

REFERENCE: SF-560151

PROJECT: 17BP.13.R.169

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-560151	1	9

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

**CONTENTS**

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
2A	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4	CROSS SECTIONS
5-8	BORE LOGS & CORE REPORTS
9	CORE PHOTOGRAPHS

COUNTY MADISON

PROJECT DESCRIPTION REPLACE BRIDGE #151  
ON SR 1330 (BAKER'S CREEK RD.)  
OVER SPILLCORN 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:
- 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.
  - 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

NCDOT - GEU

C.D. JOHNSON

D.O. CHEEK

C.J. COFFEY

INVESTIGATED BY DMM

DRAWN BY DMM

CHECKED BY JCK

SUBMITTED BY JCK

DATE 9/24/2019



DocuSigned by:  
D Matt Mullen 9/25/2019

18909BD3 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

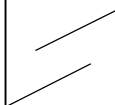
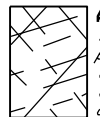
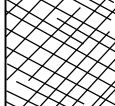
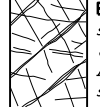



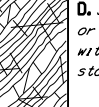

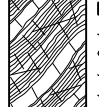


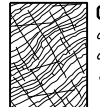

Table with 4 main columns: SOIL DESCRIPTION, GRADATION, ROCK DESCRIPTION, and TERMS AND DEFINITIONS. Includes sub-sections for SOIL LEGEND AND AASHTO CLASSIFICATION, MINERALOGICAL COMPOSITION, COMPRESSION, PERCENTAGE OF MATERIAL, GROUND WATER, MISCELLANEOUS SYMBOLS, RECOMMENDATION SYMBOLS, ABBREVIATIONS, SOIL MOISTURE - CORRELATION OF TERMS, PLASTICITY, COLOR, FRACTURE SPACING, BEDDING, and INDURATION.

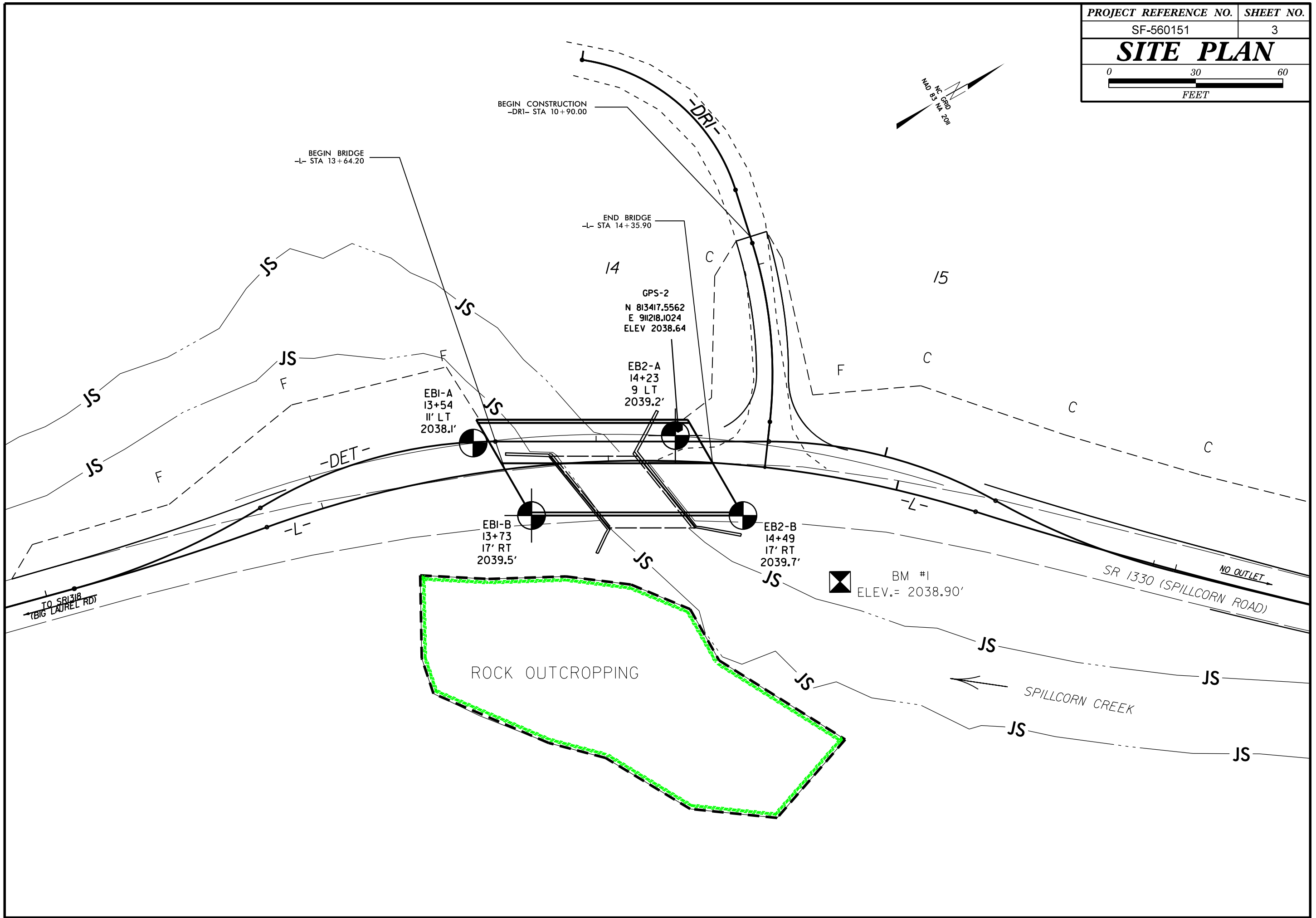
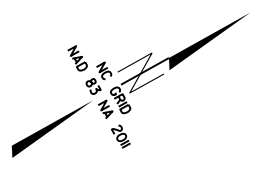
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**GEOTECHNICAL ENGINEERING UNIT**  
**SUBSURFACE INVESTIGATION**

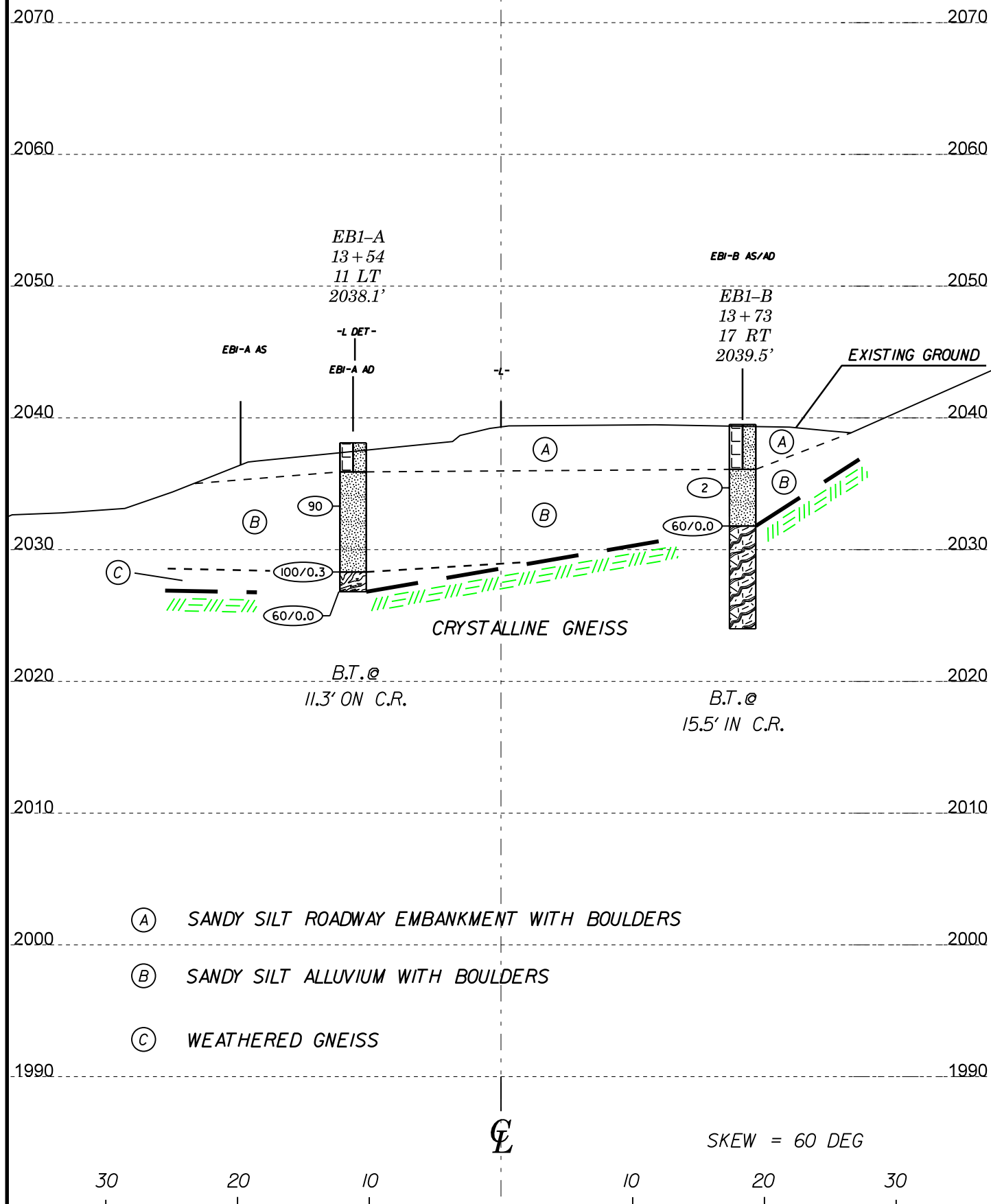
**SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES**  
**FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS**

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

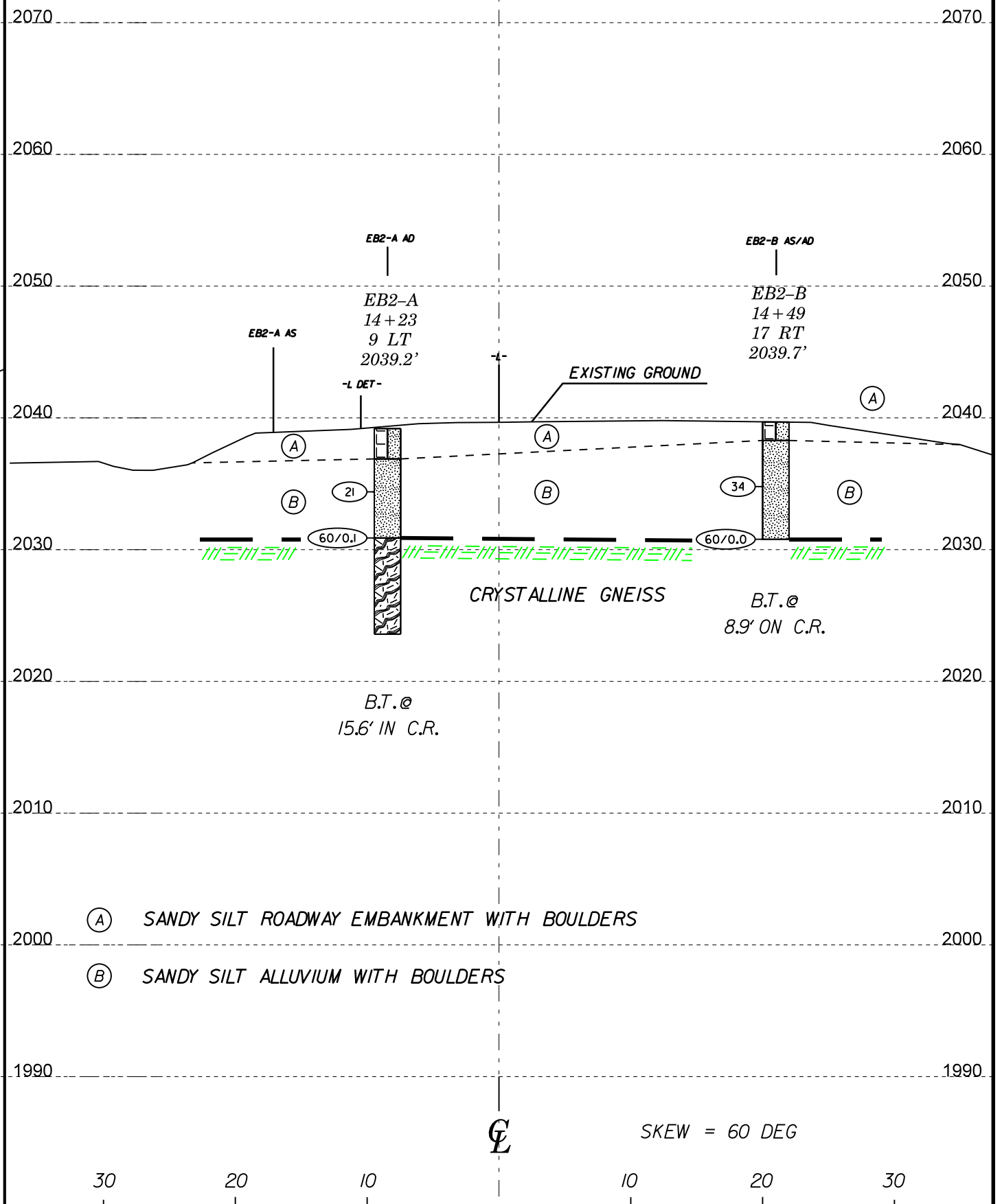
AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

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						
	<b>INTACT OR MASSIVE</b> - intact rock specimens or massive in situ rock with few widely spaced discontinuities	90			N/A	N/A	 <b>A. Thick bedded, very blocky sandstone</b> <i>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.</i>	70					
	<b>BLOCKY</b> - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets	80	70				 <b>B. Sandstone with thin inter-layers of siltstone</b>	60	50	40			
	<b>VERY BLOCKY</b> - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets		60	50			 <b>C. Sandstone and siltstone in similar amounts</b>		40	30			
	<b>BLOCKY/DISTURBED/SEAMY</b> - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity			40	30		 <b>D. Siltstone or silty shale with sandstone layers</b>			20			
	<b>DISINTEGRATED</b> - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces				20		 <b>E. Weak siltstone or clayey shale with sandstone layers</b>				10		
	<b>LAMINATED/SHEARED</b> - Lack of blockiness due to close spacing of weak schistosity or shear planes	N/A	N/A				 <b>F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</b>						
	<b>DECREASING INTERLOCKING OF ROCK PIECES</b> ↓						 <b>G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers</b>						
							 <b>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.</b>						
							→ Means deformation after tectonic disturbance						





HORIZ. SCALE 0 10 20 (FEET) VE = 1H:1V SECTION ALONG EBI



HORIZ. SCALE 0 10 20 (FEET) VE = 1H:1V SECTION ALONG EB2

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.13.R.169		TIP SF-560151		COUNTY MADISON		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION BRIDGE #151 ON SR-1330 (SPILLCORN RD.) OVER SPILLCORN CREEK							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 13+54		OFFSET 11 ft LT		ALIGNMENT L										
COLLAR ELEV. 2,038.1 ft		TOTAL DEPTH 11.3 ft		NORTHING 813,353		EASTING 911,188										
DRILL RIGHAMMER EFF./DATE AFC6744 CME - 45C 92%/07/31/2017				DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 09/12/19		COMP. DATE 09/12/19		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
2040														2,038.1	0.0	GROUND SURFACE
2035														2,035.9	2.2	ROADWAY EMBANKMENT BROWN, SND-SLT, ASPHALT/BOULDERS
2030	2,033.3	4.8	31	42	48											ALLUVIAL BROWN, SL MIC, SND-SLT, w/PEBS
	2,028.3	9.8	100/0.3											2,028.3	9.8	WEATHERED ROCK
	2,026.8	11.3	60/0.0											2,026.8	11.3	GREY, WEA GNEISS
																CRYSTALLINE ROCK GREY CRYSTALLINE ROCK (GNEISS) Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,026.8 ft ON ROCK (GNEISS)

NCDOT BORE DOUBLE SF560151\_GEO\_BRDG151\_MADISON\_BH.GPJ NC\_DOT.GDT 9/20/19

# GEOTECHNICAL BORING REPORT BORE LOG

# GEOTECHNICAL BORING REPORT CORE LOG

WBS 17BP.13.R.169		TIP SF-560151		COUNTY MADISON		GEOLOGIST Johnson, C. D.								
SITE DESCRIPTION BRIDGE #151 ON SR-1330 (SPILLCORN RD.) OVER SPILLCORN CREEK							GROUND WTR (ft)							
BORING NO. EB1-B		STATION 13+73		OFFSET 17 ft RT		ALIGNMENT L								
COLLAR ELEV. 2,039.5 ft		TOTAL DEPTH 15.5 ft		NORTHING 813,359		EASTING 911,220								
DRILL RIG/HAMMER EFF./DATE AFC6744 CME - 45C 92% 07/31/2017				DRILL METHOD NW Casing WSPT & Core		HAMMER TYPE Automatic								
DRILLER Cheek, D. O.		START DATE 09/10/19		COMP. DATE 09/10/19		SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
2040														2,039.5 GROUND SURFACE 0.0
														ROADWAY EMBANKMENT BROWN, SND-SLT, ASPHALT/BOULDERS 3.4
2035	2,034.7	4.8	1	1	1									2,036.1 ALLUVIAL BROWN, SL MIC, SND-SLT, w/PEBS 7.7
2030	2,031.8	7.7												2,031.8 CRYSTALLINE ROCK GREY-BROWN, WEA CRYSTALLINE ROCK (GNEISS) 7.7' - 11.5' GSI = 85-90 11.5' - 15.5' GSI = 50-60 7.7
2025														2,024.0 Boring Terminated at Elevation 2,024.0 ft IN ROCK (GNEISS) 15.5

WBS 17BP.13.R.169		TIP SF-560151		COUNTY MADISON		GEOLOGIST Johnson, C. D.	
SITE DESCRIPTION BRIDGE #151 ON SR-1330 (SPILLCORN RD.) OVER SPILLCORN CREEK							GROUND WTR (ft)
BORING NO. EB1-B		STATION 13+73		OFFSET 17 ft RT		ALIGNMENT L	
COLLAR ELEV. 2,039.5 ft		TOTAL DEPTH 15.5 ft		NORTHING 813,359		EASTING 911,220	
DRILL RIG/HAMMER EFF./DATE AFC6744 CME - 45C 92% 07/31/2017				DRILL METHOD NW Casing WSPT & Core		HAMMER TYPE Automatic	
DRILLER Cheek, D. O.		START DATE 09/10/19		COMP. DATE 09/10/19		SURFACE WATER DEPTH N/A	
CORE SIZE NXWL			TOTAL RUN 7.8 ft				
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RQD (ft) %	SAMP. NO.
2031.79	2,031.8	7.7	2.8	6:32/0.8 N=60/0.0	(2.4) 86%	(2.3) 82%	
2030	2,029.0	10.5	5.0	5:15/1.0 6:32/0.8 2:50/1.0	(5.0) 100%	(0.8) 16%	
2025	2,024.0	15.5		3:48/1.0 2:04/1.0 1:09/1.0 1:29/1.0 2:33/1.0			
DESCRIPTION AND REMARKS							LOG
Begin Coring @ 7.7 ft							
CRYSTALLINE ROCK							
7.7' - 11.5' GSI = 85-90							
11.5' - 15.5' GSI = 50-60							
Boring Terminated at Elevation 2,024.0 ft IN ROCK (GNEISS)							

# GEOTECHNICAL BORING REPORT BORE LOG

# GEOTECHNICAL BORING REPORT CORE LOG

WBS 17BP.13.R.169		TIP SF-560151		COUNTY MADISON		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION BRIDGE #151 ON SR-1330 (SPILLCORN RD.) OVER SPILLCORN CREEK							GROUND WTR (ft)									
BORING NO. EB2-A		STATION 14+23		OFFSET 9 ft LT		ALIGNMENT L										
COLLAR ELEV. 2,039.2 ft		TOTAL DEPTH 15.6 ft		NORTHING 813,415		EASTING 911,220										
DRILL RIGHAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017		DRILL METHOD NW Casing WSPT & Core		HAMMER TYPE Automatic												
DRILLER Cheek, D. O.		START DATE 09/12/19		COMP. DATE 09/12/19		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						
2040														2,039.2	GROUND SURFACE	0.0
														2,036.9	ROADWAY EMBANKMENT BROWN, SND-SLT, ASPHALT/BOULDERS	2.3
2035	2,034.4	4.8	4	7	14										ALLUVIAL BROWN-GREY, SND-SLT, w/PEBS	
2030	2,030.9	8.3	60/0.1												CRYSTALLINE ROCK GREY CRYSTALLINE ROCK (GNEISS)	8.3
2025															CRYSTALLINE ROCK GREY CRYSTALLINE ROCK (GNEISS)	
														2,023.6	Boring Terminated at Elevation 2,023.6 ft IN ROCK (GNEISS)	15.6

NCDOT BORE DOUBLE SF560151\_GEO\_BRDG151\_MADISON\_BH.GPJ NC\_DOT.GDT 9/20/19

WBS 17BP.13.R.169		TIP SF-560151		COUNTY MADISON		GEOLOGIST Johnson, C. D.						
SITE DESCRIPTION BRIDGE #151 ON SR-1330 (SPILLCORN RD.) OVER SPILLCORN CREEK							GROUND WTR (ft)					
BORING NO. EB2-A		STATION 14+23		OFFSET 9 ft LT		ALIGNMENT L						
COLLAR ELEV. 2,039.2 ft		TOTAL DEPTH 15.6 ft		NORTHING 813,415		EASTING 911,220						
DRILL RIGHAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017		DRILL METHOD NW Casing WSPT & Core		HAMMER TYPE Automatic								
DRILLER Cheek, D. O.		START DATE 09/12/19		COMP. DATE 09/12/19		SURFACE WATER DEPTH N/A						
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) %			
2030.86												
2030	2,030.9	8.3	2.3	0:43/0.3 N=60/0.1	(1.8)	(0.6)					Continued from previous page	
	2,028.6	10.6	5.0	0:43/0.3 1:50/1.0 2:17/1.0	78%	26%					CRYSTALLINE ROCK	8.3
					100%	66%					GSI = 65-70	
2025	2,023.6	15.6		3:31/1.0 1:51/1.0 1:47/1.0 1:36/1.0 2:38/1.0							Boring Terminated at Elevation 2,023.6 ft IN ROCK (GNEISS)	15.6

NCDOT CORE DOUBLE SF560151\_GEO\_BRDG151\_MADISON\_BH.GPJ NC\_DOT.GDT 9/20/19



# GEOTECHNICAL BORING REPORT

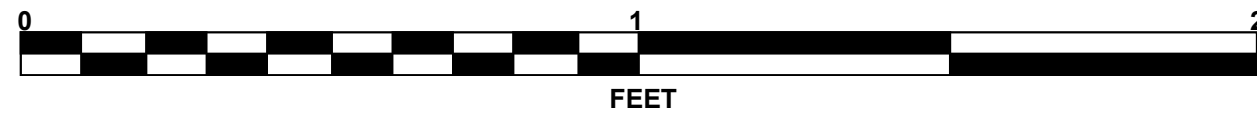
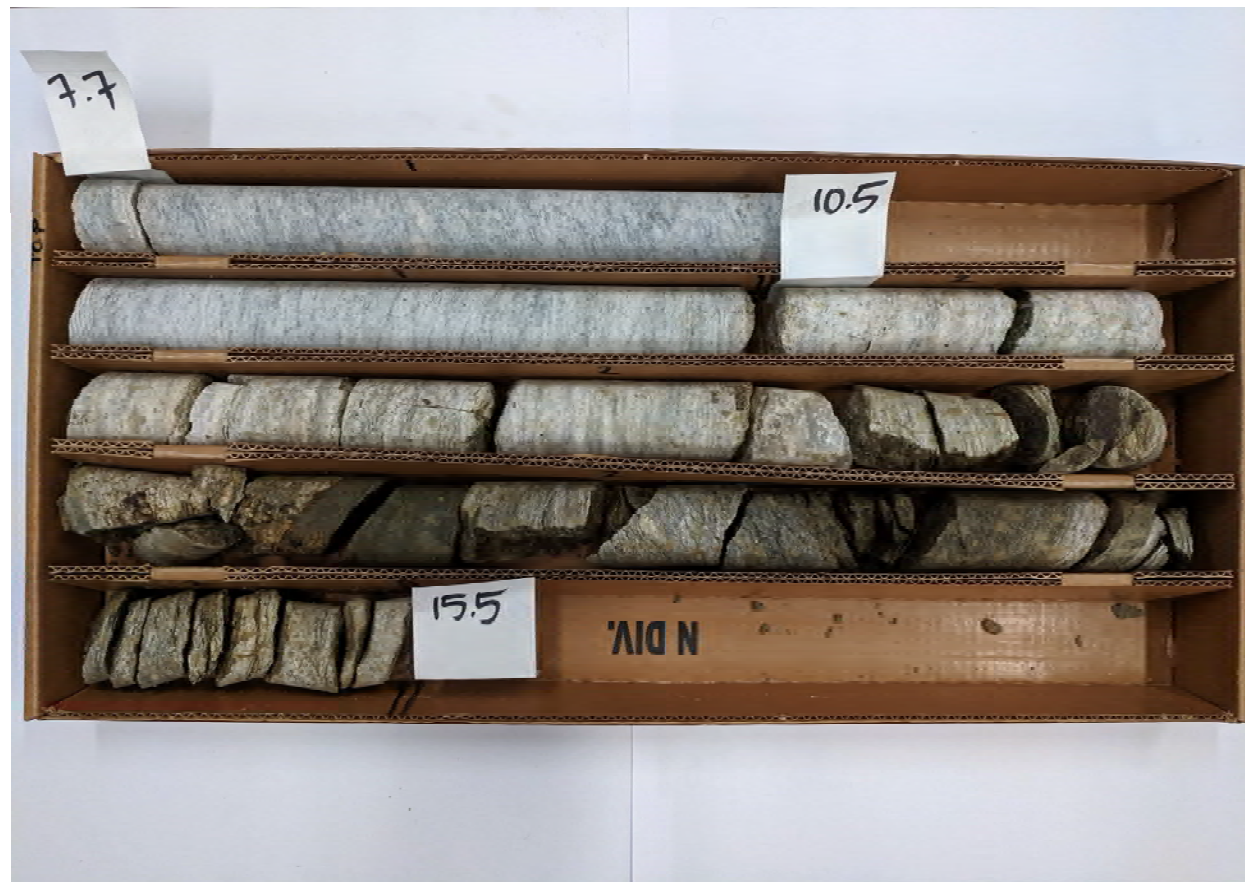
## BORE LOG

WBS 17BP.13.R.169		TIP SF-560151		COUNTY MADISON		GEOLOGIST Johnson, C. D.								
SITE DESCRIPTION BRIDGE #151 ON SR-1330 (SPILLCORN RD.) OVER SPILLCORN CREEK							GROUND WTR (ft)							
BORING NO. EB2-B		STATION 14+49		OFFSET 17 ft RT		ALIGNMENT L	0 HR. N/A							
COLLAR ELEV. 2,039.7 ft		TOTAL DEPTH 8.9 ft		NORTHING 813,422		EASTING 911,256	24 HR. Dry							
DRILL RIGHAMMER EFF./DATE AFC6744 CME - 45C 92% 07/31/2017				DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic								
DRILLER Cheek, D. O.		START DATE 09/10/19		COMP. DATE 09/10/19		SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
2040														2,039.7 GROUND SURFACE 0.0
														2,038.3 ROADWAY EMBANKMENT 1.4
														BROWN, SND-SLT, ASPHALT/BOULDERS
														ALLUVIAL
2035	2,034.8	4.9	1	2	32								M	BROWN, SL MIC, SND-SLT, w/PEBS
	2,030.8	8.9												2,030.8 8.9
														CRYSTALLINE ROCK
														GREY CRYSTALLINE ROCK (GNEISS)
														Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,030.8 ft ON ROCK (GNEISS)

# CORE PHOTOGRAPHS

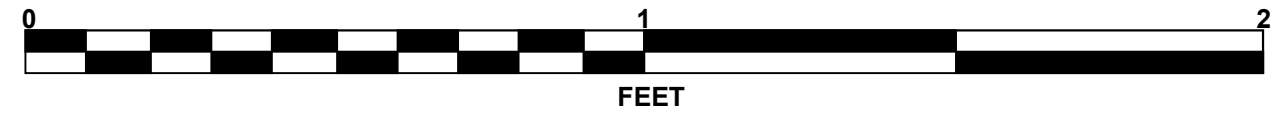
## EB1-B

BOX 1 OF 1: 7.7 - 15.5 FEET  
7.7' - 11.5' GSI = 85 - 90  
11.5' - 15.5' GSI = 50 - 60



## EB2-A

BOX 1 OF 1: 8.3 - 15.6 FEET  
GSI = 65 - 70



PROJECT: 17BP.13.R.171 REFERENCE: SF-560066

**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-560066	1	8

**CONTENTS**

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
2A	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4	CROSS SECTIONS
5-7	BORE LOGS & CORE REPORT
8	CORE PHOTOGRAPH

# STRUCTURE SUBSURFACE INVESTIGATION

COUNTY MADISON  
PROJECT DESCRIPTION REPLACE BRIDGE #66  
ON SR 1396 (HUNTER CREEK RD.) OVER  
WALNUT 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.

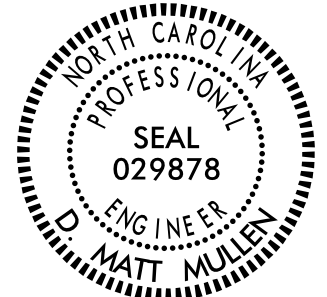
THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT 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

C.D. JOHNSON  
D.O. CHEEK  
C.J. COFFEY

INVESTIGATED BY DMM  
DRAWN BY DMM  
CHECKED BY JCK  
SUBMITTED BY JCK  
DATE 10/7/2019



DocuSigned by:  
D Matt Mullen 10/7/2019  
18909BD3CD400A 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

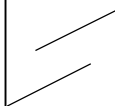
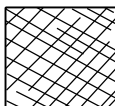


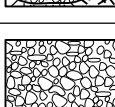

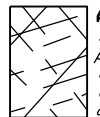
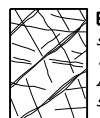


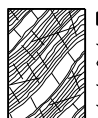

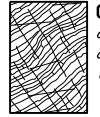

Table with 4 main columns: SOIL DESCRIPTION, GRADATION, ROCK DESCRIPTION, and TERMS AND DEFINITIONS. It contains detailed technical specifications, classification tables, and symbols for soil and rock analysis.

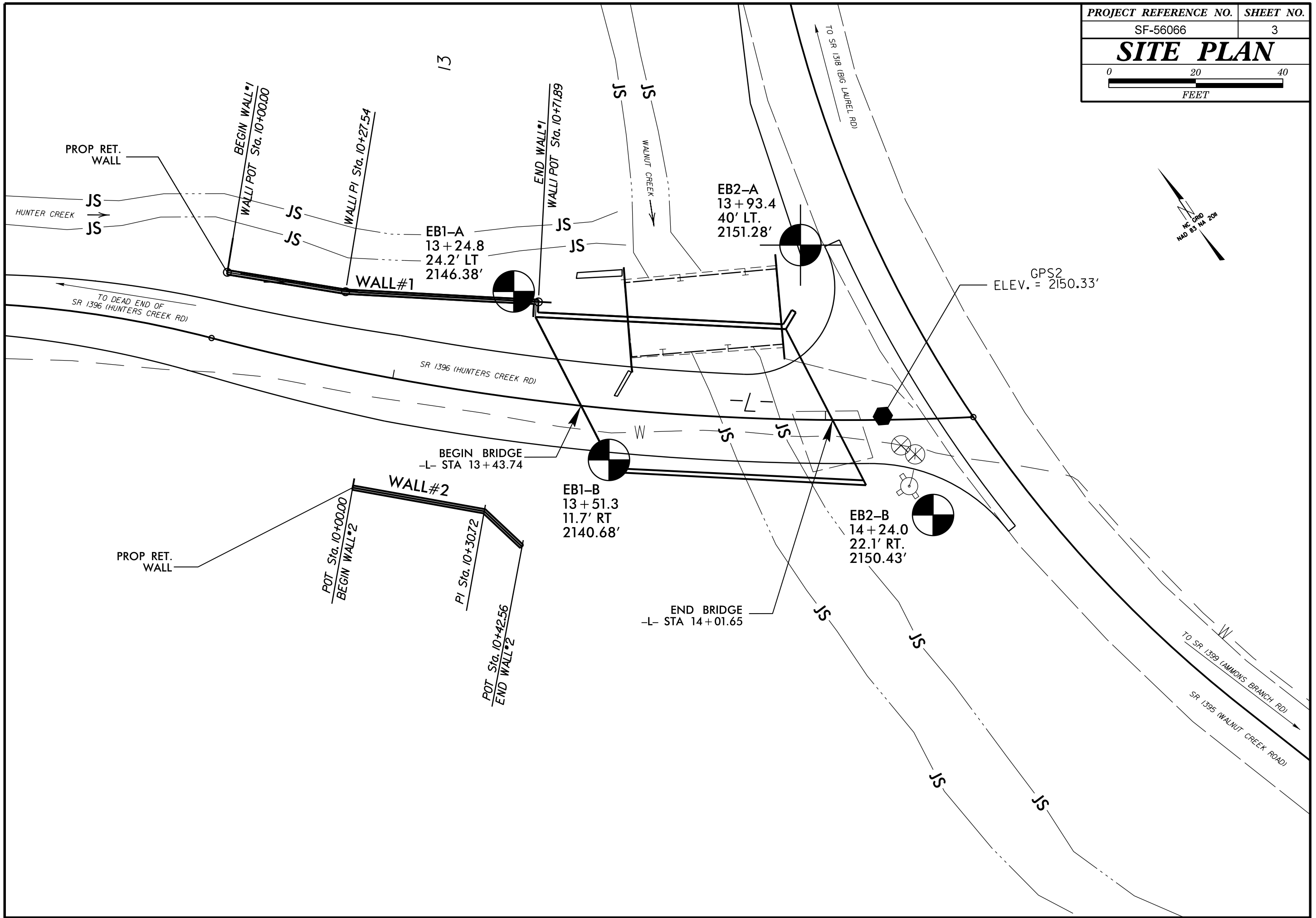
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
 DIVISION OF HIGHWAYS  
**GEOTECHNICAL ENGINEERING UNIT**  
**SUBSURFACE INVESTIGATION**

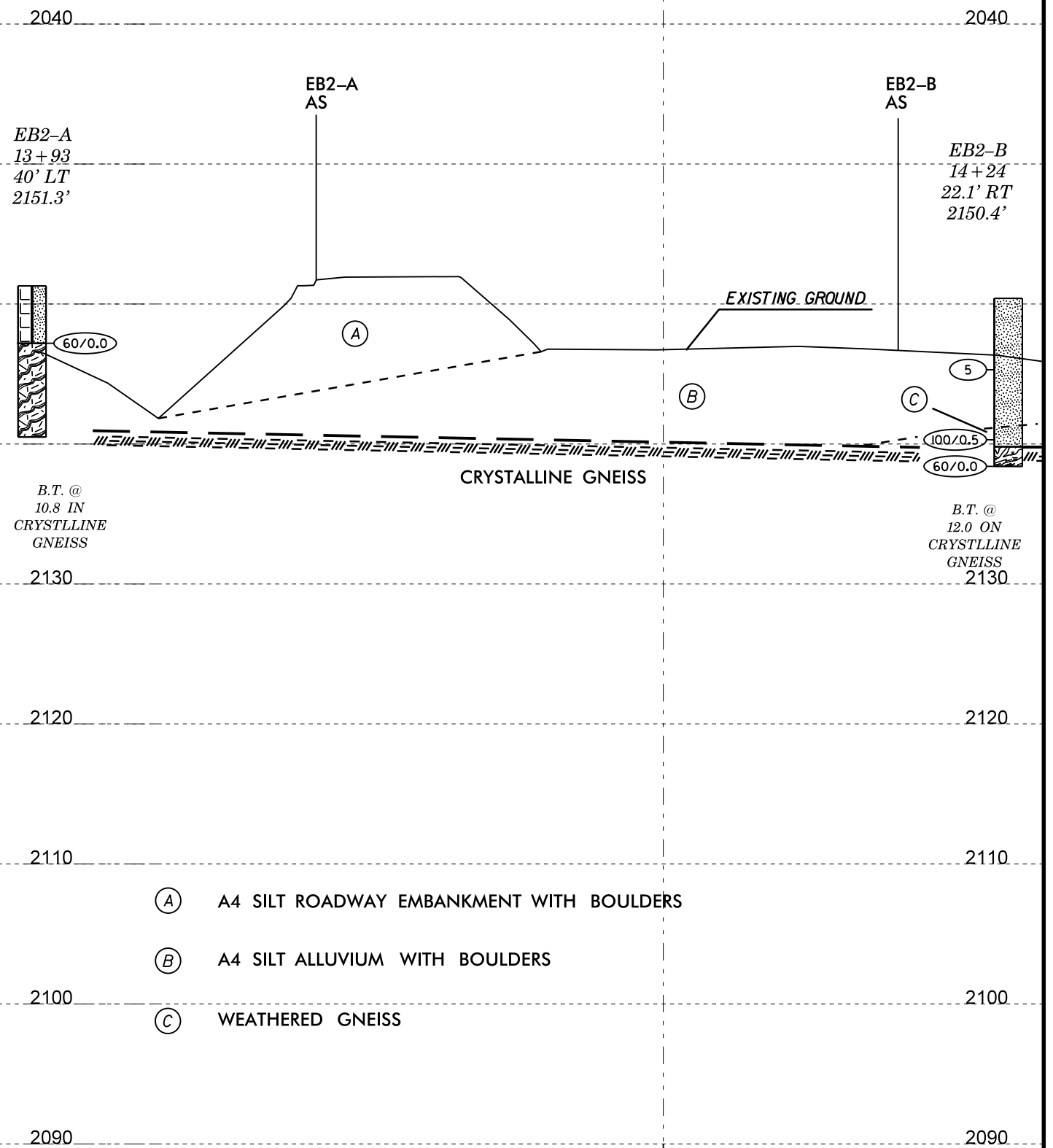
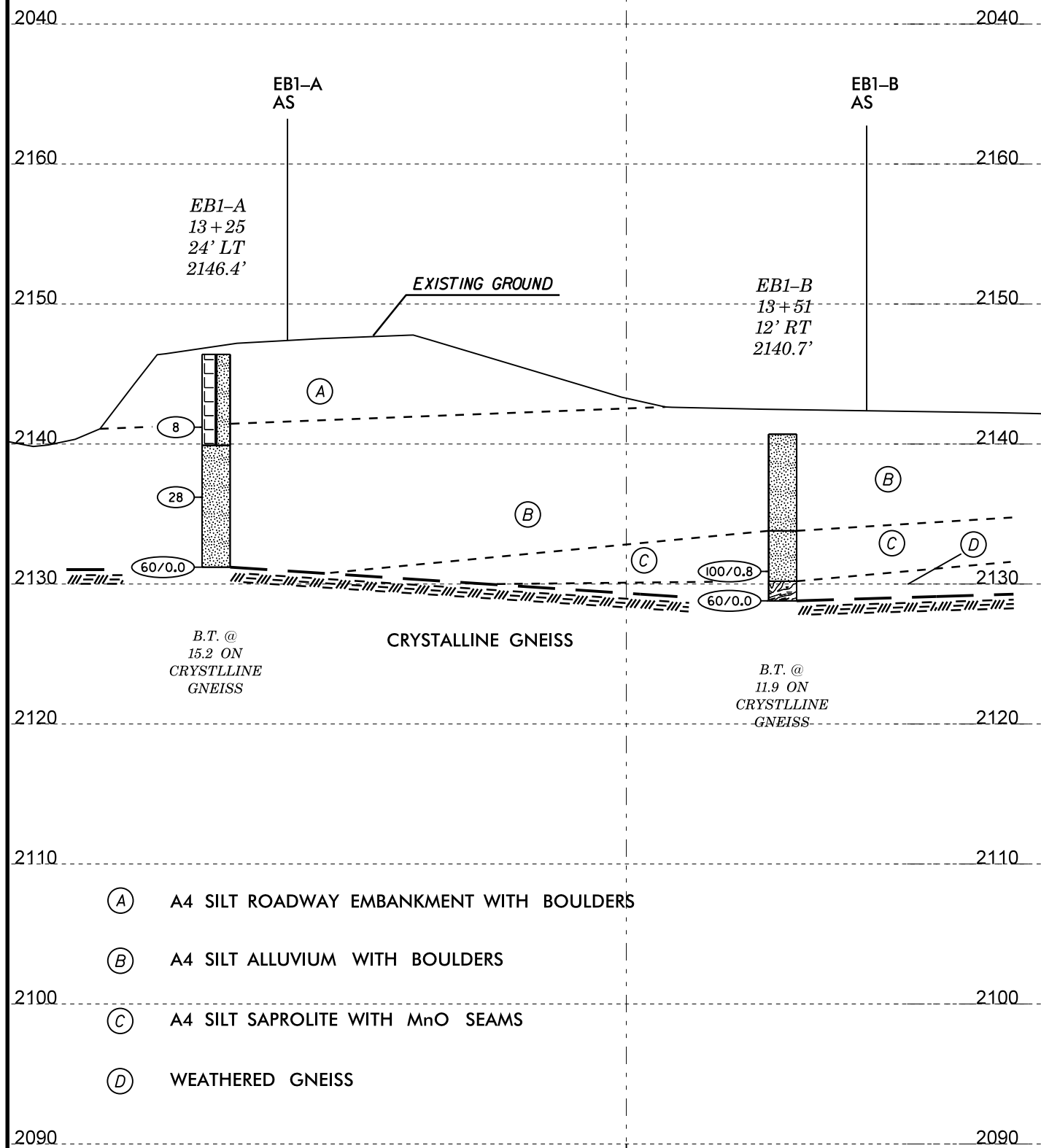
**SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES  
 FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS**

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><b>GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)</b></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><b>STRUCTURE</b></p>	<p><b>SURFACE CONDITIONS</b></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><b>GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)</b></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><b>COMPOSITION AND STRUCTURE</b></p>	<p><b>SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)</b></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><b>INTERLOCKING OF ROCK PIECES</b></p> <p>DECREASING INTERLOCKING OF ROCK PIECES ↓</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>	90	80	70	60	50	N/A	N/A	N/A	N/A	N/A	<p> <b>A. Thick bedded, very blocky sandstone</b> 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>B. Sandstone with thin inter-layers of siltstone</b></p> <p> <b>C. Sandstone and siltstone in similar amounts</b></p> <p> <b>D. Siltstone or silty shale with sandstone layers</b></p> <p> <b>E. Weak siltstone or clayey shale with sandstone layers</b></p> <p><b>C, D, E, and G</b> - may be more or less folded than illustrated but this does not change the strength. Tectonic deformation, faulting and loss of continuity moves these categories to <b>F</b> and <b>H</b>.</p> <p> <b>F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</b></p> <p> <b>G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers</b></p> <p> <b>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.</b></p> <p>→ Means deformation after tectonic disturbance</p>	70	60	50	40	30	20	10	N/A	N/A	N/A





40 LT 30 LT 20 LT 10 LT 10 RT 20 RT SKEW = 60DEG

HORIZ. SCALE 0 10 20 (FEET) VE = 1H:1V **CROSS SECTION ALONG EB1**

40 LT 30 LT 20 LT 10 LT 10 RT 20 RT SKEW = 60DEG

HORIZ. SCALE 0 10 20 (FEET) VE = 1H:1V **CROSS SECTION ALONG EB2**

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.13.R.171		TIP SF-560066		COUNTY MADISON		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION REPLACE BRDG #66 ON SR-1396 OVER WALNUT CREEK							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 13+25		OFFSET 24 ft LT		ALIGNMENT L										
COLLAR ELEV. 2,146.4 ft		TOTAL DEPTH 15.2 ft		NORTHING 786,361		EASTING 912,771										
DRILL RIG/HAMMER EFF./DATE AFC6744 CME - 45C 92%/07/31/2017		DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic												
DRILLER Cheek, D. O.		START DATE 09/24/19		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 MOI	LOG G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
2150																
2145																
2140	2,141.2	5.2	2	4	4											
2135	2,136.2	10.2	9	15	13											
	2,131.2	15.2														

WBS 17BP.13.R.171		TIP SF-560066		COUNTY MADISON		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION REPLACE BRDG #66 ON SR-1396 OVER WALNUT CREEK							GROUND WTR (ft)									
BORING NO. EB1-B		STATION 13+51		OFFSET 12 ft RT		ALIGNMENT L										
COLLAR ELEV. 2,140.7 ft		TOTAL DEPTH 11.9 ft		NORTHING 786,316		EASTING 912,768										
DRILL RIG/HAMMER EFF./DATE AFC6744 CME - 45C 92%/07/31/2017		DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic												
DRILLER Cheek, D. O.		START DATE 09/25/19		COMP. DATE 09/25/19		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
2145																
2140																
2135																
2130	2,130.9	9.8	43	57	0.3											
	2,128.8	11.9														

NCDOT BORE DOUBLE\_SF560066\_WALNUTCREEK\_BH.GPJ\_NC\_DOT.GDT\_10/7/19



# GEOTECHNICAL BORING REPORT BORE LOG

# GEOTECHNICAL BORING REPORT CORE LOG

WBS 17BP.13.R.171		TIP SF-560066		COUNTY MADISON		GEOLOGIST Johnson, C. D.									
SITE DESCRIPTION REPLACE BRDG #66 ON SR-1396 OVER WALNUT CREEK							GROUND WTR (ft)								
BORING NO. EB2-A		STATION 13+93		OFFSET 40 ft LT		ALIGNMENT L									
COLLAR ELEV. 2,151.3 ft		TOTAL DEPTH 10.8 ft		NORTHING 786,333		EASTING 912,832									
DRILL RIGHAMMER EFF./DATE AFC6744 CME - 45C 92% 07/31/2017			DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic									
DRILLER Cheek, D. O.		START DATE 09/24/19		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					
2155															
2150														2,151.3	GROUND SURFACE
														2,147.2	ROADWAY EMBANKMENT BROWN, SND-SLT, w/GRVLS
	2,147.2	4.1												2,147.2	CRYSTALLINE ROCK PINK-GREY GRANITIC GNEISS
			60/0.0											2,140.5	GSI = 55-60
2145														2,140.5	Boring Terminated at Elevation 2,140.5 ft IN ROCK (GNEISS)

NCDOT BORE DOUBLE SF560066 WALNUTCRK\_BH.GPJ NC\_DOT.GDT 10/7/19

WBS 17BP.13.R.171		TIP SF-560066		COUNTY MADISON		GEOLOGIST Johnson, C. D.						
SITE DESCRIPTION REPLACE BRDG #66 ON SR-1396 OVER WALNUT CREEK							GROUND WTR (ft)					
BORING NO. EB2-A		STATION 13+93		OFFSET 40 ft LT		ALIGNMENT L						
COLLAR ELEV. 2,151.3 ft		TOTAL DEPTH 10.8 ft		NORTHING 786,333		EASTING 912,832						
DRILL RIGHAMMER EFF./DATE AFC6744 CME - 45C 92% 07/31/2017			DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic						
DRILLER Cheek, D. O.		START DATE 09/24/19		COMP. DATE 09/24/19		SURFACE WATER DEPTH N/A						
CORE SIZE NXWL				TOTAL RUN 6.7 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) %			
2147.18												
	2,147.2	4.1	1.7	N/A/0.7	(1.6)	(0.4)					2,147.2	Begin Coring @ 4.1 ft
	2,145.5	5.8	5.0	N=60/0.0	94%	24%						CRYSTALLINE ROCK
				N/A/0.7	(4.4)	(2.2)						GSI = 55-60
				N/A/1.0	88%	44%						
	2,140.5	10.8		2:41/1.0							2,140.5	Boring Terminated at Elevation 2,140.5 ft IN ROCK (GNEISS)
				1:43/1.0								
				1:46/1.0								
				1:52/1.0								
				1:50/1.0								

NCDOT BORE DOUBLE SF560066 WALNUTCRK\_BH.GPJ NC\_DOT.GDT 10/7/19

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.13.R.171		TIP SF-560066		COUNTY MADISON		GEOLOGIST Johnson, C. D.								
SITE DESCRIPTION REPLACE BRDG #66 ON SR-1396 OVER WALNUT CREEK							GROUND WTR (ft)							
BORING NO. EB2-B		STATION 14+24		OFFSET 22 ft RT		ALIGNMENT L								
COLLAR ELEV. 2,150.4 ft		TOTAL DEPTH 12.0 ft		NORTHING 786,264		EASTING 912,822								
DRILL RIGHAMMER EFF./DATE AFC6744 CME - 45C 92% 07/31/2017		DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 09/24/19		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	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
2155														
2150														2,150.4 GROUND SURFACE 0.0
2145	2,145.3	5.1	WOH	2	3									ALLUVIAL BROWN, SL MIC, SND-SLT, w/PEBLS, GRVLS, SL CL
2140	2,140.3	10.1												2,139.8 10.6
	2,138.4	12.0												2,138.4 12.0
														WEATHERED ROCK BROWN-BLACK, MIC, WEA GNEISS
														CRYSTALLINE ROCK BROWN-BLACK GNEISS Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,138.4 ft ON ROCK (GNEISS)

# CORE PHOTOGRAPHS

## EB2-A

BOX 1 OF 1: 4.1 - 10.8 FEET

GSI 55 - 60

