

PROJECT: 33351.1.1 ID: B-3917

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	33351.1.1 (B-3917)	1	23
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
33351.1.1	BRZ-1379(1)	P.E.	
		CONST.	

# STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

## STRUCTURE SUBSURFACE INVESTIGATION

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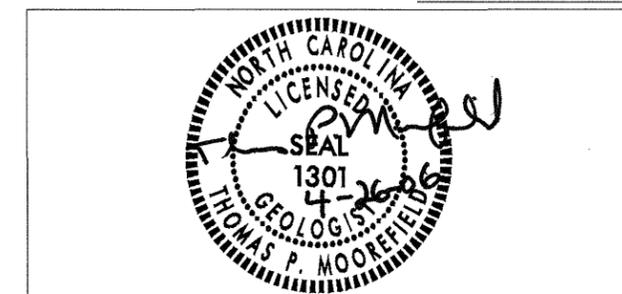
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STATE PROJECT 33351.1.1 I.D. NO. B-3917  
 F.A. PROJECT BRZ-1379(1)  
 COUNTY WAKE  
 PROJECT DESCRIPTION BRIDGE NO. 311  
ON -L- (SR 1379, PENNY RD.) OVER  
LAKE WHEELER (SWIFT CREEK)  
AT STA. 16+96.5

### INVENTORY

INVESTIGATED BY T.P. MOOREFIELD PERSONNEL N.D. MOHS  
 CHECKED BY N.T. ROBERSON T.P. MOOREFIELD  
 SUBMITTED BY N.T. ROBERSON C.D. CZAJKA  
 DATE APRIL 2006 T.T. WALKER  
S. JOHNSON  
A. BROWNING  
M. MOSELEY



DRAWN BY: N.D. MOHS

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

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





STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY  
GOVERNOR

LYNDO TIPPETT  
SECRETARY

April 21, 2006

STATE PROJECT: 33351.1.1 (B-3917)  
F.A. PROJECT: BRZ-1379(1)  
COUNTY: Wake  
DESCRIPTION: Bridge No. 311 on -L- (SR 1379, Penny Rd.) over Lake Wheeler (Swift Creek) at Station 16+96.5  
SUBJECT: Geotechnical Report – Inventory

**Project Description**

A four-span bridge, 188.94-feet in length, is proposed on -L- (SR 1379, Penny Rd.) over the western end of Lake Wheeler. The proposed bridge, which will replace the existing structure, will be located approximately 40 feet left of the existing bridge. The roadway embankment will be widened approximately 50 feet parallel to the existing embankment to accommodate the new roadway alignment. The existing bridge will remain in service while the new bridge is being constructed.

The subsurface investigation for the roadway was conducted during January and February 2006. The End Bent One borings were drilled using an ATV-mounted Mobile B-52 drill machine. A CME-45C drill machine mounted on a barge was used to drill the in-water borings. Two Standard Penetration Test borings were performed at each bent location. Rod soundings were performed at three locations on End Bent One to delineate the top of weathered rock. Four borings (EB1-A, B1-A, B2-B, and B3-A) were cored using NQ-2 core equipment. All borings were advanced until crystalline rock was encountered. Representative soil samples were obtained for visual classification in the field and selected samples were sent to the Materials and Tests Unit for laboratory analysis. Eight rock core samples were submitted to the Materials and Tests Unit to determine Unit Weight and Compressive Strength.

**Physiography and Geology**

The project is located in gently rolling terrain of the Piedmont Physiographic province. The project is located within the boundaries of Lake Wheeler Park operated by the Raleigh Parks and Recreation Department. The area adjacent to the park is mixed suburban, with scattered single family homes and housing developments. The area along Lake Wheeler is wooded. Geologically, the project is located within the Raleigh Belt and is underlain by the Raleigh Gneiss.

**Soil Properties**

Soils encountered at the project site include roadway embankment, alluvial, and residual soils.

Roadway embankment was encountered at End Bents One and Two. These soils are associated with the existing alignment of Penny Road. A rod sounding was performed at End Bent One through the embankment, but no soil samples were taken. Embankment soils range from 5.0 to 11.0 feet thick.

Alluvial soils were encountered at all bent locations except End Bent One. The alluvial soils range from 0.5 to 16.7 feet in thickness. These soils consist of gray, soft to medium stiff, wet, sandy silt (A-4), gray, very soft to soft, moist to wet, silty clay (A-7-6) and sandy clay (A-6), and gray, very loose, wet, silty sand (A-2-4). The alluvial soils were deposited on residual soil and weathered or crystalline rock.

Residual soils were encountered at EB1-B and B1-A and range from 3.5 to 6.0 feet in thickness. The residual soils consist of gray, very stiff to hard, moist, sandy silt (A-4). The residual soils are underlain by weathered and/or crystalline rock.

**Rock Properties**

Weathered rock was derived from the underlying gneissic bedrock. The weathered rock ranges in thickness from 1.1 to 2.6 feet. Weathered rock was not encountered in all borings. Three rod soundings were performed at End Bent One to identify the weathered rock line.

Crystalline rock was encountered at each boring location. EB1-A was cored to confirm the presence of shallow rock in the area. Core Recovery (REC) ranged from 85% to 97%, with an average of 92%. Rock Quality Designation (RQD) ranges from 72% to 95%, with an average of 82%. Testing indicates the gneiss has a unit weight ranging from 156.9 lbf/ft<sup>3</sup> to 164.9 lbf/ft<sup>3</sup>. Compressive strength ranges from 4.28 ksi to 38.1 ksi. More detailed rock descriptions can be found in the Core Boring Report.

**Groundwater**

Groundwater was present in the End Bent One borings. The groundwater elevations ranged from 283.0 feet at EB1-A to 283.3 feet at EB1-B. Surface water in Lake Wheeler was measured at elevation 283.0 feet in February 2006.

**Notice**

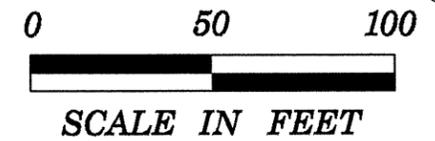
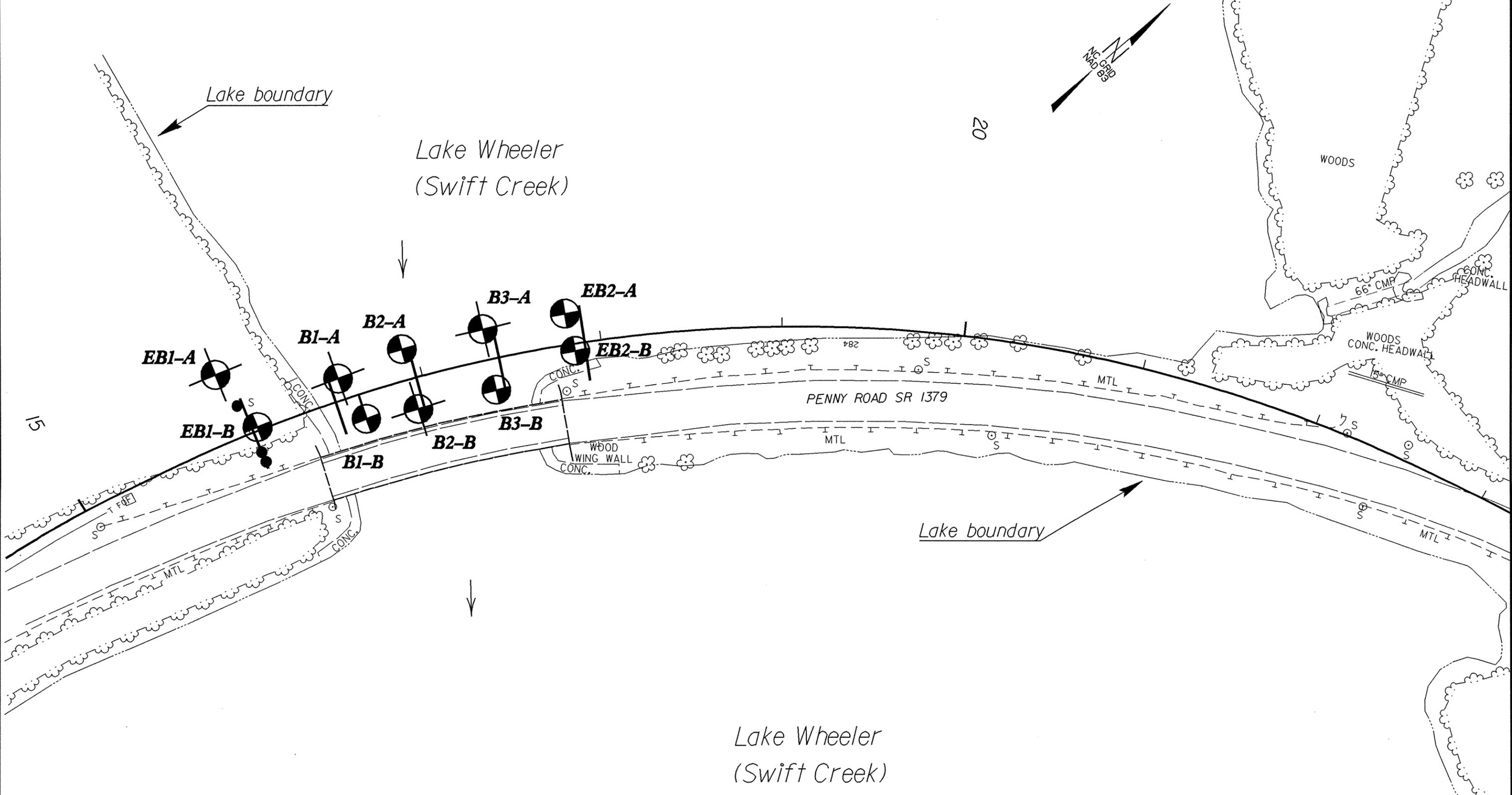
This Geotechnical foundation report is based on the Bridge Survey and Hydraulic Report for Lake Wheeler (Swift Creek), dated September 26, 2005 and the Preliminary General Drawing dated November 23, 2005. If significant changes are made in the design or location of the proposed structure, the subsurface information should be reviewed and modified as necessary.

Prepared by

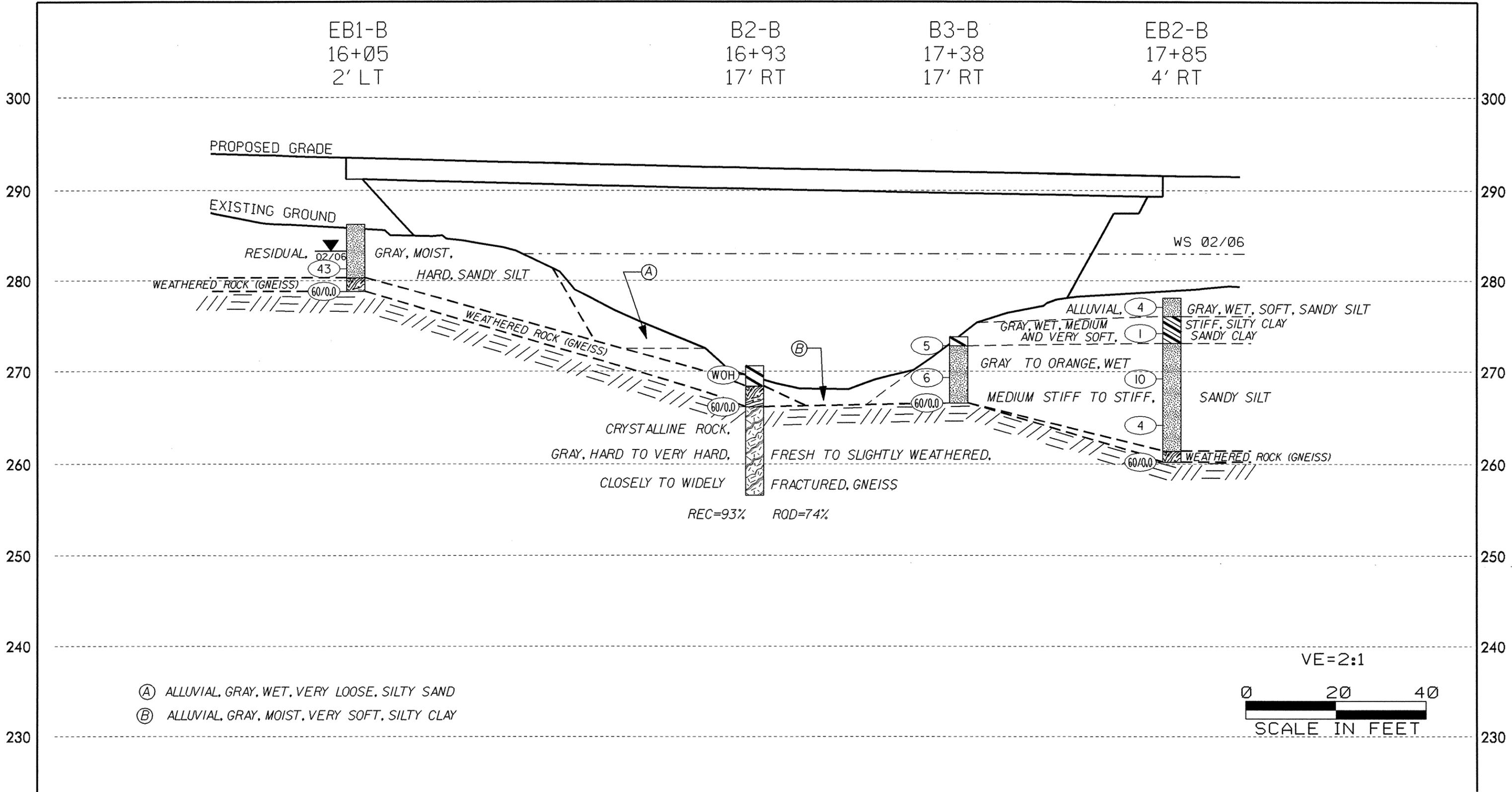
Nathan Mohs  
Engineering Geologist

STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
33351.1.1 (B-3917)	4	23

# TEST SITE PLAN



# PROFILE OF BORINGS ALONG -L-



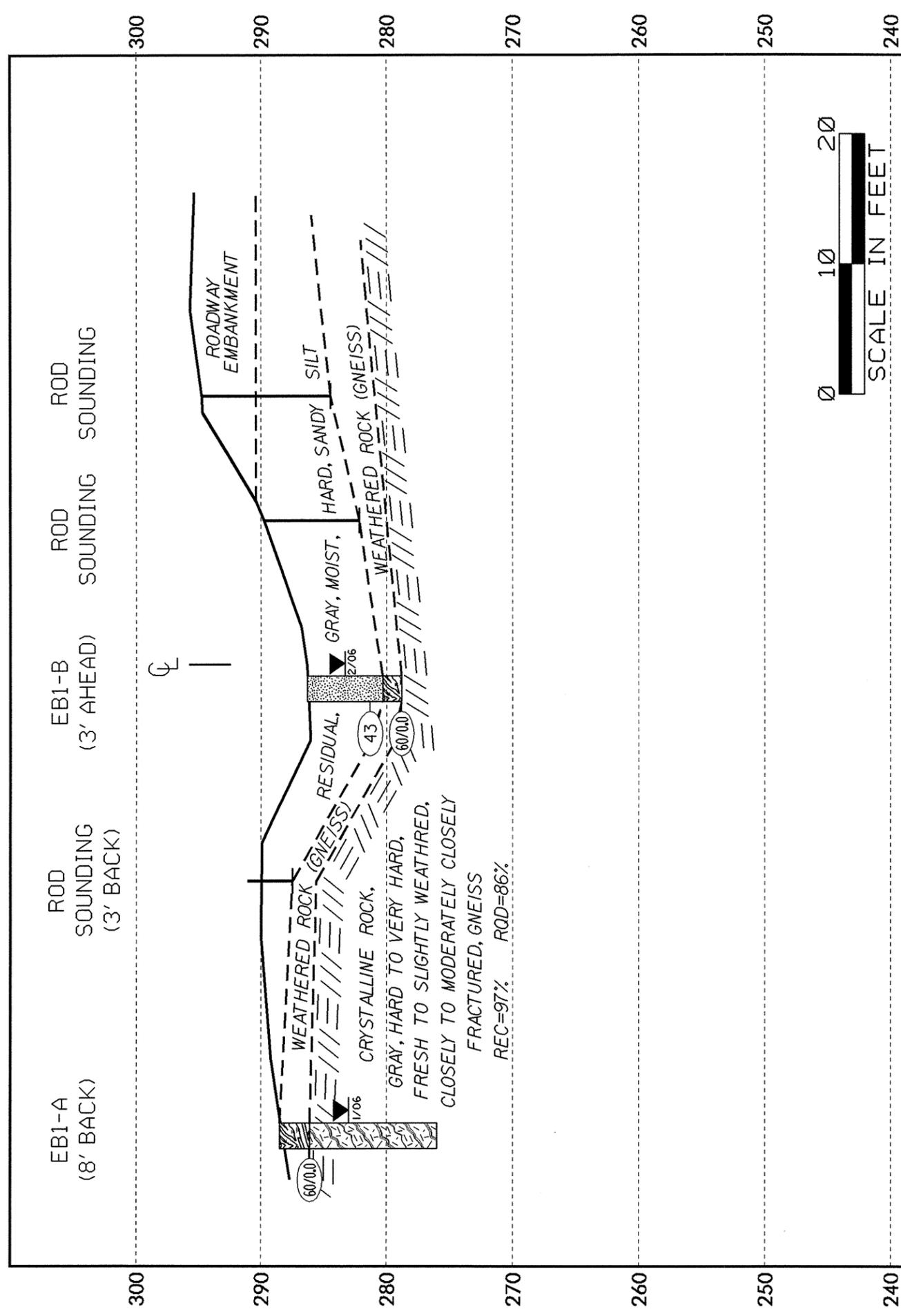
-L-

16+00

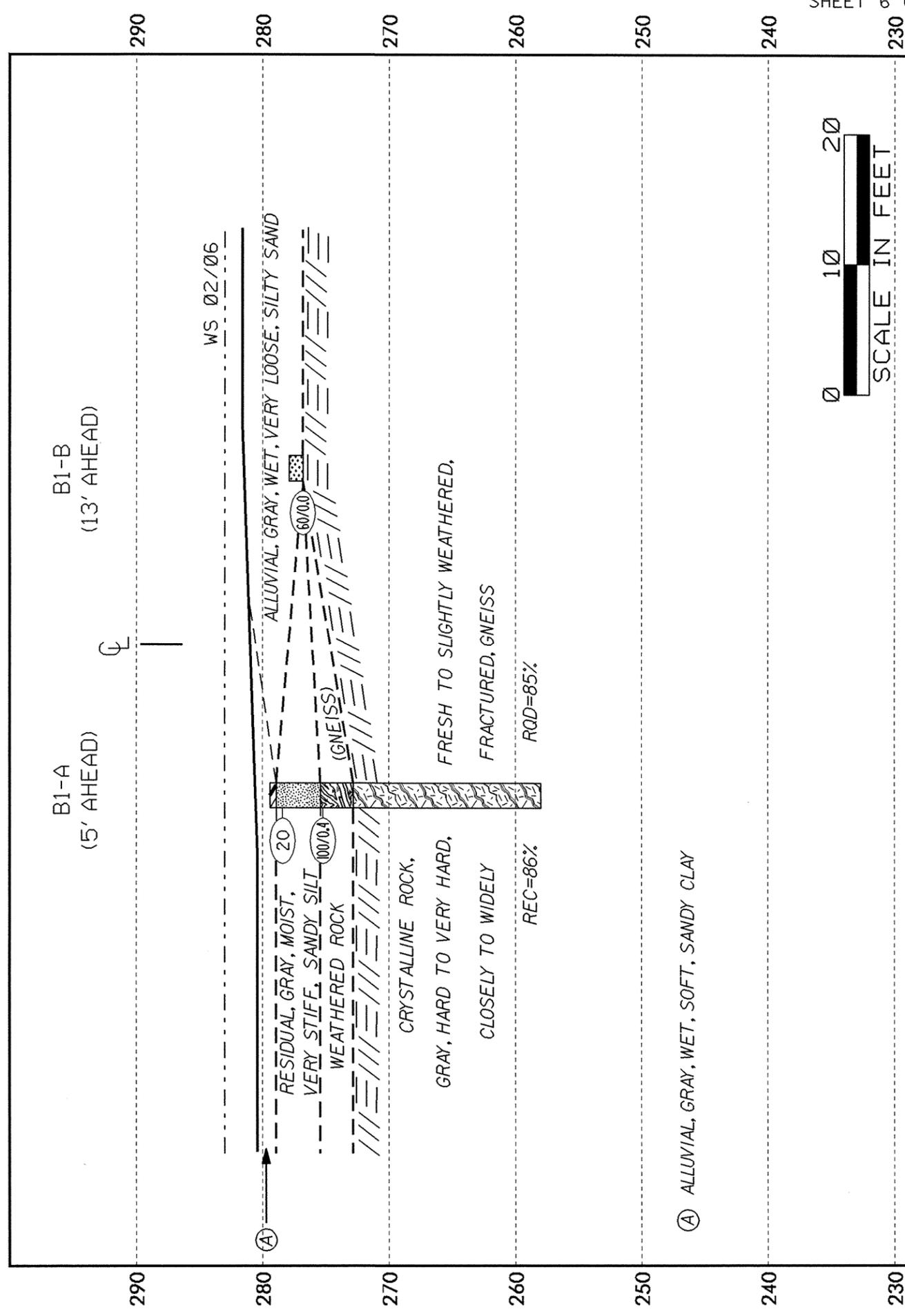
17+00

18+00

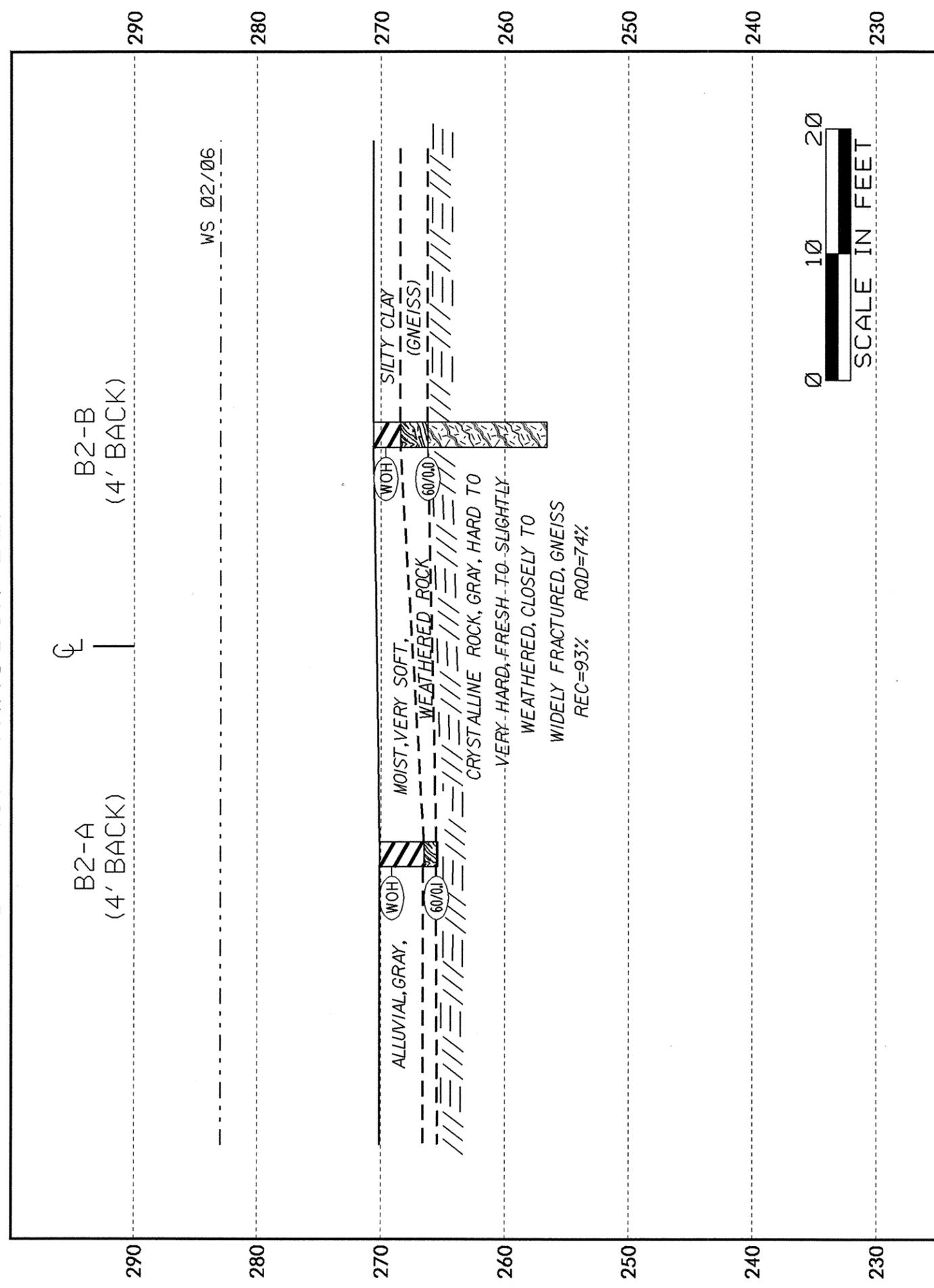
CROSS SECTION THROUGH END BENT I BRIDGE NO. 311, 33351.1.1 (B-3917)



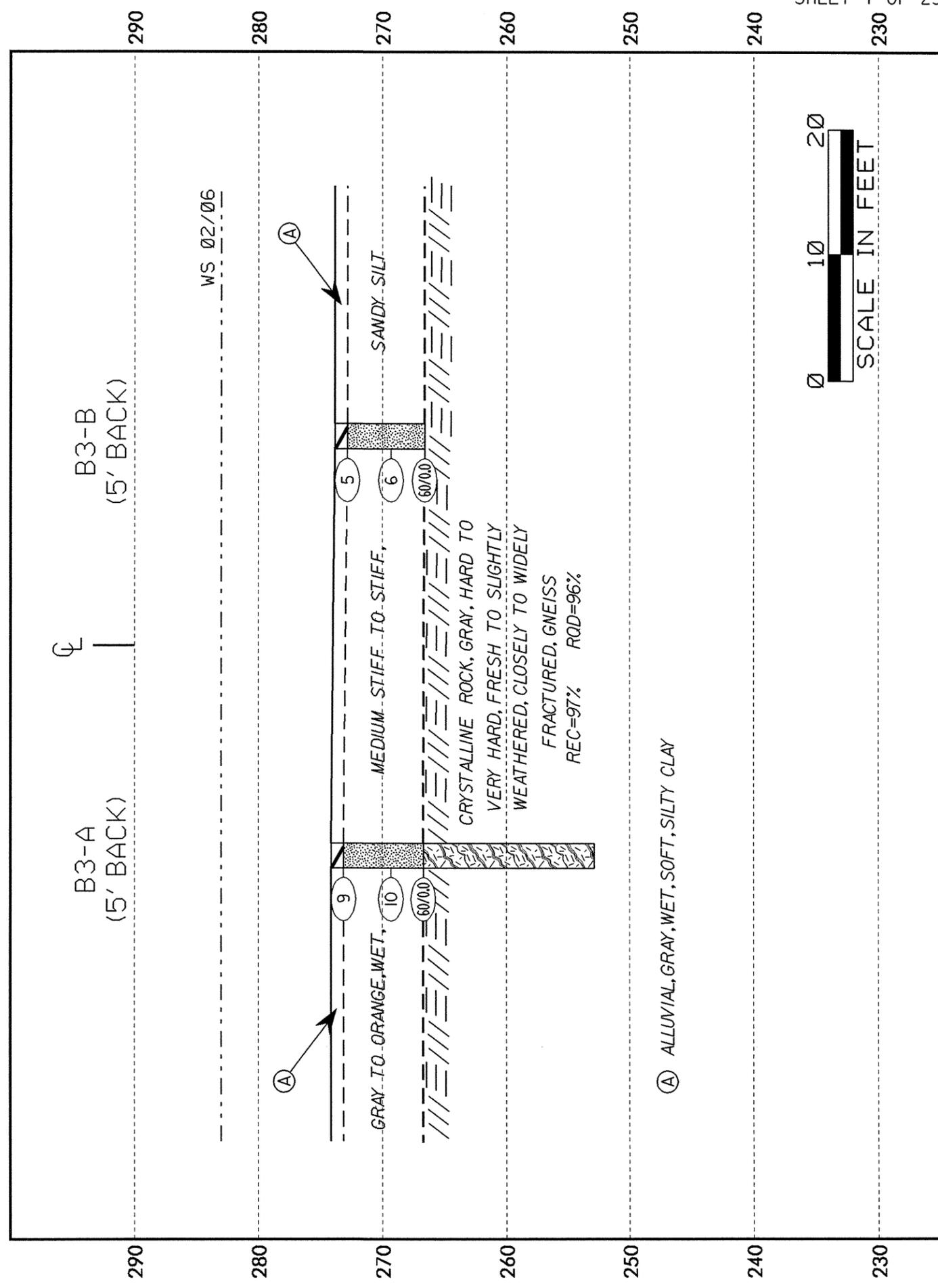
CROSS SECTION THROUGH BENT I BRIDGE NO. 311, 33351.1.1 (B-3917)



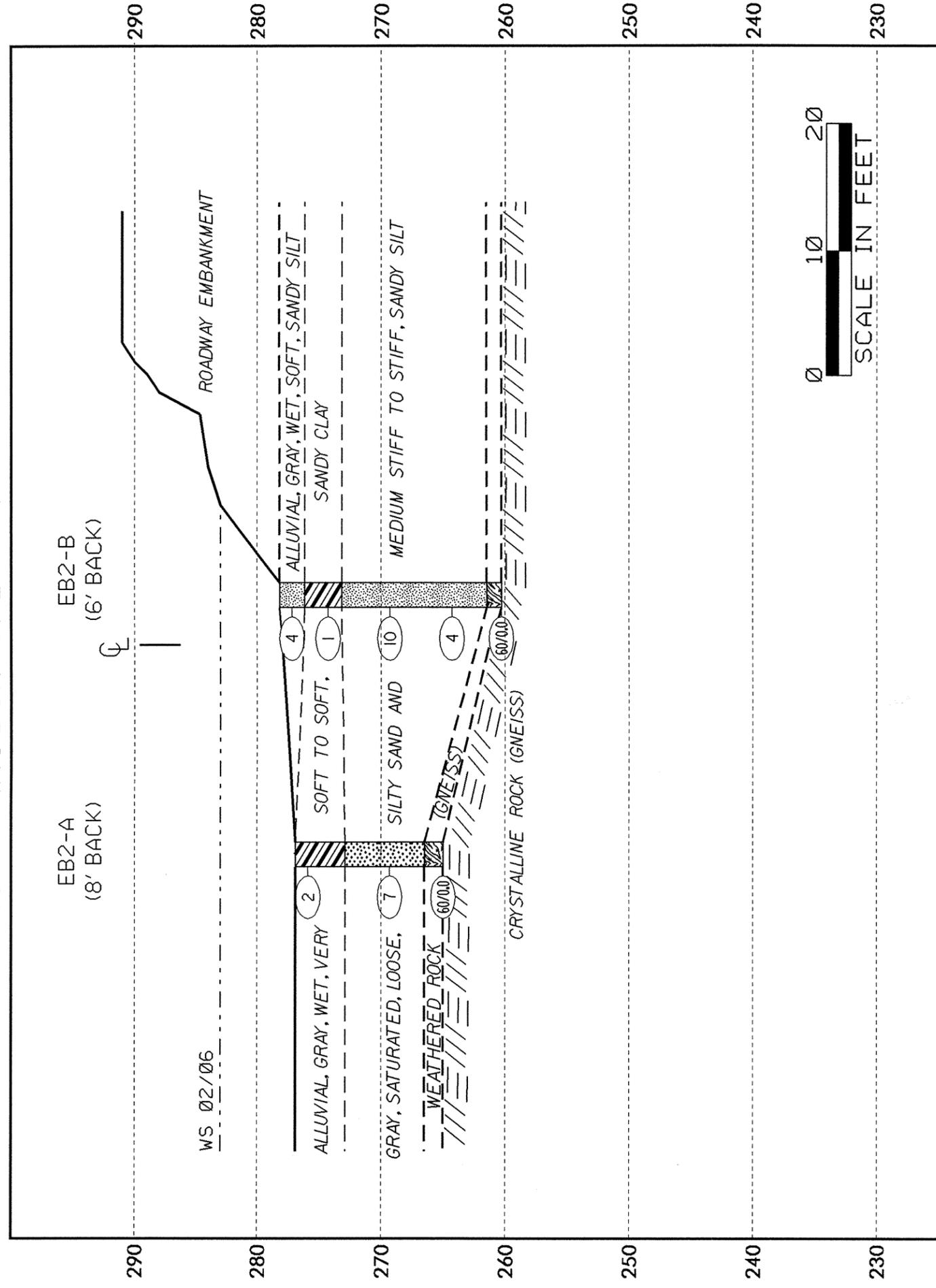
CROSS SECTION THROUGH BENT 2 BRIDGE NO. 311, 33351.1.1 (B-3917)



CROSS SECTION THROUGH BENT 3 BRIDGE NO. 311, 33351.1.1 (B-3917)



CROSS SECTION THROUGH END BENT 2 BRIDGE NO. 311, 33351.1.1 (B-3917)













**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
GEOTECHNICAL UNIT BORING LOG**

PROJECT NO. 33351.1.1		ID. B-3917		COUNTY WAKE		GEOLOGIST S. JOHNSON							
SITE DESCRIPTION BRIDGE NO. 311 ON -L- (SR 1379, PENNY RD) OVER LAKE WHEELER							GROUND WATER						
BORING NO. B3-A		BORING LOCATION 17+38		OFFSET 17' LT		ALIGNMENT -L-							
COLLAR ELEVATION 274.1'		NORTHING 709984'		EASTING 2082428'		0 HR. N/A							
TOTAL DEPTH 21.2'		DRILL MACHINE CME-45C		DRILL METHOD ROTARY W/O MUD		HAMMER TYPE MANUAL							
START DATE 2/3/06		COMPLETION DATE 2/3/06		SURFACE WATER DEPTH 8.9'		DEPTH TO ROCK 7.4'							
ELEV. (FT.)	DEPTH (FT.)	BLOW COUNT			PEN. (FT.)	BLOWS PER FOOT				SAMPLE NUMBER	LOG MOL.	SOIL AND ROCK DESCRIPTION	
		0.5'	0.5'	0.5'		0	25	50	75				100
274.1	0.0	2	4	5	1.0								ALLUVIAL, GRAY, SILTY CLAY
270.0	3.8	4	5	5	1.0								GRAY, SANDY SILT
265.0	7.4	60			0.0								CRYSTALLINE ROCK, GRAY, HARD TO VERY HARD, FRESH TO SLIGHTLY WEATHERED, CLOSELY TO WIDELY FRACTURED, GNEISS REC=97% ROD=96%
CORING TERMINATED AT ELEVATION 252.9 FEET IN CRYSTALLINE ROCK (GNEISS)													

CORE BORING REPORT							
PROJECT: 33351.1.1		ID: B-3917		COUNTY: Wake		BORING NO: B3-A	
DESCRIPTION: Bridge No. 311 on -L- (SR 1379, Penny Rd.) over Lake Wheeler (Swift Creek)							
LOCATION OF BORING: -L- 17+38 17' LT				COMPLETION DATE: 2/3/06			
COLLAR or GROUND ELEVATION: 274.1 ft				CORE SIZE: NQ-2		GEOLOGIST: S. Johnson	
CORE EQUIPMENT: CME-45C				DRILLER: M. Moseley			
ELEV (ft)	DEPTH (ft)	DRILL RATE (min/ft)	RUN (ft)	REC (ft) (%)	RQD (ft) (%)	SAMPLE NUMBER	FIELD CLASSIFICATION and REMARKS
266.7	7.4	2:20	3.8	3.6	3.6	RS-7 9.6'-10.1'	Crystalline rock ,gray, hard to very hard, fresh to slightly weathered, closely fractured, Gneiss
		1:58					
		2:00					
		2:00/8		(95%)	(95%)		
262.9	11.2		5.0	5.0	5.0		Crystalline rock ,gray, hard to very hard, fresh to slightly weathered, closely to moderately closely fractured, Gneiss
262.9	11.2	2:00					
		2:00					
		3:15		(100%)	(100%)		
257.9	16.2	2:50	5.0	4.8	4.6	RS-8 18.5'-19.2'	Crystalline rock ,gray, hard to very hard, fresh to slightly weathered, closely to moderately closely fractured, Gneiss
257.9	16.2	4:15					
		3:50					
		3:45		(96%)	(92%)		
252.9	21.2	3:15					
BOREHOLE TERMINATED AT ELEVATION OF 252.9 FEET, IN CRYSTALLINE ROCK.							

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
GEOTECHNICAL UNIT BORING LOG**

PROJECT NO. 33351.11	ID. B-3917	COUNTY WAKE	GEOLOGIST S. JOHNSON
SITE DESCRIPTION BRIDGE NO. 311 ON -L- (SR 1379, PENNY RD) OVER LAKE WHEELER			GROUND WATER
BORING NO. B3-B	BORING LOCATION 17+38	OFFSET 17' RT	ALIGNMENT -L- 0 HR. N/A
COLLAR ELEVATION 273.8'	NORTHING 709968'	EASTING 2082458'	24 HR. N/A
TOTAL DEPTH 7.2'	DRILL MACHINE CME-45C	DRILL METHOD ROTARY W/O MUD	HAMMER TYPE MANUAL
START DATE 2/3/06	COMPLETION DATE 2/3/06	SURFACE WATER DEPTH 9.2'	DEPTH TO ROCK 7.2'

ELEV. (FT.)	DEPTH (FT.)	BLOW COUNT			PEN. (FT.)	BLOWS PER FOOT					SAMPLE NUMBER	MOI.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5'	0.5'	0.5'		0	25	50	75	100					
273.8	0.0	1	2	3	1.0	X	5								ALLUVIAL, GRAY, SILTY CLAY
270.0	3.5	2	3	3	1.0	X	6								GRAY-ORANGE, SANDY SILT
	7.2	60			0.0					60	0.0				
265.0															
260.0															
255.0															
250.0															
245.0															
240.0															
235.0															
230.0															
225.0															
220.0															
215.0															
210.0															
205.0															
200.0															
195.0															

SPT REFUSAL AT  
ELEVATION 266.6 FEET  
ON CRYSTALLINE ROCK  
(GNEISS)



**EB1-B**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-1	2 LT	16+05	4.0-5.5	A-4(0)	30	NP	4.6	35.2	56.2	4.0	100	97	76	-	-

**B1-A**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-2	12 LT	16+55	0.0-1.5	A-4(0)	21	NP	10.5	26.3	57.2	6.1	94	88	68	-	-

**B2-A**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-3	17 LT	16+93	0.0-1.5	A-7-6(9)	45	16	13.5	23.2	39.0	24.2	87	79	61	-	-

**B3-A**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-6	17 LT	17+38	0.0-1.0	A-7-6(16)	48	21	3.8	27.9	36.0	32.3	100	99	74	-	-
SS-7	17 LT	17+38	1.0-1.5	A-4(3)	27	5	0.8	35.4	47.7	16.2	100	100	78	-	-
SS-8	17 LT	17+38	3.8-5.3	A-4(1)	25	3	3.6	41.2	43.0	12.1	100	98	70	-	-

**B3-B**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-4	17 RT	17+38	0.0-1.0	A-4(2)	24	5	2.4	31.3	48.1	18.2	99	98	79	-	-
SS-5	17 RT	17+38	1.0-1.5	A-4(5)	29	7	0.4	24.4	54.9	20.2	100	100	88	-	-

**EB2-A**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-9	17 LT	17+83	0.0-1.5	A-6(9)	32	11	1.2	21.6	48.9	28.3	100	100	85	-	-
SS-10	17 LT	17+83	6.6-8.1	A-2-4(0)	21	NP	36.5	46.2	13.3	4.0	100	85	23	-	-

**EB2-B**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-11	4 RT	17+85	0.0-1.5	A-4(2)	24	8	10.5	25.3	42.0	22.2	85	79	61	-	-
SS-12	4 RT	17+85	2.9-4.4	A-6(9)	30	11	1.2	21.0	49.5	28.3	100	100	87	-	-
SS-13	4 RT	17+85	7.9-9.4	A-4(0)	20	NP	17.0	54.7	22.2	6.1	100	97	36	-	-
SS-14	4 RT	17+85	12.9-14.4	Not Enough Material			20.6	28.3	39.0	12.1	100	85	59	-	-

<b>SOIL TEST RESULTS</b>							
SAMPLE NO.	OFFSET	STATION	BORING NO.	DEPTH INTERVAL	UNIT WT. LB/FT3	UNCONFINED COMPRESSIVE STRENGTH KSI	SEC MOD @ 40% MPSI
RS-1	37 LT	15+94	EB1-A	2.4-2.9	156.9	4.28	0.01582
RS-2	37 LT	15+94	EB1-A	10.5-10.9	158.3	7.42	0.05540
RS-3	12 LT	16+55	B1-A	11.4-11.9	164.4	9.05	0.43100
RS-4	12 LT	16+55	B1-A	15.8-16.4	164.9	8.95	0.47900
RS-5	17 RT	16+93	B2-B	6.5-7.0	160.5	6.27	0.10740
RS-6	17 RT	16+93	B2-B	13.3-14.0	162.7	8.95	0.46500
RS-6B	17 RT	16+93	B2-B	13.3-14.0	162.7	17.87	0.63300
RS-7	17 LT	17+38	B3-A	9.6-10.1	160.9	21.00	0.41000
RS-8	17 LT	17+38	B3-A	18.5-19.2	162.5	38.10	0.07050



**FIELD  
SCOUR REPORT**

WBS: 33351.1.1 TIP: B-3917 COUNTY: Wake

DESCRIPTION(1): Bridge No. 311 on -L- (SR 1379, Penny Rd.) over Lake Wheeler (Swift Creek)

**EXISTING BRIDGE**

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

Bridge No.: 311 Length: 135' Total Bents: 9 Bents in Channel: 7 Bents in Floodplain: 1  
Foundation Type: Timber piles

**EVIDENCE OF SCOUR(2)**

Abutments or End Bent Slopes: None

Interior Bents: None

Channel Bed: None

Channel Bank: None

**EXISTING SCOUR PROTECTION**

Type(3): Concrete apron protects lake bank and roadway embankment from wave erosion.

Extent(4): Covering end bent slopes in proximity to the bridge.

Effectiveness(5): Effective

Obstructions(6): None

**INSTRUCTIONS**

- 1 Describe the specific site's location, including route number and body of water crossed.
- 2 Note scour evidence at existing end bents or abutments (e.g. undermining, sloughing, degradations).
- 3 Note existing scour protection (e.g. rip rap).
- 4 Describe extent of existing scour protection.
- 5 Describe whether or not the scour protection appears to be working.
- 6 Note obstructions such as dams, fallen trees, debris at bents, etc.
- 7 Describe the channel bed material based on observation and/or samples. Include any lab results with report.
- 8 Describe the channel bank material based on observation and/or samples. Include any lab results with report.
- 9 Describe the material covering the banks (e.g. grass, trees, rip rap, none).
- 10 Determine the approximate floodplain width from field observation or a topographic map.
- 11 Describe the material covering the floodplain (e.g. grass, trees, crops).
- 12 Use professional judgement to specify if the stream is degrading, aggrading, or static.
- 13 Describe potential and direction of the stream to migrate laterally during the bridge's life (approx. 100 years).
- 14 Give the geotechnically adjusted scour elevation (GASE) expected over the life of the bridge (approx. 100 years). This elevation can be given as a range across the site, or for each bent. Discuss the relationship between the Hydraulics Unit theoretical scour and the GASE. If the GASE is dependent on scour counter measures, explain (e.g. rip rap armoring on slopes). The GASE is based on the erodability of materials, giving consideration to the influence of joints, foliation, bedding characteristics, % core recovery, % RQD, differential weathering, shear strength, observations at existing structures, other tests deemed appropriate, and overall geologic conditions at the site.

**DESIGN INFORMATION**

Channel Bed Material(7): Silty clay (A-7-6), sandy clay (A-6), sandy silt (A-4)

Channel Bank Material(8): Sandy silt (A-4), weathered rock (Gneiss)

Channel Bank Cover(9):

Floodplain Width(10):

Floodplain Cover(11):

Stream is(12): Aggrading \_\_\_\_\_ Degrading \_\_\_\_\_ Static

Channel Migration Tendency(13): No migration of channel

Observations and Other Comments:

**GEOTECHNICALLY ADJUSTED SCOUR ELEVATIONS(14)** Feet \_\_\_\_\_ Meters \_\_\_\_\_

Comparison of GASE to Hydraulics Unit theoretical scour:

The Hydraulics Unit has reported in the Bridge Survey & Hydraulic Design Report that no scour issues have been noted at the bridge.

**SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL**

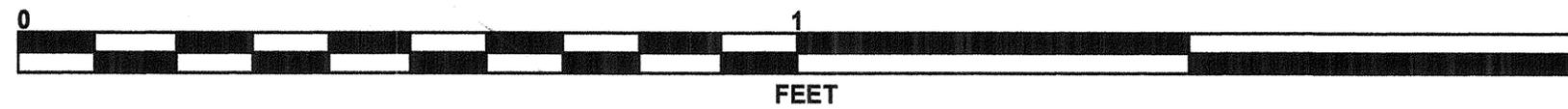
Bed or Bank	Bank	Bed	Bed	Bed			
Sample No.	SS-1	SS-3	SS-9	SS-11			
Retained #4		3		8			
Passed #10	100	87	100	85			
Passed #40	97	79	100	79			
Passed #200	76	61	85	61			
Coarse Sand	4.6	13.5	1.2	10.5			
Fine Sand	35.2	23.2	21.6	25.3			
Silt	56.2	39	48.9	42			
Clay	4	24.2	28.3	22.2			
LL	30	45	32	24			
PI	NP	16	11	8			
AASHTO	A-4(0)	A-7-6(9)	A-6(9)	A-4(2)			
Station	16+05	16+93	17+83	17+85			
Offset	2' LT	17' LT	17' LT	4' RT			
Depth	4.0'-5.0'	0.0'-1.5'	0.0'-1.5'	0.0'-1.5'			

Reported by: *Patricia M. ...* Date: 4/21/2006

# CORE PHOTOGRAPH

## EB1-A

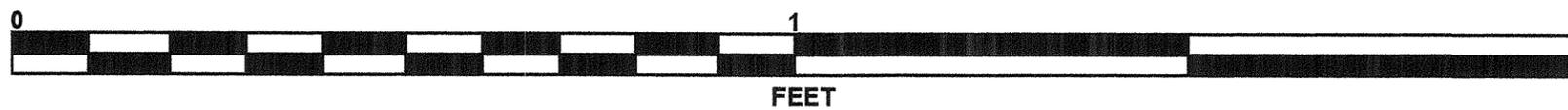
BOXES 1 & 2: 2.4-12.5 FEET



# CORE PHOTOGRAPH

## B1-A

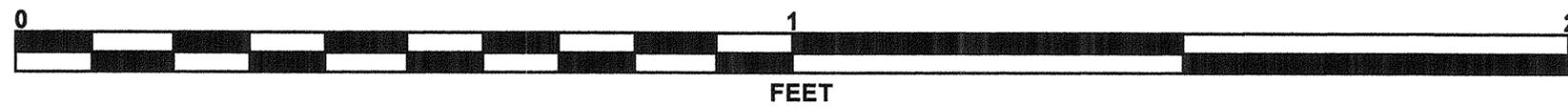
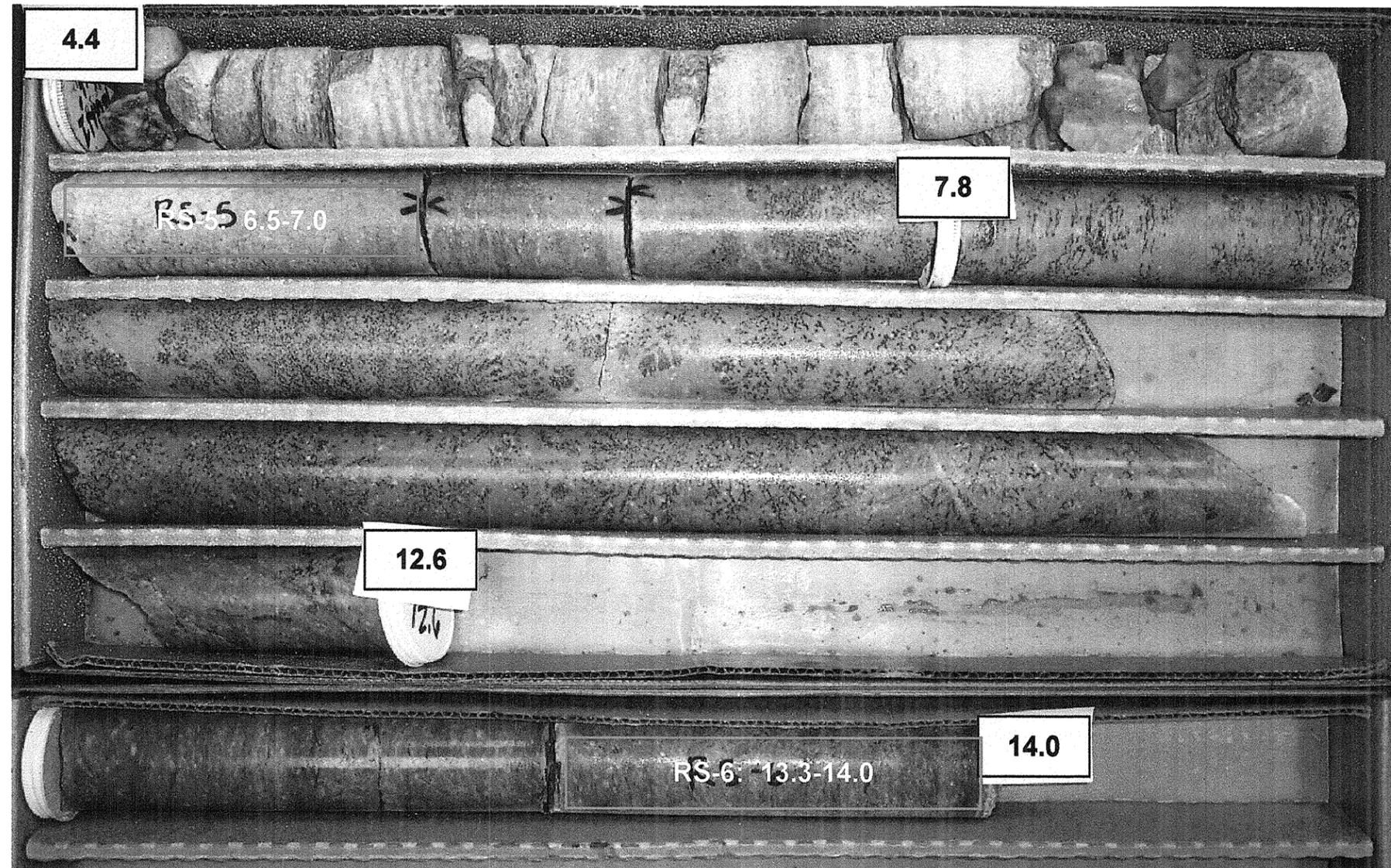
BOXES 1 & 2: 4.4-21.4 FEET



# CORE PHOTOGRAPH

## B2-B

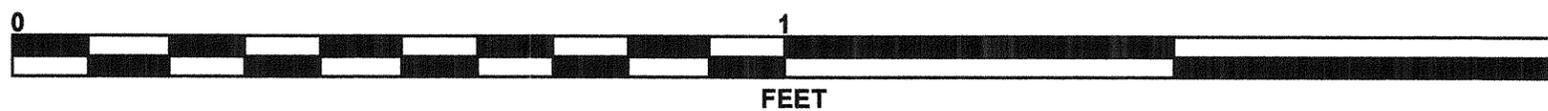
BOXES 1 & 2: 4.4-14.0 FEET



# CORE PHOTOGRAPH

## B3-A

BOXES 1 & 2: 7.4-21.2 FEET



SITE PHOTOGRAPH

BRIDGE NO. 311 ON -L- (SR 1379, PENNY RD.) OVER LAKE WHEELER (SWIFT CREEK)



LOOKING EAST