

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

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PROJ. REFERENCE NO. 33710.1.1 (B-4459) F.A. PROJ. BRSTP-0042(12)  
 COUNTY CHATHAM  
 PROJECT DESCRIPTION BRIDGE NO. 56 OVER BUCKHORN CREEK  
ON NC 42

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 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

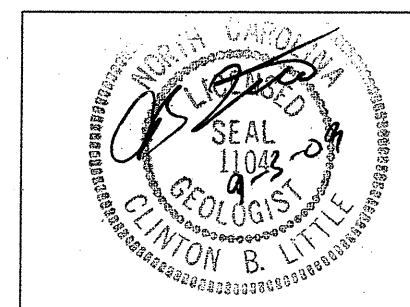
GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND 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 THIS 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.

**PROJECT: 33710.1.1 ID: B-4459**

PERSONNEL  
C.C. MURRAY  
J.E. ESTEP  
M.R. MOORE

INVESTIGATED BY R.Q. CALLAWAY  
 CHECKED BY C.B. LITTLE  
 SUBMITTED BY C.B. LITTLE  
 DATE SEPTEMBER 2009



DRAWN BY: J.K. McClURE

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N.C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS 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.



SKREW = 90° 00' 00"

RESIDUAL

WILLIAM & CAROLYN PUGH  
DB 539 PG 26  
PLAT SLIDE 89 PG 82

PROGRESS ENERGY CAROLINAS INC.  
DB 359 PG 436  
UNRECORDED PLAT  
L-D-3064  
MOORE, GARNER, & ASC. INC.

BEGIN APPROACH SLAB  
-L- STA 19+57.83

END APPROACH SLAB  
-L- STA 21+36.17

END BRIDGE  
-L- STA 21+22.00

BEGIN BRIDGE  
-L- STA 19+72.00

RESIDUAL

HIGH WATER MARK  
ELEV=162.29'  
FROM FIELD OBSERVATION  
ON MAY 7, 2008

ROADWAY EMBANKMENT

ROADWAY EMBANKMENT

BRIDGE NO. 56  
CONG. & STEEL BRIDGE  
W/ PAVED DECK

RESIDUAL N 2° 16' 42.0" E

ALLUVIUM

ARTIFICIAL  
FILL

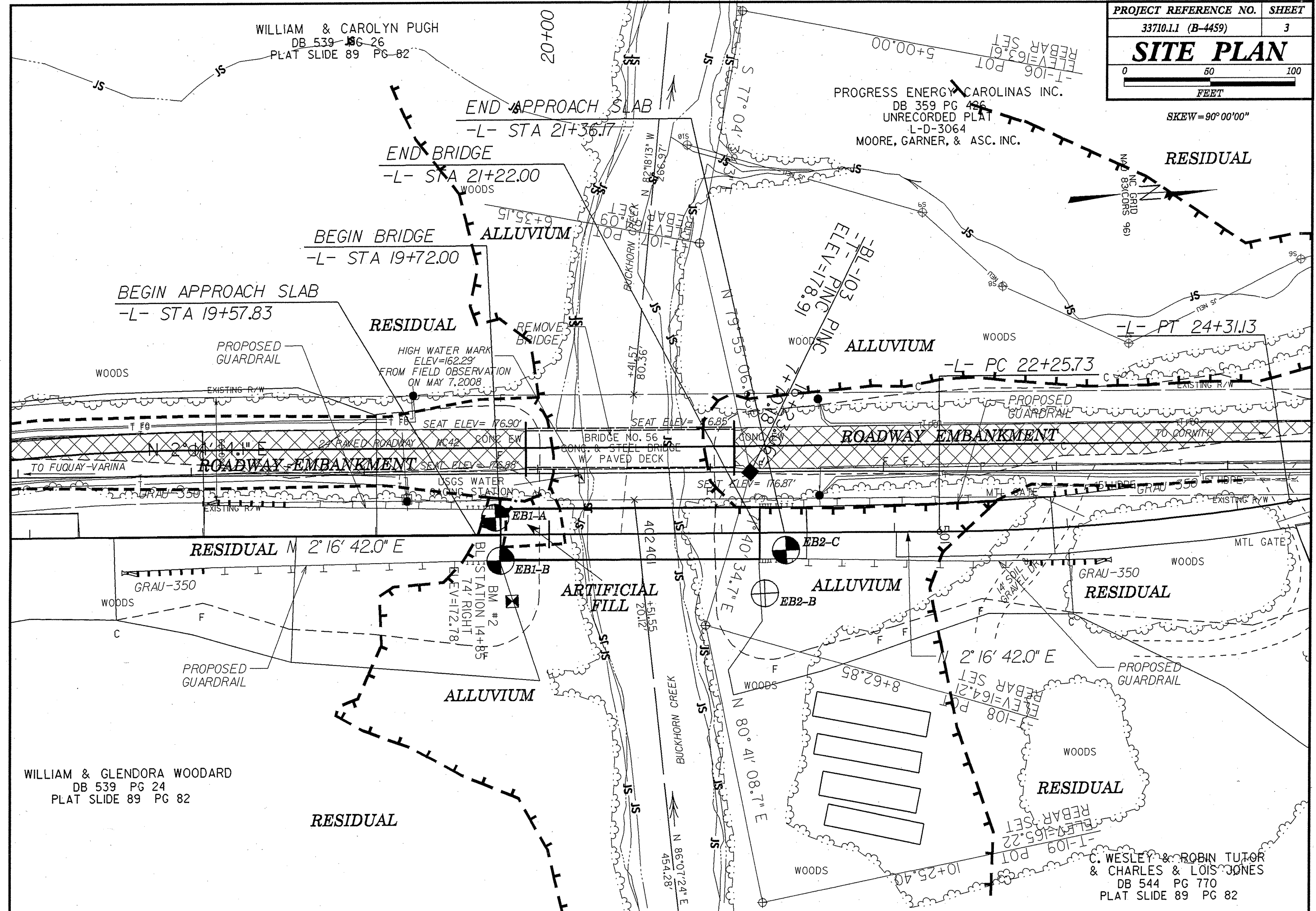
RESIDUAL

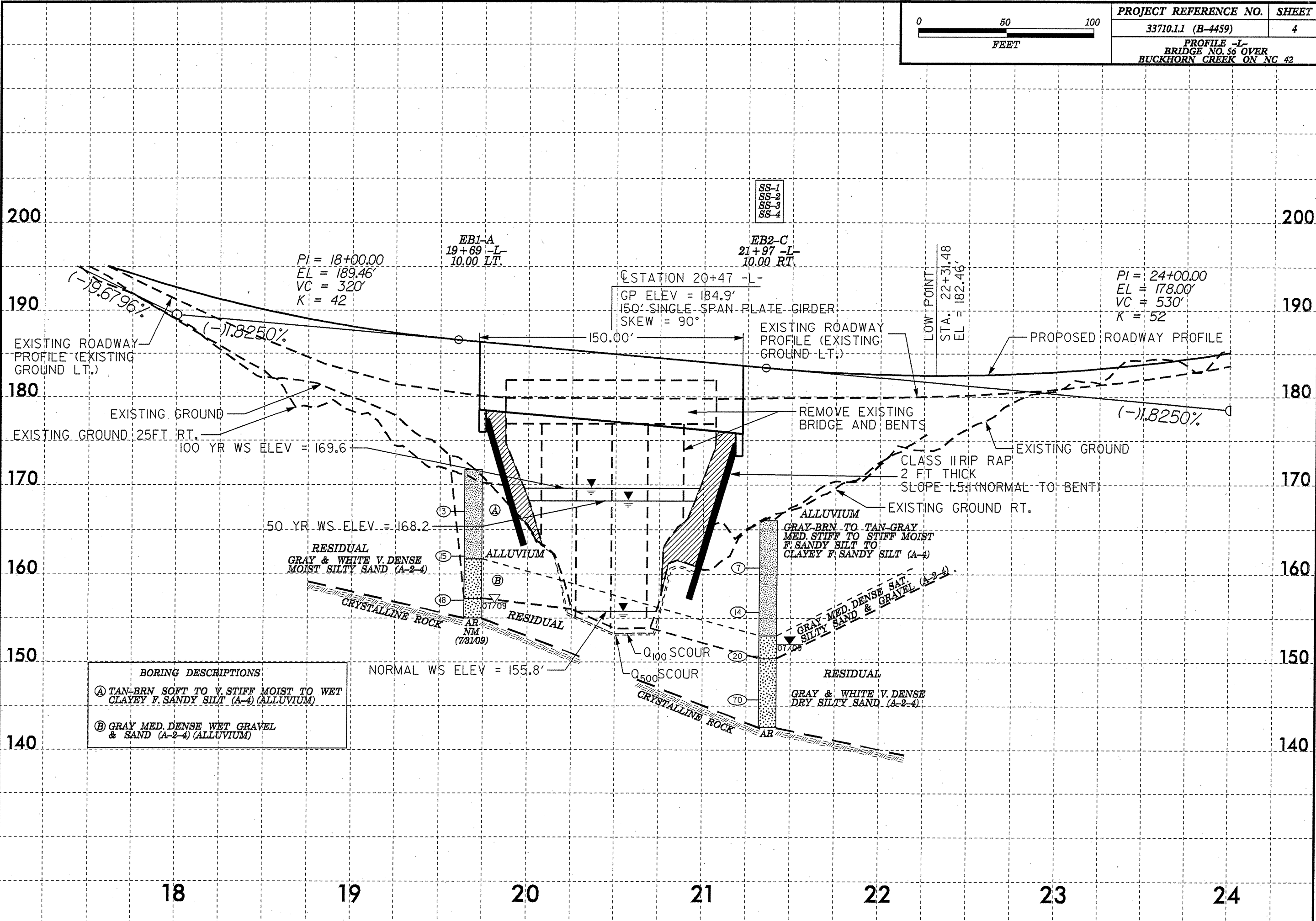
ALLUVIUM

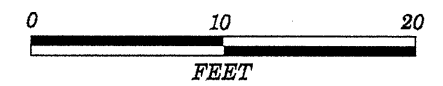
RESIDUAL

WILLIAM & GLENDORA WOODARD  
DB 539 PG 24  
PLAT SLIDE 89 PG 82

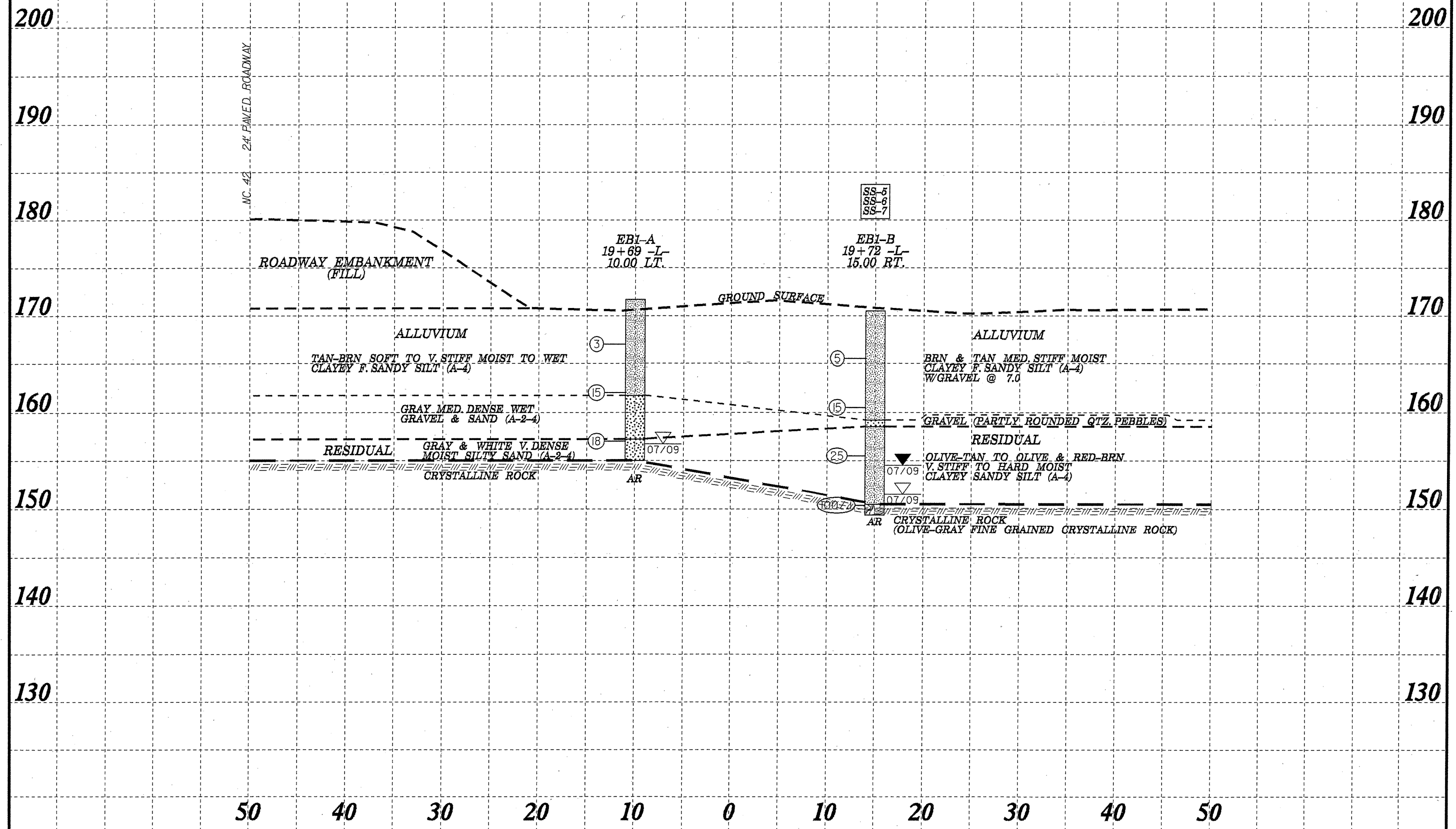
C. WESLEY & ROBIN TUTOR  
& CHARLES & LOIS JONES  
DB 544 PG 770  
PLAT SLIDE 89 PG 82

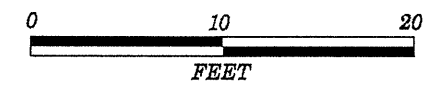






PROJECT REFERENCE NO.	SHEET
33710.1.1 (B-4459)	5
Section Thru EndBent One Sta. 19+72 -L- Skew = 90°00'00"	





200 200

190 190

180 180

170 170

160 160

150 150

140 140

130 130

NC 42 24' PAVED ROADWAY

ROADWAY EMBANKMENT (FILL)

GROUND SURFACE

SS-1  
SS-2  
SS-3  
SS-4

EB2-C  
21+37 -L-  
10.00 RT.

EB2-B  
21+25 -L-  
35.00 RT.

ALLUVIUM

GRAY-BRN TO TAN-GRAY MED. STIFF TO STIFF MOIST  
F. SANDY SILT TO CLAYEY F. SANDY SILT (A-4)

ALLUVIUM

GRAY-BRN TO TAN-GRAY  
MED. STIFF TO STIFF MOIST  
F. SANDY SILT TO  
CLAYEY F. SANDY SILT (A-4)

GRAY MED. DENSE SAT. SILTY SAND & GRAVEL (A-2-4)

GRAY MED. DENSE SAT. SILTY SAND & GRAVEL (A-2-4)

RESIDUAL

GRAY & WHITE V. DENSE  
DRY SILTY SAND (A-2-4)

RESIDUAL

GRAY & WHITE V. DENSE  
DRY SILTY SAND (A-2-4)

CRYSTALLINE ROCK

CRYSTALLINE ROCK

(7)

(14)

(20)

(70)

07/09

AR  
NM  
(7/31/09)

50 40 30 20 10 0 10 20 30 40 50

PROJECT NO. 33710.1.1		ID. B-4459		COUNTY CHATHAM		GEOLOGIST Murray, C. C.									
SITE DESCRIPTION BRIDGE 56 OVER BUCKHORN CREEK ON NC 42							GROUND WTR (ft)								
BORING NO. EB1-A		STATION 19+69		OFFSET 10ft LT		ALIGNMENT -L-									
COLLAR ELEV. 171.7 ft		TOTAL DEPTH 16.7 ft		NORTHING 658,587		EASTING 2,007,996									
DRILL MACHINE CME-550X		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
START DATE 07/30/09		COMP. DATE 07/30/09		SURFACE WATER DEPTH N/A		DEPTH TO ROCK 16.7 ft									
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					
175															
170														171.7	0.0
165	168.0	3.7	1	2	1							M			
160	163.0	8.7	4	6	9							W		161.7	10.0
155	158.0	13.7	3	4	14									157.2	14.5
150														155.0	16.7
ALLUVIAL TAN-BRN SOFT TO V. STIFF MOIST TO WET CLAYEY F. SANDY SILT (A-4) ALLUVIAL GRAY MED. DENSE WET GRAVEL & SAND (A-2-4) RESIDUAL GRAY & WHITE V. DENSE MOIST SILTY SAND (A-2-4) Boring Terminated BY AUGER REFUSAL at Elevation 155.0 ft ON CRYSTALLINE ROCK															

NCDOT BORE SINGLE B4459\_GEO\_BH\_BRD066\_CHATHAM.GPJ NC\_DOT\_GDT\_08/25/09

PROJECT NO. 33710.1.1		ID. B-4459		COUNTY CHATHAM		GEOLOGIST Murray, C. C.									
SITE DESCRIPTION BRIDGE 56 OVER BUCKHORN CREEK ON NC 42							GROUND WTR (ft)								
BORING NO. EB1-B		STATION 19+72		OFFSET 15ft RT		ALIGNMENT -L-									
COLLAR ELEV. 170.5 ft		TOTAL DEPTH 21.1 ft		NORTHING 658,589		EASTING 2,008,021									
DRILL MACHINE CME-550X		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
START DATE 07/30/09		COMP. DATE 07/30/09		SURFACE WATER DEPTH N/A		DEPTH TO ROCK 20.0 ft									
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					
175															
170														170.5	0.0
165	166.5	4.0	2	2	3							SS-5	M		
160	161.5	9.0	4	6	9							SS-6	M		
155	156.5	14.0	10	12	13							SS-7			
150	151.5	19.0	11	28	100/1									150.5	20.0
145														149.4	21.1
ALLUVIAL BRN & TAN MED. STIFF MOIST CLAYEY F. SANDY SILT (A-4) W/ GRAVEL @ 7.0 ALLUVIAL GRAVEL (PARTLY ROUNDED QTZ. PEBBLES) RESIDUAL OLIVE-TAN TO OLIVE & RED-BRN V. STIFF TO HARD MOIST CLAYEY SANDY SILT (A-4) CRYSTALLINE ROCK OLIVE-GRAY FINE GRAINED CRYSTALLINE ROCK Boring Terminated BY AUGER REFUSAL at Elevation 149.4 ft ON CRYSTALLINE ROCK															

NCDOT BORE SINGLE B4459\_GEO\_BH\_BRD066\_CHATHAM.GPJ NC\_DOT\_GDT\_08/25/09

PROJECT NO. 33710.1.1		ID. B-4459		COUNTY CHATHAM		GEOLOGIST Murray, C. C.										
SITE DESCRIPTION BRIDGE 56 OVER BUCKHORN CREEK ON NC 42							GROUND WTR (ft)									
BORING NO. EB2-C		STATION 21+37		OFFSET 10ft RT		ALIGNMENT -L-										
COLLAR ELEV. 166.0 ft		TOTAL DEPTH 23.4 ft		NORTHING 658,754		EASTING 2,008,023										
DRILL MACHINE CME-550X		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic												
START DATE 07/30/09		COMP. DATE 07/30/09		SURFACE WATER DEPTH N/A		DEPTH TO ROCK 23.4 ft										
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						
170																
165															166.0	0.0
160	161.7	4.3	3	3	4							SS-1	M			
155	156.7	9.3	4	5	9							SS-2	M			
150	151.7	14.3	2	5	15							SS-3	Sat.		153.0	13.0
145	146.7	19.3	28	23	47							SS-4	D		150.4	15.6
140															142.6	23.4
Boring Terminated BY AUGER REFUSAL at Elevation 142.6 ft ON CRYSTALLINE ROCK																

NCDOT BORE SINGLE B4459\_GEO\_BH\_BRDG056\_CHATHAM.GPJ NC\_DOT.GDT 08/28/09

PROJECT NO. 33710.1.1		ID. B-4459		COUNTY CHATHAM		GEOLOGIST Murray, C. C.										
SITE DESCRIPTION BRIDGE 56 OVER BUCKHORN CREEK ON NC 42							GROUND WTR (ft)									
BORING NO. EB2-B		STATION 21+25		OFFSET 35ft RT		ALIGNMENT -L-										
COLLAR ELEV. 164.8 ft		TOTAL DEPTH 21.0 ft		NORTHING 658,741		EASTING 2,008,047										
DRILL MACHINE CME-550X		DRILL METHOD Solid Augers		HAMMER TYPE Automatic												
START DATE 07/30/09		COMP. DATE 07/30/09		SURFACE WATER DEPTH N/A		DEPTH TO ROCK 21.0 ft										
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						
165															164.8	0.0
160																
155																
150															150.8	14.0
145															149.3	15.5
140															143.8	21.0
Boring Terminated BY AUGER REFUSAL at Elevation 143.8 ft ON CRYSTALLINE ROCK																

NCDOT BORE SINGLE B4459\_GEO\_BH\_BRDG056\_CHATHAM.GPJ NC\_DOT.GDT 08/28/09



TEST RESULTS

PROJECT: 33710.1.1 (B-4459)

COUNTY: CHATHAM

SITE DESCRIPTION: BRIDGE NO. 56 ON NC 42 OVER BUCKHORN CREEK

SHEET

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SOIL SAMPLE RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS	N	L.L.	P.I.	% BY WEIGHT				% PASSING SIEVES			% MOISTURE	% ORGANIC	UNIT WT. (d)	VOID RATIO
								C. SAND	F. SAND	SILT	CLAY	10	40	200				
<b>EB1-B</b>																		
SS-5	15 RT	19+72	4.00-5.50	A-4(0)	5	23	3	11.2	27.8	42.8	18.3	99	90	70				
SS-6	15 RT	19+72	9.00-10.50	A-4(3)	15	25	6	5.7	24.5	49.5	20.3	99	95	79				
SS-7	15 RT	19+72	14.00-15.50	A-4(1)	25	33	4	18.5	32.7	36.7	12.2	98	86	57				
<b>EB2-C</b>																		
SS-1	10 RT	21+37	4.30-5.80	A-4(0)	7	21	NP	6.8	66.7	18.4	8.1	100	100	36				
SS-2	10 RT	21+37	9.30-10.80	A-4(0)	14	22	NP	2.6	52.9	32.3	12.2	100	100	57				
SS-3	10 RT	21+37	14.30-15.80	A-2-4(0)	20	20	NP	21.3	57.7	15.9	5.1	77	72	21				
SS-4	10 RT	21+37	19.30-20.80	A-2-4(0)	70	28	3	42.8	26.6	22.5	8.1	87	59	32				

ROCK SAMPLE RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	RQD	UNIT WT	Q(MPa) (MPsi)	E(MPa) (MPsi)
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**FIELD  
SCOUR REPORT**

WBS: 33710 TIP: B-4459 COUNTY: Chatham

DESCRIPTION(1): Bridge 56 over Buckhorn Creek on NC 42

**EXISTING BRIDGE**

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

Bridge No.: 56 Length: 120' Total Bents: 7 Bents in Channel: 3 Bents in Floodplain: 4  
Foundation Type: \_\_\_\_\_

**EVIDENCE OF SCOUR(2)**

Abutments or End Bent Slopes: None

Interior Bents: None

Channel Bed: None observed

Channel Bank: None observed

**EXISTING SCOUR PROTECTION**

Type(3): None

Extent(4): \_\_\_\_\_

Effectiveness(5): \_\_\_\_\_

Obstructions(6): Logs/wood debris on interior bents.

**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 design scour elevation (DSE) 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 DSE. If the DSE is dependent on scour counter measures, explain (e.g. rip rap armoring on slopes). The DSE 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): Small sand bars over residual soil; dense silty sand A-2-4  
SS-4, SS-7

Channel Bank Material(8): Alluvial soft fine sandy silt (A-4)  
SS-1, SS-2, SS-5, SS-6

Channel Bank Cover(9): Small to medium trees

Floodplain Width(10): 225'

Floodplain Cover(11): Light woods

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

Channel Migration Tendency(13): Minor

Observations and Other Comments: \_\_\_\_\_

Reported by: [Signature] Date: 9/3/2009  
Murray/Little

DESIGN SCOUR ELEVATIONS(14) Feet  Meters \_\_\_\_\_

	100yr	500yr												
Channel	154	153												

Comparison of DSE to Hydraulics Unit theoretical scour:  
Single Span design, no abutment scour, no end bent impact.

DSE determined by: [Signature] Date: 9/3/2009  
Little

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

Bed or Bank														
Sample No.	See	attached												
Retained #4														
Passed #10														
Passed #40														
Passed #200														
Coarse Sand														
Fine Sand														
Silt														
Clay														
LL														
PI														
AASHTO														
Station														
Offset														
Depth														