STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	42285.1.1 (B-5127)	1	11

STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION
42285.1.1	BRSTP-0211(24)	P.E.
		R/W & UTIL.

NOTE: SEE SHEET 2A FOR PLAN SHEET LAYOUT AT TIME OF INVESTIGATION

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

ROADWAY SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 42285.1.1 (B-5127) F.A. PROJ. BRSTP-0211(24)

COUNTY HOKE

PROJECT DESCRIPTION BRIDGE NO. 4 ON NC 211 OVER RAFT SWAMP

INVENTORY

CONTENTS

LINE	STATION	PLAN	PROFILE	XSECT
-L-	12+00 - 16+00	4		5 - 8

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. 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.

PERSONNEL
J. BRANDSEN
S. HARDEE
M.G. MOSELEY
A.F. RIGGS JR.

INVESTIGATED BY S&ME, INC.
CHECKED BY A.F. RIGGS JR.
SUBMITTED BY S&ME, INC.
DATE MARCH 2013

NORTH CAROLINA PROFESSIONAL SEAL 14155 ENGINEER ALVER F. RIGGS, JR. 3/26/13

DRAWN BY: B. RATTI

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.

CONTRACT: ID: B-5127

PROJECT REFERENCE NO.	SHEET NO.
42285.1.1 (B-5127)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING # 10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
# 40	30 MX	50 MX	51 MN											
# 200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE MM: 305 | 75 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT PLASTIC RANGE (PI) PL — PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%
MODERATELY ORGANIC	5 - 10%	12 - 20%
HIGHLY ORGANIC	>10%	>20%

OTHER MATERIAL	
TRACE	1 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS
S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [X] CME-45B
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 2-15/16" STEEL TEETH
- [X] TRICONE 3-15/16" STEEL TEETH
- [ ] CORE BIT
- [X] 3-1/4" H.S.A.

HAMMER TYPE:
- [X] AUTOMATIC
- [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [ ] -N_____
- [ ] -H_____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [X] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [X] 1/2" STEEL ROD

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CPI)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, YIELDS SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, YIELDS SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FEET
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS. OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: (BL-102) ALLUMINUM DISC AND REBAR
STATION 8+35.36 -BL- N 415582.86 E 1938292.97
ELEVATION: 202.30 FT.

NOTES:
FIAD - FILLED IN AFTER DRILLING
ST-1 SHELBY TUBE

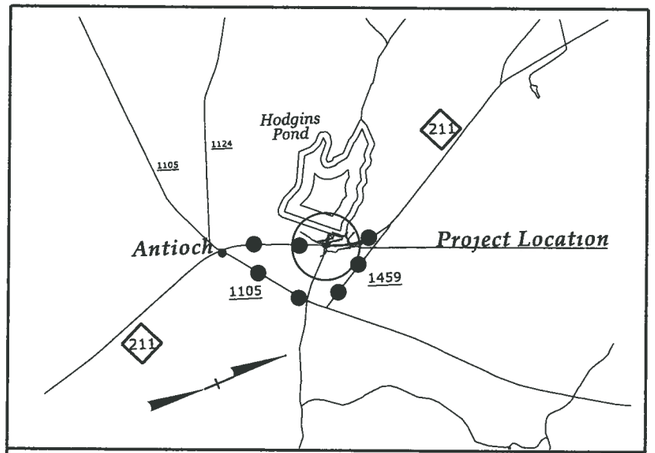
REVISED 09/23/09

11-MAR-2013 13:42
S:\PROJECTS\2012\12-417 B-5127 Hoke Co\Standard DOT Structure\GEOTECH DOT\Cadd Files\TIP\B5127_GEO_RDWY_NC211_OVER_RAFT_SWAMP\CADD_GEOTECH\PlanProf\b5127_rdy_tsh.dgn
BRATTI AT BRATTI7-T3500
08/08/99

TIP PROJECT: B-5127

CONTRACT: 42285.1.1

See Sheet 1-A For Index of Sheets



VICINITY MAP

Offsite Detour Route

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

HOKE COUNTY

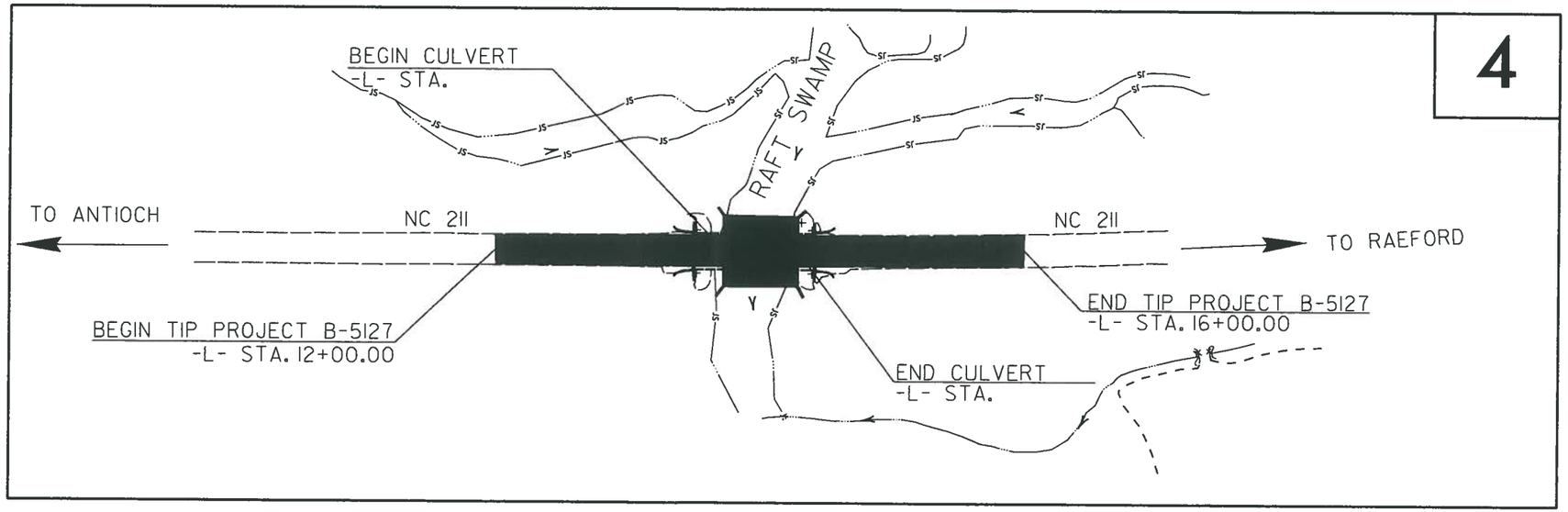
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5127	2A	11

STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION
42285.1.1	BRSTP-0211(24)	P.E.

LOCATION: ***Bridge No. 4 on NC 211 over Raft Swamp***

TYPE OF WORK: ***Grading, Drainage, Paving, and Culvert***

NAD 83/2001



METHOD OF CLEARING ??.
THIS PROJECT IS NOT WITHIN THE LIMITS OF ANY MUNICIPALITY

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

GRAPHIC SCALES

50 25 0 50 100
PLANS

50 25 0 50 100
PROFILE (HORIZONTAL)

10 5 0 10 20
PROFILE (VERTICAL)

DESIGN DATA

ADT 2014 = 5280 vpd
ADT 2035 = 7300 vpd
DHV = 10 %
D = 60 %
T = 8 % *
V = 60 MPH
* TTST 5% DUAL 3%
Regional Tier

PROJECT LENGTH

Length Roadway TIP Project B-5127 = Miles
Length Structure TIP Project B-5127 = Miles
Total Length TIP Project B-5127 = 0.076 Miles

Prepared in the Office of:
DIVISION OF HIGHWAYS
1000 Birch Ridge Dr., Raleigh NC, 27610

2012 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
February 21, 2014

LETTING DATE:
February 17, 2015

James Speer, PE
PROJECT ENGINEER

John Lansford, PE
PROJECT DESIGN ENGINEER

HYDRAULICS ENGINEER

SIGNATURE: P.E.

ROADWAY DESIGN ENGINEER

SIGNATURE: P.E.

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DATE	March 26, 2013
TO:	State of N.C. Department of Transportation Division of Highways P.O. Box 25201 Raleigh, North Carolina 27611-5201
ATTENTION:	Mr. Mohammed A. Mulla, P.E., CPM
FROM:	S&ME, Inc. 3201 Spring Forest Road Raleigh, North Carolina 27616
STATE PROJECT:	42285.1.1
F. A. PROJECT:	BRSTP-0211(24)
TIP NUMBER:	B-5127
COUNTY:	Hoke
DESCRIPTION:	Bridge No. 4 on NC 211 over Raft Swamp
SUBJECT:	Roadway Subsurface Investigation – Inventory Report

Project Description

The project is located about 0.5 miles east of Antioch, North Carolina in Hoke County. The proposed project consists of replacing existing bridge No.4 with a new culvert along the same alignment of N.C. 211. The roadway will consist of a two lane roadway with shoulder. A new culvert will be constructed along the same alignment at approximately Station 14+00 -L- over Raft Swamp. Hodgins pond and dam are located approximately 300 feet upstream from the bridge. An overhead transmission line crosses directly over the bridge site in a north-east and south-west direction.

A geotechnical investigation was conducted by S&ME between December 20, 2012 and December 21, 2012 by performing one auger probe and two soil test borings. Drilling consisted of advancing 3-1/4 inch diameter hollow stem augers at the auger probe boring and utilizing mud rotary wash boring techniques with N and H casing and standard penetration testing in the soil test borings. The drilling was performed with a CME-45B truck mounted drill rig equipped with an automatic hammer. The auger probe and borings were advanced to depths ranging from about 44.3 to 50.0 feet (elevations 152.6 to 157.7 feet) at collar elevations ranging from about 202.0 to 202.7 feet. This information was supplemented by a soil test boring performed for PDEA by NCDOT equipment and personnel on April 9, 2009. This boring was drilled to a depth of 65.0 feet (Elevation129.2 feet) utilizing wash boring techniques. Standard penetration testing was performed with a CME-550 drill rig mounted on an all- terrain carrier and equipped with an automatic hammer.

In addition to the auger probe and soil test borings, four hand auger borings were performed. The hand-augered borings were advanced using a 3-inch diameter bucket auger with 4 foot long extension rods to obtain soil samples. The hand auger borings were advanced to depths of 2.5 to 6.5 feet below the creek bottom. The subsurface soils were probed with an 8 foot long, 1/2 inch diameter, steel, T-handled, probe rod to help identify soft/loose soils. Soil samples were obtained with the auger bucket for visual classification.

Representative split-spoon and bulk soil samples were collected for visual classification and selected soil samples were submitted for laboratory analysis. Laboratory testing was performed in accordance with the AASHTO Soil Classification System.

The following alignment was investigated.

Line	Station
-L-	12+00 to 16+00

Areas of Special Geotechnical Interest

1) Alluvial Soils: The following areas contain relatively soft or wet soils which have the potential for subgrade problems during construction. In addition, these soils may contain cohesive soils or organic materials which may cause embankment instability or long term settlement problems.

Line	Station
-L-	13+68 to 14+30

2) Roadway Embankment Fill: Poorly compacted roadway embankment fill exist along the roadway alignment in areas where previous grading has occurred. Roadway embankment fill material was encountered at the following locations:

Line	Station
-L-	12+00 to 13+56
-L-	14+42 to 16+00

Physiography and Geology

The project site is located within the Coastal Plain physiographic and geologic province of North Carolina. The Coastal Plain geologic region has been formed during past transgressive and regressive movements of the ocean into and out of North Carolina. As such, the Coastal Plain province is characterized by subdued topographic features and flat, low lying terrain.

The near surface soils at the ground surface (including swamp areas and creek bottom) in this region consist of undifferentiated Holocene, Pleistocene, and Pliocene sands of alluvial deposits. The creek bed soils generally consist of light colored fine grained sands with interbedded silts and clays with varying amounts

of organic matter. The surface soils along the adjacent low wet areas consist of dark colored silts and sands with wood fragments and organic matter (muck) of Holocene Age overlying undifferentiated coastal plain deposits. Based on the 1985 Geologic Map of North Carolina, the primary geologic formation beneath the undifferentiated coastal plain deposits at this location is the Middendorf Formation. The Middendorf Formation typically consists of sands, poorly indurated sandstone, and thin beds of sandy mudstone and clay. Lateral continuity of bedding is poor and cross bedding is common. The Cape Fear Formation underlies the Middendorf Formation. The Cape Fear Formation consists of gray, sandy mudstone and blocky clay. The bedding is laterally continuous with some faint cross bedding.

Soil Properties

Soils present on this project include roadway embankment fill, alluvial soils, coastal plain deposits and soils of the Middendorf and Cape Fear Formations.

Roadway embankment fill materials were found in association with previous construction of the roadway and bridge approaches in borings B-2, B-3 and auger probe AP-1. AP-1 was drilled from the surface of the asphalt pavement consisting of about 0.6 feet of asphalt underlain by about 0.5 feet of crushed stone. The depth of the fill materials ranged from about 11 to 12 feet beneath the ground surface. The fill materials encountered consist of very loose to medium dense brown, gray and tan slightly clayey to silty fine to coarse sand (A-2-4). These soils appeared to be moist to wet.

Alluvial deposits were encountered at the ground surface within and adjacent to the creek in boring B-1 and hand auger borings, HA-1, HA-2, HA-3, and HA-4, and beneath the roadway embankment fill in borings B-2, B-3 and AP-1. The depth of the alluvial deposits ranged from about 12 to 17.5 feet (elevation 182.2 to 185.7 feet) to beneath the ground surface. Alluvial deposits encountered consist of very loose to loose gray to black silty fine sand (A-3, A-2-4, Muck) with trace to high amounts of organic matter and very soft to soft brown fine sandy silt (Muck). These soils appeared wet to saturated.

Undifferentiated Coastal Plain deposits were encountered beneath the alluvial soils in borings B-1 through B-3 and AP-1. The Undifferentiated Coastal Plain deposits consist of loose to medium dense tan, white and gray silty to clayey fine to coarse sand (A-3, A-1-b, A-2-4, and A-2-6). These soils appear to be wet to saturated.

The Undifferentiated Coastal Plain deposits are underlain by soils of the Middendorf Formation at depths of about 34 to 37.5 feet (elevations 160.2 to 167.7 feet) beneath the ground surface. Theses soils consist of loose to very dense tan-gray silty to clayey fine to coarse sands (A-3, A-2-4, and A-2-6). These sands appeared to be wet to saturated.

The Cape Fear Formation was encountered in borings B-1 and B-3 at depths of about 43.7 to 47.0 feet (elevations 150.5 to 155.6 feet) beneath the ground surface. These soils consist of hard gray silty clay (A-7-6). These clays appeared to be dry to moist.

Groundwater

Groundwater was measured only in boring B-2. The remaining soil test borings were back filled at completion of drilling. The water level measured in boring B-2 was at a depth of 12.3 feet (elevation 189.7 feet) beneath the ground surface. The hand auger borings were performed in the swamp. The water level of the swamp, at the time of our investigation on January 8, 2013, was elevation 194.2 feet. Water levels within the flood plain and surrounding swamp areas will fluctuate with seasonal precipitation and release of water from the dam upstream at Hodgkin's pond. The depth of water beneath the roadway embankment will generally occur within 8.5 to 10 feet below proposed grades.

Culvert at –L- Station 14+00

Based on the preliminary roadway plans a 4X 13'X 13' RCBC is proposed for the –L- alignment at the crossing of Raft Swamp at approximately Station 14+00. Soil test borings encountered about 2.2 to 6.2 feet of very loose sands (A-3, A-2-4, and Muck) with little to high amounts of organic matter at the proposed culvert location. The creek level at the time of our investigations was elevation 194.2 feet.

S&ME appreciates the opportunity to be your geotechnical consultant on this project.
If you have any questions or need additional information in regard to this report, please contact us.

Very truly yours,

Jeremy Brandsen
Staff Geologist

Abner F. Riggs, Jr., P.E.
Senior Geotechnical Engineer
N.C. Registration No. 14155

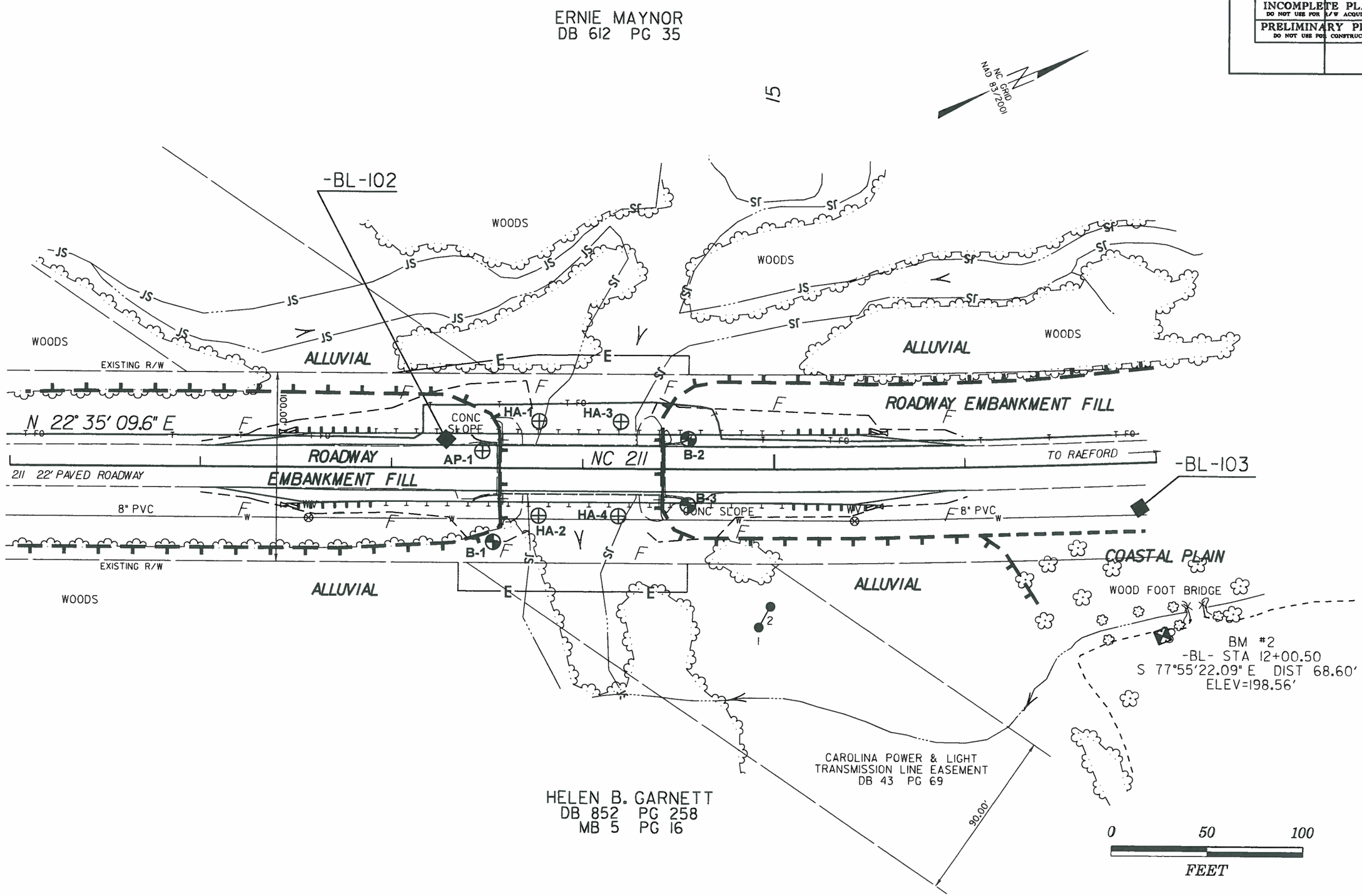
NORTH CAROLINA PROFESSIONAL SEAL 14155 3/26/13 ENGINEER ABNER F. RIGGS, JR.

S:\PROJECTS\2012\12-417BridgeNo.4 on NC211 over Raft Swamp\Geotech\Report\12-417 rpt Inventory.doc

PROJECT REFERENCE NO.	SHEET NO.
42285.1.1 (B-5127)	4
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



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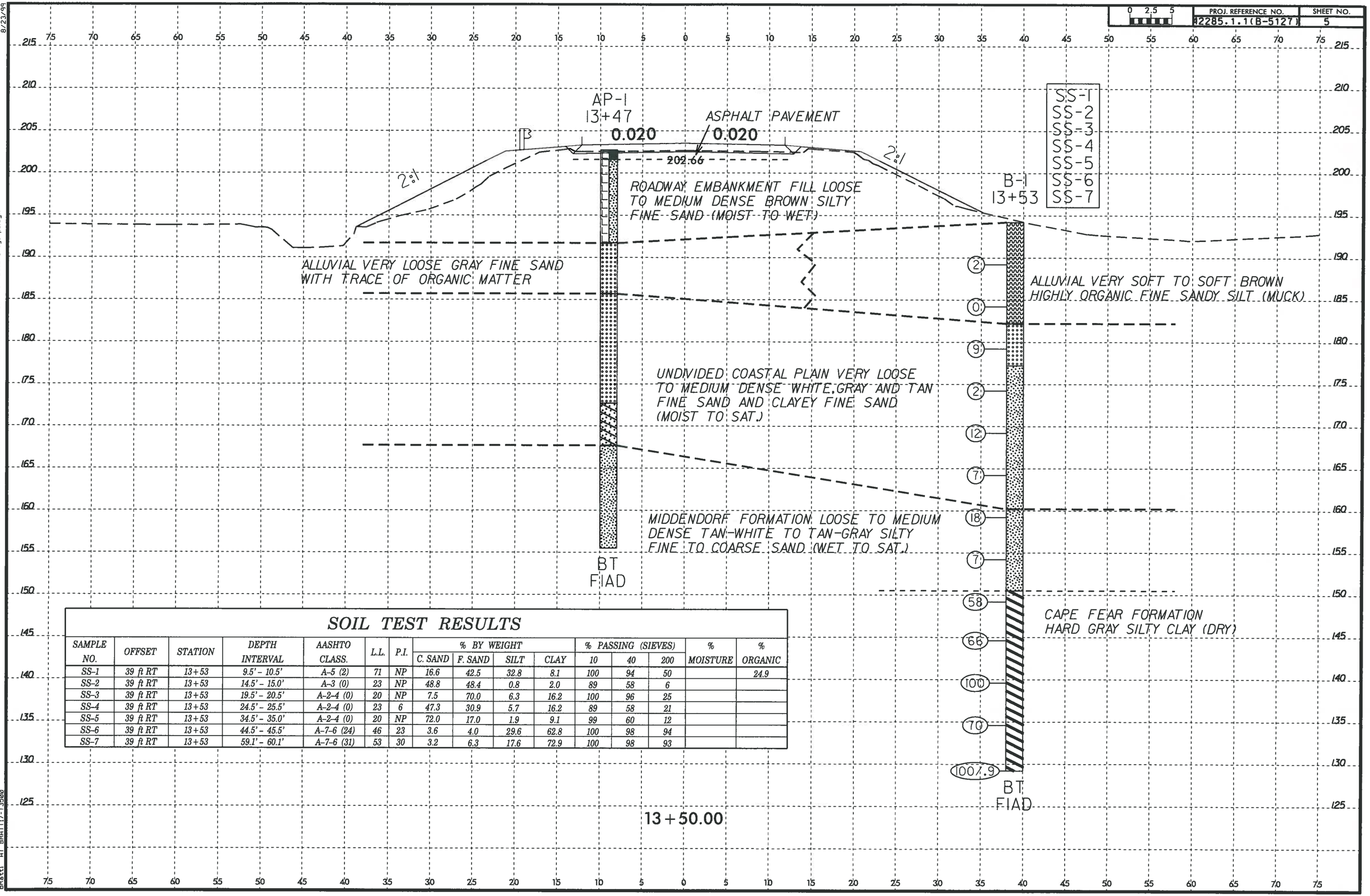

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C. SAND	F. SAND	SILT	CLAY	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
SS-1	39 ft RT	13+53	9.5' - 10.5'	A-5 (2)	71	NP	16.6	42.5	32.8	8.1	100	94	50		24.9
SS-2	39 ft RT	13+53	14.5' - 15.0'	A-3 (0)	23	NP	48.8	48.4	0.8	2.0	89	58	6		
SS-3	39 ft RT	13+53	19.5' - 20.5'	A-2-4 (0)	20	NP	7.5	70.0	6.3	16.2	100	96	25		
SS-4	39 ft RT	13+53	24.5' - 25.5'	A-2-4 (0)	23	6	47.3	30.9	5.7	16.2	89	58	21		
SS-5	39 ft RT	13+53	34.5' - 35.0'	A-2-4 (0)	20	NP	72.0	17.0	1.9	9.1	99	60	12		
SS-6	39 ft RT	13+53	44.5' - 45.5'	A-7-6 (24)	46	23	3.6	4.0	29.6	62.8	100	98	94		
SS-7	39 ft RT	13+53	59.1' - 60.1'	A-7-6 (31)	53	30	3.2	6.3	17.6	72.9	100	98	93		

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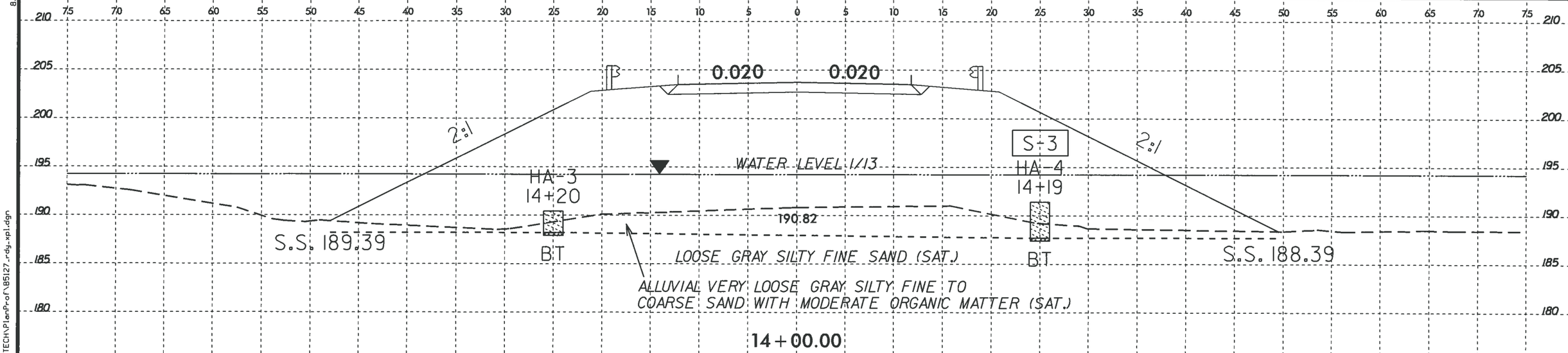
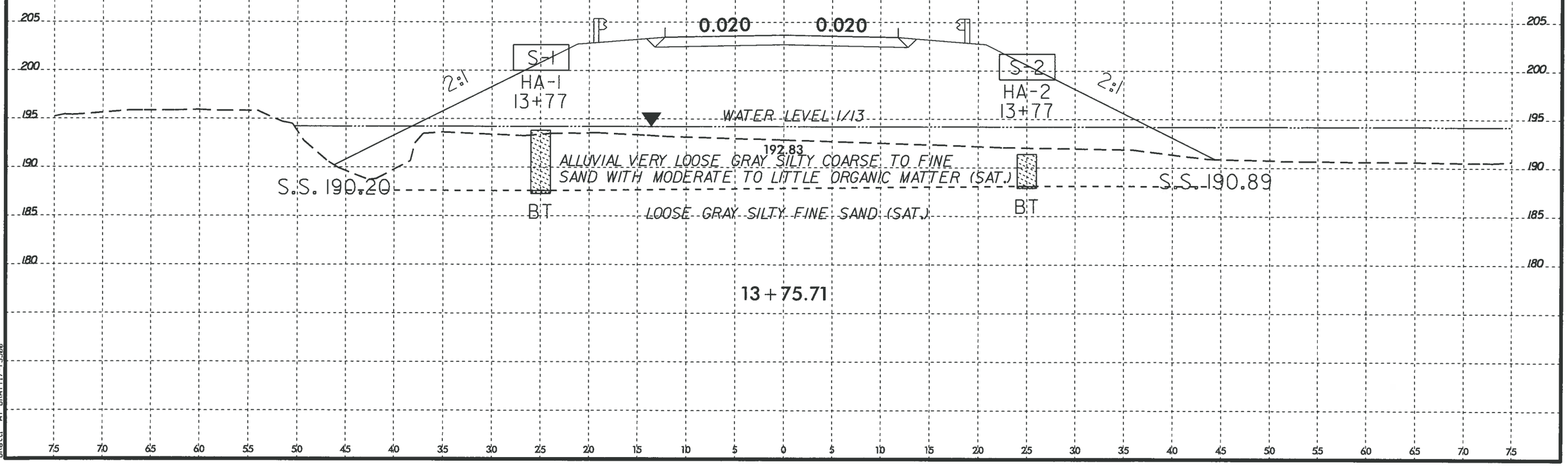


SOIL TEST RESULTS

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		
S-1	25 ft LT	13+77	2.5' - 3.5'	A-2-4 (0)	13	NP	39	47	10	4	99	79	17.2		4.4
S-2	25 ft RT	13+77	1.0' - 2.0'	A-2-4 (0)	17	NP	48	30	17	5	94	68	23.0		6.9
S-3	25 ft RT	14+19	1.0' - 2.0'	A-3 (0)	13	NP	60	32	5	3	98	78	9.5		5.7



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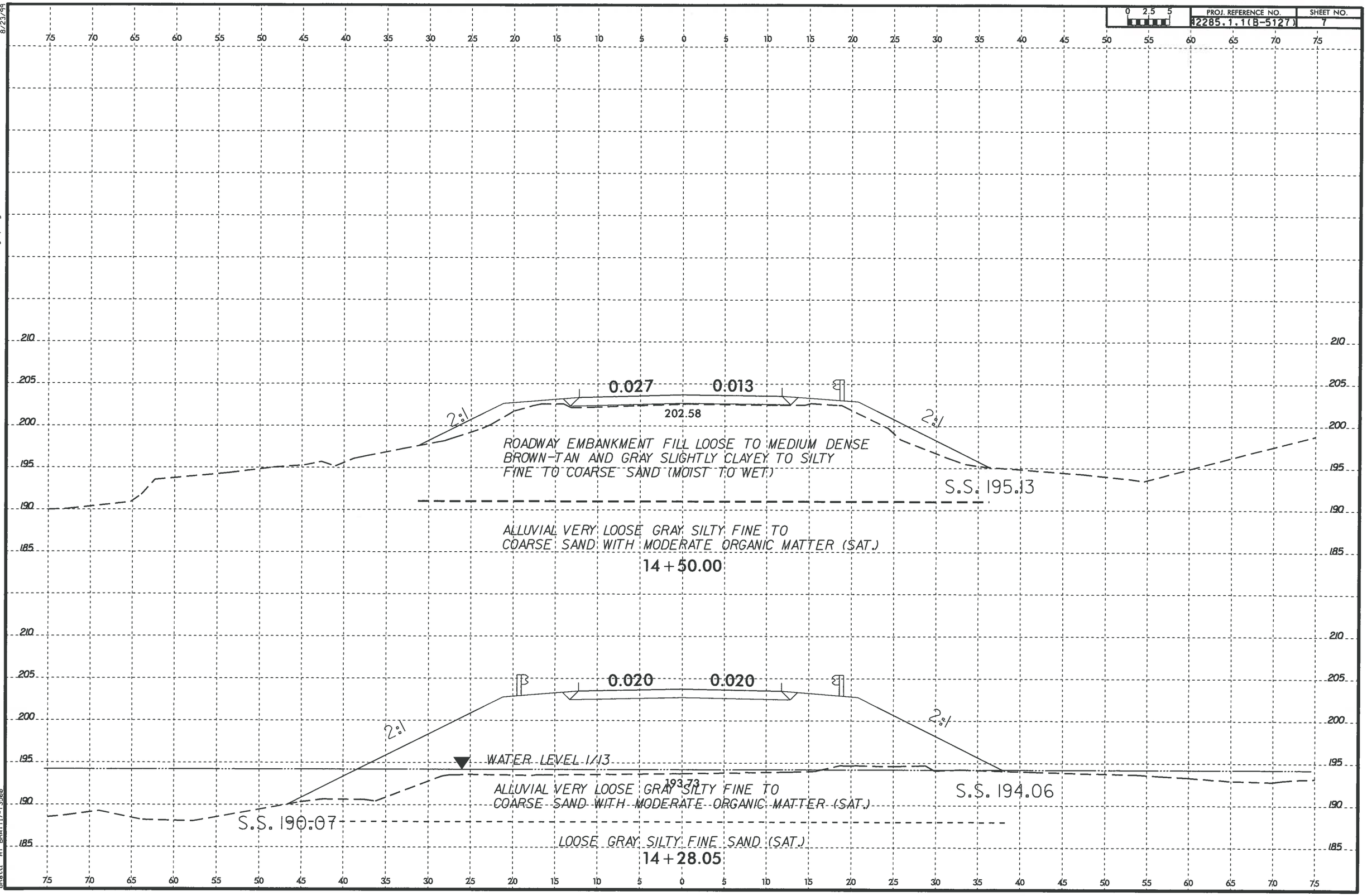

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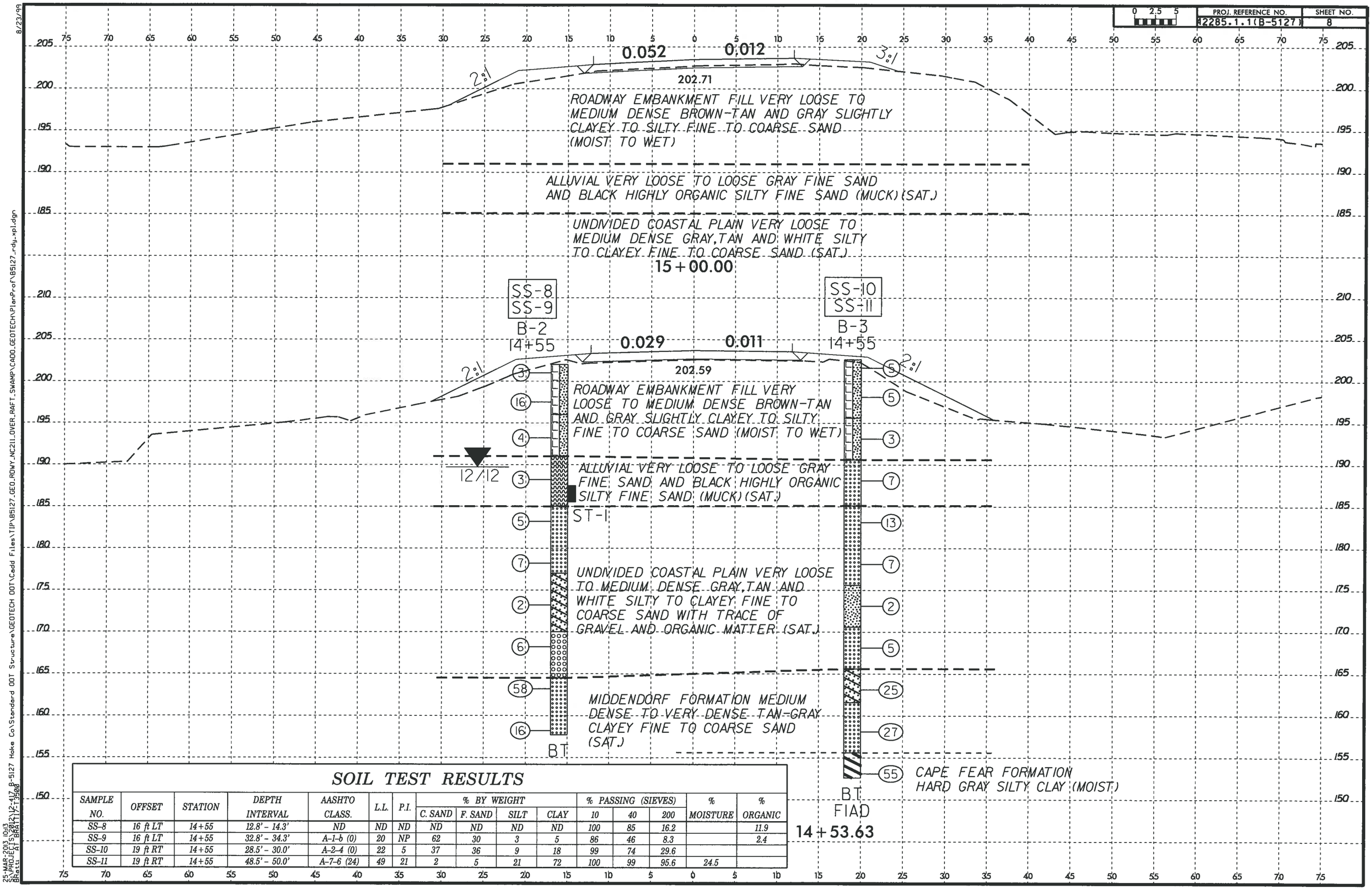

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C. SAND	F. SAND	SILT	CLAY	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
SS-8	16 ft LT	14+55	12.8' - 14.3'	ND	ND	ND	ND	ND	ND	ND	100	85	16.2		11.9
SS-9	16 ft LT	14+55	32.8' - 34.3'	A-1-b (0)	20	NP	62	30	3	5	86	46	8.3		2.4
SS-10	19 ft RT	14+55	28.5' - 30.0'	A-2-4 (0)	22	5	37	36	9	18	99	74	29.6		
SS-11	19 ft RT	14+55	48.5' - 50.0'	A-7-6 (24)	49	21	2	5	21	72	100	99	95.6	24.5	

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