 2,176,535	
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 73% 03/01/2019			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic	
DRILLER S. DAVIS		START DATE 09/23/19		COMP. DATE 09/23/19		SURFACE WATER DEPTH N/A	



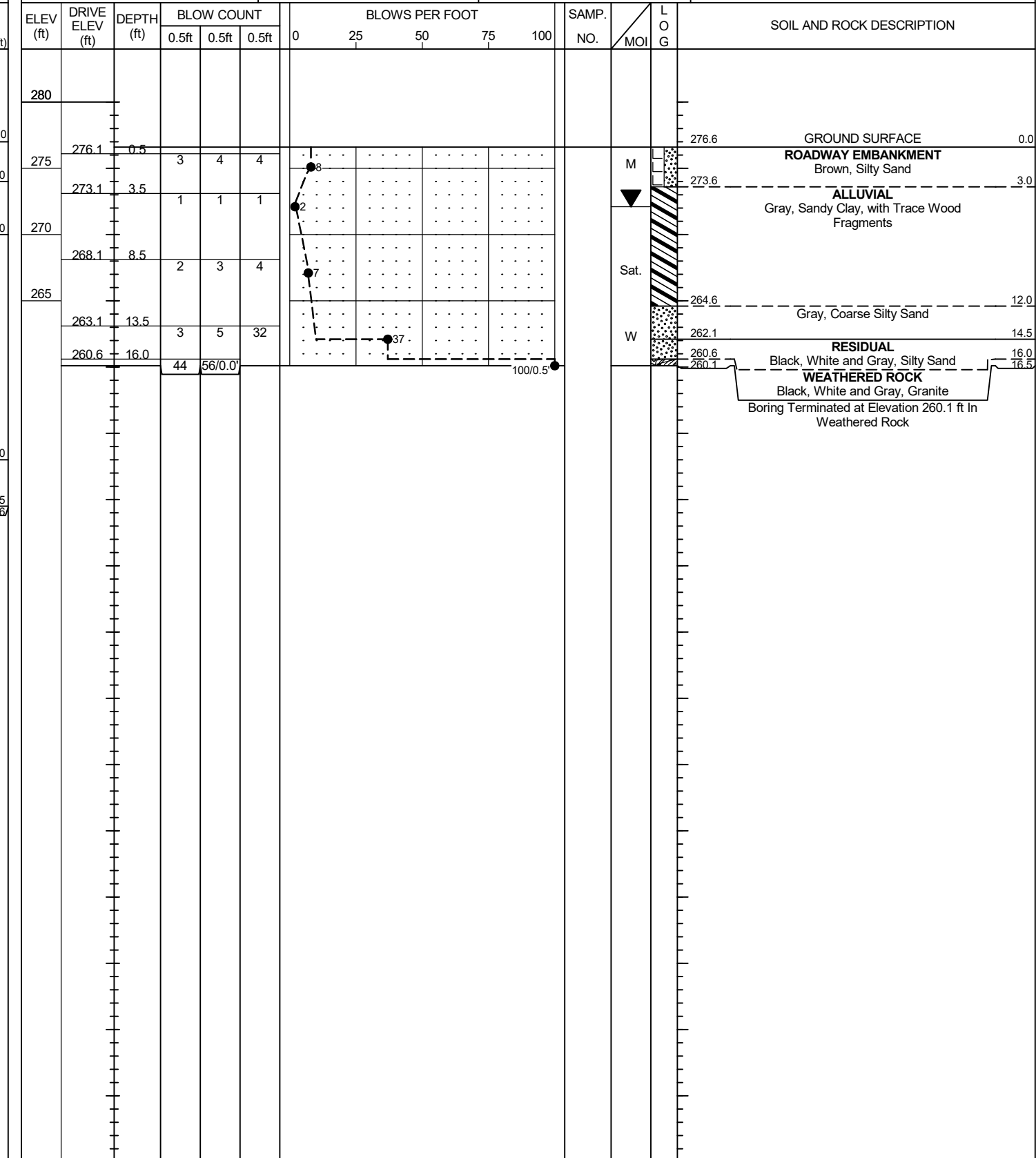
GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.5.R.79		TIP SF-910216		COUNTY WAKE		GEOLOGIST C.T. TANG	
SITE DESCRIPTION Bridge No. 216 on SR 2366 (Old Battle Bridge Road) over Buffalo Creek							GROUND WTR (ft)
BORING NO. EB1-C		STATION 11+52		OFFSET 4 ft LT		ALIGNMENT -L-	
COLLAR ELEV. 277.0 ft		TOTAL DEPTH 27.6 ft		NORTHING 746,214		EASTING 2,176,521	
DRILL RIG/HAMMER EFF./DATE BRI9103 BK-51 82% 02/23/2017			DRILL METHOD Mud Rotary			HAMMER TYPE Automatic	
DRILLER G. EISTER		START DATE 11/15/17		COMP. DATE 11/15/17		SURFACE WATER DEPTH N/A	



WBS 17BP.5.R.79		TIP SF-910216		COUNTY WAKE		GEOLOGIST C.T. TANG	
SITE DESCRIPTION Bridge No. 216 on SR 2366 (Old Battle Bridge Road) over Buffalo Creek							GROUND WTR (ft)
BORING NO. EB2-A		STATION 12+35		OFFSET 26 ft LT		ALIGNMENT -L-	
COLLAR ELEV. 276.6 ft		TOTAL DEPTH 16.5 ft		NORTHING 746,284		EASTING 2,176,579	
DRILL RIG/HAMMER EFF./DATE BRI9103 BK-51 82% 02/23/2017			DRILL METHOD Mud Rotary			HAMMER TYPE Automatic	
DRILLER G. EISTER		START DATE 11/16/17		COMP. DATE 11/16/17		SURFACE WATER DEPTH N/A	



GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.5.R.79		TIP SF-910216		COUNTY WAKE		GEOLOGIST S. Woods	
SITE DESCRIPTION Bridge No. 216 on SR 2366 (Old Battle Bridge Road) over Buffalo Creek						GROUND WTR (ft)	
BORING NO. EB2-B		STATION 12+55		OFFSET 15 ft RT		ALIGNMENT -L-	
COLLAR ELEV. 272.1 ft		TOTAL DEPTH 56.9 ft		NORTHING 746,262		EASTING 2,176,619	
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 73% 03/01/2019		DRILL METHOD H.S. Augers / Core		HAMMER TYPE Automatic			
DRILLER S. DAVIS		START DATE 09/23/19		COMP. DATE 09/24/19		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				
275														
272.1	272.1	0.0	1	1	1							W	GROUND SURFACE	0.0
270	268.6	3.5	1	1	1							Sat.	ALLUVIAL Gray-Brown, Sandy Silt, with Trace Roots, Organics and Wood Fragments	
265	263.6	8.5	4	4	5							Sat.	Gray, Silty Fine-Coarse Sand	7.0
260	258.6	13.5	6	8	10							W	RESIDUAL Tan-Brown, Sandy Silt, with Trace Mica	12.0
255	253.6	18.5	8	13	17							Sat.	Gray-Pink, Silty Sand	17.0
250	248.6	23.5	17	10	12							W	Tan-Pink, Sandy Silt, with Trace Mica	22.0
245	243.6	28.5	25	40	45							M		
240	238.6	33.5	39	60	40/0.4								WEATHERED ROCK Tan, Granite	34.0
235	233.6	38.5	100/0.4											
230	229.2	42.9	60/0.1										CRYSTALLINE ROCK Tan, Granite	42.9
225												RS-1	Light Tan, Moderately Severe Weathered, Moderately Hard, Granite with Very Close Fracture Spacing [GSI = 17-22] REC = 20% RQD = 11%	43.0
220	215.6	56.5	100/0.4										WEATHERED ROCK Tan, Granite	56.5
													Boring Terminated at Elevation 215.2 ft In Weathered Rock	56.9

WBS 17BP.5.R.79		TIP SF-910216		COUNTY WAKE		GEOLOGIST S. Woods	
SITE DESCRIPTION Bridge No. 216 on SR 2366 (Old Battle Bridge Road) over Buffalo Creek						GROUND WTR (ft)	
BORING NO. EB2-B		STATION 12+55		OFFSET 15 ft RT		ALIGNMENT -L-	
COLLAR ELEV. 272.1 ft		TOTAL DEPTH 56.9 ft		NORTHING 746,262		EASTING 2,176,619	
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 73% 03/01/2019		DRILL METHOD H.S. Augers / Core		HAMMER TYPE Automatic			
DRILLER S. DAVIS		START DATE 09/23/19		COMP. DATE 09/24/19		SURFACE WATER DEPTH N/A	

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	TOTAL RUN 13.5 ft		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %		
229.1	229.1	43.0	3.5	0:16/0.5 2:36/1.0 2:27/1.0 2:41/1.0	(1.8) 51%	(1.5) 43%		(2.7) 20%	(1.5) 11%		Begin Coring @ 43.0 ft
225	225.6	46.5	5.0	2:14/1.0 2:22/1.0 2:30/1.0 2:22/1.0 2:30/1.0	(0.5) 10%	(0.0) 0%	RS-1				Light Tan, Moderately Severe Weathered, Moderately Hard, Granite with Very Close Fracture Spacing [GSI = 17-22]
220	220.6	51.5	5.0	2:50/1.0 1:54/1.0 2:03/1.0 1:52/1.0 2:10/1.0	(0.4) 8%	(0.0) 0%					
	215.6	56.5		N=100/0.4							WEATHERED ROCK Tan, Granite Boring Terminated at Elevation 215.2 ft In Weathered Rock

NCDOT BORE DOUBLE 910216_GEO_BRD0216_BH.GPJ NC_DOT.GDT 12/11/19

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.5.R.79		TIP SF-910216		COUNTY WAKE		GEOLOGIST C.T. TANG										
SITE DESCRIPTION Bridge No. 216 on SR 2366 (Old Battle Bridge Road) over Buffalo Creek							GROUND WTR (ft)									
BORING NO. EB2-C		STATION 12+35		OFFSET 4 ft LT		ALIGNMENT -L-	0 HR. N/A									
COLLAR ELEV. 276.2 ft		TOTAL DEPTH 23.5 ft		NORTHING 746,266		EASTING 2,176,592	24 HR. 5.0									
DRILL RIG/HAMMER EFF./DATE BRI9103 BK-51 82% 02/23/2017				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic										
DRILLER G. EISTER		START DATE 11/15/17		COMP. DATE 11/15/17		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			ELEV. (ft)	DEPTH (ft)		
280																
275	275.7	0.5	1	3	6									276.2	GROUND SURFACE	0.0
														274.2	ROADWAY EMBANKMENT Brown, Sandy Clay	2.0
	272.7	3.5	1	0	1									272.2	ROADWAY EMBANKMENT Brown, Silty Sand	4.0
270														269.2	ALLUVIAL Gray, Silty Clay	7.0
	267.7	8.5	WOH	1	4										Gray, Clayey Sand, with Trace Wood Fragments	
265														264.2	Light Gray, Coarse Silty Sand	12.0
	262.7	13.5	2	2	7											
260																
	257.7	18.5	56	44/0.4'										257.7	WEATHERED ROCK Orange and Tan, Granite	18.5
255																
	252.7	23.5	60/0.0'											252.7	Boring Terminated with Standard Penetration Test Refusal at Elevation 252.7 ft on Crystalline Rock	23.5

NCDOT BORE DOUBLE 910216_GEO_BRDG0216_BH.GPJ NC_DOT.GDT 12/9/19

LAB TEST RESULTS



STEWART

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMEN

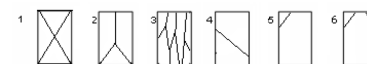
ASTM D7012

WBS No.: 17BP.5.R.79Test Date: 9/30/2019TIP No.: SF-910216Tested By: J. EvansCounty: WakeDescription: Bridge No. 216 on SR 2366 (Old Battle Bridge Road) over Buffalo Creek

Test No.	1			
Boring ID	EB2-B			
Station	12+55			
Sample ID	RS-1			
Sample Depth, ft	45.5			
Core Length #1, in.	3.896			
Core Length #2, in.	3.896			
Core Length #3, in.	3.896			
Avg. Core Length, in.	3.896			
Core Dia. #1, in.	1.770			
Core Dia. #2, in.	1.770			
Avg. Core Dia., in.	1.770			
Length/Dia. Ratio	2.20			
X-Sectional Area, in ²	2.46			
Weight, lb	0.869			
Unit Weight, pcf	156.65			
Break Type	2			
Load at Failure, lb	14,227			
Correction Factor	1.00			
Comp. Strength, psi	5,782			
Comp. Strength, ksf	833			

Rock Descriptions:

Test 1: Light Tan, Moderately Severe to Severe Weathered, Moderately Hard, Granite with Very Close Fracture Spacing

Break Types:

CORE PHOTOGRAPHS

BORING EB2-B
STA. 12+55 -L-, 15 FT RT
CORE DEPTH: 43.0 FT TO 56.5 FT

START OF CORING
RUN #1 43.0 FT

START OF CORING
RUN #2 46.5 FT

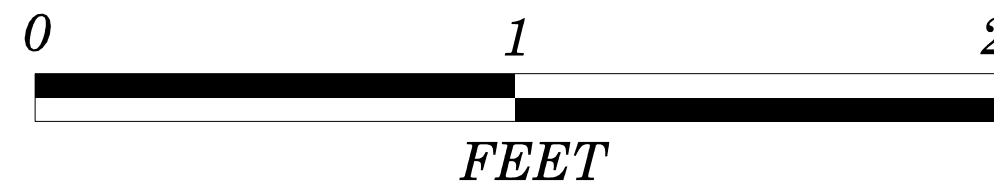
START OF CORING
RUN #3 51.5 FT



END OF CORING
RUN #1 46.5 FT

END OF CORING
RUN #2 51.5 FT

END OF CORING
RUN #3 56.5 FT



SITE PHOTOGRAPH

BRIDGE 216



PHOTOGRAPH NO. 1.: VIEW LOOKING WEST