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REFERENCE: B-4929

PROJECT: 40233

| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|
| N.C. | B-4929 | 1 | 70 |

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

# STRUCTURE SUBSURFACE INVESTIGATION

COUNTY PENDER

PROJECT DESCRIPTION BRIDGE OVER INTRACOASTAL WATERWAY ON NC50/210 BETWEEN US 17 AND TOPSAIL BEACH

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DATE FEBRUARY 2016

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*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 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 THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR 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<br>A-3 | A-4, A-5<br>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,<br>A-7-6 | | | |
| SYMBOL | | | | | | | | | | | | | | |
| % PASSING #10 | 50 MX | | | | | | | | | | | | | |
| #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 | GRANULAR SOILS | SILT-CLAY SOILS | MUCK, PEAT |
| MATERIAL PASSING #40 | | | | | | | | | | | | | | |
| LL | – | | – | | 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 |
| PI | 6 MX | | NP | | 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 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 | < 4 | |
| | LOOSE | 4 TO 10 | |
| | MEDIUM DENSE | 10 TO 30 | |
| | DENSE | 30 TO 50 | |
| | VERY DENSE | > 50 | N/A |
| GENERALLY SILT-CLAY MATERIAL (COHESIVE) | VERY SOFT | < 2 | < 0.25 |
| | SOFT | 2 TO 4 | 0.25 TO 0.5 |
| | MEDIUM STIFF | 4 TO 8 | 0.5 TO 1.0 |
| | STIFF | 8 TO 15 | 1 TO 2 |
| | VERY STIFF | 15 TO 30 | 2 TO 4 |
| | HARD | > 30 | > 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 |
|---|---|---|---|---|---|---|---|
| | 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) | - WET - (W) | SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE |
| PL — PLASTIC LIMIT | | |
| OM — OPTIMUM MOISTURE | - MOIST - (M) | SOLID; AT OR NEAR OPTIMUM MOISTURE |
| SL — SHRINKAGE LIMIT | | |
| | - DRY - (D) | REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE |

## PLASTICITY

| | PLASTICITY INDEX (PI) | DRY STRENGTH |
|---|---|---|
| NON PLASTIC | 0-5 | VERY LOW |
| SLIGHTLY PLASTIC | 6-15 | SLIGHT |
| MODERATELY PLASTIC | 16-25 | MEDIUM |
| HIGHLY PLASTIC | 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.
UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES 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 WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.

## COMPRESSIBILITY

| | |
|---|---|
| SLIGHTLY COMPRESSIBLE | LL < 31 |
| MODERATELY COMPRESSIBLE | LL = 31 - 50 |
| HIGHLY COMPRESSIBLE | LL > 50 |

## PERCENTAGE OF MATERIAL

| ORGANIC MATERIAL | GRANULAR SOILS | SILT - CLAY SOILS | OTHER MATERIAL | |
|---|---|---|---|---|
| TRACE OF ORGANIC MATTER | 2 - 3% | 3 - 5% | TRACE | 1 - 10% |
| LITTLE ORGANIC MATTER | 3 - 5% | 5 - 12% | LITTLE | 10 - 20% |
| MODERATELY ORGANIC | 5 - 10% | 12 - 20% | SOME | 20 - 35% |
| HIGHLY ORGANIC | > 10% | > 20% | 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 WITH CORE
- SPT N-VALUE

## RECOMMENDATION SYMBOLS

- UNDERCUT
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

## 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
$\gamma$ - UNIT WEIGHT
$\gamma_d$ - 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:
- [X] CME-45C
- [X] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [X] D-25
- [ ] _____

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q2

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

## ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. 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 (CP) | 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, WOULD YIELD SPT N VALUES > 100 BPF* |
| VERY SEVERE (V SEV.) | ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD 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 FOOT |
| 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 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, SUCH 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: N/A

ELEVATION: N/A FEET

NOTES:

BRIDGE BORING STATION, OFFSET, AND ELEVATIONS OBTAINED USING A SURVEY GRADE GPS UNIT

FIAD= FILL IMMEDIATELY AFTER DRILLING

NM= NOT MEASURED

DATE: 8-15-14

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| B-4929 | 3 |

# SITE PLAN

8/17/99

MATCHLINE 16+00 -L-

MATCHLINE 30+00 -L-

BEGIN RETAINING WALL -Z-

END RETAINING WALL -Z-

BEGIN RETAINING WALL -L-

END RETAINING WALL -L-

BEGIN BRIDGE -L- STA.19+27.06

EB1-A

B1-B

B2-A

B3-B

B4-A

B5-B

B6-A

B7-B

B8-A

B9-B

DO NOT DISTURB WETLANDS
USE 2:1 MAX SLOPES ON RT
-Y1- STA.17+00 TO 17+25

WOOD PIER TO
BE REMOVED

SUBAQUATIC
VEGETATION
HABITAT

NOTE: MINIMUM 120' SPAN OVER
SUBAQUATIC VEGETATION HABITAT

NC GRID
NAD 83 NA 2011

NC HWY 50 & NC 210

LITTLE RIVER RD

BOAT ACCESS CHANNEL

WOOD PIER

WOOD WALL

POOL

POOL HOUSE

1SF BUS

2SF BUS

GRAVEL

PLANTER

0 100 200
FEET

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Walker, A. Brooks

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| B-4929 | 4 |

# SITE PLAN

8/17/99

NC GRID
NAD 83 NA 2011

MATCHLINE 30+00 -L2-

MATCHLINE 44+00 -L2-

SUBAQUATIC VEGETATION HABITAT

SAV

-ICW-

-ICW- PI Sta. 23+11.72

-L2- POC Sta. 37+09.05 =
-ICW- POT Sta. 25+43.65
Skew Angle = 82° 55' 53"

-ICW- POT Sta. 28+29.66

B10-A
B11-B
B12-A
B13-B
B14-A
B14-B
B15-A
B15-B
B16-B
B17-A
B18-B
B19-A

20
25
30
35
40

0 100 200
FEET

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Walker

8/17/99

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| B-4929 | 5 |

# SITE PLAN

NC GRID
NAD 83 NA 2011

MATCHLINE 44+00 -L2-

MATCHLINE 58+00 -L2-

B20-B
B21-A
B22-B
B23-A
B24-B
B25-A
B26-B
B27-A
B28-B
EB2-A

-L2- POT Sta. 57+31.57 = (12.42' LT)
-SL1- PT Sta. 12+24.57
BEGIN RETAINING WALL

END BRIDGE
-L2- ST A 57+00.06

-Y3- PC Sta. 13+08.71

-Y3- POC Sta. 13+94.69 =
-SL1- POT Sta. 10+00.00 (25.00' RT)
S 26° 13' 54.1" W

-SL1- PC Sta. 10+67.52

END RETAINING WALL

-L2- POT Sta. 57+25.82 =
-SL2- PC Sta. 10+00.00 (28.00' RT)

-RA2- POC Sta. 13+88.08 =
-L2- POT Sta. 58+44.52

-RA2- PC Sta. 10+00.00 =
-RA2- PT Sta. 14+08.41

-Y4- POC Sta. 12+65.82 =
-SL2- PT Sta. 13+08.66 (16.79' RT)

REMOVE SIDEWALK
DO NOT DISTURB WOODEN WALKWAY
DO NOT DISTURB POLE
DO NOT DISTURB SEAWALL
TIE PROP. FENCE TO EXISTING
BEGIN RETAINING WALL
END RETAINING WALL
MSE WALL
SEA WALL
CONC
GR
15 F BUS
25 F BUS
24"
36"
45
50
55

0 100 200
FEET

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User: ajfrailow

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| B-4929 | 6 |

**PROFILE BORINGS PROJECTED ALONG –L2–**
VE = 5:1

Ⓐ VERY SOFT TO SOFT, DARK GRAY, SATURATED, SILTY CLAY (A-7-6) WITH TRACE FINE SAND **-UNDIVIDED COASTAL PLAIN-**
Ⓑ VERY LOOSE, DARK BROWN, SATURATED, SILTY FINE TO COARSE SAND (A-2-4) WITH LITTLE ORGANICS **-UNDIVIDED COASTAL PLAIN-**
Ⓒ SOFT, DARK GRAY, SATURATED, FINE TO COARSE SANDY CLAY (A-6) WITH TRACE TO SOME SHELL FRAGMENTS **-UNDIVIDED COASTAL PLAIN-**
Ⓓ DENSE, LIGHT GRAY, SATURATED, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) **-COASTAL PLAIN-** (RIVER BEND FORMATION)
Ⓔ GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE **-COASTAL PLAIN SEDIMENTARY ROCK-** (RIVER BEND FORMATION)
Ⓕ DENSE, LIGHT GRAY, SATURATED, SILTY FINE TO COARSE SAND (A-1-b) WITH SOME CEMENTED SAND FRAGMENTS **-COASTAL PLAIN-** (RIVER BEND FORMATION)

BEGIN BRIDGE
-L2- STA. 19+27.06
ELEV. = 2.32'

EB1-A 19+23 22' LT
B1-B 20+19 21' RT
B2-A 21+15 31' LT
B3-B 22+05 21' RT
B4-A 23+49 30' LT
B5-B 24+90 23' RT
B6-A 26+30 28' LT
B7-B 27+24 21' RT
B8-A 28+28 31' LT
B9-B 29+16 19' RT

WATER SURFACE

VERY SOFT, BLACK, SATURATED, MUCK **-ALLUVIAL-**

VERY SOFT TO VERY LOOSE TO MEDIUM DENSE, BROWN, BLACK, AND GRAY, SATURATED, SILTY FINE TO COARSE SAND (A-2-6), CLAYEY FINE SAND AND WITH TRACE ORGANICS, GRAVEL, CEMENTED SAND, AND WOOD (A-2-4), SHELL FRAGMENTS **-UNDIVIDED COASTAL PLAIN-** (RIVER BEND FORMATION) **-COASTAL PLAIN SEDIMENTARY ROCK-**

LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS

LOOSE TO VERY DENSE, GRAY, SATURATED, SILTY FINE TO COARSE SAND AND SHELL FRAGMENTS (A-1-b) **-COASTAL PLAIN-** (RIVER BEND FORMATION)

LIGHT GRAY TO GRAY, FRIABLE TO INDURATED SEDIMENTARY LIMESTONE **-COASTAL PLAIN-** (RIVER BEND FORMATION)

MEDIUM DENSE TO VERY DENSE, LIGHT GRAY, FRIABLE TO MOD. INDURATED LIMESTONE **-CP-**

VERY DENSE, GRAY, SATURATED, SILTY FINE TO COARSE SAND (A-2-4) WITH SOME CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) AND MEDIUM DENSE TO DENSE, GRAY, SATURATED, CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION)

GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE **-COASTAL PLAIN SEDIMENTARY ROCK-** (RIVER BEND FORMATION)

LT. GRAY, FRIABLE TO INDURATED LIMESTONE **-COASTAL PLAIN SEDIMENTARY ROCK-** (RIVER BEND FORMATION)

*WATER SURFACE: MHW, ELEVATION = 1.45' PER BSR

*GROUNDLINE PROFILE AT CL OF –L2– TAKEN FROM ROADWAY DESIGN PLANS AS OF 11/20/2015

*INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE

**–L2–**

16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00 25+00 26+00 27+00 28+00 29+00 30+00

40 30 20 10 0 –10 –20 –30 –40 –50 –60 –70 –80 –90 –100 –110 –120 –130 –140 –150

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Walker, Al Graham

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| B-4929 | 7 |

**PROFILE BORINGS PROJECTED ALONG –L2–**
VE = 5:1

*GROUNDLINE PROFILE AT CL OF –L2– TAKEN FROM ROADWAY DESIGN PLANS AS OF 11/20/2015

*INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE

*WATER SURFACE: MHW ELEVATION = 1.45' PER BSR

B10–A 30+55 37' LT
B11–B 31+98 22' RT
B12–A 33+41 30' LT
B13–B 34+80 11' RT
B14–B 36+26 26' RT
B15–B 37+83 21' RT
B16–B 39+34 20' RT
B17–A 40+77 28' LT
B18–B 42+36 14' RT
B19–A 43+82 32' LT

WATER SURFACE

SS-31

VERY SILTY SOME LOOSE TO MEDIUM FINE TO COARSE SHELL FRAGMENTS LIGHT GRAY, LOOSE TO VERY SOME CEMENTED LIGHT GRAY, MEDIUM DENSE TO VERY DENSE, GRAY, FRIABLE TO MODERATELY INDURATED SILTY FINE TO COARSE SAND (A-2-4) LIGHT GRAY, INDURATED LIMESTONE -CP- (RIVER BEND FORMATION)

DENSE, GRAY SAND (A-2-4) AND AND TRACE ORGANICS FRIABLE SAND FRAGMENTS, DENSE, GRAY, FRIABLE TO TO VERY DENSE, LIGHT GRAY TO GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE -CP- (RIVER BEND FORMATION)

TO DARK GRAY, FINE SAND (A-3) LIMESTONE WITH AND GRAVEL GRAY-BROWN AND LIGHT GRAY TO GRAY, SATURATED, LIMESTONE TO COARSE SAND (A-2-4) GRAY, -COASTAL PLAIN- (RIVER BEND FORMATION)

SATURATED, WITH TRACE TO SHELL FRAGMENTS GREENISH GRAY, -COASTAL PLAIN- INDURATED FRIABLE TO INDURATED LIMESTONE -CP- SAND (A-2-4) WITH SOME CEMENTED SAND AND GRAY, SATURATED, INDURATED TO FRIABLE LIMESTONE -COASTAL PLAIN SEDIMENTARY ROCK- (RIVER BEND FORMATION)

-UNDIVIDED COASTAL PLAIN- (RIVER BEND FORMATION) SATURATED, SILTY FINE TO COARSE SAND (A-1-b) WITH LITTLE CEMENTED GRAY, SATURATED, SILTY FINE TO COARSE SAND AND SHELL FRAGMENTS AND DENSE, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS -COASTAL PLAIN- (RIVER BEND FORMATION)

VERY SOFT TO VERY STIFF, SATURATED, FINE WITH DARK GRAY AND SANDY SILTY CLAY TRACE SHELL -UNDIVIDED COASTAL PLAIN- SEDIMENTARY -COASTAL PLAIN- (A-2-4) WITH TRACE SHELL FRAGMENTS, SEDIMENTARY ROCK- (A-1-b) AND MEDIUM DENSE TO DENSE, SHELL FRAGMENTS -COASTAL PLAIN- DENSE, LIGHT GRAY, SATURATED, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) -COASTAL PLAIN- (RIVER BEND FORMATION)

GREENISH GRAY, (A-7-6 & A-7-5) FRAGMENTS -UNDIVIDED COASTAL PLAIN- SEDIMENTARY ROCK- TRACE TO GRAY, SATURATED, (RIVER BEND FORMATION)

(G) DENSE, GRAY, SATURATED, SILTY FINE TO COARSE SAND (A-2-4) WITH SOME CEMENTED SAND AND SHELL FRAGMENTS -COASTAL PLAIN- (RIVER BEND FORMATION)

(H) VERY SOFT TO SOFT, DARK GRAY AND BLACK, SATURATED, MUCK AND PEAT -ALLUVIAL-

(I) VERY SOFT TO SOFT, DARK GRAY, SATURATED, SILTY CLAY (A-7-5) WITH TRACE TO SOME SHELL FRAGMENTS -UNDIVIDED COASTAL PLAIN-

(J) VERY SOFT TO SOFT, DARK GRAY, SATURATED, SILTY CLAY (A-7-6 AND A-7-5) WITH TRACE SHELL FRAGMENTS AND ORGANICS -UNDIVIDED COASTAL PLAIN-

(K) LOOSE TO MEDIUM DENSE, GRAY, SATURATED, SILTY FINE SAND (A-2-4) AND FINE SAND (A-3) -UNDIVIDED COASTAL PLAIN-

(L) GRAY, FRIABLE AND MODERATELY INDURATED LIMESTONE -COASTAL PLAIN SEDIMENTARY ROCK- (RIVER BEND FORMATION)

(M) VERY STIFF, GRAY, SATURATED, CLAYEY FINE TO COARSE, SANDY SILT (A-4) WITH TRACE GRAVEL AND SHELL FRAGMENTS -COASTAL PLAIN- (RIVER BEND FORMATION)

(N) GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION) -COASTAL PLAIN SEDIMENTARY ROCK-

(O) VERY SOFT, DARK GRAY, SATURATED, FINE SANDY SILT (A-4) WITH SOME CLAY -UNDIVIDED COASTAL PLAIN-

(P) VERY LOOSE TO LOOSE, SATURATED, LIGHT GRAY TO GRAY, SILTY FINE SAND (A-2-4) AND FINE SAND (A-3) WITH TRACE SHELL FRAGMENTS -UNDIVIDED COASTAL PLAIN-

(Q) LOOSE TO MEDIUM DENSE, DARK GRAY, SATURATED, SILTY FINE SAND (A-2-4) WITH LITTLE CLAY AND TRACE TO SOME SHELL FRAGMENTS -UNDIVIDED COASTAL PLAIN-

–L2–

30+00 31+00 32+00 33+00 34+00 35+00 36+00 37+00 38+00 39+00 40+00 41+00 42+00 43+00 44+00

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Walker AT 6666161084

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| B-4929 | 8 |

**PROFILE BORINGS PROJECTED ALONG -L2-**
VE = 5:1

(O) VERY SOFT TO SOFT, DARK GRAY, SATURATED, FINE SANDY SILT (A-4) WITH SOME CLAY **-UNDIVIDED COASTAL PLAIN-**
(R) VERY SOFT, DARK BROWN, SATURATED, SILTY CLAY (A-7-5) **-UNDIVIDED COASTAL PLAIN-**
(S) SOFT, DARK GRAY, SATURATED, CLAYEY, FINE SANDY SILT (A-4) WITH TRACE SHELL FRAGMENTS **-UNDIVIDED COASTAL PLAIN-**
(T) VERY SOFT, DARK GRAY AND GREENISH GRAY, SATURATED, FINE SANDY SILTY CLAY (A-7-5) WITH TRACE SHELL FRAGMENTS **-UNDIVIDED COASTAL PLAIN-**
(U) VERY SOFT, DARK GRAY, SATURATED, SILTY CLAY (A-7-5) WITH TRACE ORGANICS
(V) SOFT, DARK GRAY, SATURATED, FINE SANDY SILTY CLAY (A-7-5) WITH TRACE SHELL FRAGMENTS **-UNDIVIDED COASTAL PLAIN-**
(W) VERY LOOSE, BROWN, SATURATED, SILTY FINE SAND (A-2-4) WITH LITTLE ORGANICS **-UNDIVIDED COASTAL PLAIN-**
(X) VERY LOOSE, BROWN, WET, SILTY FINE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS AND ORGANICS **-ARTIFICIAL FILL-**
(Y) MEDIUM STIFF, DARK GRAY, SATURATED, SILTY CLAY (A-7-6) **-UNDIVIDED COASTAL PLAIN-**
(Z) VERY SOFT, DARK GRAY, SATURATED, FINE SANDY SILTY CLAY (A-6) WITH TRACE SHELL FRAGMENTS **-UNDIVIDED COASTAL PLAIN-**
(AA) VERY DENSE, LIGHT GRAY, SATURATED, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) **-COASTAL PLAIN-**
(BB) GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE **-COASTAL PLAIN SEDIMENTARY ROCK-**

END BRIDGE -L2- STA 57+00.06 ELEV.= 3.63'

B20-B 45+32 21' RT | B21-A 46+84 31' LT | B22-B 48+28 18' RT | B23-A 49+88 32' LT | B24-B 51+34 22' RT | B25-A 52+75 32' LT | B26-B 54+16 31' RT | B27-A 55+12 34' LT | B28-B 56+07 32' RT | EB2-A 56+88 29' LT

SS-537

WATER SURFACE

VERY SOFT, DARK BROWN, SATURATED, MUCK **-ALLUVIAL-**

VERY SOFT, DARK GRAY, SATURATED, MUCK **-ALLUVIAL-**

VERY SOFT, DARK BROWN, SATURATED, MUCK **-ALLUVIAL-**

VERY LOOSE TO LOOSE, BROWN, GRAY, AND GREENISH-GRAY, FINE TO COARSE SAND (A-2-6) WITH TRACE ORGANICS, SATURATED, SILTY FINE TO COARSE SAND (A-2-4), AND TRACE CEMENTED FINE SAND FRAGMENTS (A-3) AND CLAYEY SAND **-UNDIVIDED COASTAL PLAIN-**

LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) **-COASTAL PLAIN SEDIMENTARY ROCK-**

LOOSE TO VERY DENSE, GREENISH-GRAY, GRAY, AND GRAY-BROWN, SATURATED, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE TO SOME GRAVEL AND SHELL FRAGMENTS, AND CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) **-COASTAL PLAIN-** (RIVER BEND FORMATION)

LIGHT GRAY TO GRAY, FRIABLE TO INDURATED LIMESTONE **-COASTAL PLAIN SEDIMENTARY ROCK-** (RIVER BEND FORMATION)

MEDIUM DENSE TO VERY DENSE, LIGHT GRAY TO GRAY, SATURATED, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) **-COASTAL PLAIN-** (RIVER BEND FORMATION)

GRAY, INDURATED TO MODERATELY INDURATED LIMESTONE **-CP-**

VERY STIFF, SATURATED, LIGHT GRAY, CLAYEY FINE TO COARSE SANDY SILT (A-4) WITH TRACE GRAVEL **-COASTAL PLAIN-** (RIVER BEND FORMATION)

GRAY, INDURATED LIMESTONE **-CP-**

MEDIUM DENSE, SATURATED, LIGHT GRAY, CLAYEY FINE TO COARSE SAND (A-2-6) WITH TRACE SHELL FRAGMENTS **-COASTAL PLAIN-** (RIVER BEND FORMATION)

*WATER SURFACE: MHW ELEVATION=1.45' PER BSR

*GROUNDLINE PROFILE AT CL OF -L2- TAKEN FROM ROADWAY DESIGN PLANS AS OF 11/20/2015

*INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE

-L2-

44+00 45+00 46+00 47+00 48+00 49+00 50+00 51+00 52+00 53+00 54+00 55+00 56+00 57+00 58+00

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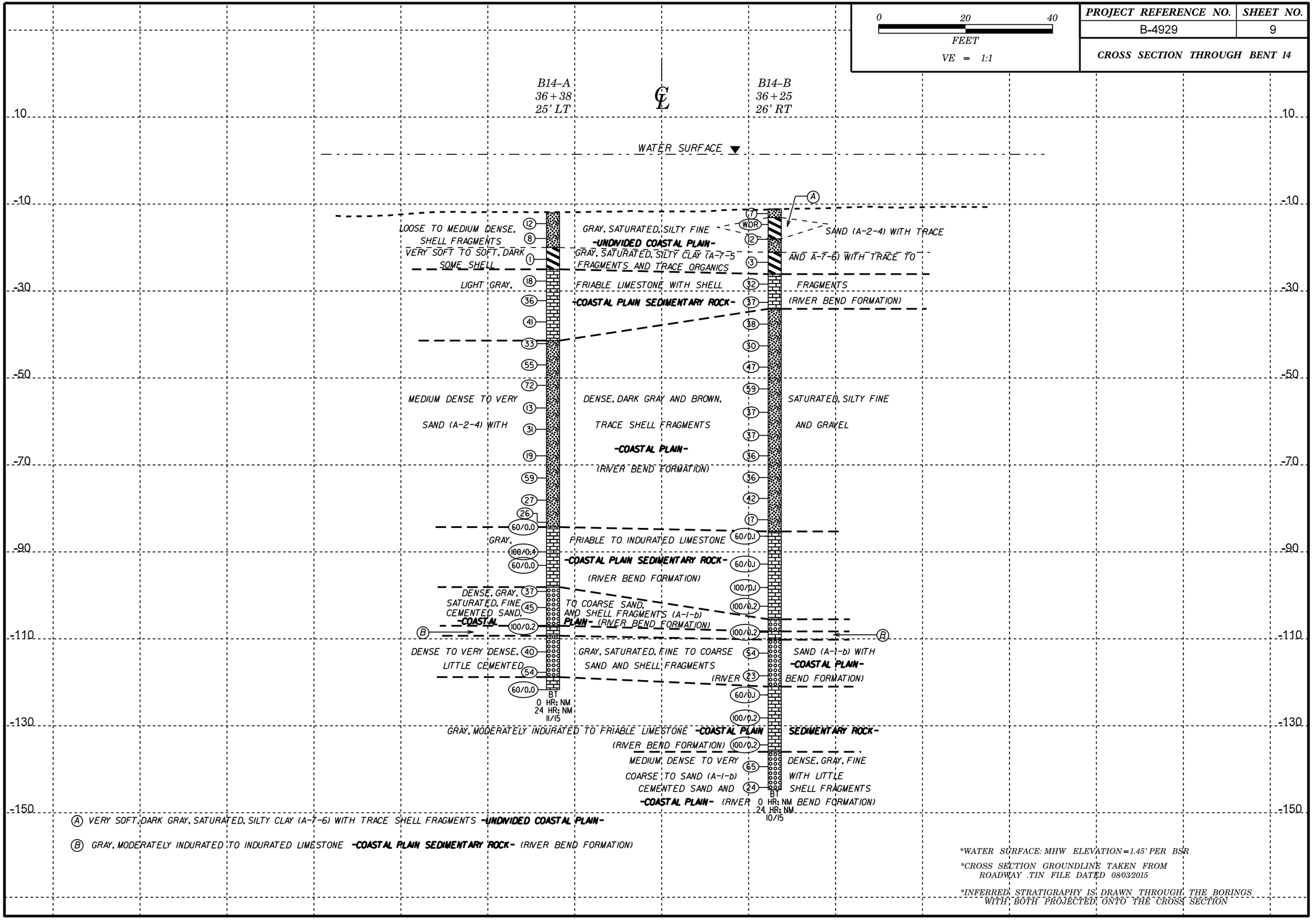
Walker, A. 66T0161063

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| B-4929 | 9 |

CROSS SECTION THROUGH BENT 14

0 20 40
FEET
VE = 1:1




Ⓐ VERY SOFT, DARK GRAY, SATURATED, SILTY CLAY (A-7-6) WITH TRACE SHELL FRAGMENTS **-UNDIVIDED COASTAL PLAIN-**

Ⓑ GRAY, MODERATELY INDURATED TO INDURATED LIMESTONE **-COASTAL PLAIN SEDIMENTARY ROCK-** (RIVER BEND FORMATION)

*WATER SURFACE: MHW ELEVATION=1.45' PER BSR

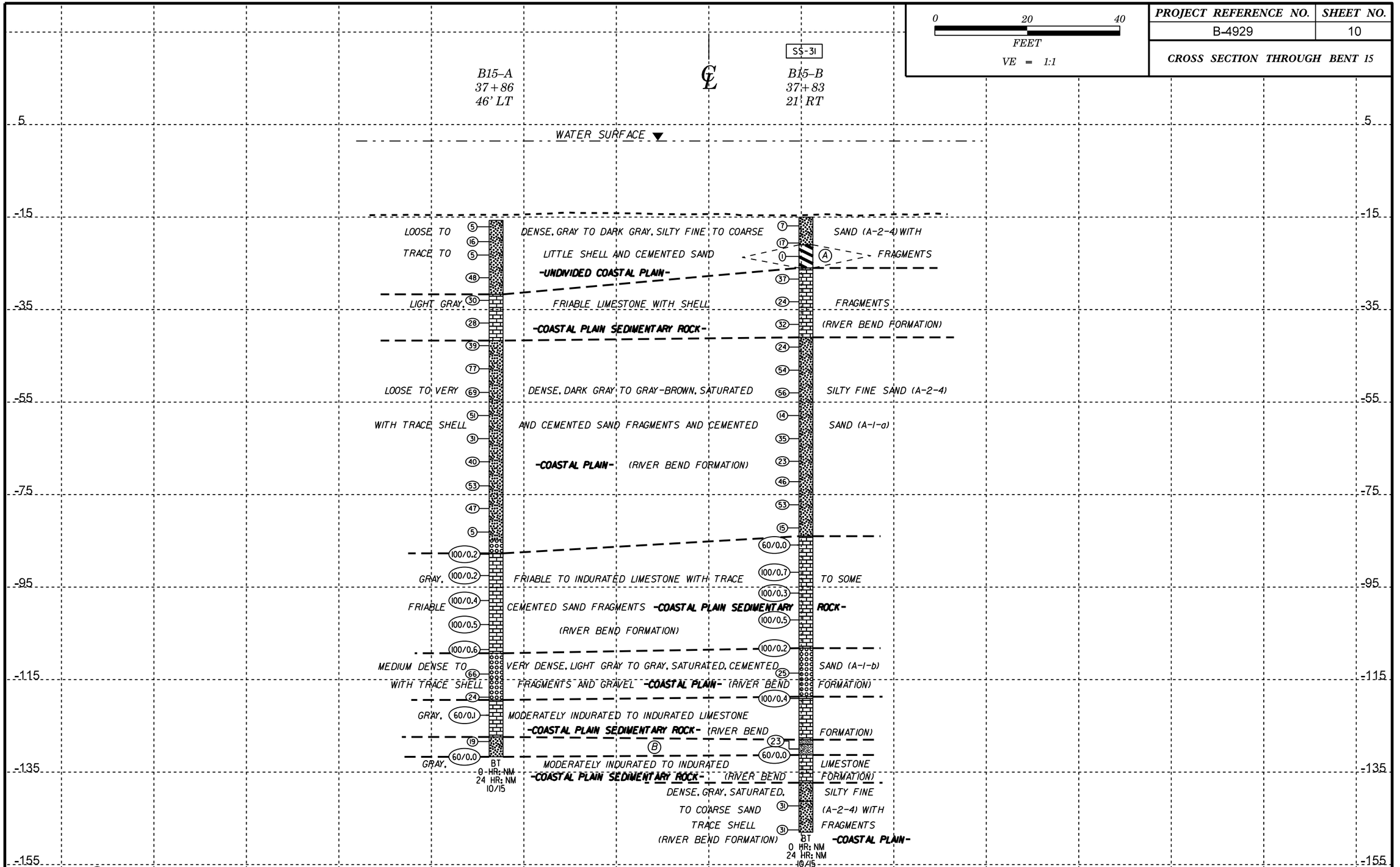
*CROSS SECTION GROUNDLINE TAKEN FROM ROADWAY .TIN FILE DATED 08032015

*INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| B-4929 | 10 |

CROSS SECTION THROUGH BENT 15

0 20 40
FEET
VE = 1:1




(A) VERY SOFT, SATURATED, DARK GRAY, SILTY CLAY (A-7-5) WITH TRACE SHELL FRAGMENTS -UNDIVIDED COASTAL PLAIN-

(B) MEDIUM DENSE, LIGHT GRAY, SATURATED, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE CEMENTED SAND FRAGMENTS AND VERY STIFF, GRAY, SATURATED, CLAYEY FINE TO COARSE SANDY SILT (A-4) WITH TRACE GRAVEL AND SHELL FRAGMENTS -COASTAL PLAIN- (RIVER BEND FORMATION)

*WATER SURFACE: MHW ELEVATION=1.45' PER BSR

*CROSS SECTION GROUNDLINE TAKEN FROM ROADWAY .TIN FILE DATED 08/03/2015

*INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** D. RACEY | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** EB1-A | **STATION** 19+23 | **OFFSET** 22 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 1.5 ft | **TOTAL DEPTH** 110.0 ft | **NORTHING** 252,215 | **EASTING** 2,436,409 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** F&R3495 CME-55 73% 02/15/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** D. TIGNOR | **START DATE** 10/26/15 | **COMP. DATE** 10/28/15 | **SURFACE WATER DEPTH** 0.9ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| | 1.5 | 0.0 | | | | | | | | GROUND SURFACE 0.0 |
| 0 | | | WOH | WOH | 2 | 2 | | Sat. | | 1.0 0.9<br>**ALLUVIAL**<br>BLACK, MUCK |
| | -2.0 | 3.5 | 5 | 5 | 4 | 9 | | Sat. | | **UNDIVIDED COASTAL PLAIN**<br>DARK GRAY-BROWN, SILTY FINE SAND<br>(A-2-4) WITH TRACE ORGANICS |
| -5 | | | | | | | | | | |
| | -7.0 | 8.5 | WOH | WOH | 1 | 1 | | Sat. | | -7.0 8.5<br>DARK GRAY, SILTY CLAY (A-7-6) WITH<br>TRACE FINE SAND |
| -10 | | | | | | | | | | -9.0 10.5<br>DARK GRAY, SILTY FINE SAND (A-2-4) |
| | -12.0 | 13.5 | 1 | 1 | 1 | 2 | | Sat. | | |
| -15 | | | | | | | | | | |
| | -17.0 | 18.5 | 7 | 18 | 14 | 32 | | Sat. | | -16.5 18.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH<br>SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -20 | | | | | | | | | | |
| | -22.0 | 23.5 | 13 | 17 | 13 | 30 | | Sat. | | |
| -25 | | | | | | | | | | |
| | -27.0 | 28.5 | 14 | 14 | 21 | 35 | | Sat. | | |
| -30 | | | | | | | | | | |
| | -32.0 | 33.5 | 11 | 15 | 21 | 36 | | Sat. | | |
| -35 | | | | | | | | | | |
| | -37.0 | 38.5 | 4 | 7 | 10 | 17 | | Sat. | | -36.5 38.0<br>**COASTAL PLAIN**<br>GRAY-BROWN, SILTY FINE SAND (A-2-4)<br>WITH TRACE SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -40 | | | | | | | | | | |
| | -42.0 | 43.5 | 29 | 31 | 41 | 72 | | Sat. | | |
| -45 | | | | | | | | | | |
| | -47.0 | 48.5 | 17 | 25 | 29 | 54 | | Sat. | | |
| -50 | | | | | | | | | | |
| | -52.0 | 53.5 | 27 | 19 | 14 | 33 | | Sat. | | -HARD DRILLING NOTED FROM 51.0'-51.3' |
| -55 | | | | | | | | | | |
| | -57.0 | 58.5 | 7 | 18 | 30 | 48 | | Sat. | | |
| -60 | | | | | | | | | | |
| | -62.0 | 63.5 | 7 | 6 | 9 | 15 | | Sat. | | |
| -65 | | | | | | | | | | |
| | -67.0 | 68.5 | 8 | 24 | 33 | 57 | | Sat. | | |
| -70 | | | | | | | | | | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -70 | | | | | | Match Line | | | | |
| | -72.0 | 73.5 | 23 | 28 | 34 | 62 | | Sat. | | **COASTAL PLAIN**<br>GRAY-BROWN, SILTY FINE SAND (A-2-4)<br>WITH TRACE SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -75 | | | | | | | | | | |
| | -77.0 | 78.5 | 5 | 6 | 9 | 15 | | Sat. | | |
| -80 | | | | | | | | | | |
| | -82.0 | 83.5 | 4 | 4 | 9 | 13 | | Sat. | | |
| -85 | | | | | | | | | | |
| | -87.0 | 88.5 | 100/0.3 | | | 100/0.3 | | | | -HARD DRILLING NOTED FROM 51.0'-51.3'<br>*(continued)* |
| -90 | | | | | | | | | | -86.6 88.1<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, MODERATELY INDURATED<br>TO FRIABLE LIMESTONE<br>(RIVER BEND FORMATION) |
| | -92.0 | 93.5 | 32 | 100/0.5 | | 100/0.5 | | | | |
| -95 | | | | | | | | | | -SOFT DRILLING NOTED FROM 91.5'-94.0' |
| | -97.0 | 98.5 | 60/0.1 | | | 60/0.1 | | | | -SOFT DRILLING NOTED FROM 96.5'-98.5' |
| -100 | | | | | | | | | | -SOFT DRILLING NOTED FROM<br>100.0'-101.7' AND FROM 102.5'-104.0' |
| | -102.0 | 103.5 | 35 | 100/0.2 | | 100/0.2 | | | | |
| -105 | | | | | | | | | | |
| | -107.0 | 108.5 | 26 | 24 | 29 | 53 | | | | -106.0 107.5<br>**COASTAL PLAIN**<br>LIGHT GRAY, SILTY FINE TO COARSE<br>SAND (A-2-4) WITH SOME CEMENTED<br>SAND FRAGMENTS<br>(RIVER BEND FORMATION) |
| | | | | | | | | Sat. | | -108.5 110.0<br>Boring Terminated at Elevation -108.5 ft in<br>SAND (RIVER BEND FORMATION) |

TUBES OBTAINED IN OFFSET HOLE
-L2- 19+23, 19' LT:
ST-1 7.0'-9.0'
ST-2 9.0'-11.0'

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B1-B | **STATION** 20+19 | **OFFSET** 21 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.9 ft | **TOTAL DEPTH** 120.0 ft | **NORTHING** 252,116 | **EASTING** 2,436,375 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** J. STEWART | **START DATE** 11/30/15 | **COMP. DATE** 12/02/15 | **SURFACE WATER DEPTH** 0.5ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | |
| 0 | 0.9 | 0.0 | WOH | WOH | 1 | 1 | | Sat. | | 0.9 0.0 GROUND SURFACE<br>**ALLUVIAL**<br>MUCK |
| -5 | -2.7 | 3.6 | 3 | 7 | 6 | 13 | | Sat. | | -2.1 3.0<br>**UNDIVIDED COASTAL PLAIN**<br>BROWN, BLACK, SILTY FINE SAND (A-2-4) |
| -10 | -7.7 | 8.6 | 3 | 8 | 8 | 16 | | Sat. | | -6.1 7.0<br>GRAY, SILTY CLAY (A-7-5)<br>-8.4 9.3<br>GRAY, FINE SAND (A-3) |
| -15 | -12.7 | 13.6 | 1 | 1 | 2 | 3 | | Sat. | | -12.1 13.0<br>BLACK AND GRAY, SILTY FINE SAND<br>(A-2-4) WITH TRACE SHELL FRAGMENTS |
| -20 | -17.7 | 18.6 | 5 | 6 | 4 | 10 | | Sat. | | |
| -25 | -22.7 | 23.6 | 8 | 13 | 13 | 26 | | Sat. | | -22.1 23.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH<br>SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -30 | -27.7 | 28.6 | 6 | 10 | 11 | 21 | | Sat. | | |
| -35 | -32.7 | 33.6 | 2 | 12 | 13 | 25 | | Sat. | | |
| -40 | -37.7 | 38.6 | 4 | 3 | 5 | 8 | | Sat. | | -37.1 38.0<br>**COASTAL PLAIN**<br>GRAY, SILTY FINE SAND (A-2-4) WITH<br>TRACE SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -45 | -42.7 | 43.6 | 33 | 28 | 41 | 69 | | Sat. | | |
| -50 | -47.7 | 48.6 | 20 | 40 | 45 | 85 | | Sat. | | |
| -55 | -52.7 | 53.6 | 27 | 23 | 19 | 42 | | Sat. | | |
| -60 | -57.7 | 58.6 | 13 | 6 | 7 | 13 | | Sat. | | |
| -65 | -62.7 | 63.6 | 5 | 6 | 8 | 14 | | Sat. | | |
| -70 | -67.7 | 68.6 | 10 | 20 | 33 | 53 | | Sat. | | |
| -75 | -72.7 | 73.6 | 13 | 16 | 23 | 39 | | Sat. | | |

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B1-B | **STATION** 20+19 | **OFFSET** 21 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.9 ft | **TOTAL DEPTH** 120.0 ft | **NORTHING** 252,116 | **EASTING** 2,436,375 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** J. STEWART | **START DATE** 11/30/15 | **COMP. DATE** 12/02/15 | **SURFACE WATER DEPTH** 0.5ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| -80 | -77.7 | 78.6 | 3 | 2 | 3 | 5 | | Sat. | | **COASTAL PLAIN**<br>GRAY, SILTY FINE SAND (A-2-4) WITH<br>TRACE SHELL FRAGMENTS<br>(RIVER BEND FORMATION) *(continued)* |
| -85 | -82.7 | 83.6 | 4 | 9 | 15 | 24 | | Sat. | | |
| -90 | -87.3 | 88.2 | 60/0.1 | | | 60/0.1 | | | | -87.3 88.2<br>-87.4 88.3<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE TO INDURATED<br>LIMESTONE (RIVER BEND FORMATION) |
| | -89.6 | 90.5 | 100/0.3 | | | 100/0.3 | | | | |
| -95 | -94.6 | 95.5 | 60/0.0 | | | 60/0.0 | | | | |
| -100 | -99.6 | 100.5 | 72 | 28/0.2 | | 100/0.7 | | | | |
| -105 | -104.6 | 105.5 | 100/0.3 | | | 100/0.3 | | | | -106.2 107.1<br>**COASTAL PLAIN**<br>LIGHT GRAY, CEMENTED SAND AND<br>SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION)<br>-109.6 110.5 |
| -110 | -109.6 | 110.5 | 83 | 17/0.1 | | 100/0.6 | | | | **COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE<br>(RIVER BEND FORMATION)<br>-112.6 113.5 |
| -115 | -112.6 | 113.5 | 56 | 32 | 31 | 63 | | Sat. | | **COASTAL PLAIN**<br>LIGHT GRAY, CEMENTED SAND AND<br>SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| | -117.6 | 118.5 | 12 | 11 | 15 | 26 | | Sat. | | -119.1 120.0<br>Boring Terminated at Elevation -119.1 ft in<br>CEMENTED SAND AND SHELL<br>FRAGMENTS (RIVER BEND FORMATION) |

# GEOTECHNICAL BORING REPORT
# CORE LOG

| | | | |
|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | **GROUND WTR (ft)** |
| **BORING NO.** B1-B | **STATION** 20+19 | **OFFSET** 21 ft RT | **ALIGNMENT** -L2- — **0 HR.** N/M |
| **COLLAR ELEV.** 0.9 ft | **TOTAL DEPTH** 120.0 ft | **NORTHING** 252,116 | **EASTING** 2,436,375 — **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic |
| **DRILLER** J. STEWART | **START DATE** 11/30/15 | **COMP. DATE** 12/02/15 | **SURFACE WATER DEPTH** 0.5ft |
| **CORE SIZE** NQ2 | **TOTAL RUN** 20.9 ft | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -87.4 | | | | | | | | | | | Begin Coring @ 88.3 ft |
| | -87.4 | 88.3 | 2.2 | 3:15/1.0<br>2:32/1.0<br>0:25/0.2 | (2.0)<br>91% | (0.0)<br>0% | | (14.8)<br>79% | (0.0)<br>0% | | -87.4 **COASTAL PLAIN SEDIMENTARY ROCK** 88.3<br>LIGHT GRAY, FRIABLE TO INDURATED LIMESTONE (RIVER BEND FORMATION) |
| -90 | -89.6 | 90.5 | | | | | | | | | |
| | -89.9 | 90.8 | 4.7 | *N=100/0.3*<br>3:18/0.7<br>1:50/1.0<br>2:06/1.0<br>2:42/1.0 | (3.8)<br>81% | (0.0)<br>0% | | | | | |
| -95 | -94.6 | 95.5 | | | | | | | | | |
| | | | 5.0 | 1:42/1.0<br>*N=60/0.0*<br>1:57/1.0<br>1:44/1.0<br>2:55/1.0<br>1:15/1.0<br>1:13/1.0 | (4.1)<br>82% | (0.0)<br>0% | | | | | |
| -100 | -99.6<br>-100.3 | 100.5<br>101.2 | | | | | | | | | |
| | | | 4.3 | *N=100/0.7*<br>0:15/0.3<br>1:15/1.0<br>1:20/1.0<br>2:32/1.0<br>1:36/1.0 | (3.6)<br>84% | (0.0)<br>0% | | | | | |
| -105 | -104.6<br>-104.9 | 105.5<br>105.8 | | | | | | | | | |
| | | | 4.7 | *N=100/0.3*<br>1:18/0.7<br>0:50/1.0<br>0:05/1.0<br>0:04/1.0<br>0:20/1.0 | (1.3)<br>28% | (0.0)<br>0% | | (0.0)<br>0% | (0.0)<br>0% | | -106.2 107.1<br>**COASTAL PLAIN**<br>LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION)<br>-109.6 110.5 |
| -110 | -109.6 | 110.5 | | *N=100/0.6* | | | | | | | **COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE<br>(RIVER BEND FORMATION)<br>-112.6 113.5 |
| -115 | | | | *N=63* | | | | | | | **COASTAL PLAIN**<br>LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| | | | | *N=26* | | | | | | | -119.1 120.0<br>Boring Terminated at Elevation -119.1 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

NCDOT CORE DOUBLE B4929_GEO_BH_TOPSAIL.GPJ NC_DOT.GDT 2/4/16

## CORE PHOTOGRAPHS: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach, B1-B: -L2- Station 20+19, 21’ RT

**Begin Run 1**
**88.3 feet**

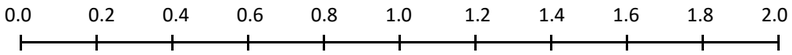
**Begin Run 2**
**90.8 feet**

**Begin Run 3**
**95.5 feet**


**End Run 1**
**90.5 feet**

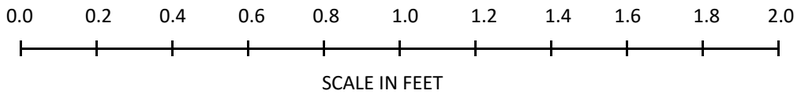
**End Run 2**
**95.5 feet**

**End Run 3**
**100.5 feet**




**Begin Run 4**
**101.2 feet**


**End Run 4**
**105.5 feet**
**Begin Run 5**
**105.8 feet**



# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG/D. RACEY | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B2-A | **STATION** 21+15 | **OFFSET** 31 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.4 ft | **TOTAL DEPTH** 119.9 ft | **NORTHING** 252,025 | **EASTING** 2,436,436 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** M. DOOGAN/J. STEW. | **START DATE** 11/20/15 | **COMP. DATE** 11/25/15 | **SURFACE WATER DEPTH** 0.1ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | ELEV. (ft) DEPTH (ft) |
| 5 | | | | | | | | | | |
| 0 | 0.4 | 0.0 | WOH | WOH | WOH | 0 | | Sat. | | 0.4 GROUND SURFACE 0.0 |
| | | | | | | | | | | **ALLUVIAL** |
| | -3.0 | 3.4 | | | | | | | | -1.6 MUCK 2.0 |
| -5 | | | 4 | 4 | 5 | 9 | | Sat. | | **UNDIVIDED COASTAL PLAIN** |
| | -8.0 | 8.4 | | | | | | | | GRAY, BLACK, FINE SAND (A-3) WITH TRACE ORGANICS |
| -10 | | | WOH | WOH | 1 | 1 | | Sat. | | |
| | -13.0 | 13.4 | | | | | | | | -12.6 13.0 |
| -15 | | | WOH | 1 | 1 | 2 | | Sat. | | GRAY, CLAYEY FINE SAND (A-2-6) |
| | -18.0 | 18.4 | | | | | | | | -17.6 18.0 |
| -20 | | | 1 | 1 | 1 | 2 | | Sat. | | GRAY, BLACK, SILTY FINE SAND (A-2-4) |
| | -23.0 | 23.4 | | | | | | | | -22.6 23.0 |
| -25 | | | 3 | 5 | 9 | 14 | | Sat. | | **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) |
| | -28.0 | 28.4 | | | | | | | | |
| -30 | | | 8 | 16 | 14 | 30 | | Sat. | | |
| | -33.0 | 33.4 | | | | | | | | |
| -35 | | | 19 | 20 | 18 | 38 | | Sat. | | |
| | -38.0 | 38.4 | | | | | | | | |
| -40 | | | 10 | 13 | 17 | 30 | | Sat. | | |
| | -43.0 | 43.4 | | | | | | | | -42.6 43.0 |
| -45 | | | 26 | 39 | 44 | 83 | | Sat. | | **COASTAL PLAIN** GRAY-BROWN, SILTY FINE SAND (A-2-4) (RIVER BEND FORMATION) |
| | -48.0 | 48.4 | | | | | | | | |
| -50 | | | 26 | 34 | 47 | 81 | | Sat. | | |
| | -53.0 | 53.4 | | | | | | | | |
| -55 | | | 9 | 12 | 12 | 24 | | Sat. | | |
| | -58.0 | 58.4 | | | | | | | | |
| -60 | | | 6 | 17 | 26 | 43 | | Sat. | | |
| | -63.0 | 63.4 | | | | | | | | |
| -65 | | | 4 | 6 | 9 | 15 | | Sat. | | |
| | -68.0 | 68.4 | | | | | | | | |
| -70 | | | 9 | 25 | 30 | 55 | | Sat. | | |
| | -73.0 | 73.4 | | | | | | | | |
| -75 | | | 9 | 17 | 24 | 41 | | Sat. | | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| | -78.0 | 78.4 | 4 | 5 | 3 | 8 | | Sat. | | **COASTAL PLAIN** GRAY-BROWN, SILTY FINE SAND (A-2-4) (RIVER BEND FORMATION) *(continued)* |
| -80 | | | | | | | | | | |
| | -83.0 | 83.4 | 7 | 11 | 15 | 26 | | Sat. | | |
| -85 | | | | | | | | | | |
| | -88.0 | 88.4 | 60/0.1 | | | 60/0.1 | | | | -88.0 88.4 |
| -90 | | | | | | | | | | **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, MODERATELY INDURATED TO INDURATED LIMESTONE (RIVER BEND FORMATION) |
| | -93.0 | 93.4 | 100/0.2 | | | 100/0.2 | | | | |
| -95 | | | | | | | | | | |
| | -98.0 | 98.4 | 60/0.1 | | | 60/0.1 | | | | |
| -100 | | | | | | | | | | |
| | -103.0 | 103.4 | 100/0.2 | | | 100/0.2 | | | | |
| -105 | | | | | | | | | | -105.6 106.0 |
| | -108.0 | 108.4 | 19 | 24 | 100/0.3 | 100/0.3 | | Sat. | | **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) |
| -110 | | | | | | | | | | -109.0 109.4 |
| | -113.0 | 113.4 | 13 | 29 | 21 | 50 | | Sat. | | -110.6 111.0 |
| -115 | | | | | | | | | | **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION) |
| | -118.0 | 118.4 | 15 | 19 | 28 | 47 | | Sat. | | **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) |
| | | | | | | | | | | -119.5 119.9 |
| | | | | | | | | | | Boring Terminated at Elevation -119.5 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B3-B | **STATION** 22+05 | **OFFSET** 21 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.2 ft | **TOTAL DEPTH** 115.0 ft | **NORTHING** 251,931 | **EASTING** 2,436,393 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** J. STEWART | **START DATE** 12/02/15 | **COMP. DATE** 12/04/15 | **SURFACE WATER DEPTH** 0.2ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | | |
| 0 | 0.2 | 0.0 | WOH | WOH | WOH | 0 | | Sat. | | 0.2 GROUND SURFACE | 0.0 |
| | | | | | | | | | | **ALLUVIAL** MUCK | |
| | -3.3 | 3.5 | | | | | | | | -2.8 | 3.0 |
| -5 | | | 1 | 1 | 1 | 2 | | Sat. | | **UNDIVIDED COASTAL PLAIN** BLACK TO GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE ORGANICS, CEMENTED SAND FRAGMENTS, AND SHELL FRAGMENTS | |
| | -8.3 | 8.5 | | | | | | | | | |
| -10 | | | WOH | 1 | 1 | 2 | | Sat. | | | |
| | -13.3 | 13.5 | | | | | | | | | |
| -15 | | | WOH | WOH | 1 | 1 | | Sat. | | | |
| | -18.3 | 18.5 | | | | | | | | | |
| -20 | | | WOH | WOH | WOH | 0 | | Sat. | | | |
| | -23.3 | 23.5 | | | | | | | | | |
| -25 | | | WOH | 1 | 2 | 3 | | Sat. | | | |
| | -28.3 | 28.5 | | | | | | | | -27.8 | 28.0 |
| -30 | | | 6 | 4 | 4 | 8 | | Sat. | | **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) | |
| | -33.3 | 33.5 | | | | | | | | | |
| -35 | | | 15 | 13 | 18 | 31 | | Sat. | | | |
| | -38.3 | 38.5 | | | | | | | | | |
| -40 | | | 18 | 19 | 22 | 41 | | Sat. | | | |
| | -43.3 | 43.5 | | | | | | | | -42.8 | 43.0 |
| -45 | | | 25 | 30 | 31 | 61 | | Sat. | | **COASTAL PLAIN** DARK GRAY, SILTY FINE SAND (A-2-4) (RIVER BEND FORMATION) | |
| | -48.3 | 48.5 | | | | | | | | | |
| -50 | | | 18 | 21 | 32 | 53 | | Sat. | | | |
| | -53.3 | 53.5 | | | | | | | | | |
| -55 | | | 7 | 13 | 9 | 22 | | Sat. | | | |
| | -58.3 | 58.5 | | | | | | | | | |
| -60 | | | 13 | 18 | 28 | 46 | | Sat. | | | |
| | -63.3 | 63.5 | | | | | | | | | |
| -65 | | | 5 | 5 | 14 | 19 | | Sat. | | | |
| | -68.3 | 68.5 | | | | | | | | | |
| -70 | | | 18 | 32 | 45 | 77 | | Sat. | | | |
| | -73.3 | 73.5 | | | | | | | | | |
| -75 | | | 21 | 25 | 34 | 59 | | Sat. | | | |

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B3-B | **STATION** 22+05 | **OFFSET** 21 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.2 ft | **TOTAL DEPTH** 115.0 ft | **NORTHING** 251,931 | **EASTING** 2,436,393 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** J. STEWART | **START DATE** 12/02/15 | **COMP. DATE** 12/04/15 | **SURFACE WATER DEPTH** 0.2ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | **COASTAL PLAIN** DARK GRAY, SILTY FINE SAND (A-2-4) (RIVER BEND FORMATION) *(continued)* |
| | -78.3 | 78.5 | 5 | 4 | 4 | 8 | | Sat. | | |
| -80 | | | | | | | | | | |
| | -83.3 | 83.5 | 18 | 19 | 18 | 37 | | Sat. | | |
| -85 | | | | | | | | | | |
| | -87.0 | 87.2 | 100/0.3 | | | 100/0.3 | | | | -87.0 87.2 |
| -90 | | | | | | | | | | -87.3 87.5 **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE TO INDURATED LIMESTONE (RIVER BEND FORMATION) |
| | -90.2 | 90.4 | 100/0.2 | | | 100/0.2 | RS-7 | | | |
| -95 | | | | | | | | | | |
| | -95.2 | 95.4 | 60/0.1 | | | 60/0.1 | RS-8 | | | |
| -100 | | | | | | | | | | |
| | -100.2 | 100.4 | 100/0.4 | | | 100/0.4 | | | | |
| -105 | | | | | | | | | | |
| | -105.2 | 105.4 | 31 | 45 | 15 | 60 | | Sat. | | -105.2 105.4 **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) |
| -110 | | | | | | | | | | -108.8 109.0 **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION) |
| | -108.3 | 108.5 | 16 | 45 | 55/0.2 | 100/0.7 | | | | -113.3 113.5 |
| | -113.3 | 113.5 | 14 | 20 | 17 | 37 | | Sat. | | -114.8 115.0 **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) |
| | | | | | | | | | | Boring Terminated at Elevation -114.8 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

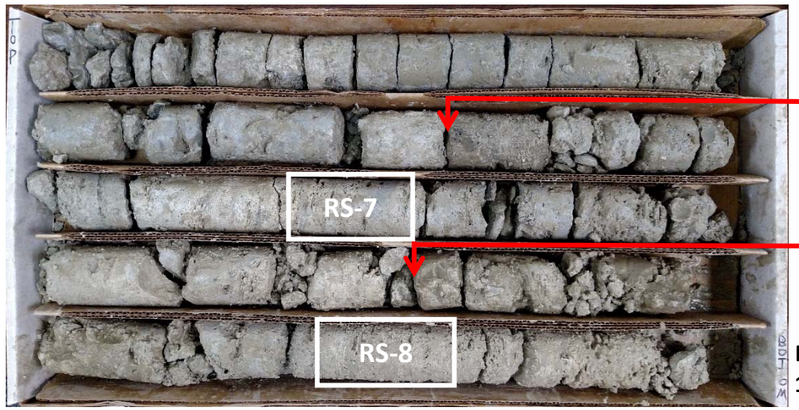
# GEOTECHNICAL BORING REPORT
# CORE LOG

| | | | |
|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | **GROUND WTR (ft)** |
| **BORING NO.** B3-B | **STATION** 22+05 | **OFFSET** 21 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.2 ft | **TOTAL DEPTH** 115.0 ft | **NORTHING** 251,931 | **EASTING** 2,436,393 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic |
| **DRILLER** J. STEWART | **START DATE** 12/02/15 | **COMP. DATE** 12/04/15 | **SURFACE WATER DEPTH** 0.2ft |
| **CORE SIZE** NQ2 | **TOTAL RUN** 17.2 ft | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -87.3 | | | | | | | | | | | Begin Coring @ 87.5 ft |
| | -87.3 | 87.5 | 2.9 | 3:05/0.9<br>2:56/1.0<br>3:58/1.0 | (2.9)<br>100% | (0.3)<br>10% | | (13.0)<br>73% | (2.0)<br>11% | | -87.3 **COASTAL PLAIN SEDIMENTARY ROCK** 87.5<br>LIGHT GRAY, FRIABLE TO INDURATED LIMESTONE (RIVER BEND FORMATION)<br>RS-7: 92.1'-92.4', qu= 1,667 psi, RMR=10<br>RS-8: 95.5'-95.8', qu=660 psi, RMR=9 |
| -90 | -90.2<br>-90.4 | 90.4<br>90.6 | 4.8 | *N=100/0.2*<br>0:58/0.8<br>2:17/1.0<br>4:06/1.0<br>3:30/1.0<br>5:04/1.0 | (3.7)<br>77% | (0.8)<br>17% | RS-7 | | | | |
| -95 | -95.2<br>-95.3 | 95.4<br>95.5 | 4.9 | *N=60/0.1*<br>1:17/0.9<br>0:39/1.0<br>2:02/1.0<br>1:11/1.0<br>0:18/1.0 | (2.6)<br>53% | (0.9)<br>18% | RS-8 | | | | |
| -100 | -100.2<br>-100.6 | 100.4<br>100.8 | 4.6 | *N=100/0.4*<br>1:02/0.6<br>1:59/1.0<br>1:55/1.0<br>1:59/1.0<br>0:58/1.0 | (3.7)<br>80% | (0.0)<br>0% | | | | | |
| -105 | -105.2 | 105.4 | | *N=60* | | | | | | | -105.2 105.4<br>**COASTAL PLAIN**<br>LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION)<br>-108.8 109.0 |
| -110 | | | | *N=100/0.7* | | | | | | | **COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION)<br>-113.3 113.5<br>**COASTAL PLAIN**<br>-114.8 115.0<br>LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION)<br>Boring Terminated at Elevation -114.8 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |
| | | | | *N=37* | | | | | | | |

**CORE PHOTOGRAPHS: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach, B3-B: -L2- Station 22+05, 21' RT**

**Begin Run 1**
**87.5 feet**




**End Run 1**
**90.4 feet**
**Begin Run 2**
**90.6 feet**

**End Run 2**
**95.4 feet**
**Begin Run 3**
**95.5 feet**

**End Run 3**
**100.4 feet**

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET

**Begin Run 4**
**100.8 feet**

**End Run 4**
**105.4 feet**

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B4-A | **STATION** 23+49 | **OFFSET** 30 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -0.1 ft | **TOTAL DEPTH** 119.5 ft | **NORTHING** 251,792 | **EASTING** 2,436,457 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** J. STEWART | **START DATE** 10/30/15 | **COMP. DATE** 11/05/15 | **SURFACE WATER DEPTH** 0.2ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION — ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | | |
| 0 | -0.1 | 0.0 | WOH | WOH | WOH | 0 | | Sat. | | -0.1 GROUND SURFACE | 0.0 |
| | | | | | | | | | | **ALLUVIAL** DARK BROWN-BLACK, MUCK | |
| -5 | -4.1 | 4.0 | 1 | 3 | 0 | 3 | | Sat. | | -4.5 | 4.4 |
| | | | | | | | | | | **UNDIVIDED COASTAL PLAIN** GRAY AND BROWN AND LIGHT GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE ORGANICS, CEMENTED SAND FRAGMENTS, AND CLAY | |
| -10 | -8.1 | 8.0 | 4 | 3 | 2 | 5 | | Sat. | | | |
| | -13.1 | 13.0 | 1 | 0 | 1 | 1 | | Sat. | | | |
| -15 | | | | | | | | | | | |
| -20 | -18.1 | 18.0 | WOH | WOH | 1 | 1 | | Sat. | | -HARD DRILLING NOTED FROM 21.8'-22.9' | |
| | -23.1 | 23.0 | 3 | 0 | 1 | 1 | | Sat. | | -22.1 **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) | 22.0 |
| -25 | | | | | | | | | | | |
| | -28.1 | 28.0 | 12 | 15 | 18 | 33 | | Sat. | | | |
| -30 | | | | | | | | | | | |
| | -33.1 | 33.0 | 6 | 14 | 37 | 51 | | Sat. | | | |
| -35 | | | | | | | | | | | |
| | -38.1 | 38.0 | 11 | 24 | 21 | 45 | | Sat. | | -37.1 **COASTAL PLAIN** GRAY TO DARK GRAY, SILTY FINE SAND (A-2-4) WITH TRACE CEMENTED SAND FRAGMENTS (RIVER BEND FORMATION) | 37.0 |
| -40 | | | | | | | | | | | |
| | -43.1 | 43.0 | 12 | 22 | 33 | 55 | | Sat. | | | |
| -45 | | | | | | | | | | | |
| | -48.1 | 48.0 | 19 | 28 | 37 | 65 | | Sat. | | | |
| -50 | | | | | | | | | | | |
| | -53.1 | 53.0 | 9 | 5 | 13 | 18 | | Sat. | | | |
| -55 | | | | | | | | | | | |
| | -58.1 | 58.0 | 5 | 6 | 13 | 19 | | Sat. | | | |
| -60 | | | | | | | | | | | |
| | -63.1 | 63.0 | 7 | 5 | 4 | 9 | | Sat. | | | |
| -65 | | | | | | | | | | | |
| | -68.1 | 68.0 | 5 | 7 | 9 | 16 | | Sat. | | | |
| -70 | | | | | | | | | | | |
| | -73.1 | 73.0 | 5 | 4 | 4 | 8 | | Sat. | | -HARD DRILLING NOTED FROM 85.5'-85.7' | |
| -75 | | | | | | | | | | | |



| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B4-A | **STATION** 23+49 | **OFFSET** 30 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -0.1 ft | **TOTAL DEPTH** 119.5 ft | **NORTHING** 251,792 | **EASTING** 2,436,457 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** J. STEWART | **START DATE** 10/30/15 | **COMP. DATE** 11/05/15 | **SURFACE WATER DEPTH** 0.2ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| -80 | -78.1 | 78.0 | 5 | 4 | 7 | 11 | | Sat. | | |
| -85 | -83.1 | 83.0 | 7 | 16 | 22 | 38 | | Sat. | | |
| -90 | -88.1 | 88.0 | 60/0.1 | | | 60/0.1 | | | | -86.6 **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, FRIABLE TO MODERATELY INDURATED, LIMESTONE (RIVER BEND FORMATION) 86.5 |
| -95 | -93.1 | 93.0 | 38 | 100/0.3 | | 100/0.3 | | | | |
| -100 | -98.1 | 98.0 | 23 | 100/0.5 | | 100/0.5 | | | | |
| | -103.1 | 103.0 | 60 | 40/0.3 | | 100/0.8 | | | | -104.1 104.0 |
| -105 | | | | | | | | | | **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) -107.1 107.0 |
| -110 | -108.1 | 108.0 | 70 | 30/0.1 | | 100/0.6 | | | | **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, FRIABLE LIMESTONE (RIVER BEND FORMATION) |
| | -113.1 | 113.0 | 18 | 21 | 16 | 37 | | Sat. | | -113.1 113.0 |
| -115 | | | | | | | | | | **COASTAL PLAIN** LIGHT GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH SOME CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |
| | -118.1 | 118.0 | 13 | 12 | 12 | 24 | | Sat. | | -119.6 119.5 |
| | | | | | | | | | | Boring Terminated at Elevation -119.6 ft in SAND (RIVER BEND FORMATION) |



NCDOT BORE DOUBLE B4929_GEO_BH_TOPSAIL.GPJ NC_DOT.GDT 2/4/16

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG & D. RACEY | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B5-B | **STATION** 24+90 | **OFFSET** 23 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.2 ft | **TOTAL DEPTH** 115.4 ft | **NORTHING** 251,647 | **EASTING** 2,436,418 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** B. FOWLER/ J. STEW. | **START DATE** 12/04/15 | **COMP. DATE** 12/09/15 | **SURFACE WATER DEPTH** 2.2ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | ELEV. (ft) DEPTH (ft) |
| -1.2 | | 0.0 | WOH | WOH | WOH | 0 | | Sat. | | GROUND SURFACE 0.0<br>**ALLUVIAL**<br>DARK BROWN, SILTY FINE TO COARSE SAND (A-2-4) WITH LITTLE ORGANICS |
| | -5.2 | 4.0 | 1 | 2 | 2 | 4 | | Sat. | | |
| | -10.2 | 9.0 | 1 | 1 | 1 | 2 | | Sat. | | -10.2 9.0<br>**UNDIVIDED COASTAL PLAIN**<br>BROWN, FINE TO COARSE SAND (A-3) WITH TRACE SHELL FRAGMENTS |
| | -15.2 | 14.0 | 2 | 16 | 17 | 33 | | Sat. | | -15.2 14.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) |
| | -20.2 | 19.0 | 12 | 18 | 22 | 40 | | Sat. | | |
| | -25.2 | 24.0 | 12 | 15 | 16 | 31 | | Sat. | | |
| | -30.2 | 29.0 | 7 | 9 | 8 | 17 | | Sat. | | |
| | -35.2 | 34.0 | 14 | 18 | 15 | 33 | | Sat. | | |
| | -40.2 | 39.0 | 12 | 18 | 21 | 39 | | Sat. | | -40.2 39.0<br>**COASTAL PLAIN**<br>DARK GRAY, SILTY FINE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS (RIVER BEND FORMATION) |
| | -45.2 | 44.0 | 20 | 31 | 31 | 62 | | Sat. | | |
| | -50.2 | 49.0 | 21 | 33 | 30 | 63 | | Sat. | | |
| | -55.2 | 54.0 | 5 | 7 | 18 | 25 | | Sat. | | |
| | -60.2 | 59.0 | 3 | 6 | 4 | 10 | | Sat. | | |
| | -65.2 | 64.0 | 5 | 6 | 9 | 15 | | Sat. | | |
| | -70.2 | 69.0 | 3 | 3 | 5 | 8 | | Sat. | | |
| -75 | | | | | | | | | | |



| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG & D. RACEY | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B5-B | **STATION** 24+90 | **OFFSET** 23 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.2 ft | **TOTAL DEPTH** 115.4 ft | **NORTHING** 251,647 | **EASTING** 2,436,418 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** B. FOWLER/ J. STEW. | **START DATE** 12/04/15 | **COMP. DATE** 12/09/15 | **SURFACE WATER DEPTH** 2.2ft | |



| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| | -75.2 | 74.0 | 9 | 9 | 11 | 20 | | Sat. | | **COASTAL PLAIN**<br>DARK GRAY, SILTY FINE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS (RIVER BEND FORMATION) *(continued)* |
| | -80.2 | 79.0 | 9 | 18 | 25 | 43 | | Sat. | | |
| | -82.0 | 80.8 | 15 | 14 | 12 | 26 | | Sat. | | -82.0 80.8<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) |
| | -85.2 | 84.0 | 60/0.0 | | | 60/0.0 | | | | -85.0 83.8<br>-85.2 84.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, INDURATED TO MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION) |
| | -90.2 | 89.0 | 60/0.0 | | | 60/0.0 | | | | |
| | -95.3 | 94.1 | 60/0.1 | | | 60/0.1 | | | | |
| | -100.4 | 99.2 | 60/0.1 | | | 60/0.1 | | | | -102.1 100.9<br>**COASTAL PLAIN**<br>LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) |
| | -105.5 | 104.3 | 25 | 100/0.4 | | 100/0.4 | | | | -105.5 104.3<br>-106.0 104.8<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE (RIVER BEND FORMATION) |
| | -110.1 | 108.9 | 22 | 20 | 18 | 38 | | Sat. | | -108.9 107.7<br>**COASTAL PLAIN**<br>LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) |
| | -115.1 | 113.9 | 16 | 13 | 12 | 25 | | Sat. | | -116.6 115.4<br>Boring Terminated at Elevation -116.6 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

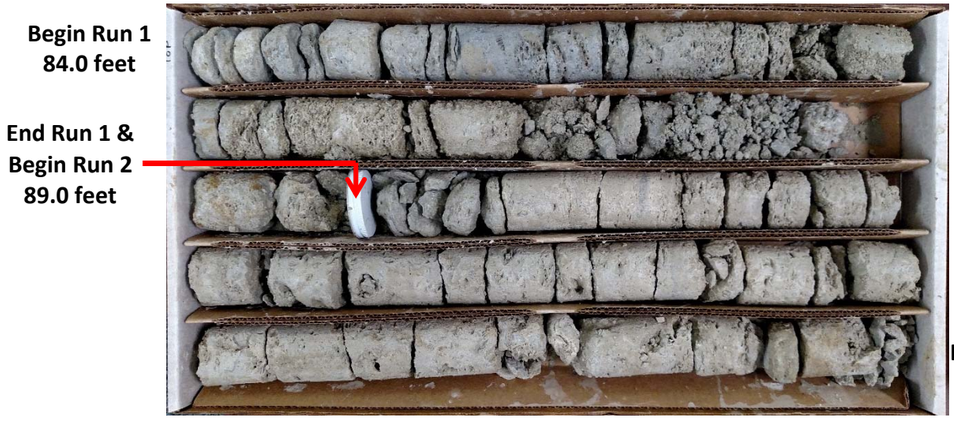
# GEOTECHNICAL BORING REPORT
# CORE LOG

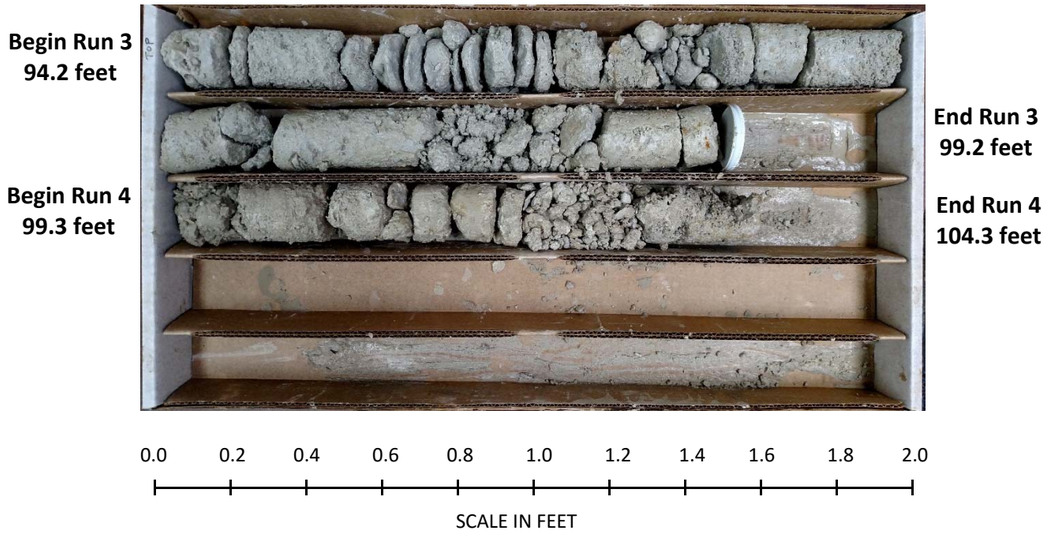
| | | | |
|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG & D. RACEY |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | **GROUND WTR (ft)** |
| **BORING NO.** B5-B | **STATION** 24+90 | **OFFSET** 23 ft RT | **ALIGNMENT** -L2- — **0 HR.** N/M |
| **COLLAR ELEV.** -1.2 ft | **TOTAL DEPTH** 115.4 ft | **NORTHING** 251,647 | **EASTING** 2,436,418 — **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic |
| **DRILLER** B. FOWLER/ J. STEW. | **START DATE** 12/04/15 | **COMP. DATE** 12/09/15 | **SURFACE WATER DEPTH** 2.2ft |
| **CORE SIZE** NQ2 | **TOTAL RUN** 20.1 ft | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -85.2 | | | | | | | | | | | Begin Coring @ 84.0 ft |
| | -85.2 | 84.0 | 5.0 | *N=60/0.0*<br>4:53/1.0<br>3:49/1.0<br>1:22/1.0<br>0:40/1.0<br>1:09/1.0 | (4.2)<br>84% | (0.3)<br>6% | | (14.4)<br>85% | (0.7)<br>4% | | -85.2 **COASTAL PLAIN SEDIMENTARY ROCK** 84.0<br>LIGHT GRAY, INDURATED TO MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -90 | -90.2 | 89.0 | 5.1 | *N=60/0.0*<br>2:24/1.0<br>3:18/1.0<br>3:46/1.0<br>2:27/1.0<br>1:58/1.1 | (5.1)<br>100% | (0.0)<br>0% | | | | | |
| -95 | -95.3 | 94.1 | | | | | | | | | |
| | -95.4 | 94.2 | 5.0 | *N=60/0.1*<br>1:33/1.0<br>0:49/1.0<br>2:19/1.0<br>0:35/1.0<br>3:41/1.0 | (3.5)<br>70% | (0.4)<br>8% | | | | | |
| -100 | -100.4 | 99.2 | | | | | | | | | |
| | -100.5 | 99.3 | 5.0 | *N=60/0.1*<br>1:13/1.0<br>0:28/1.0<br>0:13/1.0<br>0:19/1.0<br>0:54/1.0 | (1.6)<br>32% | (0.0)<br>0% | | | | | -102.1 100.9 |
| -105 | -105.5 | 104.3 | | *N=100/0.4* | | | | (0.0)<br>0% | (0.0)<br>0% | | **COASTAL PLAIN**<br>LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION)<br>-105.5 104.3<br>-106.0 104.8<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE<br>(RIVER BEND FORMATION)<br>-108.9 107.7 |
| -110 | | | | *N=38* | | | | | | | **COASTAL PLAIN**<br>LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| -115 | | | | *N=25* | | | | | | | -116.6 115.4<br>Boring Terminated at Elevation -116.6 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

NCDOT CORE DOUBLE B4929_GEO_BH_TOPSAIL.GPJ NC_DOT.GDT 2/4/16

**CORE PHOTOGRAPHS: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach, B5-B: -L2- Station 24+90, 23' RT**



# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B6-A | **STATION** 26+30 | **OFFSET** 28 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -2.1 ft | **TOTAL DEPTH** 129.5 ft | **NORTHING** 251,512 | **EASTING** 2,436,483 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** J. STEWART | **START DATE** 11/18/15 | **COMP. DATE** 11/20/15 | **SURFACE WATER DEPTH** 1.6ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | -2.1 GROUND SURFACE | 0.0 |
| | -2.1 | 0.0 | WOH | WOH | 1 | 1 | | Sat. | | -4.1 **ALLUVIAL**<br>BLACK, MUCK | 2.0 |
| | -4.7 | 2.6 | WOH | 1 | 2 | 3 | | Sat. | | **UNDIVIDED COASTAL PLAIN**<br>BROWN, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS | |
| | -9.7 | 7.6 | 1 | 1 | 2 | 3 | | Sat. | | -10.9 | 8.8 |
| | -14.7 | 12.6 | 6 | 14 | 9 | 23 | | Sat. | | DARK GRAY, FINE TO COARSE SANDY CLAY (A-6) WITH TRACE TO SOME SHELL FRAGMENTS | |
| | -20.7 | 18.6 | 19 | 15 | 19 | 34 | | Sat. | | -15.0 **COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS<br>(RIVER BEND FORMATION) | 12.9 |
| | -25.7 | 23.6 | 15 | 18 | 17 | 35 | | Sat. | | | |
| | -30.7 | 28.6 | 11 | 19 | 19 | 38 | | Sat. | | | |
| | -35.7 | 33.6 | 14 | 22 | 20 | 42 | | Sat. | | | |
| | -40.7 | 38.6 | 9 | 19 | 33 | 52 | | Sat. | | -39.1 **COASTAL PLAIN**<br>DARK GRAY, SILTY FINE TO COARSE SAND (A-2-4)<br>(RIVER BEND FORMATION) | 37.0 |
| | -45.7 | 43.6 | 27 | 41 | 50 | 91 | | Sat. | | | |
| | -50.7 | 48.6 | 19 | 33 | 42 | 75 | | Sat. | | | |
| | -55.7 | 53.6 | 5 | 8 | 15 | 23 | | Sat. | | | |
| | -60.7 | 58.6 | 13 | 21 | 27 | 48 | | Sat. | | | |
| | -65.7 | 63.6 | 8 | 9 | 12 | 21 | | Sat. | | | |
| | -70.7 | 68.6 | 2 | 2 | 3 | 5 | | Sat. | | | |

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B6-A | **STATION** 26+30 | **OFFSET** 28 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -2.1 ft | **TOTAL DEPTH** 129.5 ft | **NORTHING** 251,512 | **EASTING** 2,436,483 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** J. STEWART | **START DATE** 11/18/15 | **COMP. DATE** 11/20/15 | **SURFACE WATER DEPTH** 1.6ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| | -75.7 | 73.6 | 9 | 9 | 13 | 22 | | Sat. | | **COASTAL PLAIN**<br>DARK GRAY, SILTY FINE TO COARSE SAND (A-2-4)<br>(RIVER BEND FORMATION) *(continued)* |
| -80 | -80.7 | 78.6 | 9 | 15 | 61 | 76 | | Sat. | | -82.4 80.3 |
| -85 | -85.7 | 83.6 | 100/0.2 | | | 100/0.2 | | | | **COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -90 | -90.7 | 88.6 | 100/0.3 | | | 100/0.3 | | | | |
| -95 | -95.7 | 93.6 | 60/0.1 | | | 60/0.1 | | | | |
| -100 | -100.7 | 98.6 | 60/0.1 | | | 60/0.1 | | | | |
| -105 | -105.7 | 103.6 | 20 | 23 | 50 | 73 | | Sat. | | -102.4 100.3 |
| -110 | -110.7 | 108.6 | 22 | 17 | 17 | 34 | | Sat. | | **COASTAL PLAIN**<br>LIGHT GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH SOME CEMENTED SAND AND SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -115 | -115.7 | 113.6 | 24 | 14 | 13 | 27 | | Sat. | | |
| -120 | -120.7 | 118.6 | 60/0.1 | | | 60/0.1 | | | | -118.9 116.8 |
| -125 | -125.7 | 123.6 | 18 | 16 | 22 | 38 | | Sat. | | **COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -130 | -130.7 | 128.6 | 17 | 100/0.4 | | 100/0.4 | | | | -124.5 122.4 |
| | | | | | | | | | | **COASTAL PLAIN**<br>LIGHT GRAY, SILTY FINE TO COARSE SAND (A-1-b) WITH SOME CEMENTED SAND FRAGMENTS<br>(RIVER BEND FORMATION) |
| | | | | | | | | | | -131.2 129.1<br>-131.6 129.5 **COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| | | | | | | | | | | Boring Terminated at Elevation -131.6 ft in LIMESTONE (RIVER BEND FORMATION) |

NCDOT BORE DOUBLE B4929_GEO_BH_TOPSAIL.GPJ NC_DOT.GDT 2/4/16

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** D. RACEY | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B7-B | **STATION** 27+24 | **OFFSET** 21 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.8 ft | **TOTAL DEPTH** 115.3 ft | **NORTHING** 251,414 | **EASTING** 2,436,443 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** B. FOWLER/ M. WIGG | **START DATE** 12/09/15 | **COMP. DATE** 12/11/15 | **SURFACE WATER DEPTH** 2.0ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) — DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | |
| 0 | -1.8 | 0.0 | WOH | WOH | WOH | 0 | | Sat. | | -1.8 — 0.0<br>GROUND SURFACE<br>**UNDIVIDED COASTAL PLAIN**<br>DARK GRAY-BLACK, CLAYEY SILTY FINE SAND (A-2-4) |
| -5 | -5.2 | 3.4 | WOH | 1 | 0 | 1 | | Sat. | | -6.9 — 5.1<br>WOOD |
| -10 | -10.4 | 8.6 | WOH | 1 | 1 | 2 | | Sat. | | -12.4 — 10.6<br>BROWN, FINE TO COARSE SAND (A-3) |
| -15 | -15.4 | 13.6 | 18 | 21 | 43 | 64 | | Sat. | | -15.3 — 13.5<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -20 | -20.4 | 18.6 | 10 | 16 | 16 | 32 | | Sat. | | |
| -25 | -25.4 | 23.6 | 11 | 16 | 14 | 30 | | Sat. | | |
| -30 | -30.4 | 28.6 | 10 | 16 | 18 | 34 | | Sat. | | |
| -35 | -35.4 | 33.6 | 14 | 14 | 21 | 35 | | Sat. | | |
| -40 | -40.4 | 38.6 | 8 | 9 | 16 | 25 | | Sat. | | -39.8 — 38.0<br>**COASTAL PLAIN**<br>DARK GRAY, SILTY FINE SAND (A-2-4) WITH TRACE SHELL AND CEMENTED SAND FRAGMENTS<br>(RIVER BEND FORMATION) |
| -45 | -45.4 | 43.6 | 18 | 31 | 41 | 72 | | Sat. | | |
| -50 | -50.4 | 48.6 | 21 | 35 | 59 | 94 | | Sat. | | |
| -55 | -55.4 | 53.6 | 6 | 6 | 7 | 13 | | Sat. | | |
| -60 | -60.4 | 58.6 | 10 | 14 | 19 | 33 | | Sat. | | |
| -65 | -65.4 | 63.6 | 12 | 15 | 11 | 26 | | Sat. | | |
| -70 | -70.4 | 68.6 | 5 | 3 | 3 | 6 | | Sat. | | |
| -75 | | | | | | | | | | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| -80 | -75.4 | 73.6 | 7 | 8 | 10 | 18 | | Sat. | | **COASTAL PLAIN**<br>DARK GRAY, SILTY FINE SAND (A-2-4) WITH TRACE SHELL AND CEMENTED SAND FRAGMENTS<br>(RIVER BEND FORMATION) *(continued)* |
| -85 | -80.4 | 78.6 | 11 | 14 | 60 | 74 | | Sat. | | -81.5 — 79.7<br>DARK GRAY, CEMENTED SAND (A-1-b)<br>(RIVER BEND FORMATION) |
| -90 | -85.4 | 83.6 | 100/0.3 | | | 100/0.3 | | | | -85.4 — 83.6<br>-86.0 — 84.2<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -95 | -89.0 | 87.2 | 37 | 21 | 25 | 46 | | Sat. | | -89.0 — 87.2<br>-91.0 — 89.2<br>-91.3 — 89.5<br>**COASTAL PLAIN**<br>LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| -100 | -90.5 | 88.7 | 40 | 100/0.3 | | 100/0.3 | | | | **COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, MODERATELY INDURATED TO INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -105 | -96.3 | 94.5 | 100/0.4 | | | 100/0.4 | | | | |
| -110 | -100.5 | 98.7 | 60/0.1 | | | 60/0.1 | | | | -102.7 — 100.9<br>**COASTAL PLAIN**<br>LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| -115 | -105.6 | 103.8 | 11 | 16 | 83 | 99 | | Sat. | | -105.6 — 103.8 |
| | -110.6 | 108.8 | 8 | 13 | 27 | 40 | | Sat. | | |
| | -115.6 | 113.8 | 13 | 20 | 17 | 37 | | Sat. | | -117.1 — 115.3<br>Boring Terminated at Elevation -117.1 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

NCDOT BORE DOUBLE B4929_GEO_BH_TOPSAIL.GPJ NC_DOT.GDT 2/4/16

# GEOTECHNICAL BORING REPORT
# CORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** D. RACEY | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B7-B | **STATION** 27+24 | **OFFSET** 21 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.8 ft | **TOTAL DEPTH** 115.3 ft | **NORTHING** 251,414 | **EASTING** 2,436,443 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** B. FOWLER/ M. WIGG | **START DATE** 12/09/15 | **COMP. DATE** 12/11/15 | **SURFACE WATER DEPTH** 2.0ft | |
| **CORE SIZE** NQ2 | **TOTAL RUN** 16.8 ft | | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | ELEV. (ft) DEPTH (ft) |
| -86 | | | | | | | | | | | Begin Coring @ 84.2 ft |
| | -86.0 | 84.2 | 3.0 | 1:57/1.0<br>2:50/1.0<br>2:17/1.0 | (2.5)<br>83% | (0.0)<br>0% | | (2.5)<br>83% | (0.0)<br>0% | | -86.0 **COASTAL PLAIN SEDIMENTARY ROCK** 84.2<br>LIGHT GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| | -89.0 | 87.2 | | *N=46* | | | | | | | -89.0 87.2 |
| -90 | | | | | | | | | | | **COASTAL PLAIN** |
| | -91.3 | 89.5 | | *N=100/0.3* | | | | | | | -91.0 89.2<br>LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>-91.3 89.5<br>(RIVER BEND FORMATION) |
| | | | 5.0 | 2:03/1.0<br>3:10/1.0<br>2:32/1.0<br>1:34/1.0<br>2:26/1.0 | (5.0)<br>100% | (0.4)<br>8% | | (8.8)<br>77% | (0.9)<br>8% | | **COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, MODERATELY INDURATED TO INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -95 | | | | | | | | | | | |
| | -96.3 | 94.5 | | | | | | | | | |
| | -96.7 | 94.9 | | *N=100/0.4* | | | | | | | |
| | | | 3.8 | 2:05/1.0<br>0:36/1.0<br>1:10/1.0<br>6:50/0.8 | (1.7)<br>45% | (0.0)<br>0% | | | | | |
| -100 | -100.5 | 98.7 | | | | | | | | | |
| | -100.6 | 98.8 | | *N=60/0.1* | | | | | | | |
| | | | 5.0 | 4:53/1.0<br>3:16/1.0<br>0:59/1.0<br>0:36/1.0<br>0:20/1.0 | (2.1)<br>42% | (0.5)<br>10% | | | | | |
| -105 | -105.6 | 103.8 | | *N=99* | | | | (0.0)<br>0% | (0.0)<br>0% | | -102.7 100.9<br>**COASTAL PLAIN**<br>LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>-105.6 103.8<br>(RIVER BEND FORMATION) |
| -110 | | | | *N=40* | | | | | | | |
| -115 | | | | *N=37* | | | | | | | -117.1 115.3<br>Boring Terminated at Elevation -117.1 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

## CORE PHOTOGRAPHS: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach, B7-B: -L2- Station 27+24, 21’ RT

**Begin Run 1**
**84.2 feet**


**Begin Run 2**
**89.5 feet**

**End Run 2**
**94.5 feet**

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET

**Begin Run 3**
**94.9 feet**

**Begin Run 4**
**98.8 feet**


**End Run 3**
**98.7 feet**

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B8-A | **STATION** 28+28 | **OFFSET** 31 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -2.3 ft | **TOTAL DEPTH** 114.5 ft | **NORTHING** 251,316 | **EASTING** 2,436,505 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** J. STEWART | **START DATE** 11/06/15 | **COMP. DATE** 11/17/15 | **SURFACE WATER DEPTH** 2.3ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) — DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | |
| | -2.3 | 0.0 | | | | | | | | -2.3 — 0.0<br>GROUND SURFACE |
| -5 | -5.0 | 2.7 | 1 | 1 | 2 | 3 | | Sat. | | **UNDIVIDED COASTAL PLAIN**<br>GRAY-BLACK, SILTY FINE TO COARSE SAND (A-3) WITH TRACE SHELL FRAGMENTS AND ORGANICS |
| | | | 1 | WOH | WOH | 0 | | Sat. | | |
| -10 | -10.0 | 7.7 | | | | | | | | |
| | | | 2 | 3 | 5 | 8 | | Sat. | | |
| -15 | -15.0 | 12.7 | | | | | | | | -14.3 — 12.0<br>BLACK, SILTY FINE SAND (A-2-4) WITH TRACE CLAY |
| | | | WOH | 1 | WOH | 1 | | Sat. | | |
| -20 | -20.0 | 17.7 | | | | | | | | -19.3 — 17.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| | | | 13 | 13 | 18 | 31 | | Sat. | | |
| -25 | -25.0 | 22.7 | | | | | | | | |
| | | | 12 | 21 | 10 | 31 | | Sat. | | |
| -30 | -30.0 | 27.7 | | | | | | | | |
| | | | 9 | 16 | 15 | 31 | | Sat. | | |
| -35 | -35.3 | 33.0 | | | | | | | | |
| | | | 5 | 15 | 17 | 32 | | Sat. | | |
| -40 | -40.3 | 38.0 | | | | | | | | -39.3 — 37.0<br>**COASTAL PLAIN**<br>DARK GRAY, SILTY FINE SAND (A-2-4) WITH TRACE CEMENTED SAND FRAGMENTS<br>(RIVER BEND FORMATION) |
| | | | 17 | 14 | 14 | 28 | | Sat. | | |
| -45 | -45.3 | 43.0 | | | | | | | | |
| | | | 18 | 20 | 30 | 50 | | Sat. | | |
| -50 | -50.3 | 48.0 | | | | | | | | |
| | | | 14 | 30 | 33 | 63 | | Sat. | | |
| -55 | -55.3 | 53.0 | | | | | | | | |
| | | | 17 | 11 | 10 | 21 | | Sat. | | |
| -60 | -60.3 | 58.0 | | | | | | | | |
| | | | 8 | 11 | 9 | 20 | | Sat. | | |
| -65 | -65.3 | 63.0 | | | | | | | | |
| | | | 9 | 11 | 12 | 23 | | Sat. | | |
| -70 | -70.3 | 68.0 | | | | | | | | |
| | | | 6 | 7 | 8 | 15 | | Sat. | | |
| -75 | -75.3 | 73.0 | | | | | | | | |
| | | | 3 | 4 | 4 | 8 | | Sat. | | |
| -80 | | | | | | | | | | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -80 | | | | | | Match Line | | | | |
| | -80.3 | 78.0 | 3 | 3 | 4 | 7 | | Sat. | | |
| -85 | -85.3 | 83.0 | 18 | 49 | 51/0.4 | 100/0.9 | | | | -85.3 — 83.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -90 | -90.3 | 88.0 | 57 | 43/0.4 | | 100/0.9 | | | | |
| -95 | -95.3 | 93.0 | 60/0.1 | | | 60/0.1 | | | | |
| -100 | -100.3 | 98.0 | 100/0.4 | | | 100/0.4 | | | | |
| -105 | -105.3 | 103.0 | 7 | 7 | 12 | 19 | | Sat. | | -105.3 — 103.0<br>**COASTAL PLAIN**<br>LIGHT GRAY, FINE TO COARSE SAND (A-1-b) WITH SOME CEMENTED SAND FRAGMENTS<br>(RIVER BEND FORMATION) |
| -110 | -110.3 | 108.0 | 9 | 10 | 18 | 28 | | Sat. | | |
| -115 | -115.3 | 113.0 | 9 | 11 | 9 | 20 | | Sat. | | -116.8 — 114.5<br>Boring Terminated at Elevation -116.8 ft in SAND (RIVER BEND FORMATION) |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B9-B | **STATION** 29+16 | **OFFSET** 19 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.2 ft | **TOTAL DEPTH** 118.6 ft | **NORTHING** 251,223 | **EASTING** 2,436,463 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** J. STEWART | **START DATE** 12/16/15 | **COMP. DATE** 12/18/15 | **SURFACE WATER DEPTH** 2.0ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | |
| | -1.2 | 0.0 | WOH | WOH | WOH | 0 | | Sat. | | -1.2 GROUND SURFACE | 0.0 |
| | | | | | | | | | | **UNDIVIDED COASTAL PLAIN** DARK GRAY, CLAYEY FINE SAND (A-2-6) | |
| -5 | -4.7 | 3.5 | WOH | WOH | WOH | 0 | | Sat. | | | |
| -10 | -9.7 | 8.5 | 2 | 3 | 4 | 7 | | Sat. | | -9.2 | 8.0 |
| | | | | | | | | | | BROWN, FINE TO COARSE SAND (A-3) WITH TRACE SHELL FRAGMENTS, ORGANICS, AND GRAVEL | |
| -15 | -14.7 | 13.5 | 1 | 1 | 1 | 2 | | Sat. | | | |
| -20 | -19.7 | 18.5 | WOH | WOH | WOH | 0 | | Sat. | | | |
| -25 | -24.7 | 23.5 | 7 | 10 | 14 | 24 | | Sat. | | -24.2 | 23.0 |
| | | | | | | | | | | **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) | |
| -30 | -29.7 | 28.5 | 11 | 12 | 14 | 26 | | Sat. | | | |
| -35 | -34.7 | 33.5 | 6 | 10 | 12 | 22 | | Sat. | | -34.2 | 33.0 |
| | | | | | | | | | | **COASTAL PLAIN** GRAY, SILTY FINE TO COARSE SAND (A-2-4) (RIVER BEND FORMATION) | |
| -40 | -39.7 | 38.5 | 20 | 25 | 26 | 51 | | Sat. | | | |
| -45 | -44.7 | 43.5 | 14 | 22 | 33 | 55 | | Sat. | | | |
| -50 | -49.7 | 48.5 | 23 | 31 | 34 | 65 | | Sat. | | | |
| -55 | -54.7 | 53.5 | 17 | 9 | 16 | 25 | | Sat. | | | |
| -60 | -59.7 | 58.5 | 8 | 9 | 17 | 26 | | Sat. | | | |
| -65 | -64.7 | 63.5 | 6 | 9 | 15 | 24 | | Sat. | | | |
| -70 | -69.7 | 68.5 | 11 | 12 | 22 | 34 | | Sat. | | | |
| -75 | -74.7 | 73.5 | 10 | 12 | 17 | 29 | | Sat. | | | |
| -80 | -79.7 | 78.5 | | | | | | | | | |

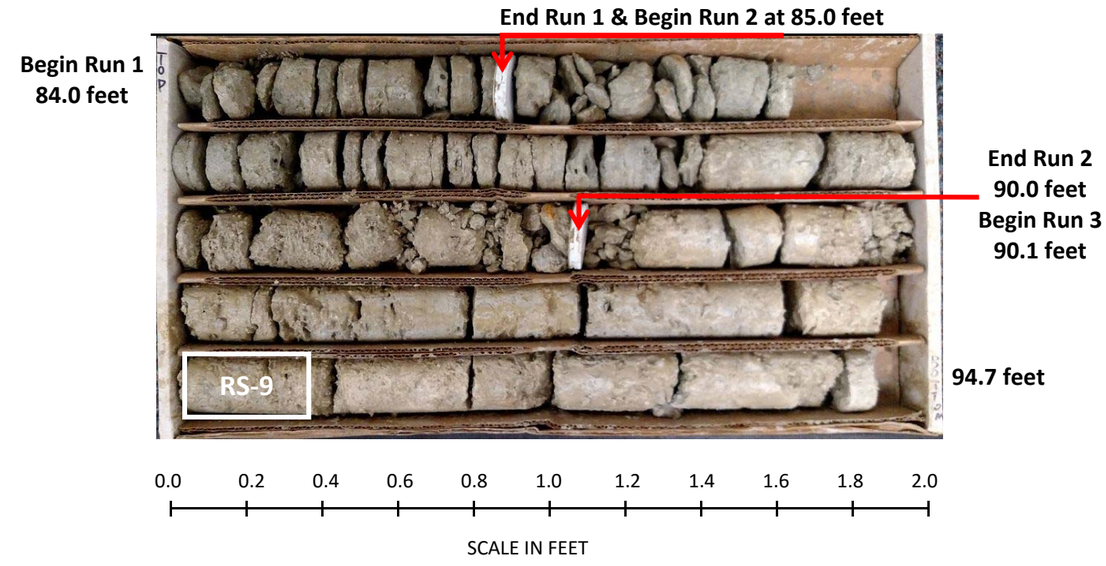
| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -80 | | | | | | Match Line | | | | |
| | | | 5 | 4 | 7 | 11 | | Sat. | | **COASTAL PLAIN** GRAY, SILTY FINE TO COARSE SAND (A-2-4) (RIVER BEND FORMATION) *(continued)* |
| -85 | -84.7 | 83.5 | 100/0.5 | | | 100/0.5 | | | | -84.7 / -85.2 **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION) 84.0 |
| -90 | -91.2 | 90.0 | 60/0.1 | | | 60/0.1 | | | | |
| -95 | -96.2 | 95.0 | 100/0.2 | | | 100/0.2 | RS-9 | | | |
| -100 | -101.2 | 100.0 | 60/0.1 | | | 60/0.1 | RS-10 | | | |
| -105 | -106.2 | 105.0 | 14 | 40 | 60/0.1 | 100/0.6 | | | | -103.2 102.0 **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) 105.0 |
| -110 | -109.7 | 108.5 | 37 | 15 | 17 | 32 | | Sat. | | -106.7 105.5 -108.2 107.0 **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE (RIVER BEND FORMATION) |
| -115 | -114.7 | 113.5 | 12 | 10 | 10 | 20 | | Sat. | | **COASTAL PLAIN** LIGHT GRAY, SILTY FINE TO COARSE SAND (A-1-b) WITH SOME CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |
| | -119.7 | 118.5 | 60/0.1 | | | 60/0.1 | | | | -118.6 117.4 -119.8 **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY INDURATED LIMESTONE (RIVER BEND FORMATION) 118.6 |
| | | | | | | | | | | Boring Terminated with Standard Penetration Test Refusal at Elevation -119.8 ft in LIMESTONE (RIVER BEND FORMATION) |

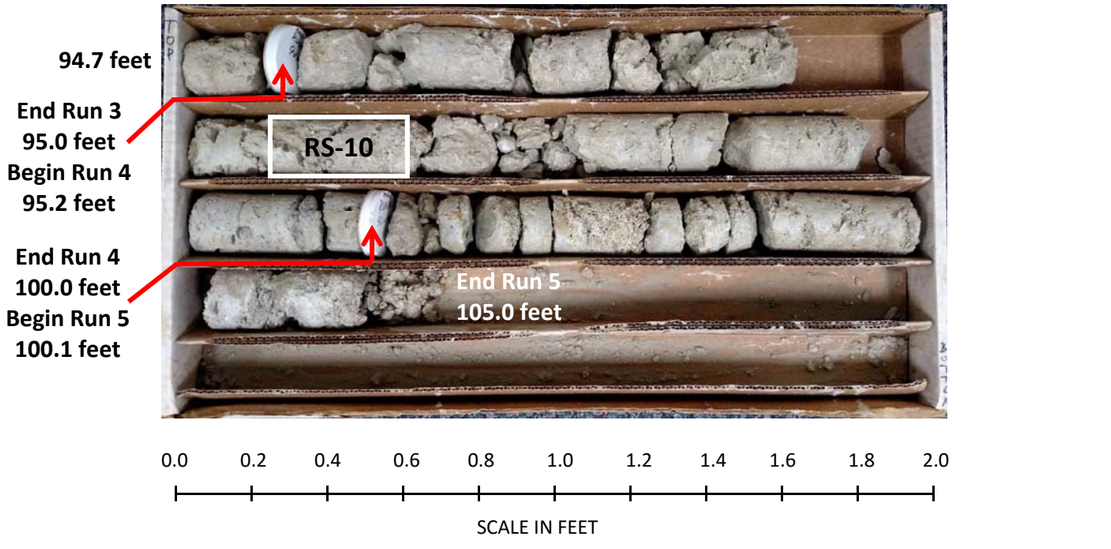
# GEOTECHNICAL BORING REPORT
# CORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B9-B | **STATION** 29+16 | **OFFSET** 19 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.2 ft | **TOTAL DEPTH** 118.6 ft | **NORTHING** 251,223 | **EASTING** 2,436,463 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** J. STEWART | **START DATE** 12/16/15 | **COMP. DATE** 12/18/15 | **SURFACE WATER DEPTH** 2.0ft | |
| **CORE SIZE** NQ2 | **TOTAL RUN** 20.6 ft | | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -85.2 | | | | | | | | | | | Begin Coring @ 84.0 ft |
| | -85.2 | 84.0 | 1.0 | 3:15/1.0 | (1.0) 100% | (0.0) 0% | | (14.9) 83% | (4.3) 24% | | -85.2 **COASTAL PLAIN SEDIMENTARY ROCK** 84.0<br>LIGHT GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION)<br>RS-9: 92.7'-93.0', qu=1,149 psi, RMR=19<br>RS-10: 96.7'-97.0', qu=5,972 psi, RMR=14 |
| | -86.2 | 85.0 | 5.0 | 2:19/1.0<br>2:16/1.0<br>0:34/1.0<br>0:16/1.0<br>1:09/1.0 | (3.7) 74% | (0.0) 0% | | | | | |
| -90 | -91.2 | 90.0 | | | | | | | | | |
| | -91.3 | 90.1 | 4.9 | *N=60/0.1*<br>2:30/0.9<br>2:51/1.0<br>2:40/1.0<br>2:10/1.0<br>1:12/1.0 | (4.9) 100% | (2.2) 45% | RS-9 | | | | |
| -95 | -96.2 | 95.0 | | | | | | | | | |
| | -96.4 | 95.2 | 4.8 | *N=100/0.2*<br>1:58/0.8<br>2:22/1.0<br>1:26/1.0<br>2:12/1.0<br>4:27/1.0 | (3.4) 71% | (1.3) 27% | RS-10 | | | | |
| -100 | -101.2 | 100.0 | | | | | | | | | |
| | -101.3 | 100.1 | 4.9 | *N=60/0.1*<br>1:53/0.9<br>1:17/1.0<br>0:18/1.0<br>0:08/1.0<br>0:10/1.0 | (1.9) 39% | (0.8) 16% | | | | | -103.2 102.0 |
| -105 | -106.2 | 105.0 | | *N=100/0.6* | | | | (0.0) 0% | (0.0) 0% | | **COASTAL PLAIN**<br>LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION)<br>-106.2 105.0<br>-106.7 105.5 |
| -110 | | | | *N=32* | | | | | | | -108.2 107.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE<br>(RIVER BEND FORMATION)<br>**COASTAL PLAIN**<br>LIGHT GRAY, SILTY FINE TO COARSE SAND (A-1-b) WITH SOME<br>CEMENTED SAND AND SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -115 | | | | *N=20* | | | | | | | -118.6 117.4 |
| | | | | *N=60/0.1* | | | | | | | -119.8 118.6<br>Boring Terminated with Standard Penetration Test Refusal at Elevation<br>-119.8 ft in LIMESTONE (RIVER BEND FORMATION) |

## CORE PHOTOGRAPHS: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach, B9-B: -L2- Station 29+16, 19' RT



# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B10-A | **STATION** 30+55 | **OFFSET** 37 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -2.2 ft | **TOTAL DEPTH** 121.6 ft | **NORTHING** 251,090 | **EASTING** 2,436,533 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID6214 CME-45C 81% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** B. FOWLER | **START DATE** 11/16/15 | **COMP. DATE** 11/17/15 | **SURFACE WATER DEPTH** 2.4ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | |
| | -2.3 | 0.1 | WOH | WOH | WOH | 0 | | Sat. | | -2.2 GROUND SURFACE | 0.0 |
| -5 | -6.9 | 4.7 | 1 | 3 | 2 | 5 | | Sat. | | **ALLUVIAL**<br>DARK GRAY AND BLACK MUCK<br>-5.2 **UNDIVIDED COASTAL PLAIN**<br>GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE TO SOME SHELL FRAGMENTS AND GRAVEL | 3.0 |
| -10 | -11.6 | 9.4 | 2 | 3 | 4 | 7 | | Sat. | | | |
| -15 | -16.6 | 14.4 | 1 | 1 | 2 | 3 | | Sat. | | | |
| -20 | -21.6 | 19.4 | 1 | 2 | 2 | 4 | | Sat. | | | |
| -25 | -26.6 | 24.4 | 11 | 15 | 14 | 29 | | Sat. | | -26.1 **COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS<br>(RIVER BEND FORMATION) | 23.9 |
| -30 | -31.7 | 29.5 | 12 | 20 | 23 | 43 | | Sat. | | | |
| -35 | -36.7 | 34.5 | 9 | 9 | 12 | 21 | | Sat. | | | |
| -40 | -41.8 | 39.6 | 13 | 15 | 19 | 34 | | Sat. | | -41.2 **COASTAL PLAIN**<br>GRAY-BROWN, SILTY FINE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS<br>(RIVER BEND FORMATION) | 39.0 |
| -45 | -46.9 | 44.7 | 27 | 30 | 39 | 69 | | Sat. | | | |
| -50 | -52.0 | 49.8 | 24 | 31 | 45 | 76 | | Sat. | | -HARD DRILLING NOTED FROM 64.6'-64.9' | |
| -55 | -57.0 | 54.8 | 11 | 10 | 10 | 20 | | Sat. | | | |
| -60 | -62.0 | 59.8 | 12 | 14 | 32 | 46 | | Sat. | | | |
| -65 | -67.1 | 64.9 | 6 | 11 | 11 | 22 | | Sat. | | | |
| -70 | -72.1 | 69.9 | 15 | 18 | 26 | 44 | | Sat. | | | |
| -75 | -77.1 | 74.9 | 11 | 16 | 20 | 36 | | Sat. | | | |
| -80 | | | | | | | | | | | |



| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B10-A | **STATION** 30+55 | **OFFSET** 37 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -2.2 ft | **TOTAL DEPTH** 121.6 ft | **NORTHING** 251,090 | **EASTING** 2,436,533 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID6214 CME-45C 81% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** B. FOWLER | **START DATE** 11/16/15 | **COMP. DATE** 11/17/15 | **SURFACE WATER DEPTH** 2.4ft | |



| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -80 | | | | | | Match Line | | | | |
| | -82.2 | 80.0 | 3 | 4 | 5 | 9 | | Sat. | | -86.3 **COASTAL PLAIN SEDIMENTARY ROCK** 84.1<br>GRAY, FRIABLE TO INDURATED LIMESTONE (RIVER BEND FORMATION) |
| -85 | -87.2 | 85.0 | 60/0.1 | | | 60/0.1 | | | | |
| -90 | -92.2 | 90.0 | 100/0.2 | | | 100/0.2 | | | | -SOFT DRILLING NOTED FROM 88.4'-89.1', 92.4'-93.1', AND FROM 97.3'-98.3' |
| -95 | -97.5 | 95.3 | 100/0.5 | | | 100/0.5 | | | | |
| -100 | -102.5 | 100.3 | 60/0.1 | | | 60/0.1 | | | | |
| -105 | -107.4 | 105.2 | 50 | 50/0.4 | | 100/0.9 | | | | |
| -110 | -112.4 | 110.2 | 21 | 18 | 23 | 41 | | Sat. | | -103.7 **COASTAL PLAIN** 101.5<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION)<br>-106.8 **COASTAL PLAIN SEDIMENTARY ROCK** 104.6<br>GRAY, FRIABLE LIMESTONE<br>(RIVER BEND FORMATION)<br>-109.8 **COASTAL PLAIN** 107.6<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| -115 | -117.4 | 115.2 | 33 | 60/0.0 | | 60/0.0 | | | | |
| -120 | -122.3 | 120.1 | 23 | 27 | 19 | 46 | | Sat. | | -117.9 **COASTAL PLAIN SEDIMENTARY ROCK** 115.7<br>-119.3 GRAY, MODERATELY INDURATED LIMESTONE 117.1<br>(RIVER BEND FORMATION)<br>-123.8 **COASTAL PLAIN** 121.6<br>GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH SOME CEMENTED SAND AND SHELL FRAGMENTS<br>(RIVER BEND FORMATION)<br>Boring Terminated at Elevation -123.8 ft in SAND (RIVER BEND FORMATION) |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. WANG | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B11-B | **STATION** 31+98 | **OFFSET** 22 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.6 ft | **TOTAL DEPTH** 123.8 ft | **NORTHING** 250,942 | **EASTING** 2,436,488 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** J. STEWART | **START DATE** 12/14/15 | **COMP. DATE** 12/16/15 | **SURFACE WATER DEPTH** 0.6ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | |
| 0 | 0.6 | 0.0 | WOH | WOH | 2 | 2 | | Sat. | | 0.6 GROUND SURFACE 0.0<br>**ALLUVIAL** |
| | -3.2 | 3.8 | 1 | 1 | 4 | 5 | | Sat. | | -1.4 PEAT 2.0<br>**UNDIVIDED COASTAL PLAIN**<br>GRAY, SILTY FINE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS AND ORGANICS |
| -5 | -8.2 | 8.8 | 1 | 3 | 4 | 7 | | Sat. | | |
| -10 | -13.2 | 13.8 | 2 | 7 | 11 | 18 | | Sat. | | |
| -15 | -19.2 | 19.8 | WOH | WOH | WOH | 0 | | Sat. | | -22.4 23.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -20 | -23.2 | 23.8 | 9 | 7 | 4 | 11 | | Sat. | | |
| -25 | -28.2 | 28.8 | 5 | 3 | 1 | 4 | | Sat. | | |
| -30 | -33.2 | 33.8 | 13 | 18 | 16 | 34 | | Sat. | | |
| -35 | -38.2 | 38.8 | 17 | 12 | 12 | 24 | | Sat. | | -38.8 39.4<br>**COASTAL PLAIN**<br>LIGHT GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH SOME CEMENTED SAND FRAGMENTS TO 43.8'<br>(RIVER BEND FORMATION) |
| -40 | -43.2 | 43.8 | 9 | 15 | 22 | 37 | | Sat. | | |
| -45 | -48.2 | 48.8 | 20 | 27 | 36 | 63 | | Sat. | | |
| -50 | -53.2 | 53.8 | 27 | 45 | 55/0.3 | 100/0.8 | | Sat. | | |
| -55 | -58.2 | 58.8 | 7 | 8 | 11 | 19 | | Sat. | | |
| -60 | -63.2 | 63.8 | 10 | 10 | 13 | 23 | | Sat. | | |
| -65 | -68.2 | 68.8 | 8 | 8 | 10 | 18 | | Sat. | | |
| -70 | -73.2 | 73.8 | 5 | 3 | 4 | 7 | | Sat. | | |
| -75 | | | | | | | | | | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| -80 | -78.2 | 78.8 | 3 | 2 | 4 | 6 | | Sat. | | **COASTAL PLAIN**<br>LIGHT GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH SOME CEMENTED SAND FRAGMENTS TO 43.8'<br>(RIVER BEND FORMATION) *(continued)* |
| -85 | -83.2 | 83.8 | 4 | 10 | 15 | 25 | | Sat. | | -84.7 85.3<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -90 | -88.2 | 88.8 | 32 | 80 | 20/0.4 | 100/0.9 | | | | |
| -95 | -93.2 | 93.8 | 60/0.1 | | | 60/0.1 | | | | |
| -100 | -98.2 | 98.8 | 16 | 12 | 11 | 23 | | Sat. | | -97.2 97.8<br>**COASTAL PLAIN**<br>LIGHT GRAY, SILTY FINE TO COARSE SAND (A-1-b) WITH SOME CEMENTED SAND FRAGMENTS<br>(RIVER BEND FORMATION)<br>HARDER DRILLING NOTED FROM 101.4'-102.2' |
| -105 | -103.2 | 103.8 | 7 | 6 | 6 | 12 | | Sat. | | |
| -110 | -108.2 | 108.8 | 60/0.1 | | | 60/0.1 | | | | -108.2 108.8<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -115 | -113.2 | 113.8 | 26 | 20 | 14 | 34 | | Sat. | | -110.7 111.3<br>**COASTAL PLAIN**<br>LIGHT GRAY, SILTY FINE TO COARSE SAND (A-1-b)<br>(RIVER BEND FORMATION) |
| -120 | -118.2 | 118.8 | 100/0.4 | | | 100/0.4 | | | | -118.2 118.8<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| | -123.2 | 123.8 | 60/0.0 | | | 60/0.0 | | | | -123.2 123.8<br>Boring Terminated with Standard Penetration Test Refusal at Elevation -123.2 ft in LIMESTONE (RIVER BEND FORMATION) |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B12-A | **STATION** 33+41 | **OFFSET** 30 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.5 ft | **TOTAL DEPTH** 116.8 ft | **NORTHING** 250,805 | **EASTING** 2,436,553 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID6214 CME-45C 81% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** B. FOWLER | **START DATE** 11/11/15 | **COMP. DATE** 11/13/15 | **SURFACE WATER DEPTH** 1.9ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) / DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | |
| | -1.8 | 0.3 | WOH | WOH | WOH | 0 | | Sat. | | -1.5 / 0.0 GROUND SURFACE<br>**UNDIVIDED COASTAL PLAIN**<br>DARK GRAY, SILTY FINE SAND (A-2-4)<br>WITH TRACE SHELL FRAGMENTS |
| -5 | -6.5 | 5.0 | 3 | 4 | 5 | 9 | | Sat. | | |
| -10 | -11.6 | 10.1 | 5 | 2 | 1 | 3 | | Sat. | | -14.5 / 13.0 DARK GRAY, SILTY CLAY (A-7-5) WITH<br>LITTLE FINE SAND |
| -15 | -16.6 | 15.1 | 2 | 1 | 1 | 2 | | Sat. | | -19.5 / 18.0 DARK GRAY, SILTY FINE SAND (A-2-4)<br>WITH TRACE SHELL FRAGMENTS |
| -20 | -21.6 | 20.1 | 1 | 1 | 4 | 5 | | Sat. | | -22.5 / 21.0 **COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH<br>SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -25 | -26.7 | 25.2 | 7 | 10 | 16 | 26 | | Sat. | | |
| -30 | -31.7 | 30.2 | 8 | 13 | 17 | 30 | | Sat. | | |
| -35 | -36.7 | 35.2 | 19 | 17 | 26 | 43 | | Sat. | | |
| -40 | -41.7 | 40.2 | 12 | 14 | 10 | 24 | | Sat. | | -39.5 / 38.0 **COASTAL PLAIN**<br>GRAY-BROWN, SILTY FINE SAND (A-2-4)<br>WITH TRACE GRAVEL<br>(RIVER BEND FORMATION) |
| -45 | -46.8 | 45.3 | 25 | 26 | 33 | 59 | | Sat. | | |
| -50 | -51.8 | 50.3 | 24 | 38 | 46 | 84 | | Sat. | | |
| -55 | -56.8 | 55.3 | 6 | 6 | 8 | 14 | | Sat. | | |
| -60 | -61.8 | 60.3 | 8 | 14 | 16 | 30 | | Sat. | | |
| -65 | -66.9 | 65.4 | 11 | 12 | 27 | 39 | | Sat. | | |
| -70 | -71.9 | 70.4 | 13 | 20 | 36 | 56 | | Sat. | | |
| -75 | -76.9 | 75.4 | 13 | 13 | 15 | 28 | | Sat. | | |
| -80 | | | | | | | | | | |

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B12-A | **STATION** 33+41 | **OFFSET** 30 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.5 ft | **TOTAL DEPTH** 116.8 ft | **NORTHING** 250,805 | **EASTING** 2,436,553 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID6214 CME-45C 81% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** B. FOWLER | **START DATE** 11/11/15 | **COMP. DATE** 11/13/15 | **SURFACE WATER DEPTH** 1.9ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -80 | | | | | | Match Line | | | | |
| | -81.9 | 80.4 | 4 | 4 | 5 | 9 | | Sat. | | **COASTAL PLAIN**<br>GRAY-BROWN, SILTY FINE SAND (A-2-4)<br>WITH TRACE GRAVEL<br>(RIVER BEND FORMATION) *(continued)* |
| -85 | -85.5 | 84.0 | 60/0.0 | | | 60/0.0 | | | | -85.4 / 83.9 -85.9 / 84.4 **COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE TO INDURATED<br>LIMESTONE (RIVER BEND FORMATION) |
| -90 | -90.9 | 89.4 | 100/0.2 | | | 100/0.2 | RS-4 | | | |
| -95 | -96.4 | 94.9 | 60/0.0 | | | 60/0.0 | | | | |
| -100 | -101.6 | 100.1 | 60/0.1 | | | 60/0.1 | | | | |
| -105 | -106.9 | 105.4 | 50 | 50/0.2 | | 100/0.7 | | | | -103.1 / 101.6 **COASTAL PLAIN**<br>GRAY, CEMENTED SAND AND SHELL<br>FRAGMENTS (A-1-b) -105.9 / 104.4<br>(RIVER BEND FORMATION)<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE TO MODERATELY<br>INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -110 | -112.9 | 111.4 | 52 | 38 | 35 | 73 | | Sat. | | -113.3 / 111.8 **COASTAL PLAIN**<br>GRAY, FINE TO COARSE SANDY GRAVEL<br>(A-1-b) WITH TRACE SILT (FRIABLE<br>LIMESTONE) -117.5 / 116.0<br>(RIVER BEND FORMATION) -118.3 / 116.8<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE AND MODERATELY<br>INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -115 | -117.9 | 116.4 | 100/0.4 | | | 100/0.4 | | | | Boring Terminated at Elevation -118.3 ft in<br>LIMESTONE (RIVER BEND FORMATION) |

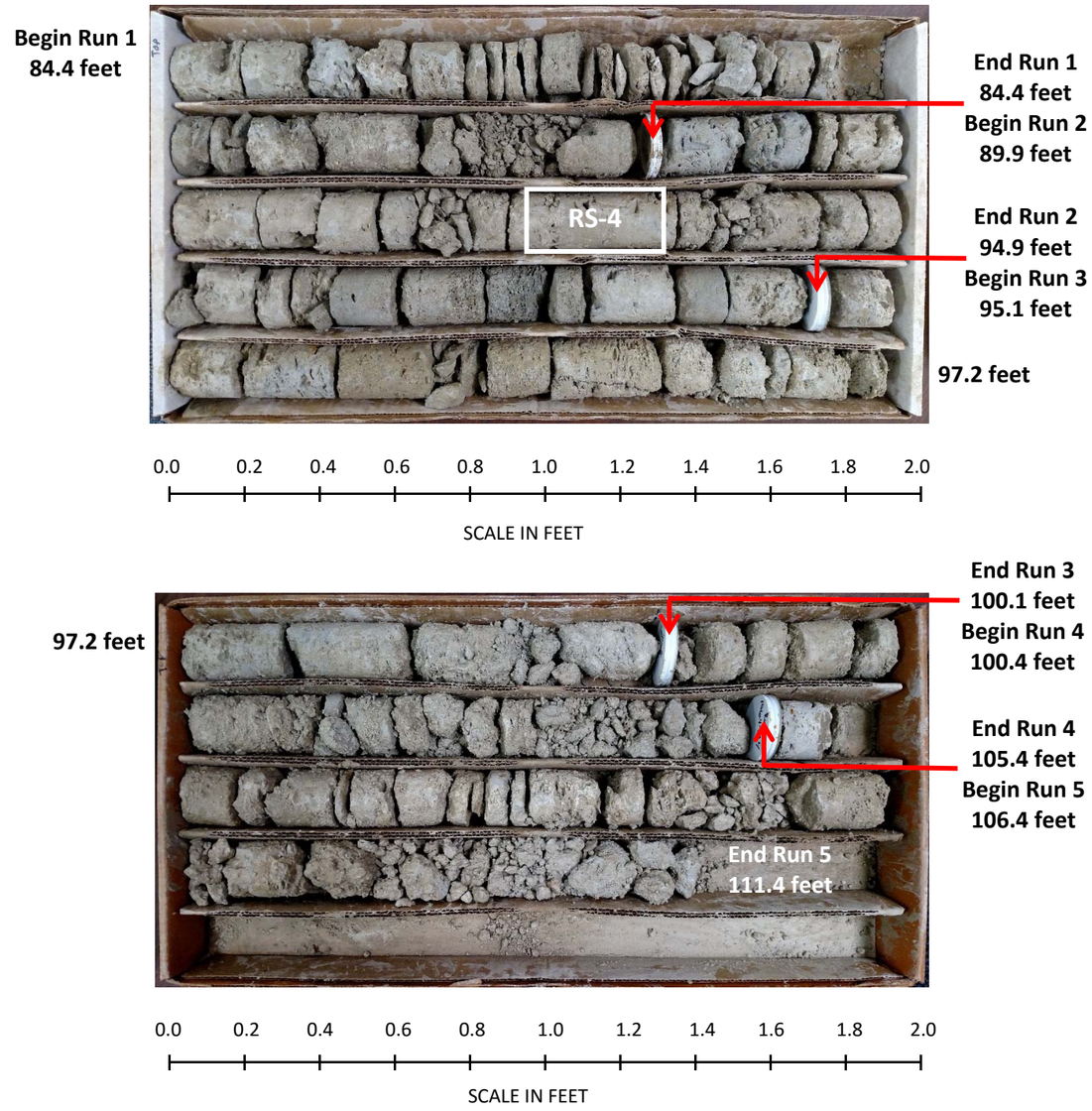
# GEOTECHNICAL BORING REPORT
# CORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B12-A | **STATION** 33+41 | **OFFSET** 30 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.5 ft | **TOTAL DEPTH** 116.8 ft | **NORTHING** 250,805 | **EASTING** 2,436,553 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID6214 CME-45C 81% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** B. FOWLER | **START DATE** 11/11/15 | **COMP. DATE** 11/13/15 | **SURFACE WATER DEPTH** 1.9ft | |
| **CORE SIZE** NQ2 | **TOTAL RUN** 25.0 ft | | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -85.9 | | | | | | | | | | | Begin Coring @ 84.4 ft |
| | -85.9 | 84.4 | 5.0 | 4:25/1.0<br>1:58/1.0<br>2:09/1.0<br>0:43/1.0<br>1:17/1.0 | (3.1)<br>62% | (0.0)<br>0% | | (16.7)<br>97% | (0.8)<br>5% | | -85.9 **COASTAL PLAIN SEDIMENTARY ROCK** 84.4<br>GRAY, FRIABLE TO INDURATED LIMESTONE (RIVER BEND FORMATION)<br>RS-4: 91.6'-91.9', qu=1,472 psi, RMR=10 |
| -90 | -90.9 | 89.4 | | | | | | | | | |
| | -91.4 | 89.9 | | *N=100/0.2* | | | | | | | |
| | | | 5.0 | 1:59/1.0<br>1:54/1.0<br>2:18/1.0<br>2:10/1.0<br>2:46/1.0 | (4.5)<br>90% | (0.5)<br>10% | RS-4 | | | | |
| -95 | -96.4 | 94.9 | | | | | | | | | |
| | -96.6 | 95.1 | 5.0 | *N=60/0.0* | (3.4)<br>68% | (0.3)<br>6% | | | | | |
| | | | | 1:16/1.0<br>0:32/1.0<br>0:13/1.0<br>0:36/1.0<br>2:23/1.0 | | | | | | | |
| -100 | -101.6 | 100.1 | | | | | | | | | |
| | -101.9 | 100.4 | 5.0 | *N=60/0.1* | (2.2)<br>44% | (0.0)<br>0% | | | | | -103.1 101.6 |
| | | | | 1:32/1.0<br>0:14/1.0<br>0:06/1.0<br>0:09/1.0<br>0:40/1.0 | | | | (0.0)<br>0% | (0.0)<br>0% | | -105.9 **COASTAL PLAIN** 104.4<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| -105 | -106.9 | 105.4 | | | | | | | | | |
| | -107.9 | 106.4 | | *N=100/0.7* | | | | (4.5)<br>61% | (0.0)<br>0% | | **COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| | | | 5.0 | 1:39/1.0<br>1:07/1.0<br>0:35/1.0<br>0:18/1.0<br>1:10/1.0 | (3.5)<br>70% | (0.0)<br>0% | | | | | -113.3 111.8 |
| -110 | -112.9 | 111.4 | | | | | | | | | **COASTAL PLAIN**<br>GRAY, FINE TO COARSE SANDY GRAVEL (A-1-b) WITH TRACE SILT<br>(FRIABLE LIMESTONE)<br>(RIVER BEND FORMATION) 116.0 |
| | | | | *N=73* | | | | | | | -117.5 |
| -115 | | | | | | | | | | | -118.3 116.8 **COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE AND MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| | | | | *N=100/0.4* | | | | | | | Boring Terminated at Elevation -118.3 ft in LIMESTONE (RIVER BEND FORMATION) |

NCDOT CORE DOUBLE B4929_GEO_BH_TOPSAIL.GPJ NC_DOT.GDT 2/4/16

**CORE PHOTOGRAPHS: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach, B12-A: -L2- Station 33+41, 30’ LT**



# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B13-B | **STATION** 34+80 | **OFFSET** 11 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -2.4 ft | **TOTAL DEPTH** 114.3 ft | **NORTHING** 250,662 | **EASTING** 2,436,528 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID6214 CME-45C 81% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** B. FOWLER | **START DATE** 11/10/15 | **COMP. DATE** 11/11/15 | **SURFACE WATER DEPTH** 4.3ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) / DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | |
| | -2.4 | 0.0 | | | | | | | | -2.4 / 0.0 GROUND SURFACE |
| | -2.7 | 0.3 | WOH | 2 | 2 | 4 | | Sat. | | **UNDIVIDED COASTAL PLAIN**<br>DARK GRAY, FINE SAND (A-3) WITH TRACE SHELL FRAGMENTS |
| -5 | -6.3 | 3.9 | 6 | 11 | 11 | 22 | | Sat. | | |
| -10 | -9.9 | 7.5 | 5 | 3 | 3 | 6 | | Sat. | | |
| | -13.4 | 11.0 | | | | | | | | -13.4 / 11.0 DARK GRAY, SILTY CLAY (A-7-5) WITH TRACE SHELL FRAGMENTS |
| -15 | -14.9 | 12.5 | WOH | WOH | 2 | 2 | | Sat. | | |
| | -18.4 | 16.0 | | | | | | | | -18.4 / 16.0 **COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) |
| -20 | -19.9 | 17.5 | 6 | 6 | 6 | 12 | | Sat. | | |
| -25 | -24.9 | 22.5 | 20 | 26 | 16 | 42 | | Sat. | | |
| -30 | -30.0 | 27.6 | 15 | 14 | 15 | 29 | | Sat. | | |
| -35 | -35.0 | 32.6 | 12 | 15 | 29 | 44 | | Sat. | | |
| -40 | -40.2 | 37.8 | 9 | 8 | 13 | 21 | | Sat. | | |
| | -38.4 | 36.0 | | | | | | | | -38.4 / 36.0 **COASTAL PLAIN**<br>BROWN AND GRAY, SILTY FINE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS AND GRAVEL (RIVER BEND FORMATION) |
| -45 | -45.6 | 43.2 | 19 | 26 | 34 | 60 | | Sat. | | |
| -50 | -50.6 | 48.2 | 16 | 26 | 59 | 85 | | Sat. | | -HARD DRILLING NOTED FROM 57.6'-58.3' |
| -55 | -55.7 | 53.3 | 11 | 11 | 11 | 22 | | Sat. | | |
| -60 | -60.7 | 58.3 | 6 | 6 | 15 | 21 | | Sat. | | |
| -65 | -65.8 | 63.4 | 13 | 16 | 14 | 30 | | Sat. | | |
| -70 | -70.8 | 68.4 | 12 | 15 | 21 | 36 | | Sat. | | |
| -75 | -75.8 | 73.4 | 12 | 14 | 18 | 32 | | Sat. | | |
| -80 | | | | | | | | | | |



| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B13-B | **STATION** 34+80 | **OFFSET** 11 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -2.4 ft | **TOTAL DEPTH** 114.3 ft | **NORTHING** 250,662 | **EASTING** 2,436,528 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID6214 CME-45C 81% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** B. FOWLER | **START DATE** 11/10/15 | **COMP. DATE** 11/11/15 | **SURFACE WATER DEPTH** 4.3ft | |



| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -80 | | | | | | Match Line | | | | |
| | -80.9 | 78.5 | 7 | 8 | 10 | 18 | | Sat. | | -84.3 / 81.9 **COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE TO INDURATED LIMESTONE (RIVER BEND FORMATION) |
| -85 | -85.9 | 83.5 | 60/0.0 | | | 60/0.0 | | | | |
| -90 | -91.0 | 88.6 | 60/0.1 | | | 60/0.1 | | | | |
| -95 | -96.1 | 93.7 | 100/0.4 | | | 100/0.4 | | | | -SOFT DRILLING NOTED FROM 95.8'-97.1' |
| -100 | -100.5 | 98.1 | 100/0.5 | | | 100/0.5 | | | | -102.8 / 100.4 **COASTAL PLAIN**<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) |
| -105 | -105.4 | 103.0 | 12 | 22 | 100/0.5 | 100/0.5 | | | | -106.4 / 104.0 **COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE AND MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION) |
| -110 | -110.3 | 107.9 | 63 | 37/0.4 | | 100/0.9 | | | | -112.5 / 110.1 **COASTAL PLAIN**<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) |
| -115 | -115.2 | 112.8 | 9 | 11 | 13 | 24 | | Sat. | | -116.7 / 114.3 Boring Terminated at Elevation -116.7 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B14-A | **STATION** 36+38 | **OFFSET** 25 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -12.0 ft | **TOTAL DEPTH** 109.7 ft | **NORTHING** 250,516 | **EASTING** 2,436,595 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID6214 CME-45C 81% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 11/04/15 | **COMP. DATE** 11/06/15 | **SURFACE WATER DEPTH** 12.5ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft)) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | |
| | | | | | | | | | | -12.0 / 0.0 GROUND SURFACE |
| | -13.5 | 1.5 | | | | | | | | **UNDIVIDED COASTAL PLAIN** GRAY, SILTY FINE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS |
| -15 | | | 5 | 6 | 6 | 12 | | Sat. | | |
| | -16.9 | 4.9 | | | | | | | | |
| -20 | | | 5 | 5 | 3 | 8 | | Sat. | | -20.0 / 8.0 DARK GRAY, SILTY CLAY (A-7-5) WITH SOME SHELL FRAGMENTS |
| | -21.7 | 9.7 | WOH | WOH | 1 | 1 | | Sat. | | |
| -25 | | | | | | | | | | -25.0 / 13.0 **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) |
| | -26.7 | 14.7 | 13 | 6 | 12 | 18 | | Sat. | | |
| -30 | | | | | | | | | | |
| | -31.2 | 19.2 | 23 | 17 | 19 | 36 | | Sat. | | |
| -35 | | | | | | | | | | |
| | -36.1 | 24.1 | 12 | 22 | 19 | 41 | | Sat. | | |
| -40 | | | | | | | | | | |
| | -41.1 | 29.1 | 10 | 16 | 17 | 33 | | Sat. | | -41.4 / 29.4 **COASTAL PLAIN** DARK GRAY AND BROWN, SILTY FINE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS AND GRAVEL (RIVER BEND FORMATION) |
| -45 | | | | | | | | | | |
| | -46.0 | 34.0 | 15 | 23 | 32 | 55 | | Sat. | | |
| -50 | | | | | | | | | | |
| | -50.7 | 38.7 | 21 | 31 | 41 | 72 | | Sat. | | |
| -55 | | | | | | | | | | |
| | -55.9 | 43.9 | 1 | 7 | 6 | 13 | | Sat. | | |
| -60 | | | | | | | | | | |
| | -60.8 | 48.8 | 8 | 12 | 19 | 31 | | Sat. | | |
| -65 | | | | | | | | | | |
| | -66.9 | 54.9 | 10 | 6 | 13 | 19 | | Sat. | | |
| -70 | | | | | | | | | | |
| | -72.0 | 60.0 | 14 | 27 | 32 | 59 | | Sat. | | |
| -75 | | | | | | | | | | |
| | -77.1 | 65.1 | 10 | 12 | 15 | 27 | | Sat. | | |
| -80 | | | | | | | | | | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -80 | | | | | | Match Line | | | | |
| | -82.2 | 70.2 | 3 | 4 | 22 | 26 | | Sat. | | |
| -85 | -84.3 | 72.3 | 60/0.0 | | | 60/0.0 | | | | -84.3 / 72.3 -84.6 / 72.6 **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, FRIABLE TO INDURATED LIMESTONE (RIVER BEND FORMATION) |
| -90 | -89.6 | 77.6 | 100/0.4 | | | 100/0.4 | | | | |
| | -93.1 | 81.1 | 60/0.0 | | | 60/0.0 | | | | |
| -95 | | | | | | | | | | |
| | -98.1 | 86.1 | 45 | 18 | 19 | 37 | | Sat. | | -98.1 / 86.1 **COASTAL PLAIN** GRAY, FINE TO COARSE SAND (A-1-b) (RIVER BEND FORMATION) |
| -100 | | | | | | | | | | |
| | -101.8 | 89.8 | 25 | 30 | 15 | 45 | | Sat. | | |
| -105 | | | | | | | | | | |
| | -107.0 | 95.0 | 100/0.2 | | | 100/0.2 | | | | -107.0 / 95.0 -107.4 / 95.4 **COASTAL PLAIN SEDIMENTARY ROCK** |
| -110 | | | | | | | | | | -109.3 / 97.3 GRAY, MODERATELY INDURATED TO INDURATED LIMESTONE (RIVER BEND FORMATION) -111.4 / 99.4 |
| | -112.0 | 100.0 | 28 | 22 | 18 | 40 | | Sat. | | **COASTAL PLAIN** GRAY, FINE TO COARSE SAND (A-1-b) (RIVER BEND FORMATION) |
| -115 | | | | | | | | | | |
| | -116.7 | 104.7 | 13 | 12 | 42 | 54 | | Sat. | | -118.8 / 106.8 **COASTAL PLAIN SEDIMENTARY ROCK** |
| -120 | | | | | | | | | | |
| | -121.7 | 109.7 | 60/0.0 | | | 60/0.0 | | | | -121.7 / 109.7 GRAY, MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION) Boring Terminated with Standard Penetration Test Refusal at Elevation -121.7 ft in LIMESTONE (RIVER BEND FORMATION) |

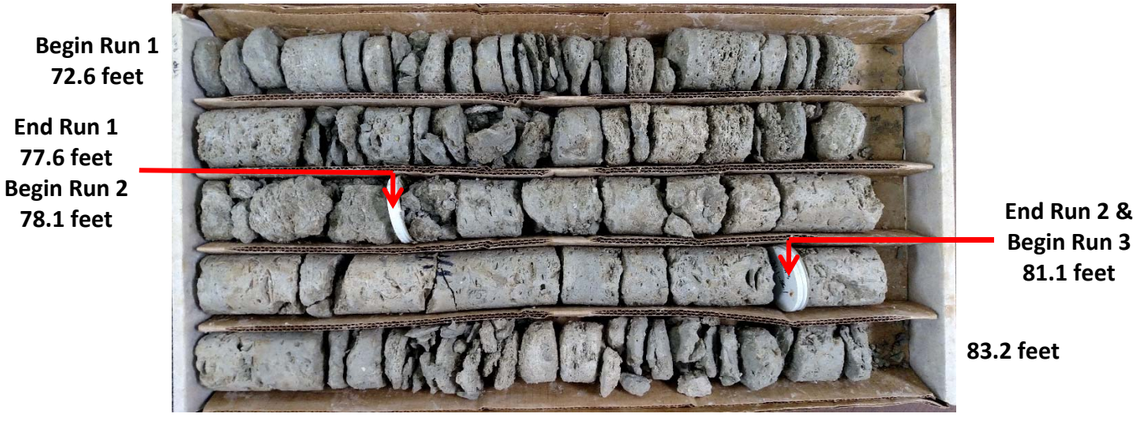
# GEOTECHNICAL BORING REPORT
# CORE LOG

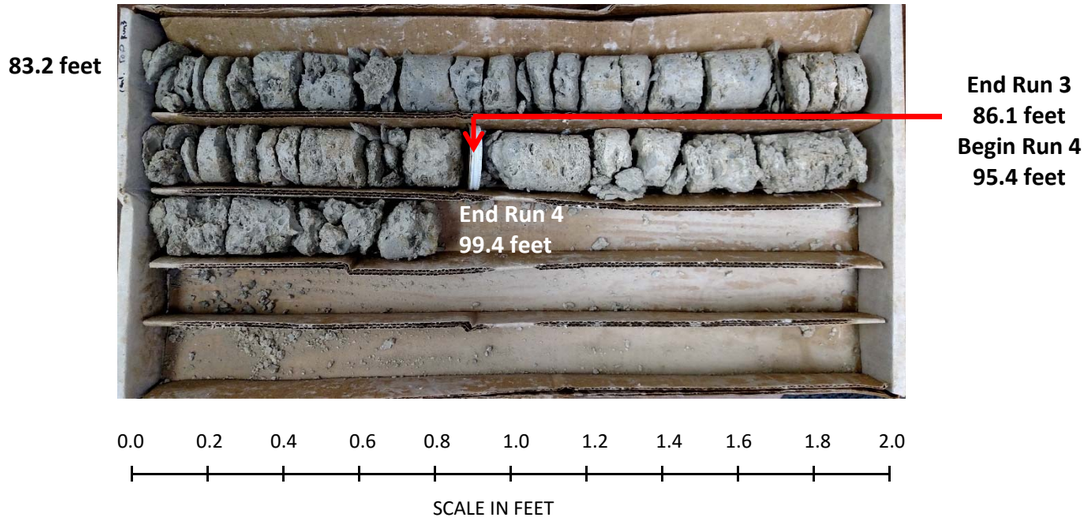
| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B14-A | **STATION** 36+38 | **OFFSET** 25 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -12.0 ft | **TOTAL DEPTH** 109.7 ft | **NORTHING** 250,516 | **EASTING** 2,436,595 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID6214 CME-45C 81% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 11/04/15 | **COMP. DATE** 11/06/15 | **SURFACE WATER DEPTH** 12.5ft | |
| **CORE SIZE** NQ | **TOTAL RUN** 17.0 ft | | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -84.6 | | | | | | | | | | | Begin Coring @ 72.6 ft |
| | -84.6 | 72.6 | 5.0 | 2:24/1.0<br>3:05/1.0<br>2:10/1.0<br>0:55/1.0<br>0:39/1.0 | (4.2)<br>84% | (0.0)<br>0% | | (11.9)<br>88% | (0.6)<br>4% | | -84.6 **COASTAL PLAIN SEDIMENTARY ROCK** 72.6<br>GRAY, FRIABLE TO INDURATED LIMESTONE (RIVER BEND FORMATION) |
| -90 | -89.6 | 77.6 | | | | | | | | | |
| | -90.1 | 78.1 | | *N=100/0.4* | | | | | | | |
| | -93.1 | 81.1 | 3.0 | 1:07/1.0<br>2:13/1.0<br>2:16/1.0 | (2.9)<br>97% | (0.6)<br>20% | | | | | |
| -95 | | | 5.0 | *N=60/0.0*<br>2:01/1.0<br>1:15/1.0<br>1:47/1.0<br>1:57/1.0<br>1:31/1.0 | (4.8)<br>96% | (0.0)<br>0% | | | | | |
| | -98.1 | 86.1 | | | | | | | | | -98.1 86.1 |
| -100 | | | | *N=37* | | | | | | | **COASTAL PLAIN**<br>GRAY, FINE TO COARSE SAND (A-1-b)<br>(RIVER BEND FORMATION) |
| -105 | | | | *N=45* | | | | | | | |
| | -107.4 | 95.4 | | | | | | | | | -107.0 95.0 |
| | | | 4.0 | *N=100/0.2*<br>0:51/1.0<br>0:40/1.0<br>0:37/1.0<br>1:25/1.0 | (1.9)<br>48% | (0.0)<br>0% | | (1.9)<br>100% | (0.0)<br>0% | | -107.4 **COASTAL PLAIN SEDIMENTARY ROCK** 95.4<br>-109.3 GRAY, MODERATELY INDURATED TO INDURATED LIMESTONE 97.3<br>(RIVER BEND FORMATION) |
| -110 | | | | | | | | (0.0)<br>0% | (0.0)<br>0% | | |
| | -111.4 | 99.4 | | | | | | | | | -111.4 99.4<br>**COASTAL PLAIN**<br>GRAY, FINE TO COARSE SAND (A-1-b)<br>(RIVER BEND FORMATION) |
| -115 | | | | *N=40* | | | | | | | |
| | | | | *N=54* | | | | | | | |
| -120 | | | | | | | | | | | -118.8 106.8<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| | | | | *N=60/0.0* | | | | | | | -121.7 109.7<br>Boring Terminated with Standard Penetration Test Refusal at Elevation -121.7 ft in LIMESTONE (RIVER BEND FORMATION) |

NCDOT CORE DOUBLE B4929_GEO_BH_TOPSAIL.GPJ NC_DOT.GDT 2/4/16

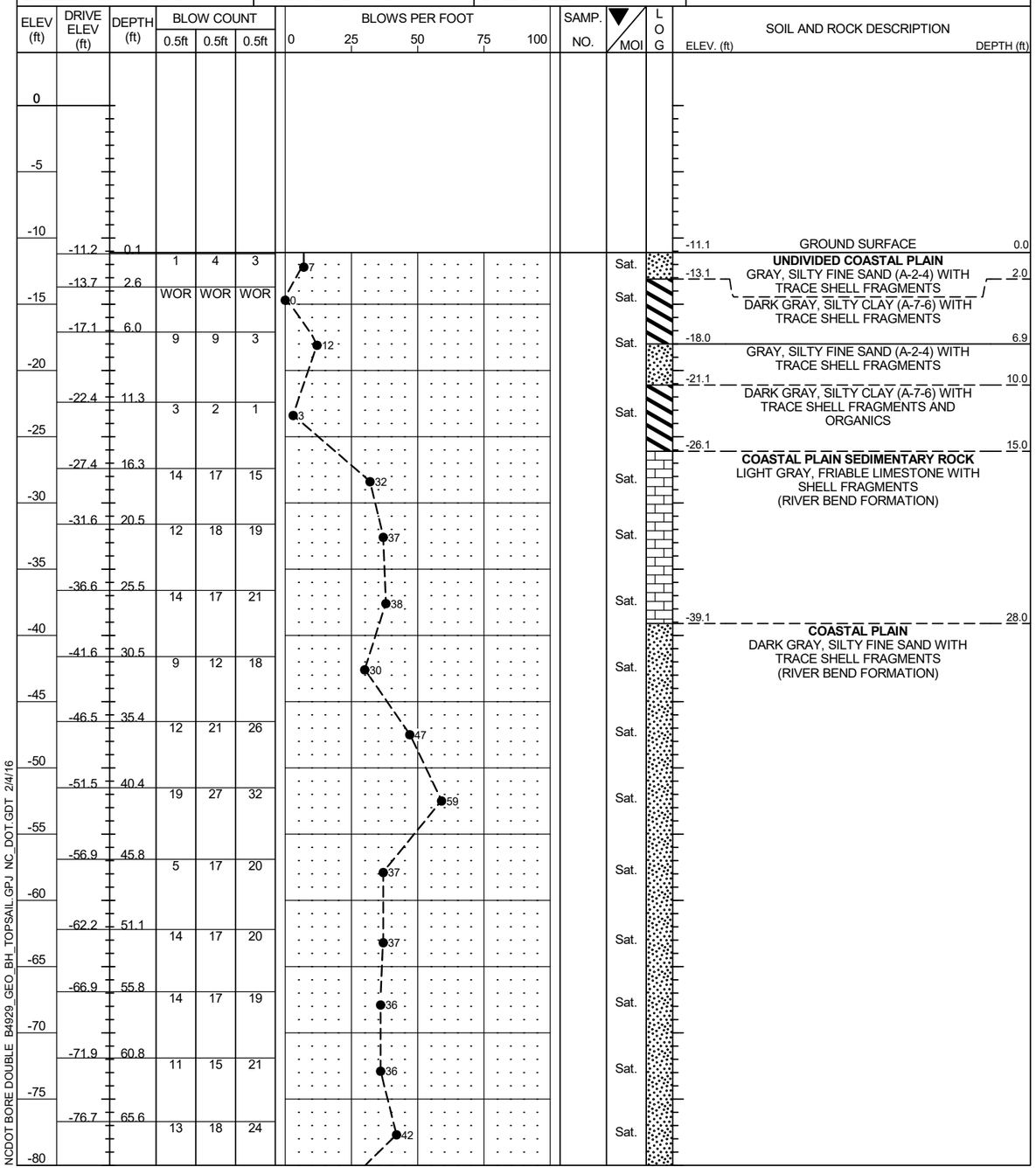
**CORE PHOTOGRAPHS: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach, B14-A: -L2- Station 36+38, 25' LT**



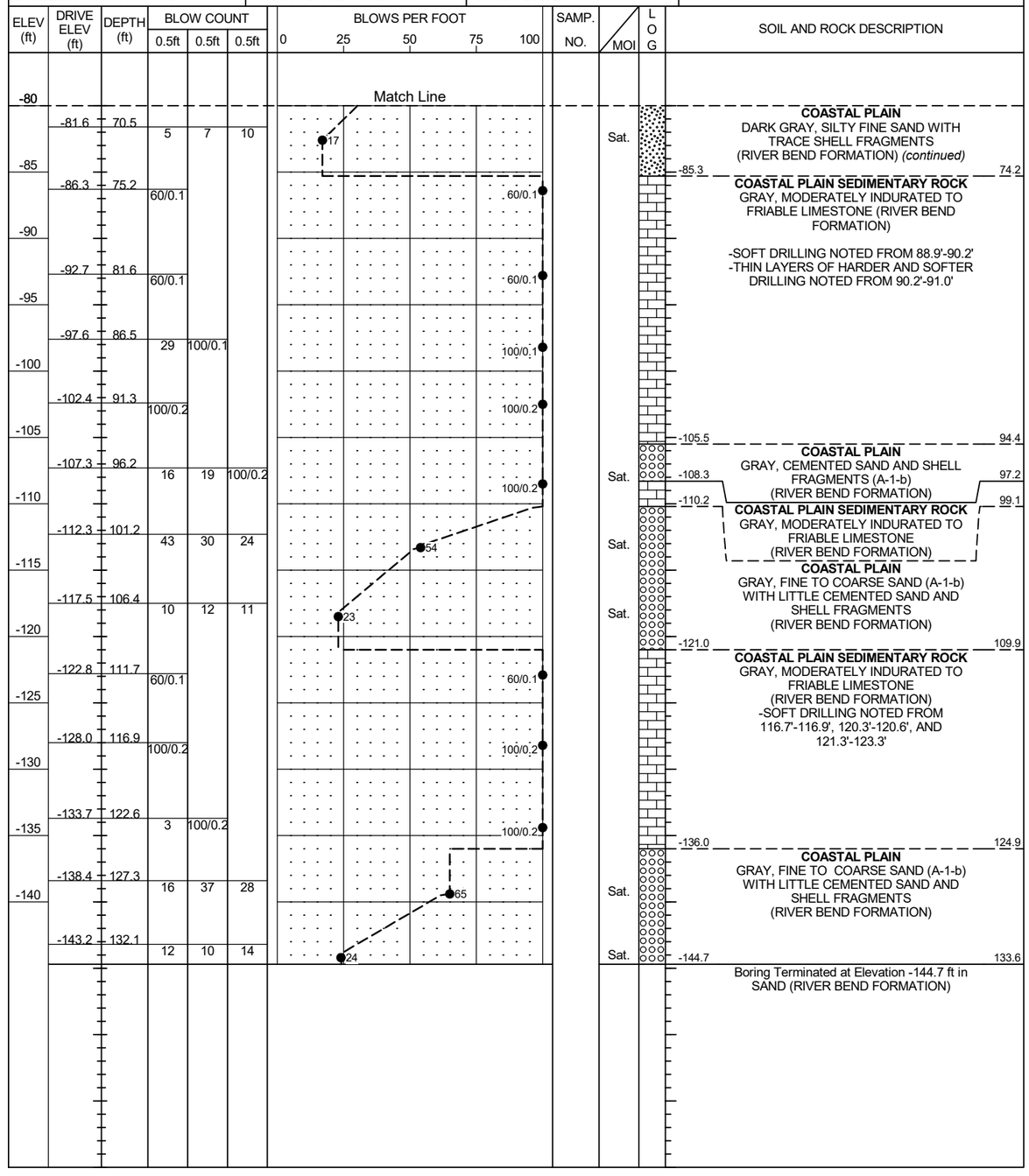



# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B14-B | **STATION** 36+25 | **OFFSET** 26 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -11.1 ft | **TOTAL DEPTH** 133.6 ft | **NORTHING** 250,515 | **EASTING** 2,436,542 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID6214 CME-45C 81% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 10/26/15 | **COMP. DATE** 10/30/15 | **SURFACE WATER DEPTH** 11.4ft | |




| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B14-B | **STATION** 36+25 | **OFFSET** 26 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -11.1 ft | **TOTAL DEPTH** 133.6 ft | **NORTHING** 250,515 | **EASTING** 2,436,542 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID6214 CME-45C 81% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 10/26/15 | **COMP. DATE** 10/30/15 | **SURFACE WATER DEPTH** 11.4ft | |



# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B15-A | **STATION** 37+86 | **OFFSET** 46 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -15.7 ft | **TOTAL DEPTH** 116.0 ft | **NORTHING** 250,385 | **EASTING** 2,436,660 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** B. FOWLER | **START DATE** 10/15/15 | **COMP. DATE** 10/16/15 | **SURFACE WATER DEPTH** 15.4ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) — DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| -5 | | | | | | | | | | |
| -10 | | | | | | | | | | |
| -15 | | | | | | | | | | |
| | -16.1 | 0.4 | 4 | 3 | 2 | 5 16 | | Sat. | | -15.7 GROUND SURFACE 0.0<br>**UNDIVIDED COASTAL PLAIN**<br>GRAY TO DARK GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS AND TRACE TO LITTLE CEMENTED SAND FRAGMENTS |
| -20 | -19.3 | 3.6 | 3 | 6 | 10 | | | Sat. | | |
| | -22.2 | 6.5 | 7 | 4 | 1 | 5 | | Sat. | | |
| -25 | | | | | | | | | | |
| | -27.1 | 11.4 | 31 | 28 | 20 | 48 | | Sat. | | |
| -30 | | | | | | | | | | |
| | -32.0 | 16.3 | 18 | 15 | 15 | 30 | | Sat. | | -31.7 16.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -35 | | | | | | | | | | |
| | -36.9 | 21.2 | 11 | 15 | 13 | 28 | | Sat. | | |
| -40 | | | | | | | | | | |
| | -41.8 | 26.1 | 11 | 16 | 23 | 39 | | Sat. | | -41.7 26.0<br>**COASTAL PLAIN**<br>DARK GRAY, SILTY FINE SAND (A-2-4)<br>(RIVER BEND FORMATION) |
| -45 | | | | | | | | | | |
| | -46.8 | 31.1 | 22 | 32 | 45 | 77 | | Sat. | | |
| -50 | | | | | | | | | | |
| | -51.9 | 36.2 | 22 | 33 | 36 | 69 | | Sat. | | |
| -55 | | | | | | | | | | |
| | -56.9 | 41.2 | 26 | 26 | 25 | 51 | | Sat. | | |
| -60 | | | | | | | | | | |
| | -61.9 | 46.2 | 12 | 12 | 19 | 31 | | Sat. | | |
| -65 | | | | | | | | | | |
| | -66.9 | 51.2 | 10 | 17 | 23 | 40 | | Sat. | | |
| -70 | | | | | | | | | | |
| | -72.1 | 56.4 | 16 | 23 | 30 | 53 | | Sat. | | |
| -75 | | | | | | | | | | |
| | -77.0 | 61.3 | 16 | 22 | 25 | 47 | | Sat. | | -79.2 63.5 |
| -80 | | | | | | | | | | |
| | -82.1 | 66.4 | 3 | 2 | 3 | 5 | | Sat. | | -84.8 69.1 |
| -85 | | | | | | | | | | |



| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B15-A | **STATION** 37+86 | **OFFSET** 46 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -15.7 ft | **TOTAL DEPTH** 116.0 ft | **NORTHING** 250,385 | **EASTING** 2,436,660 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** B. FOWLER | **START DATE** 10/15/15 | **COMP. DATE** 10/16/15 | **SURFACE WATER DEPTH** 15.4ft | |



| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -85 | | | | | | Match Line | | | | |
| -90 | -87.2 | 71.5 | 41 | 100/0.2 | | 100/0.2 | | | | LIGHT GRAY, CEMENTED SAND (A-1-a) FRIABLE<br>-87.7 (RIVER BEND FORMATION) *(continued)* 72.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, MODERATELY INDURATED LIMESTONE WITH TRACE TO SOME FRIABLE CEMENTED SAND FRAGMENTS<br>(RIVER BEND FORMATION)<br><br>-THIN LAYERS OF HARDER AND SOFTER DRILLING NOTED FROM 72'-76.6'<br>-SOFT DRILLING NOTED FROM 77.9'-79.1'<br>-HARD DRILLING NOTED FROM 79.1'-80.3'<br>-SOFT DRILLING NOTED FROM 80.3'-81.8'<br>-THIN LAYERS OF HARDER AND SOFTER DRILLING NOTED FROM 83.1'-86.9' AND FROM 87.4'-92.2'<br>-SOFT DRILLING NOTED FROM 93.6'-94.9' |
| | -92.3 | 76.6 | 100/0.2 | | | 100/0.2 | | | | |
| -95 | | | | | | | | | | |
| | -97.5 | 81.8 | 100/0.4 | | | 100/0.4 | | | | |
| -100 | | | | | | | | | | |
| | -102.6 | 86.9 | 100/0.5 | | | 100/0.5 | | | | |
| -105 | | | | | | | | | | |
| | -107.9 | 92.2 | 57 | 43/0.1 | | 100/0.6 | | | | -109.3 93.6<br>**COASTAL PLAIN**<br>LIGHT GRAY, FRIABLE CEMENTED SAND FRAGMENTS AND COARSE SAND (A-1-b)<br>(RIVER BEND FORMATION) |
| -110 | | | | | | | | | | |
| | -112.8 | 97.1 | 44 | 34 | 32 | 66 | | Sat. | | |
| -115 | | | | | | | | | | |
| | -117.8 | 102.1 | 14 | 10 | 14 | 24 | | Sat. | | -119.4 103.7<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION)<br>-SOFTER DRILLING NOTED FROM 107.8'-108.8' |
| -120 | | | | | | | | | | |
| | -122.6 | 106.9 | 60/0.1 | | | 60/0.1 | | | | |
| -125 | | | | | | | | | | |
| | -127.4 | 111.7 | 14 | 9 | 10 | 19 | | Sat. | | -127.4 111.7<br>**COASTAL PLAIN**<br>LIGHT GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE CEMENTED SAND FRAGMENTS<br>-131.7 (RIVER BEND FORMATION) 116.0<br>Boring Terminated with Standard Penetration Test Refusal at Elevation -131.7 ft on LIMESTONE (RIVER BEND FORMATION) |
| -130 | | | | | | | | | | |
| | -131.7 | 116.0 | 60/0.0 | | | 60/0.0 | | | | |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B15-B | **STATION** 37+83 | **OFFSET** 21 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -15.0 ft | **TOTAL DEPTH** 133.0 ft | **NORTHING** 250,364 | **EASTING** 2,436,596 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** B. FOWLER | **START DATE** 10/19/15 | **COMP. DATE** 10/22/15 | **SURFACE WATER DEPTH** 14.5ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -15 | | | | | | | | | | ELEV. (ft) DEPTH (ft) |
| | -15.0 | 0.0 | | | | | | | | GROUND SURFACE |
| | -15.9 | 0.9 | 3 | 5 | 2 | 7 | | Sat. | | **UNDIVIDED COASTAL PLAIN** DARK GRAY, SILTY FINE SAND (A-2-4) WITH LITTLE SHELL FRAGMENTS |
| -20 | -19.6 | 4.6 | 4 | 7 | 10 | 17 | | Sat. | | |
| | -21.0 | 6.0 | | | | | | | | DARK GRAY, SILTY CLAY (A-7-5) WITH TRACE SHELL FRAGMENTS |
| | -22.5 | 7.5 | WOH | WOH | 1 | 1 | | Sat. | | |
| -25 | -26.0 | 11.0 | | | | | | | | **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) |
| | -27.4 | 12.4 | 26 | 16 | 21 | 37 | | Sat. | | |
| -30 | -32.3 | 17.3 | 17 | 12 | 12 | 24 | | Sat. | | |
| -35 | -37.2 | 22.2 | 11 | 14 | 18 | 32 | | Sat. | | |
| -40 | -41.0 | 26.0 | | | | | | | | **COASTAL PLAIN** GRAY-BROWN, SILTY FINE SAND (A-2-4) WITH TRACE SHELL AND CEMENTED SAND FRAGMENTS (RIVER BEND FORMATION) |
| | -42.1 | 27.1 | 6 | 11 | 13 | 24 | | Sat. | | |
| -45 | -47.1 | 32.1 | 17 | 25 | 29 | 54 | | Sat. | | |
| -50 | -52.0 | 37.0 | 15 | 25 | 31 | 56 | | Sat. | | |
| -55 | -56.9 | 41.9 | 7 | 6 | 8 | 14 | | Sat. | | |
| -60 | -61.9 | 46.9 | 10 | 15 | 20 | 35 | | Sat. | | |
| -65 | -66.8 | 51.8 | 5 | 11 | 12 | 23 | | Sat. | | |
| -70 | -71.2 | 56.2 | 8 | 20 | 26 | 46 | | Sat. | | |
| -75 | -76.2 | 61.2 | 17 | 23 | 30 | 53 | | Sat. | | |
| -80 | -81.2 | 66.2 | 4 | 5 | 10 | 15 | | Sat. | | |
| -85 | -84.0 | 69.0 | | | | | | | | **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, FRIABLE TO INDURATED LIMESTONE (RIVER BEND FORMATION) |
| | -85.9 | 70.9 | 60/0.0 | | | 60/0.0 | | | | |
| -90 | -91.1 | 76.1 | 66 | 34/0.2 | | 100/0.7 | RS-1 | | | |
| -95 | | | | | | | | | | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -95 | | | | | | Match Line | | | | |
| | -96.0 | 81.0 | 100/0.3 | | | 100/0.3 | | | | **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, FRIABLE TO INDURATED LIMESTONE (RIVER BEND FORMATION) *(continued)* |
| -100 | -101.6 | 86.6 | 100/0.5 | | | 100/0.5 | | | | -101.6 86.6 |
| -105 | -107.5 | 92.5 | 30 | 100/0.2 | | 100/0.2 | | | | -108.2 93.2 **COASTAL PLAIN** GRAY, FINE TO COARSE SAND (A-1-b) WITH TRACE GRAVEL AND SHELL FRAGMENTS (RIVER BEND FORMATION) |
| -110 | -112.6 | 97.6 | 17 | 14 | 11 | 25 | | Sat. | | |
| -115 | -117.7 | 102.7 | 12 | 18 | 100/0.4 | 100/0.4 | RS-2 | | | -118.7 103.7 -119.5 104.5 **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, MODERATELY INDURATED TO INDURATED LIMESTONE (RIVER BEND FORMATION) |
| -120 | | | | | | | RS-3 | | | |
| -125 | -129.0 | 114.0 | 2 | 6 | 17 | 23 | SS-31 | 29% | | -128.0 113.0 -129.0 114.0 **COASTAL PLAIN** GRAY, CLAYEY FINE TO COARSE SANDY SILT (A-4) WITH TRACE GRAVEL AND SHELL FRAGMENTS (RIVER BEND FORMATION) |
| -130 | -131.3 | 116.3 | 60/0.0 | | | 60/0.0 | | | | -131.3 116.3 **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, MODERATELY INDURATED TO INDURATED LIMESTONE (RIVER BEND FORMATION) |
| -135 | | | | | | | | | | -137.3 122.3 **COASTAL PLAIN** GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS (RIVER BEND FORMATION) |
| -140 | -141.3 | 126.3 | 5 | 15 | 16 | 31 | | Sat. | | -141.3 126.3 |
| -145 | -146.5 | 131.5 | 13 | 17 | 14 | 31 | | Sat. | | -148.0 133.0 Boring Terminated at Elevation -148.0 ft in SAND (RIVER BEND FORMATION) |

NCDOT BORE DOUBLE B4929_GEO_BH_TOPSAIL.GPJ NC_DOT.GDT 2/4/16

# GEOTECHNICAL BORING REPORT
# CORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B15-B | **STATION** 37+83 | **OFFSET** 21 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -15.0 ft | **TOTAL DEPTH** 133.0 ft | **NORTHING** 250,364 | **EASTING** 2,436,596 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** B. FOWLER | **START DATE** 10/19/15 | **COMP. DATE** 10/22/15 | **SURFACE WATER DEPTH** 14.5ft | |
| **CORE SIZE** NQ | **TOTAL RUN** 29.5 ft | | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -86.1 | | | | | | | | | | | Begin Coring @ 71.1 ft |
| -90 | -86.1 | 71.1 | 5.0 | 2:05/1.0<br>2:24/1.0<br>1:57/1.0<br>1:21/1.0<br>0:59/1.0 | (3.8)<br>76% | (0.8)<br>16% | RS-1 | (3.8)<br>76% | (0.8)<br>16% | | **COASTAL PLAIN SEDIMENTARY ROCK** *(continued)*<br>GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION)<br>RS-1: 73.9'-74.2', qu=1,403 psi, RMR=9, ROCK TYPE =A |
| -95 | -91.1 | 76.1 | | *N=100/0.7* | | | | | | | -91.1 / 76.1 |
| | -96.6 | 81.6 | | *N=100/0.3* | | | | | | | |
| -100 | | | 5.0 | 1:14/1.0<br>1:37/1.0<br>0:21/1.0<br>0:15/1.0<br>0:40/1.0 | (3.3)<br>66% | (0.5)<br>10% | | (3.3)<br>66% | (0.5)<br>10% | | |
| -105 | -101.6 | 86.6 | | *N=100/0.5* | | | | | | | -101.6 / 86.6 |
| -110 | | | | *N=100/0.2* | | | | | | | -108.2 / 93.2<br>**COASTAL PLAIN**<br>GRAY, FINE TO COARSE SAND (A-1-b) WITH TRACE GRAVEL AND SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -115 | | | | *N=25* | | | | | | | |
| -120 | -119.5 | 104.5 | | *N=100/0.4* | | | | | | | -118.7 / 103.7<br>-119.5 / 104.5<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, MODERATELY INDURATED TO INDURATED LIMESTONE (RIVER BEND FORMATION)<br>RS-2:105.1'-105.4', qu=2,717 psi, RMR=10<br>RS-3: 109.9'-110.2', qu=5,422 psi, RMR=12 |
| | -121.5 | 106.5 | 2.0 | 1:24/1.0<br>3:52/1.0 | (1.5)<br>75% | (0.4)<br>20% | RS-2 | (6.7)<br>79% | (1.1)<br>13% | | |
| -125 | | | 5.0 | 2:05/1.0<br>1:56/1.0<br>1:55/1.0<br>4:42/1.0<br>3:58/1.0 | (4.4)<br>88% | (0.4)<br>8% | RS-3 | | | | |
| | -126.5 | 111.5 | 2.5 | 2:40/0.5<br>3:04/1.0<br>0:27/1.0 | (0.8)<br>32% | (0.3)<br>12% | | | | | -128.0 / 113.0 |
| -130 | -129.0 | 114.0 | | *N=23* | | | *SS-31* | (0.0)<br>0% | (0.0)<br>0% | | -129.0 / 114.0<br>**COASTAL PLAIN**<br>GRAY, CLAYEY FINE TO COARSE SANDY SILT (A-4) WITH TRACE GRAVEL AND SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| | -131.3 | 116.3 | | | | | | | | | -131.3 / 116.3 |
| -135 | | | 5.0 | *N=60/0.0*<br>3:20/1.0<br>4:00/1.0<br>3:06/1.0<br>2:29/1.0<br>3:22/1.0 | (3.8)<br>76% | (0.3)<br>6% | | (4.8)<br>80% | (0.8)<br>13% | | **COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, MODERATELY INDURATED TO INDURATED LIMESTONE (RIVER BEND FORMATION) |
| | -136.3 | 121.3 | | | | | | | | | -137.3 / 122.3 |
| -140 | | | 5.0 | 1:13/1.0<br>0:17/1.0<br>0:06/1.0<br>0:15/1.0<br>0:14/1.0 | (1.0)<br>20% | (0.5)<br>10% | | (0.0)<br>0% | (0.0)<br>0% | | **COASTAL PLAIN**<br>GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| | -141.3 | 126.3 | | *N=31* | | | | | | | -141.3 / 126.3 |
| -145 | | | | *N=31* | | | | | | | -148.0 / 133.0<br>Boring Terminated at Elevation -148.0 ft in SAND (RIVER BEND FORMATION) |

# CORE PHOTOGRAPHS: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach, B15-B: -L2- Station 37+83, 21' RT

**Begin Run 1**
**71.1 feet**


**End Run 1**
**76.1 feet**

**Begin Run 2**
**81.6 feet**

**End Run 2**
**86.6 feet**

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET

**Begin Run 6**
**116.3 feet**

**End Run 6**
**121.3 feet**

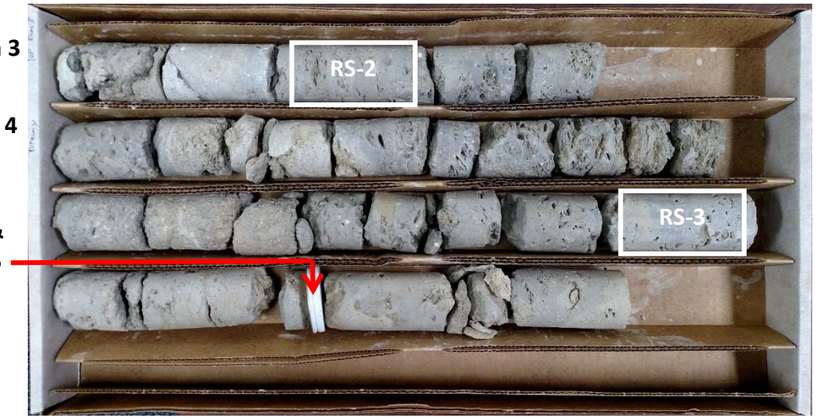
**Begin Run 7**
**121.3 feet**

**End Run 7**
**126.3 feet**

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET

**Begin Run 3**
**104.5**




**End Run 3**
**106.5 feet**

**Begin Run 4**
**106.5**

**End Run 4 &**
**Begin Run 5**
**111.5 feet**

**End Run 5**
**114.0 feet**

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B16-B | **STATION** 39+34 | **OFFSET** 20 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -2.7 ft | **TOTAL DEPTH** 115.2 ft | **NORTHING** 250,225 | **EASTING** 2,436,660 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** B. FOWLER | **START DATE** 10/12/15 | **COMP. DATE** 10/14/15 | **SURFACE WATER DEPTH** 3.8ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | | |
| 0 | | | | | | | | | | | |
| | -2.8 | 0.1 | WOH | WOH | 1 | 1 | | Sat. | | -2.7 GROUND SURFACE | 0.0 |
| -5 | | | | | | | | | | **UNDIVIDED COASTAL PLAIN**<br>DARK GRAY, FINE SANDY SILTY CLAY<br>(A-7-6) | |
| | -6.2 | 3.5 | WOH | WOH | WOH | 0 | | Sat. | | | |
| -10 | | | | | | | | | | | |
| | -12.1 | 9.4 | 1 | 7 | 10 | 17 | | Sat. | | -12.6 GRAY, SILTY FINE TO COARSE SAND | 9.9 |
| -15 | | | | | | | | | | (A-2-4) WITH TRACE SHELL FRAGMENTS | |
| | -16.3 | 13.6 | 3 | 3 | 7 | 10 | | Sat. | | | |
| -20 | | | | | | | | | | | |
| | -21.3 | 18.6 | 5 | 5 | 6 | 11 | | Sat. | | | |
| -25 | | | | | | | | | | | |
| | -26.6 | 23.9 | 1 | 1 | 46 | 47 | | Sat. | | -27.6 **COASTAL PLAIN SEDIMENTARY ROCK** | 24.9 |
| -30 | | | | | | | | | | LIGHT GRAY, FRIABLE LIMESTONE WITH<br>SHELL FRAGMENTS<br>(RIVER BEND FORMATION) | |
| | -31.1 | 28.4 | 12 | 14 | 16 | 30 | | Sat. | | | |
| -35 | | | | | | | | | | | |
| | -36.1 | 33.4 | 18 | 22 | 24 | 46 | | Sat. | | | |
| -40 | | | | | | | | | | | |
| | -41.2 | 38.5 | 13 | 9 | 16 | 25 | | Sat. | | -40.7 **COASTAL PLAIN** | 38.0 |
| -45 | | | | | | | | | | DARK GRAY, SILTY FINE SAND (A-2-4)<br>WITH TRACE CEMENTED SAND<br>FRAGMENTS<br>(RIVER BEND FORMATION) | |
| | -46.1 | 43.4 | 18 | 29 | 32 | 61 | | Sat. | | | |
| -50 | | | | | | | | | | | |
| | -51.0 | 48.3 | 17 | 29 | 35 | 64 | | Sat. | | | |
| -55 | | | | | | | | | | | |
| | -56.0 | 53.3 | 19 | 12 | 16 | 28 | | Sat. | | | |
| -60 | | | | | | | | | | | |
| | -61.0 | 58.3 | 15 | 21 | 18 | 39 | | Sat. | | | |
| -65 | | | | | | | | | | | |
| | -66.0 | 63.3 | 3 | 5 | 13 | 18 | | Sat. | | | |
| -70 | | | | | | | | | | | |
| | -70.9 | 68.2 | 11 | 15 | 21 | 36 | | Sat. | | | |
| -75 | | | | | | | | | | | |


| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B16-B | **STATION** 39+34 | **OFFSET** 20 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -2.7 ft | **TOTAL DEPTH** 115.2 ft | **NORTHING** 250,225 | **EASTING** 2,436,660 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID5152 D-25 79% 07/30/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** B. FOWLER | **START DATE** 10/12/15 | **COMP. DATE** 10/14/15 | **SURFACE WATER DEPTH** 3.8ft | |


| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| | -75.9 | 73.2 | 10 | 11 | 15 | 26 | | Sat. | | **COASTAL PLAIN**<br>DARK GRAY, SILTY FINE SAND (A-2-4)<br>WITH TRACE CEMENTED SAND<br>FRAGMENTS<br>(RIVER BEND FORMATION) *(continued)* |
| -80 | | | | | | | | | | |
| | -81.0 | 78.3 | 5 | 5 | 10 | 15 | | Sat. | | |
| -85 | | | | | | | | | | |
| | -85.9 | 83.2 | 60/0.0 | | | 60/0.0 | | | | |
| -90 | | | | | | | | | | |
| | -91.8 | 89.1 | 100/0.5 | | | 100/0.5 | | | | |
| -95 | | | | | | | | | | |
| | -96.9 | 94.2 | 60/0.1 | | | 60/0.1 | | | | |
| -100 | | | | | | | | | | |
| | -101.9 | 99.2 | 26 | 18 | 20 | 38 | | Sat. | | -101.9 **COASTAL PLAIN** 99.2 |
| -105 | | | | | | | | | | GRAY, SILTY FINE TO COARSE SAND<br>(A-2-4) WITH SOME CEMENTED SAND<br>AND SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| | -106.9 | 104.2 | 8 | 9 | 62 | 71 | | Sat. | | -107.9 LIGHT GRAY, CEMENTED SAND (A-1-a) 105.2 |
| -110 | | | | | | | | | | (RIVER BEND FORMATION) |
| | -112.6 | 109.9 | 20 | 23 | 24 | 47 | | Sat. | | -111.2 LIGHT GRAY, SILTY FINE TO COARSE 108.5 |
| -115 | | | | | | | | | | SAND (A-2-4) WITH SOME CEMENTED<br>SAND FRAGMENTS<br>(RIVER BEND FORMATION) |
| | -116.4 | 113.7 | 10 | 13 | 14 | 27 | | Sat. | | -117.9 Boring Terminated at Elevation -117.9 ft in 115.2 |
| | | | | | | | | | | SAND (RIVER BEND FORMATION) |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B17-A | **STATION** 40+77 | **OFFSET** 28 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.4 ft | **TOTAL DEPTH** 115.6 ft | **NORTHING** 250,126 | **EASTING** 2,436,774 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID6214 CME-45C 81% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** B. FOWLER | **START DATE** 11/17/15 | **COMP. DATE** 11/18/15 | **SURFACE WATER DEPTH** 1.4ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | | |
| 0 | -1.4 | 0.0 | WOH | WOH | WOH | 0 | | Sat. | | -1.4 GROUND SURFACE | 0.0 |
| -5 | -5.2 | 3.8 | WOH | WOH | WOH | 0 | | Sat. | | **UNDIVIDED COASTAL PLAIN**<br>GRAY, SILTY FINE SAND (A-2-4) WITH TRACE CLAY AND SHELL FRAGMENTS | |
| -10 | -11.7 | 10.3 | 2 | 5 | 11 | 16 | | Sat. | | -12.3 DARK GRAY, SILTY CLAY (A-7-5) WITH LITTLE FINE SAND AND TRACE SHELL FRAGMENTS | 10.9 |
| -15 | -16.7 | 15.3 | 1 | 2 | 1 | 3 | | Sat. | | -19.9 GRAY, SILTY FINE SAND (A-2-4) | 18.5 |
| -20 | -21.7 | 20.3 | 10 | 5 | 4 | 9 | | Sat. | | -22.2 DARK GRAY, SILTY CLAY (A-7-5) | 20.8 |
| -25 | -26.7 | 25.3 | 2 | 3 | 5 | 8 | | Sat. | | -24.9 **COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS<br>(RIVER BEND FORMATION) | 23.5 |
| -30 | -31.7 | 30.3 | 13 | 19 | 23 | 42 | | Sat. | | | |
| -35 | -36.5 | 35.1 | 16 | 18 | 18 | 36 | | Sat. | | | |
| -40 | -41.4 | 40.0 | 20 | 22 | 21 | 43 | | Sat. | | -40.4 **COASTAL PLAIN**<br>GRAY-BROWN, SILTY FINE SAND (A-2-4) WITH TRACE CEMENTED SAND FRAGMENTS<br>(RIVER BEND FORMATION) | 39.0 |
| -45 | -46.4 | 45.0 | 16 | 27 | 38 | 65 | | Sat. | | | |
| -50 | -51.4 | 50.0 | 25 | 45 | 55/0.4 | 100/0.9 | | Sat. | | | |
| -55 | -56.4 | 55.0 | 18 | 13 | 13 | 26 | | Sat. | | | |
| -60 | -61.5 | 60.1 | 12 | 17 | 27 | 44 | | Sat. | | | |
| -65 | -66.5 | 65.1 | 12 | 22 | 24 | 46 | | Sat. | | | |
| -70 | -71.6 | 70.2 | 15 | 17 | 24 | 41 | | Sat. | | | |
| -75 | | | | | | | | | | | |

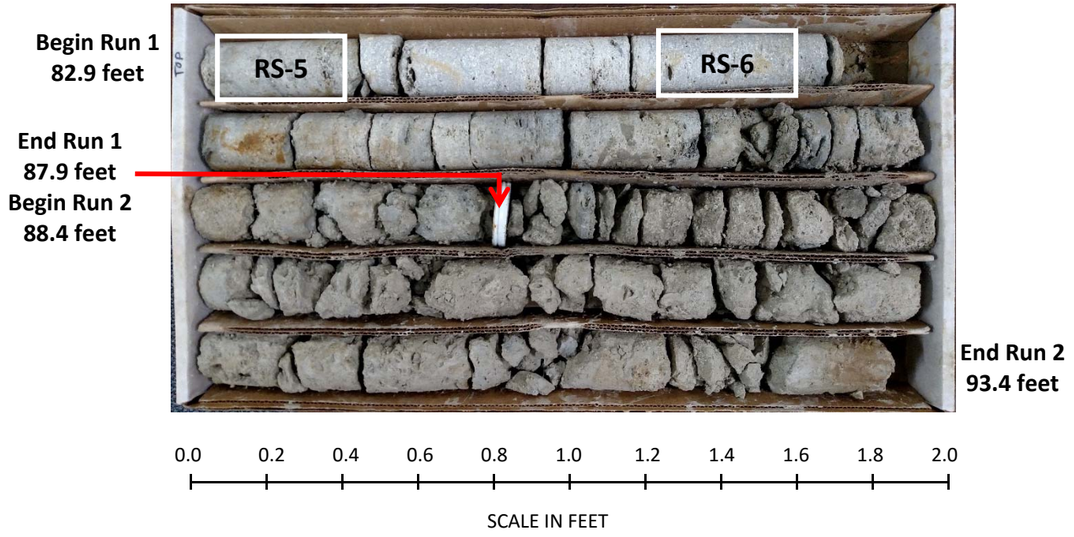
| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| -80 | -76.6 | 75.2 | 11 | 13 | 17 | 30 | | Sat. | | **COASTAL PLAIN**<br>GRAY-BROWN, SILTY FINE SAND (A-2-4) WITH TRACE CEMENTED SAND FRAGMENTS<br>(RIVER BEND FORMATION) *(continued)* |
| -85 | -81.6 | 80.2 | 8 | 8 | 15 | 23 | | Sat. | | |
| -90 | -84.1 | 82.7 | 60/0.1 | | | 60/0.1 | RS-5<br>RS-6 | | | -84.1 **COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE TO INDURATED LIMESTONE (RIVER BEND FORMATION) |
| -95 | -89.3 | 87.9 | 100/0.5 | | | 100/0.5 | | | | |
| -100 | -94.8 | 93.4 | 60/0.1 | | | 60/0.1 | | | | |
| -105 | -99.9 | 98.5 | 100/0.3 | | | 100/0.3 | | | | -102.4 **COASTAL PLAIN**<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| -110 | -105.2 | 103.8 | 12 | 15 | 16 | 31 | | Sat. | | -105.2 -108.6 **COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE AND MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -115 | -110.3 | 108.9 | 62 | 38/0.4 | | 100/0.9 | | | | -113.4 **COASTAL PLAIN**<br>GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE GRAVEL<br>(RIVER BEND FORMATION) |
| | -115.5 | 114.1 | 12 | 10 | 9 | 19 | | Sat. | | -117.0 Boring Terminated at Elevation -117.0 ft in SAND (RIVER BEND FORMATION) |

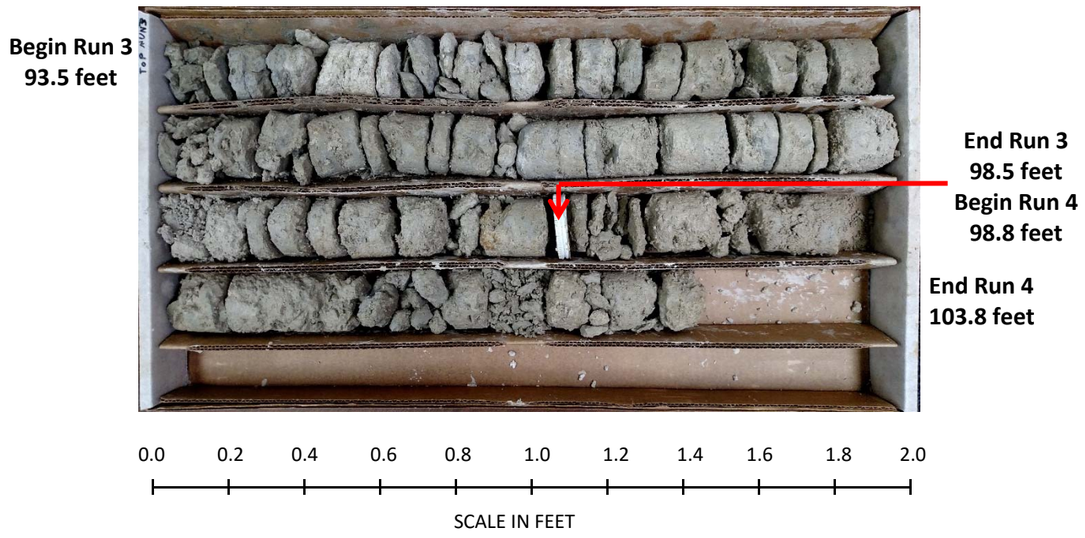
# GEOTECHNICAL BORING REPORT
# CORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B17-A | **STATION** 40+77 | **OFFSET** 28 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.4 ft | **TOTAL DEPTH** 115.6 ft | **NORTHING** 250,126 | **EASTING** 2,436,774 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID6214 CME-45C 81% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** B. FOWLER | **START DATE** 11/17/15 | **COMP. DATE** 11/18/15 | **SURFACE WATER DEPTH** 1.4ft | |
| **CORE SIZE** NQ | **TOTAL RUN** 20.0 ft | | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -84.3 | | | | | | | | | | | Begin Coring @ 82.9 ft |
| -85 | -84.3 | 82.9 | 5.0 | 4:35/1.0<br>5:14/1.0<br>3:29/1.0<br>2:22/1.0<br>1:04/1.0 | (4.6)<br>92% | (1.6)<br>32% | RS-5<br>RS-6 | (16.8)<br>93% | (1.6)<br>9% | | -84.3 **COAST PLAIN SEDIMENTARY ROCK** 82.9<br>GRAY, FRIABLE TO INDURATED LIMESTONE (RIVER BEND FORMATION)<br>RS-5: 83.0'-83.3', qu=3,920 psi, RMR=12<br>RS-6: 84.2'-84.5', qu=8,292 psi, RMR=15 |
| -90 | -89.3<br>-89.8 | 87.9<br>88.4 | | *N=100/0.5* | | | | | | | |
| -95 | -94.8<br>-94.9 | 93.4<br>93.5 | 5.0 | 1:02/1.0<br>0:59/1.0<br>1:18/1.0<br>1:10/1.0<br>2:28/1.0 | (5.0)<br>100% | (0.0)<br>0% | | | | | |
| -100 | -99.9<br>-100.2 | 98.5<br>98.8 | 5.0 | *N=60/0.1*<br>0:57/1.0<br>2:25/1.0<br>2:17/1.0<br>1:52/1.0<br>1:55/1.0 | (5.0)<br>100% | (0.0)<br>0% | | | | | -102.4 101.0 |
| -105 | -105.2 | 103.8 | 5.0 | *N=100/0.3*<br>1:23/1.0<br>0:30/1.0<br>1:00/1.0<br>1:04/1.0<br>0:14/1.0 | (2.2)<br>44% | (0.0)<br>0% | | (0.0)<br>0% | (0.0)<br>0% | | **COASTAL PLAIN**<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION)<br>-105.2 103.8 |
| -110 | | | | *N=31*<br>*N=100/0.9* | | | | | | | -108.6 107.2<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE AND MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -115 | | | | *N=19* | | | | | | | -113.4 112.0<br>**COASTAL PLAIN**<br>GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE GRAVEL<br>(RIVER BEND FORMATION)<br>-117.0 115.6 |
| | | | | | | | | | | | Boring Terminated at Elevation -117.0 ft in SAND (RIVER BEND FORMATION) |

**CORE PHOTOGRAPHS: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach, B17-A: -L2- Station 40+77, 28' LT**



# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** P. FAHEY | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B18-B | **STATION** 42+36 | **OFFSET** 14 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.3 ft | **TOTAL DEPTH** 125.1 ft | **NORTHING** 249,974 | **EASTING** 2,436,835 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** M. WIGGINS | **START DATE** 11/12/15 | **COMP. DATE** 11/16/15 | **SURFACE WATER DEPTH** 0.5ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | | |
| 0 | 0.3 | 0.0 | WOH | WOH | WOH | 0 | | Sat. | | 0.3 GROUND SURFACE | 0.0 |
| | | | | | | | | | | **UNDIVIDED COASTAL PLAIN** LIGHT GRAY, FINE SAND (A-3) | |
| -5 | -4.8 | 5.1 | 2 | 1 | 1 | 2 | | Sat. | | -2.7 DARK GRAY, SILTY CLAY (A-7-5) WITH TRACE SHELL FRAGMENTS | 3.0 |
| | -8.3 | 8.6 | WOR | WOR | WOR | 0 | | Sat. | | | |
| -10 | | | | | | | | | | | |
| | -13.3 | 13.6 | WOH | WOH | WOH | 0 | | Sat. | | | |
| -15 | | | | | | | | | | | |
| | -18.3 | 18.6 | 6 | 14 | 13 | 27 | | Sat. | | -17.7 LIGHT GRAY, FINE SAND (A-3) | 18.0 |
| -20 | | | | | | | | | | | |
| | -23.3 | 23.6 | WOH | WOH | WOH | 0 | | Sat. | | -22.7 GREENISH GRAY, FINE SANDY SILTY CLAY (A-7-5) WITH TRACE SHELL FRAGMENTS | 23.0 |
| -25 | | | | | | | | | | | |
| | -28.3 | 28.6 | 10 | 15 | 16 | 31 | | Sat. | | -27.7 **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) | 28.0 |
| -30 | | | | | | | | | | | |
| | -33.3 | 33.6 | 12 | 13 | 14 | 27 | | Sat. | | | |
| -35 | | | | | | | | | | | |
| | -38.3 | 38.6 | 24 | 26 | 32 | 58 | | Sat. | | | |
| -40 | | | | | | | | | | | |
| | -43.3 | 43.6 | 12 | 12 | 14 | 26 | | Sat. | | -42.7 **COASTAL PLAIN** GREENISH GRAY, SILTY FINE SAND (A-2-4) (RIVER BEND FORMATION) | 43.0 |
| -45 | | | | | | | | | | | |
| | -48.3 | 48.6 | 20 | 27 | 45 | 72 | | Sat. | | | |
| -50 | | | | | | | | | | | |
| | -53.3 | 53.6 | 25 | 40 | 60/0.4 | 100/0.9 | | Sat. | | | |
| -55 | | | | | | | | | | | |
| | -58.3 | 58.6 | 5 | 7 | 15 | 22 | | Sat. | | | |
| -60 | | | | | | | | | | | |
| | -63.3 | 63.6 | 10 | 12 | 14 | 26 | | Sat. | | | |
| -65 | | | | | | | | | | | |
| | -68.3 | 68.6 | 8 | 7 | 12 | 19 | | Sat. | | | |
| -70 | | | | | | | | | | | |
| | -73.3 | 73.6 | 12 | 19 | 24 | 43 | | Sat. | | | |
| -75 | | | | | | | | | | | |

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** P. FAHEY | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B18-B | **STATION** 42+36 | **OFFSET** 14 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.3 ft | **TOTAL DEPTH** 125.1 ft | **NORTHING** 249,974 | **EASTING** 2,436,835 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** M. WIGGINS | **START DATE** 11/12/15 | **COMP. DATE** 11/16/15 | **SURFACE WATER DEPTH** 0.5ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| -80 | -78.3 | 78.6 | 9 | 13 | 20 | 33 | | Sat. | | **COASTAL PLAIN** GREENISH GRAY, SILTY FINE SAND (A-2-4) (RIVER BEND FORMATION) *(continued)* |
| -85 | -83.3 | 83.6 | 100/0.5 | | | 100/0.5 | | | | -83.3 **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, LIMESTONE, FRIABLE TO MODERATELY INDURATED (RIVER BEND FORMATION) 83.6 |
| -90 | -88.3 | 88.6 | 100/0.3 | | | 100/0.3 | | | | |
| -95 | -93.3 | 93.6 | 100/0.2 | | | 100/0.2 | | | | |
| -100 | -98.3 | 98.6 | 100/0.2 | | | 100/0.2 | | | | |
| -105 | -103.3 | 103.6 | 12 | 10 | 11 | 21 | | Sat. | | -101.7 **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) 102.0 |
| -110 | -108.3 | 108.6 | 51 | 23 | 36 | 59 | | Sat. | | |
| -115 | -113.3 | 113.6 | 20 | 16 | 13 | 29 | | Sat. | | |
| -120 | -118.3 | 118.6 | 100/0.3 | | | 100/0.3 | | | | -118.3 **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE (RIVER BEND FORMATION) 118.6 |
| | -121.7 | 122.0 | | | | | | | | -121.7 **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) 122.0 |
| | -123.3 | 123.6 | 19 | 24 | 22 | 46 | | Sat. | | -124.8 125.1 Boring Terminated at Elevation -124.8 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

NCDOT BORE DOUBLE B4929_GEO_BH_TOPSAIL.GPJ NC_DOT.GDT 2/4/16

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS/P. FAHEY | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B19-A | **STATION** 43+82 | **OFFSET** 32 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.7 ft | **TOTAL DEPTH** 119.3 ft | **NORTHING** 249,900 | **EASTING** 2,436,967 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** M. WIGGINS | **START DATE** 11/17/15 | **COMP. DATE** 11/20/15 | **SURFACE WATER DEPTH** 0.3ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | ELEV. (ft) DEPTH (ft) |
| 5 | | | | | | | | | | |
| 0 | 0.7 | 0.0 | WOH | WOH | WOH | 0 | | Sat. | | 0.7 0.0 GROUND SURFACE<br>**UNDIVIDED COASTAL PLAIN**<br>LIGHT GRAY, FINE SAND (A-3) |
| -5 | -3.3 | 4.0 | 12 | 5 | 4 | 9 | | Sat. | | |
| -10 | -8.3 | 9.0 | WOH | WOH | WOH | 0 | | Sat. | | -8.3 9.0<br>DARK GRAY, SILTY CLAY (A-7-5) |
| -15 | -13.3 | 14.0 | 3 | 3 | 2 | 5 | | Sat. | | -13.3 14.0<br>DARK GRAY, SILTY FINE SAND (A-2-4) WITH LTTLE CLAY AND TRACE TO SOME SHELL FRAGMENTS |
| -20 | -18.3 | 19.0 | 10 | 6 | 8 | 14 | | Sat. | | |
| -25 | -23.3 | 24.0 | WOH | WOH | WOH | 0 | | Sat. | | -23.3 24.0<br>DARK GRAY, FINE SANDY SILT WITH SOME CLAY (A-4) |
| -30 | -28.3 | 29.0 | 9 | 13 | 15 | 28 | | Sat. | | -28.3 29.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -35 | -33.3 | 34.0 | 8 | 16 | 20 | 36 | | Sat. | | |
| -40 | -38.3 | 39.0 | 16 | 17 | 3 | 20 | | Sat. | | |
| -45 | -43.3 | 44.0 | 15 | 18 | 18 | 36 | | Sat. | | -43.3 44.0<br>**COASTAL PLAIN**<br>GREENISH GRAY, SILTY FINE SAND WITH TRACE TO LITTLE CEMENTED SAND FRAGMENTS (A-2-4)<br>(RIVER BEND FORMATION) |
| -50 | -48.3 | 49.0 | 21 | 27 | 36 | 63 | | Sat. | | |
| -55 | -53.3 | 54.0 | 20 | 40 | 60/0.5 | 100/1.0 | | Sat. | | |
| -60 | -58.3 | 59.0 | 6 | 9 | 14 | 23 | | Sat. | | |
| -65 | -63.3 | 64.0 | 14 | 14 | 17 | 31 | | Sat. | | |
| -70 | -68.3 | 69.0 | 7 | 17 | 32 | 49 | | Sat. | | |
| -75 | -73.3 | 74.0 | 16 | 20 | 31 | 51 | | Sat. | | |



| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS/P. FAHEY | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B19-A | **STATION** 43+82 | **OFFSET** 32 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.7 ft | **TOTAL DEPTH** 119.3 ft | **NORTHING** 249,900 | **EASTING** 2,436,967 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** M. WIGGINS | **START DATE** 11/17/15 | **COMP. DATE** 11/20/15 | **SURFACE WATER DEPTH** 0.3ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| -80 | -78.3 | 79.0 | 10 | 14 | 21 | 35 | | Sat. | | **COASTAL PLAIN**<br>GREENISH GRAY, SILTY FINE SAND WITH TRACE TO LITTLE CEMENTED SAND FRAGMENTS (A-2-4)<br>(RIVER BEND FORMATION) *(continued)* |
| -85 | -83.3 | 84.0 | 100/0.5 | | | 100/0.5 | | | | -81.3 82.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION) |
| -90 | -87.4 | 88.1 | 60/0.1 | | | 60/0.1 | | | | |
| -95 | -92.4 | 93.1 | 45 | 55/0.3 | | 100/0.8 | | | | |
| -100 | -97.4 | 98.1 | 100/0.2 | | | 100/0.2 | | | | -98.8 99.5<br>**COASTAL PLAIN**<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| -105 | -102.4 | 103.1 | 32 | 21 | 12 | 33 | | Sat. | | |
| -110 | -107.4 | 108.1 | 30 | 16 | 17 | 33 | | Sat. | | |
| -115 | -112.4 | 113.1 | 13 | 14 | 16 | 30 | | Sat. | | |
| | -117.4 | 118.1 | 15 | 12 | 100/0.2 | 100/0.2 | | | | -118.4 -118.6 119.1 119.3<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION)<br>Boring Terminated at Elevation -118.6 ft in LIMESTONE (RIVER BEND FORMATION) |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** P. FAHEY | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B20-B | **STATION** 45+32 | **OFFSET** 21 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 1.6 ft | **TOTAL DEPTH** 115.3 ft | **NORTHING** 249,762 | **EASTING** 2,437,046 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** M. WIGGINS | **START DATE** 11/10/15 | **COMP. DATE** 11/11/15 | **SURFACE WATER DEPTH** 0.5ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION — ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | | |
| | 1.6 | 0.0 | WOH | 1 | 2 | 3 | | Sat. | | 1.6 GROUND SURFACE | 0.0 |
| 0 | | | | | | | | | | -0.4 **ALLUVIAL** DARK BROWN, MUCK | 2.0 |
| | -3.4 | 5.0 | 5 | 2 | 1 | 3 | | Sat. | | **UNDIVIDED COASTAL PLAIN** DARK BROWN, SILTY FINE SAND WITH TRACE ORGANICS (A-2-4) | |
| -5 | -7.2 | 8.8 | 5 | 6 | 3 | 9 | | Sat. | | -5.4 LIGHT GRAY, FINE SAND (A-3) | 7.0 |
| -10 | -12.2 | 13.8 | 4 | 7 | 7 | 14 | | Sat. | | -10.4 GRAY, SILTY FINE SAND WITH TRACE SHELL FRAGMENTS (A-2-4) | 12.0 |
| -15 | -17.2 | 18.8 | 5 | 11 | 16 | 27 | | Sat. | | | |
| -20 | -22.2 | 23.8 | WOH | WOH | WOH | 0 | | Sat. | | -21.4 GRAY, SILTY CLAY (A-7-5) | 23.0 |
| -25 | -27.2 | 28.8 | 3 | 4 | 4 | 8 | | Sat. | | -26.4 GREENISH GRAY, SILTY FINE SAND WITH TRACE SHELL FRAGMENTS (A-2-4) | 28.0 |
| -30 | -32.2 | 33.8 | 14 | 16 | 21 | 37 | | Sat. | | -30.9 **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) | 32.5 |
| -35 | -37.2 | 38.8 | 16 | 16 | 25 | 41 | | Sat. | | | |
| -40 | -42.2 | 43.8 | 16 | 30 | 34 | 64 | | Sat. | | -41.4 **COASTAL PLAIN** GREENISH GRAY, SILTY FINE SAND (A-2-4) (RIVER BEND FORMATION) | 43.0 |
| -45 | -47.2 | 48.8 | 12 | 15 | 32 | 47 | | Sat. | | | |
| -50 | -52.2 | 53.8 | 22 | 35 | 48 | 83 | | Sat. | | | |
| -55 | -57.2 | 58.8 | 33 | 15 | 14 | 29 | | Sat. | | | |
| -60 | -62.2 | 63.8 | 8 | 9 | 14 | 23 | | Sat. | | | |
| -65 | -67.2 | 68.8 | 9 | 18 | 28 | 46 | | Sat. | | | |
| -70 | -72.2 | 73.8 | 13 | 22 | 33 | 55 | | Sat. | | | |
| -75 | | | | | | | | | | | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| | -77.2 | 78.8 | 13 | 20 | 29 | 49 | | Sat. | | **COASTAL PLAIN** GREENISH GRAY, SILTY FINE SAND (A-2-4) (RIVER BEND FORMATION) *(continued)* |
| -80 | -82.2 | 83.8 | 7 | 9 | 19 | 28 | | Sat. | | |
| -85 | -87.2 | 88.8 | 60/0.0 | | | 60/0.0 | | | | -85.9 **COASTAL PLAIN SEDIMENTARY ROCK** LIMESTONE (RIVER BEND FORMATION) 87.5 |
| -90 | -92.2 | 93.8 | 16 | 29 | 35 | 64 | | Sat. | | -90.4 **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) 92.0 |
| -95 | -97.2 | 98.8 | 60/0.0 | | | 60/0.0 | | | | -93.7 95.3 **COASTAL PLAIN SEDIMENTARY ROCK** LIMESTONE (RIVER BEND FORMATION) |
| -100 | -102.2 | 103.8 | 29 | 34 | 35 | 69 | | Sat. | | -100.4 **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) 102.0 |
| -105 | -107.2 | 108.8 | 14 | 22 | 34 | 56 | | Sat. | | |
| -110 | -112.2 | 113.8 | 34 | 56 | 36 | 92 | | Sat. | | -113.7 Boring Terminated at Elevation -113.7 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) 115.3 |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B21-A | **STATION** 46+84 | **OFFSET** 31 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.0 ft | **TOTAL DEPTH** 114.5 ft | **NORTHING** 249,720 | **EASTING** 2,437,200 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** M. WIGGINS | **START DATE** 11/30/15 | **COMP. DATE** 12/02/15 | **SURFACE WATER DEPTH** 0.1ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION — ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | 0.0 GROUND SURFACE | 0.0 |
| | -0.1 | 0.1 | WOH | WOH | WOH | 0 | | Sat. | | **UNDIVIDED COASTAL PLAIN** DARK BROWN, SILTY CLAY (A-7-5) | |
| -5 | -4.6 | 4.6 | 4 | 5 | 7 | 12 | | Sat. | | -3.0 DARK GRAY, SILTY FINE SAND (A-2-4) | 3.0 |
| | -8.0 | 8.0 | 2 | 1 | 1 | 2 | | Sat. | | -6.5 DARK GRAY, CLAYEY FINE SANDY SILT (A-4) WITH TRACE SHELL FRAGMENTS | 6.5 |
| -10 | | | | | | | | | | | |
| -15 | -13.0 | 13.0 | 5 | 9 | 8 | 17 | | Sat. | | -13.0 DARK GRAY, SILTY FINE SAND (A-2-4) | 13.0 |
| | -18.0 | 18.0 | 6 | 3 | 3 | 6 | | Sat. | | | |
| -20 | | | | | | | | | | | |
| -25 | -23.0 | 23.0 | WOH | WOH | WOH | 0 | | Sat. | | -21.0 DARK GRAY, SILTY CLAY (A-7-5) WITH TRACE SHELL FRAGMENTS | 21.0 |
| | -28.0 | 28.0 | 5 | 4 | 7 | 11 | | Sat. | | -26.0 GRAY-BROWN, SILTY FINE SAND (A-2-4) WITH TRACE SHELL AND CEMENTED SAND FRAGMENTS | 26.0 |
| -30 | | | | | | | | | | | |
| -35 | -33.0 | 33.0 | 13 | 14 | 16 | 30 | | Sat. | | -31.0 **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) | 31.0 |
| | -38.0 | 38.0 | 14 | 16 | 38 | 54 | | Sat. | | -36.0 **COASTAL PLAIN** GRAY, SILTY FINE SAND (A-2-4) WITH TRACE TO LITTLE CEMENTED SAND FRAGMENTS (RIVER BEND FORMATION) | 36.0 |
| -40 | | | | | | | | | | | |
| -45 | -43.0 | 43.0 | 15 | 20 | 26 | 46 | | Sat. | | | |
| | -48.0 | 48.0 | 22 | 34 | 33 | 67 | | Sat. | | | |
| -50 | | | | | | | | | | | |
| -55 | -53.0 | 53.0 | 35 | 49 | 51/0.4 | 100/0.9 | | Sat. | | | |
| | -58.0 | 58.0 | 5 | 7 | 8 | 15 | | Sat. | | | |
| -60 | | | | | | | | | | | |
| -65 | -63.0 | 63.0 | 5 | 8 | 21 | 29 | | Sat. | | | |
| | -68.0 | 68.0 | 6 | 6 | 7 | 13 | | Sat. | | | |
| -70 | | | | | | | | | | | |
| -75 | -73.0 | 73.0 | 15 | 21 | 31 | 52 | | Sat. | | | |
| | -78.0 | 78.0 | 10 | 13 | 20 | 33 | | Sat. | | | |
| -80 | | | | | | | | | | | |

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B21-A | **STATION** 46+84 | **OFFSET** 31 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.0 ft | **TOTAL DEPTH** 114.5 ft | **NORTHING** 249,720 | **EASTING** 2,437,200 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** M. WIGGINS | **START DATE** 11/30/15 | **COMP. DATE** 12/02/15 | **SURFACE WATER DEPTH** 0.1ft | |

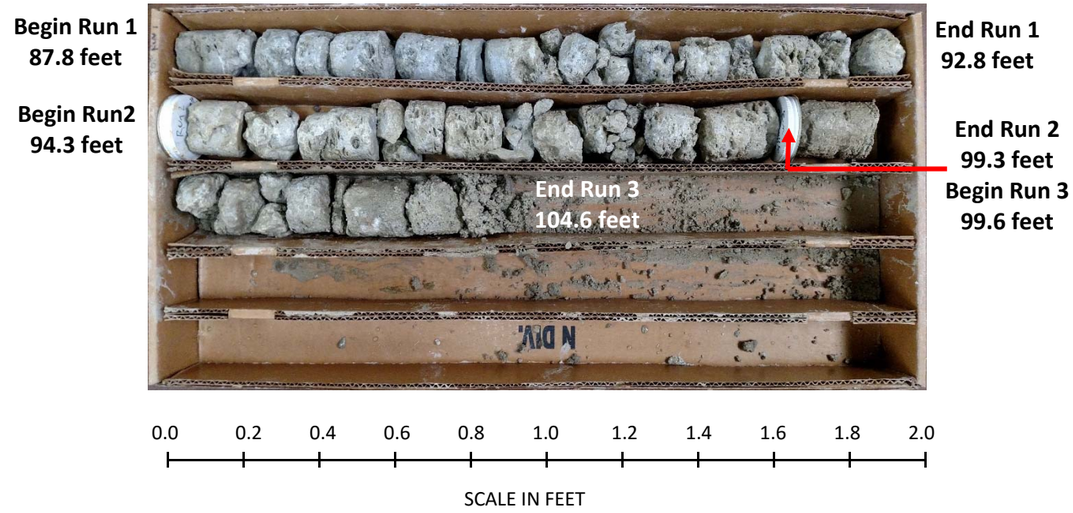
| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -80 | | | | | | Match Line | | | | |
| -85 | -83.0 | 83.0 | 8 | 7 | 8 | 15 | | Sat. | | **COASTAL PLAIN** GRAY, SILTY FINE SAND (A-2-4) WITH TRACE TO LITTLE CEMENTED SAND FRAGMENTS (RIVER BEND FORMATION) *(continued)* |
| | -87.7 | 87.7 | 60/0.1 | | | 60/0.1 | | | | -87.7 87.7 |
| -90 | | | | | | | | | | -87.8 **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, MODERATELY INDURATED TO INDURATED LIMESTONE (RIVER BEND FORMATION) 87.8 |
| -95 | -92.8 | 92.8 | 36 | 51 | 49/0.3 | 100/0.8 | | Sat. | | -91.8 91.8 |
| | -99.3 | 99.3 | 100/0.3 | | | 100/0.3 | | | | -93.3 **COASTAL PLAIN** GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) 93.3 |
| -100 | | | | | | | | | | **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, FRIABLE AND MODERATELY INDURATED LIMESTONE |
| -105 | -104.6 | 104.6 | 11 | 8 | 9 | 17 | | Sat. | | -100.7 (RIVER BEND FORMATION) 100.7 |
| | -108.0 | 108.0 | 9 | 17 | 20 | 37 | | Sat. | | **COASTAL PLAIN** GRAY, SILTY FINE SAND (A-2-4) WITH TRACE SHELL AND CEMENTED SAND FRAGMENTS |
| -110 | | | | | | | | | | -104.6 (RIVER BEND FORMATION) 104.6 |
| | -113.0 | 113.0 | 14 | 19 | 19 | 38 | | Sat. | | -107.0 GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) THIN LAYERS OF HARD DRILLING NOTED THROUGHOUT 107.0 |
| | | | | | | | | | | -114.5 114.5 |
| | | | | | | | | | | Boring Terminated at Elevation -114.5 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

# GEOTECHNICAL BORING REPORT
# CORE LOG

| | | | |
|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | **GROUND WTR (ft)** |
| **BORING NO.** B21-A | **STATION** 46+84 | **OFFSET** 31 ft LT | **ALIGNMENT** -L2- — **0 HR.** N/M |
| **COLLAR ELEV.** 0.0 ft | **TOTAL DEPTH** 114.5 ft | **NORTHING** 249,720 | **EASTING** 2,437,200 — **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 11/30/15 | **COMP. DATE** 12/02/15 | **SURFACE WATER DEPTH** 0.1ft |
| **CORE SIZE** NQ | **TOTAL RUN** 15.0 ft | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -87.8 | | | | | | | | | | | Begin Coring @ 87.8 ft |
| -90 | -87.8 | 87.8 | 5.0 | 3:54/1.0<br>3:47/1.0<br>3:14/1.0<br>3:02/1.0<br>1:21/1.0 | (2.1)<br>42% | (0.0)<br>0% | | (2.1)<br>53% | (0.0)<br>0% | | -87.8 **COASTAL PLAIN SEDIMENTARY ROCK** 87.8<br>GRAY, FRIABLE TO INDURATED LIMESTONE (RIVER BEND FORMATION) |
| | -92.8 | 92.8 | | *N=100/0.8* | | | | (0.0)<br>0% | (0.0)<br>0% | | -91.8 91.8<br>**COASTAL PLAIN** -93.3 93.3 |
| -95 | -94.3 | 94.3 | 5.0 | 3:03/1.0<br>3:57/1.0<br>3:01/1.0<br>4:34/1.0<br>2:48/1.0 | (1.7)<br>34% | (0.0)<br>0% | | (2.8)<br>38% | (0.0)<br>0% | | GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION)<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE AND MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -100 | -99.3<br>-99.6 | 99.3<br>99.6 | | *N=100/0.3* | | | | | | | -100.7 100.7 |
| -105 | -104.6 | 104.6 | 5.0 | 1:11/1.0<br>1:17/1.0<br>1:33/1.0<br>1:16/1.0<br>0:32/1.0 | (1.1)<br>22% | (0.0)<br>0% | | (0.0)<br>0% | (0.0)<br>0% | | **COASTAL PLAIN**<br>GRAY, SILTY FINE SAND (A-2-4) WITH TRACE SHELL AND CEMENTED SAND FRAGMENTS<br>(RIVER BEND FORMATION) -104.6 104.6 |
| | | | | *N=17* | | | | | | | -107.0 107.0 |
| -110 | | | | *N=37* | | | | | | | GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION)<br>THIN LAYERS OF HARD DRILLING NOTED THROUGHOUT |
| | | | | *N=38* | | | | | | | -114.5 114.5 |
| | | | | | | | | | | | Boring Terminated at Elevation -114.5 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

**CORE PHOTOGRAPHS: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach, B21-A: -L2- Station 46+84, 31' LT**



# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B22-B | **STATION** 48+28 | **OFFSET** 18 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.3 ft | **TOTAL DEPTH** 134.5 ft | **NORTHING** 249,609 | **EASTING** 2,437,303 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 11/23/15 | **COMP. DATE** 11/25/15 | **SURFACE WATER DEPTH** 2.5ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | -1.3 GROUND SURFACE | 0.0 |
| | -2.1 | 0.8 | 1 | 2 | 2 | 4 | | | | **UNDIVIDED COASTAL PLAIN** GRAY, FINE SAND (A-3) WITH TRACE SHELL FRAGMENTS | |
| -5 | -4.3 | 3.0 | 8 | 12 | 16 | 28 | | | | | |
| -10 | -9.3 | 8.0 | 7 | 4 | 2 | 6 | | | | | |
| | | | | | | | | | | -12.3 GRAY, CLAYEY SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS | 11.0 |
| -15 | -14.3 | 13.0 | WOH | WOH | 2 | 2 | | Sat. | | | |
| -20 | -19.3 | 18.0 | 3 | 2 | 1 | 3 | | Sat. | | | |
| -25 | -24.3 | 23.0 | 3 | 4 | 2 | 6 | | Sat. | | | |
| -30 | -29.3 | 28.0 | 6 | 8 | 19 | 27 | | Sat. | | | |
| | | | | | | | | | | -32.3 **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) | 31.0 |
| -35 | -34.3 | 33.0 | 9 | 13 | 13 | 26 | | Sat. | | | |
| -40 | -39.3 | 38.0 | 12 | 16 | 18 | 34 | | Sat. | | | |
| | | | | | | | | | | -42.3 **COASTAL PLAIN** GRAY-BROWN, SILTY FINE SAND WITH TRACE TO LITTLE GRAVEL (A-2-4) (RIVER BEND FORMATION) | 41.0 |
| -45 | -44.3 | 43.0 | 17 | 14 | 18 | 32 | | Sat. | | | |
| -50 | -49.3 | 48.0 | 15 | 28 | 34 | 62 | | Sat. | | | |
| -55 | -54.3 | 53.0 | 22 | 36 | 47 | 83 | | Sat. | | | |
| -60 | -59.3 | 58.0 | 5 | 11 | 13 | 24 | | Sat. | | | |
| -65 | -64.3 | 63.0 | 13 | 6 | 22 | 28 | | Sat. | | | |
| -70 | -69.3 | 68.0 | 6 | 8 | 6 | 14 | | Sat. | | | |
| -75 | -74.3 | 73.0 | 12 | 16 | 22 | 38 | | Sat. | | | |
| -80 | -79.3 | 78.0 | | | | | | | | | |

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B22-B | **STATION** 48+28 | **OFFSET** 18 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.3 ft | **TOTAL DEPTH** 134.5 ft | **NORTHING** 249,609 | **EASTING** 2,437,303 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 11/23/15 | **COMP. DATE** 11/25/15 | **SURFACE WATER DEPTH** 2.5ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -80 | | | 9 | 9 | 15 | Match Line 24 | | Sat. | | **COASTAL PLAIN** GRAY-BROWN, SILTY FINE SAND WITH TRACE TO LITTLE GRAVEL (A-2-4) (RIVER BEND FORMATION) *(continued)* |
| -85 | -84.3 | 83.0 | 3 | 3 | 5 | 8 | | Sat. | | |
| | | | | | | | | | | -87.7 **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, MODERATELY INDURATED TO INDURATED LIMESTONE (RIVER BEND FORMATION) 86.4 |
| -90 | -89.3 | 88.0 | 100/0.3 | | | 100/0.3 | | | | -92.5 **COASTAL PLAIN** GRAY, CEMENTED SAND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) 91.2 |
| -95 | -94.3 | 93.0 | 30 | 60/0.1 | | 60/0.1 | | | | -94.8 **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, MODERATELY INDURATED TO INDURATED LIMESTONE (RIVER BEND FORMATION) 93.5 |
| -100 | -99.3 | 98.0 | 100/0.3 | | | 100/0.3 | | | | |
| -105 | -104.3 | 103.0 | 31 | 73 | 27/0.4 | 100/0.9 | | Sat. | | -102.3 **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) 101.0 |
| -110 | -109.3 | 108.0 | 16 | 27 | 26 | 53 | | Sat. | | -104.8 **COASTAL PLAIN SEDIMENTARY ROCK** FRIABLE LIMESTONE (RIVER BEND FORMATION) 103.5 |
| -115 | -114.3 | 113.0 | 18 | 21 | 22 | 43 | | Sat. | | -108.3 **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) 107.0 |
| -120 | -119.3 | 118.0 | 10 | 16 | 14 | 30 | | Sat. | | -HARD DRILLING NOTED FROM 110.0'-112.6' |
| -125 | -124.3 | 123.0 | 60/0.0 | | | 60/0.0 | | | | -122.1 **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, MODERATELY INDURATED TO INDURATED LIMESTONE (RIVER BEND FORMATION) 120.8 |
| -130 | -129.3 | 128.0 | 60/0.0 | | | 60/0.0 | | | | -SOFT DRILLING NOTED FROM 126.2'-127.3' |
| -135 | -134.3 | 133.0 | 6 | 7 | 10 | 17 | SS-537 | 31% | | -130.7 **COASTAL PLAIN** LIGHT GRAY, CLAYEY FINE TO COARSE SANDY SILT (A-4) WITH TRACE GRAVEL (RIVER BEND FORMATION) 129.4 |
| | | | | | | | | | | -135.8 Boring Terminated at Elevation -135.8 ft in SILT (RIVER BEND FORMATION) 134.5 |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B23-A | **STATION** 49+88 | **OFFSET** 32 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.4 ft | **TOTAL DEPTH** 119.5 ft | **NORTHING** 249,596 | **EASTING** 2,437,469 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 12/03/15 | **COMP. DATE** 12/04/15 | **SURFACE WATER DEPTH** 0.1ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | | |
| 0 | 0.4 | 0.0 | WOH | WOH | WOH | 0 | | Sat. | | 0.4 GROUND SURFACE | 0.0 |
| | | | | | | | | | | **ALLUVIAL** | |
| | | | | | | | | | | DARK GRAY, MUCK | |
| -5 | -4.0 | 4.4 | 7 | 10 | 12 | 22 | | Sat. | | -2.1 | 2.5 |
| | -7.6 | 8.0 | 7 | 11 | 15 | 26 | | Sat. | | **UNDIVIDED COASTAL PLAIN** GRAY, SILTY FINE SAND (A-2-4) WITH TRACE TO LITTLE SHELL FRAGMENTS | |
| -10 | | | | | | | | | | | |
| | -12.6 | 13.0 | 7 | 9 | 13 | 22 | | Sat. | | | |
| -15 | | | | | | | | | | | |
| | -17.6 | 18.0 | 6 | 12 | 17 | 29 | | Sat. | | | |
| -20 | | | | | | | | | | | |
| | -22.6 | 23.0 | 1 | 2 | 4 | 6 | | Sat. | | | |
| -25 | | | | | | | | | | | |
| | -27.6 | 28.0 | 3 | 2 | 4 | 6 | | Sat. | | | |
| -30 | | | | | | | | | | HARD DRILLING NOTED FROM 32.5'-33' | |
| | -32.6 | 33.0 | 9 | 6 | 12 | 18 | | Sat. | | -32.1 | 32.5 |
| -35 | | | | | | | | | | **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) | |
| | -37.6 | 38.0 | 9 | 15 | 17 | 32 | | Sat. | | | |
| -40 | | | | | | | | | | | |
| | -42.6 | 43.0 | 15 | 23 | 39 | 62 | | Sat. | | | |
| -45 | | | | | | | | | | | |
| | -47.6 | 48.0 | 10 | 19 | 29 | 48 | | Sat. | | -47.6 | 48.0 |
| -50 | | | | | | | | | | **COASTAL PLAIN** GRAY-BROWN, SILTY FINE SAND (A-2-4) WITH CEMENTED TRACE SAND FRAGMENTS (RIVER BEND FORMATION) | |
| | -52.6 | 53.0 | 21 | 34 | 51 | 85 | | Sat. | | | |
| -55 | | | | | | | | | | | |
| | -57.6 | 58.0 | 37 | 21 | 13 | 34 | | Sat. | | | |
| -60 | | | | | | | | | | | |
| | -62.6 | 63.0 | 10 | 13 | 16 | 29 | | Sat. | | | |
| -65 | | | | | | | | | | | |
| | -67.6 | 68.0 | 5 | 7 | 9 | 16 | | Sat. | | | |
| -70 | | | | | | | | | | | |
| | -72.6 | 73.0 | 14 | 20 | 25 | 45 | | Sat. | | | |
| -75 | | | | | | | | | | | |



| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B23-A | **STATION** 49+88 | **OFFSET** 32 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.4 ft | **TOTAL DEPTH** 119.5 ft | **NORTHING** 249,596 | **EASTING** 2,437,469 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 12/03/15 | **COMP. DATE** 12/04/15 | **SURFACE WATER DEPTH** 0.1ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| | -77.6 | 78.0 | 13 | 13 | 19 | 32 | | Sat. | | **COASTAL PLAIN** GRAY-BROWN, SILTY FINE SAND (A-2-4) WITH CEMENTED TRACE SAND FRAGMENTS (RIVER BEND FORMATION) *(continued)* |
| -80 | | | | | | | | | | |
| | -82.6 | 83.0 | 6 | 8 | 11 | 19 | | Sat. | | |
| -85 | | | | | | | | | | |
| | -87.6 | 88.0 | 8 | 18 | 16 | 34 | | Sat. | | -88.0 88.4 |
| -90 | | | | | | | | | | GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) |
| | -92.6 | 93.0 | 60/0.1 | | | 60/0.1 | | | | -92.3 92.7 |
| -95 | | | | | | | | | | **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, MODERATELY INDURATED AND INDURATED LIMESTONE (RIVER BEND FORMATION) |
| | -97.6 | 98.0 | 60/0.1 | | | 60/0.1 | | | | -94.3 94.7 |
| -100 | | | | | | | | | | -97.4 97.8 |
| | -102.6 | 103.0 | 38 | 48 | 52/0.4 | 100/0.9 | | | | **COASTAL PLAIN** GRAY, CEMENTED SAND (A-1-b) (RIVER BEND FORMATION) |
| -105 | | | | | | | | | | -100.6 101.0 |
| | -107.6 | 108.0 | 12 | 9 | 6 | 15 | | Sat. | | **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, MODERATELY INDURATED TO FRIABLE LIMESTONE (RIVER BEND FORMATION) |
| -110 | | | | | | | | | | -103.1 103.5 |
| | -112.6 | 113.0 | 100/0.4 | | | 100/0.4 | | | | **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) |
| -115 | | | | | | | | | | -106.6 107.0 |
| | -117.6 | 118.0 | 13 | 13 | 34 | 47 | | Sat. | | **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, FRIABLE, LIMESTONE (RIVER BEND FORMATION) |
| | | | | | | | | | | -112.5 112.9 |
| | | | | | | | | | | **COASTAL PLAIN** GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) |
| | | | | | | | | | | -115.6 116.0 |
| | | | | | | | | | | **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION) |
| | | | | | | | | | | -119.1 119.5 |
| | | | | | | | | | | **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) |
| | | | | | | | | | | Boring Terminated at Elevation -119.1 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B24-B | **STATION** 51+34 | **OFFSET** 22 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.9 ft | **TOTAL DEPTH** 114.5 ft | **NORTHING** 249,505 | **EASTING** 2,437,594 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 12/08/15 | **COMP. DATE** 12/09/15 | **SURFACE WATER DEPTH** 3.4ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) / DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | |
| | -1.9 | 0.0 | WOR | WOR | WOR | 0 | | Sat. | | -1.9 / 0.0 GROUND SURFACE |
| -5 | | | | | | | | | | **UNDIVIDED COASTAL PLAIN**<br>DARK GRAY, SILTY CLAY (A-7-5) WITH TRACE ORGANICS |
| | -6.1 | 4.2 | 5 | 4 | 4 | 8 | | Sat. | | -4.4 / 2.5<br>GRAY, SILTY FINE SAND (A-2-4) |
| -10 | -9.9 | 8.0 | 2 | 2 | 2 | 4 | | Sat. | | |
| -15 | -14.9 | 13.0 | 7 | 8 | 11 | 19 | | Sat. | | |
| -20 | -19.9 | 18.0 | 6 | 8 | 10 | 18 | | Sat. | | -22.9 / 21.0<br>DARK GRAY, FINE SANDY SILTY CLAY (A-7-5) WITH TRACE SHELL FRAGMENTS |
| -25 | -24.9 | 23.0 | 2 | 1 | 1 | 2 | | Sat. | | -27.9 / 26.0<br>GRAY, SILTY FINE SAND (A-2-4) WITH TRACE GRAVEL |
| -30 | -29.9 | 28.0 | 6 | 8 | 7 | 15 | | Sat. | | -32.9 / 31.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -35 | -34.9 | 33.0 | 13 | 14 | 12 | 26 | | Sat. | | |
| -40 | -39.9 | 38.0 | 8 | 12 | 12 | 24 | | Sat. | | -42.9 / 41.0<br>**COASTAL PLAIN**<br>GRAY-BROWN, SILTY FINE SAND (A-2-4) WITH TRACE CEMENTED SAND FRAGMENTS<br>(RVER BEND FORMATION) |
| -45 | -44.9 | 43.0 | 12 | 18 | 11 | 29 | | Sat. | | |
| -50 | -49.9 | 48.0 | 17 | 31 | 36 | 67 | | Sat. | | |
| -55 | -54.9 | 53.0 | 28 | 35 | 40 | 75 | | Sat. | | |
| -60 | -59.9 | 58.0 | 16 | 15 | 30 | 45 | | Sat. | | |
| -65 | -64.9 | 63.0 | 11 | 17 | 28 | 45 | | Sat. | | |
| -70 | -69.9 | 68.0 | 8 | 11 | 12 | 23 | | Sat. | | |
| -75 | -74.9 | 73.0 | 15 | 20 | 27 | 47 | | Sat. | | |
| -80 | -79.9 | 78.0 | | | | | | | | |



| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B24-B | **STATION** 51+34 | **OFFSET** 22 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.9 ft | **TOTAL DEPTH** 114.5 ft | **NORTHING** 249,505 | **EASTING** 2,437,594 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 12/08/15 | **COMP. DATE** 12/09/15 | **SURFACE WATER DEPTH** 3.4ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -80 | | | | | | Match Line | | | | |
| | | | 15 | 16 | 23 | 39 | | Sat. | | **COASTAL PLAIN**<br>GRAY-BROWN, SILTY FINE SAND (A-2-4) WITH TRACE CEMENTED SAND FRAGMENTS<br>(RVER BEND FORMATION) *(continued)* |
| -85 | -84.9 | 83.0 | 5 | 5 | 5 | 10 | | Sat. | | |
| -90 | -89.9 | 88.0 | 60/0.0 | | | 60/0.0 | | Sat. | | -88.9 / 87.0<br>-89.9 / 88.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION) |
| -95 | -94.9 | 93.0 | 14 | 100/0.3 | | 100/0.3 | | Sat. | | -93.9 / 92.0<br>-95.4 / 93.5<br>**COASTAL PLAIN**<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| -100 | -100.8 | 98.9 | 100/0.4 | | | 100/0.4 | | | | **COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -105 | -106.2 | 104.3 | 54 | 44 | 41 | 85 | | Sat. | | -106.2 / 104.3<br>**COASTAL PLAIN**<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| -110 | -109.9 | 108.0 | 16 | 25 | 24 | 49 | | Sat. | | |
| -115 | -114.9 | 113.0 | 16 | 38 | 23 | 61 | | Sat. | | -116.4 / 114.5<br>Boring Terminated at Elevation -116.4 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

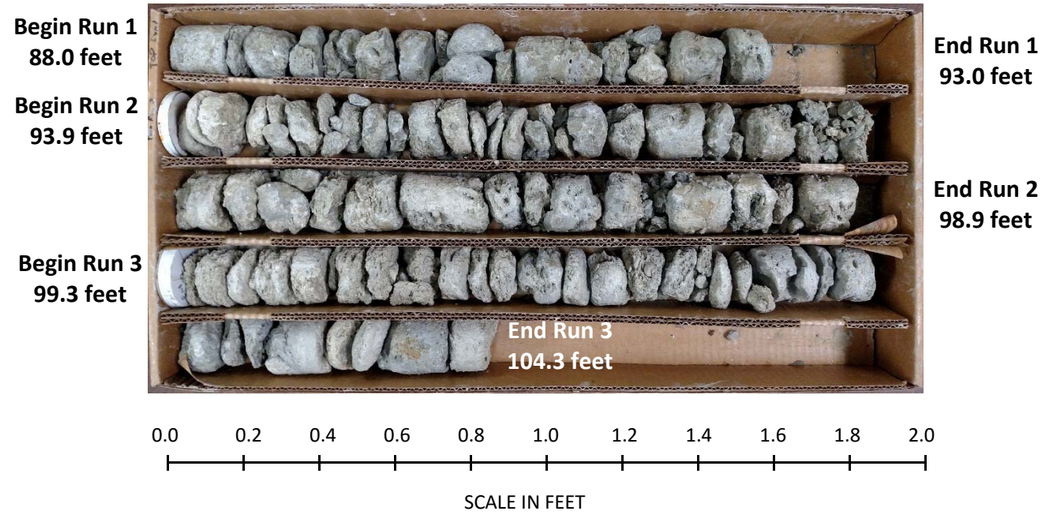
# GEOTECHNICAL BORING REPORT
# CORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B24-B | **STATION** 51+34 | **OFFSET** 22 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -1.9 ft | **TOTAL DEPTH** 114.5 ft | **NORTHING** 249,505 | **EASTING** 2,437,594 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 12/08/15 | **COMP. DATE** 12/09/15 | **SURFACE WATER DEPTH** 3.4ft | |
| **CORE SIZE** NQ3 | **TOTAL RUN** 15.0 ft | | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -89.9 | | | | | | | | | | | Begin Coring @ 88.0 ft |
| | -89.9 | 88.0 | 5.0 | N=60/0.0<br>1:10/1.0<br>1:41/1.0<br>1:52/1.0<br>3:14/1.0<br>1:49/1.0 | (1.8)<br>36% | (0.0)<br>0% | | (1.8)<br>45% | (0.0)<br>0% | | -89.9 **COASTAL PLAIN SEDIMENTARY ROCK** 88.0<br>GRAY, MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION) |
| -95 | -94.9 | 93.0 | | N=100/0.3 | | | | (0.0)<br>0% | (0.0)<br>0% | | -93.9 92.0<br>-95.4 **COASTAL PLAIN** 93.5<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| | -95.8 | 93.9 | 5.0 | 1:34/1.0<br>1:59/1.0<br>1:27/1.0<br>1:39/1.0<br>1:46/1.0 | (3.8)<br>76% | (0.0)<br>0% | | (6.6)<br>61% | (0.0)<br>0% | | **COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -100 | -100.8 | 98.9 | | | | | | | | | |
| | -101.2 | 99.3 | 5.0 | N=100/0.4<br>1:24/1.0<br>1:19/1.0<br>1:52/1.0<br>1:59/1.0<br>1:47/1.0 | (2.8)<br>56% | (0.0)<br>0% | | | | | |
| -105 | -106.2 | 104.3 | | N=85 | | | | | | | -106.2 104.3<br>**COASTAL PLAIN**<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| -110 | | | | N=49 | | | | | | | |
| -115 | | | | N=61 | | | | | | | -116.4 114.5<br>Boring Terminated at Elevation -116.4 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

NCDOT CORE DOUBLE B4929_GEO_BH_TOPSAIL.GPJ NC_DOT.GDT 2/4/16

**CORE PHOTOGRAPHS: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach, B24-B: -L2- Station 51+34, 22' RT**



# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** P. FAHEY | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B25-A | **STATION** 52+75 | **OFFSET** 32 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.3 ft | **TOTAL DEPTH** 114.2 ft | **NORTHING** 249,521 | **EASTING** 2,437,744 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** B. FOWLER | **START DATE** 11/06/15 | **COMP. DATE** 11/06/15 | **SURFACE WATER DEPTH** 0.3ft | |


| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** P. FAHEY | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B25-A | **STATION** 52+75 | **OFFSET** 32 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.3 ft | **TOTAL DEPTH** 114.2 ft | **NORTHING** 249,521 | **EASTING** 2,437,744 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** B. FOWLER | **START DATE** 11/06/15 | **COMP. DATE** 11/06/15 | **SURFACE WATER DEPTH** 0.3ft | |

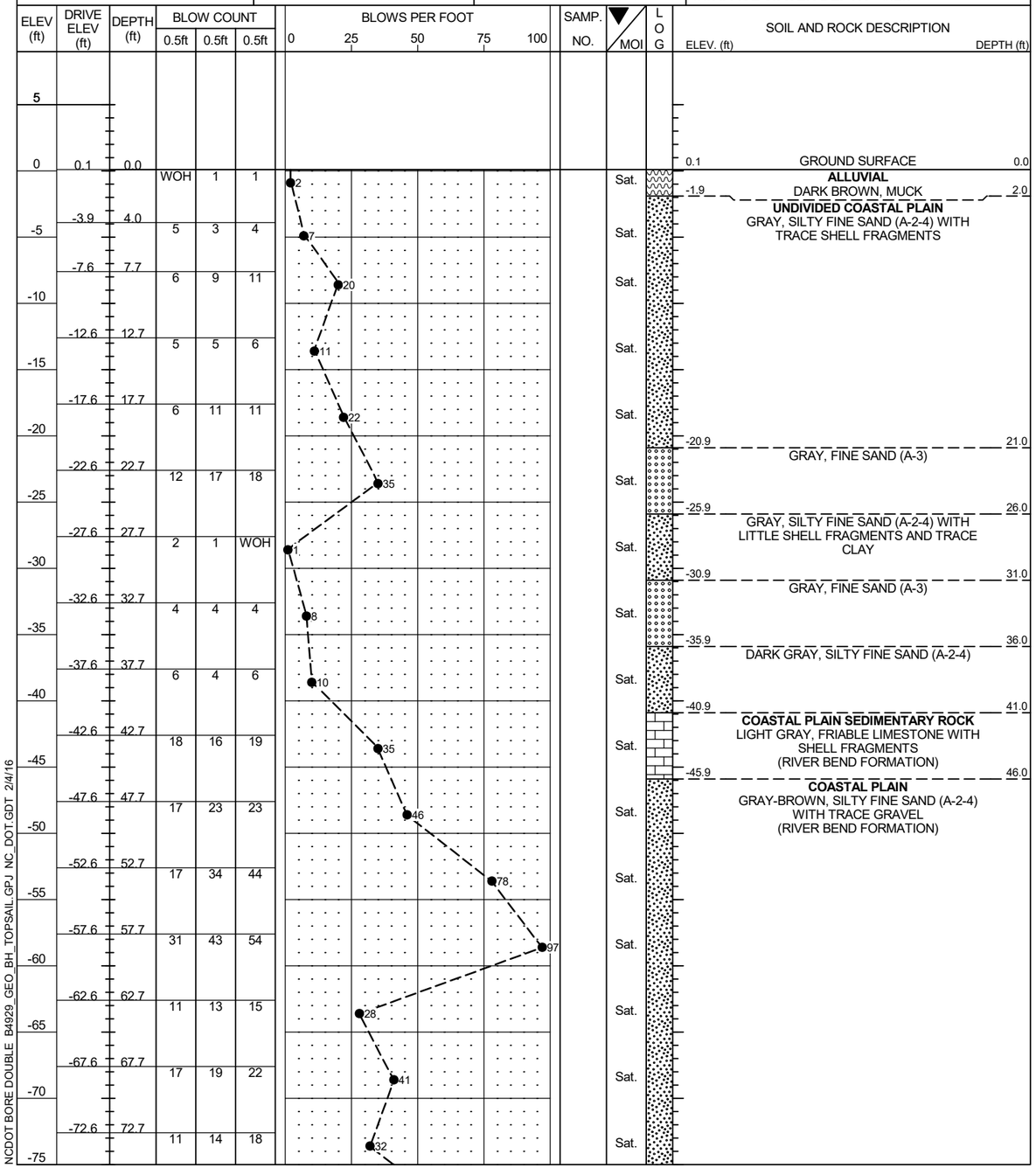

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft)) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | |
| 0 | 0.3 | 0.0 | WOH | WOH | WOH | 0 | | Sat. | | 0.3 / 0.0 GROUND SURFACE |
| | | | | | | | | | | **ALLUVIAL** DARK BROWN, MUCK |
| | -3.5 | 3.8 | | | | | | | | -2.7 / 3.0 |
| -5 | | | 6 | 5 | 4 | 9 | | Sat. | | **UNDIVIDED COASTAL PLAIN** GRAY, FINE SAND (A-3) WITH TRACE TO SOME SHELL FRAGMENTS |
| | -8.5 | 8.8 | | | | | | | | |
| -10 | | | 12 | 14 | 13 | 27 | | Sat. | | |
| | -13.5 | 13.8 | | | | | | | | |
| -15 | | | 3 | 3 | 4 | 7 | | Sat. | | |
| | -18.5 | 18.8 | | | | | | | | |
| -20 | | | 5 | 5 | 7 | 12 | | Sat. | | -HARD DRILLING NOTED FROM 22.5'-22.8' |
| | -23.5 | 23.8 | | | | | | | | |
| -25 | | | 8 | 12 | 13 | 25 | | Sat. | | |
| | -28.5 | 28.8 | | | | | | | | -26.7 / 27.0 |
| -30 | | | 3 | 3 | 6 | 9 | | Sat. | | GRAY, SILTY FINE SAND (A-2-4) |
| | -33.5 | 33.8 | | | | | | | | |
| -35 | | | 9 | 11 | 11 | 22 | | Sat. | | |
| | -38.5 | 38.8 | | | | | | | | -36.7 / 37.0 |
| -40 | | | 9 | 14 | 15 | 29 | | Sat. | | **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) |
| | -43.5 | 43.8 | | | | | | | | |
| -45 | | | 11 | 15 | 24 | 39 | | Sat. | | -42.7 / 43.0 |
| | -48.5 | 48.8 | | | | | | | | **COASTAL PLAIN** GRAY, SILTY FINE TO COARSE SAND (A-2-4) AND TRACE TO SOME CEMENTED SAND FRAGMENTS (RIVER BEND FORMATION) |
| -50 | | | 8 | 11 | 20 | 31 | | Sat. | | |
| | -53.5 | 53.8 | | | | | | | | |
| -55 | | | 25 | 32 | 53 | 85 | | Sat. | | |
| | -58.5 | 58.8 | | | | | | | | |
| -60 | | | 20 | 40 | 60/0.4 | 100/0.9 | | | | |
| | -63.5 | 63.8 | | | | | | | | |
| -65 | | | 5 | 6 | 5 | 11 | | Sat. | | |
| | -68.5 | 68.8 | | | | | | | | |
| -70 | | | 5 | 7 | 9 | 16 | | Sat. | | |
| | -73.5 | 73.8 | | | | | | | | |
| -75 | | | 11 | 24 | 30 | 54 | | Sat. | | |

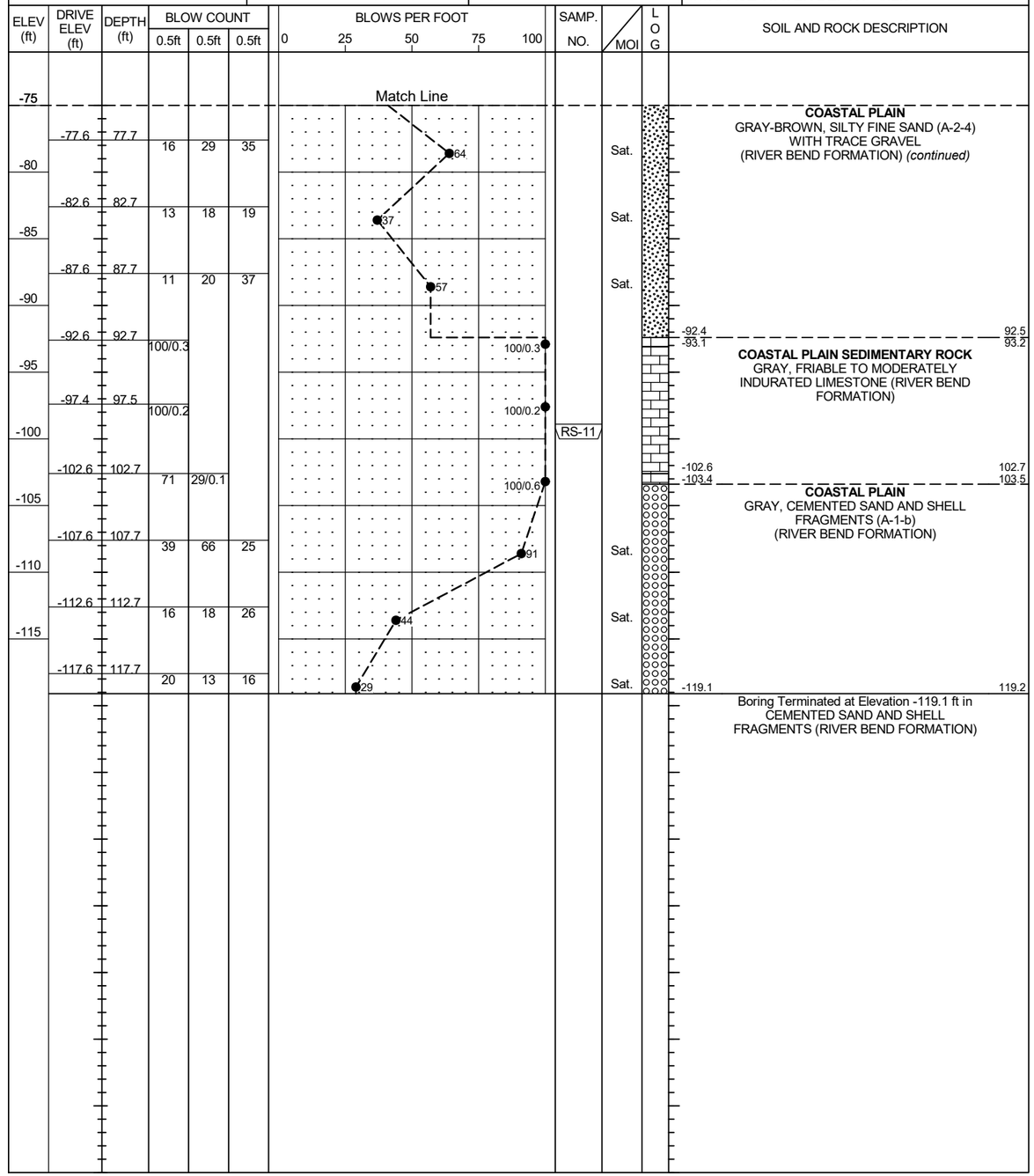
| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| | -78.5 | 78.8 | | | | | | | | |
| -80 | | | 13 | 15 | 23 | 38 | | Sat. | | **COASTAL PLAIN** GRAY, SILTY FINE TO COARSE SAND (A-2-4) AND TRACE TO SOME CEMENTED SAND FRAGMENTS (RIVER BEND FORMATION) *(continued)* |
| | -83.5 | 83.8 | | | | | | | | |
| -85 | | | 7 | 10 | 12 | 22 | | Sat. | | |
| | -88.5 | 88.8 | | | | | | | | |
| -90 | | | 6 | 5 | 20 | 25 | | Sat. | | -90.2 / 90.5 |
| | -93.5 | 93.8 | | | | | | | | **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE (RIVER BEND FORMATION) -HARD DRILLING NOTED FROM 93.8'-98.8' |
| -95 | | | 60/0.0 | | | 60/0.0 | | | | |
| | -98.5 | 98.8 | | | | | | | | |
| -100 | | | 70 | 30/0.1 | | 100/0.6 | | | | -100.7 / 101.0 |
| | -103.5 | 103.8 | | | | | | | | **COASTAL PLAIN** LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) -HARD AND SOFT DRILLING NOTED FROM 105'-108.8' |
| -105 | | | 63 | 46 | 27 | 73 | | Sat. | | |
| | -108.5 | 108.8 | | | | | | | | |
| -110 | | | 11 | 13 | 14 | 27 | | Sat. | | |
| | -113.5 | 113.8 | | | | | | | | -112.7 / 113.0 |
| | | | 100/0.4 | | | 100/0.4 | | | | -113.9 / 114.2 **COASTAL PLAIN SEDIMENTARY ROCK** LIGHT GRAY, FRIABLE LIMESTONE (RIVER BEND FORMATION) |
| | | | | | | | | | | Boring Terminated at Elevation -113.9 ft in LIMESTONE (RIVER BEND FORMATION) |

NCDOT BORE DOUBLE B4929_GEO_BH_TOPSAIL.GPJ NC_DOT.GDT 2/4/16

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B26-B | **STATION** 54+16 | **OFFSET** 31 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.1 ft | **TOTAL DEPTH** 119.2 ft | **NORTHING** 249,424 | **EASTING** 2,437,865 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** M. WIGGINS | **START DATE** 12/09/15 | **COMP. DATE** 12/15/15 | **SURFACE WATER DEPTH** 0.2ft | |



# GEOTECHNICAL BORING REPORT
# CORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B26-B | **STATION** 54+16 | **OFFSET** 31 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.1 ft | **TOTAL DEPTH** 119.2 ft | **NORTHING** 249,424 | **EASTING** 2,437,865 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 12/09/15 | **COMP. DATE** 12/15/15 | **SURFACE WATER DEPTH** 0.2ft | |
| **CORE SIZE** NQ2 | **TOTAL RUN** 9.3 ft | | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -93.1 | | | | | | | | | | | Begin Coring @ 93.2 ft |
| -95 | -93.1 | 93.2 | 4.3 | 1:45/1.0<br>1:42/1.0<br>1:26/1.0<br>4:09/1.0<br>2:07/0.3 | (2.1)<br>49% | (0.3)<br>7% | | (5.6)<br>59% | (0.7)<br>7% | | -93.1 **COASTAL PLAIN SEDIMENTARY ROCK** 93.2<br>GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION)<br>RS-11: 99.0'-99.3', qu=2,593 psi, RMR=10 |
| | -97.4 | 97.5 | | | | | | | | | |
| | -97.6 | 97.7 | 5.0 | *N=100/0.2* | (3.5)<br>70% | (0.4)<br>8% | RS-11 | | | | |
| -100 | | | | 3:16/1.0<br>3:50/1.0<br>1:09/1.0<br>1:43/1.0<br>3:30/1.0 | | | | | | | |
| | -102.6 | 102.7 | | *N=100/0.6* | | | | | | | -102.6 102.7<br>-103.4 103.5 |
| -105 | | | | | | | | | | | **COASTAL PLAIN**<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| -110 | | | | *N=91* | | | | | | | |
| | | | | *N=44* | | | | | | | |
| -115 | | | | *N=29* | | | | | | | -119.1 119.2<br>Boring Terminated at Elevation -119.1 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

## CORE PHOTOGRAPHS: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach, B26-B: -L2- Station 54+16, 31’ RT

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B27-A | **STATION** 55+12 | **OFFSET** 34 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.3 ft | **TOTAL DEPTH** 139.3 ft | **NORTHING** 249,463 | **EASTING** 2,437,974 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 12/16/15 | **COMP. DATE** 12/17/15 | **SURFACE WATER DEPTH** 0.0ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) / DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | |
| 0 | 0.3 | 0.0 | WOH | WOH | 1 | 1 | | Sat. | | 0.3 GROUND SURFACE 0.0 |
| | -3.6 | 3.9 | | | | | | | | **ALLUVIAL** |
| -5 | | | 6 | 4 | 4 | 8 | | Sat. | | DARK BROWN, MUCK |
| | -7.5 | 7.8 | | | | | | | | -1.7 2.0 |
| -10 | | | 8 | 10 | 11 | 21 | | Sat. | | **UNDIVIDED COASTAL PLAIN** |
| | -12.5 | 12.8 | | | | | | | | GRAY, FINE SAND (A-3) WITH TRACE SILT AND TRACE TO LITTLE SHELL FRAGMENTS |
| -15 | | | 5 | 5 | 6 | 11 | | Sat. | | |
| | -17.5 | 17.8 | | | | | | | | |
| -20 | | | 6 | 8 | 7 | 15 | | Sat. | | |
| | -22.5 | 22.8 | | | | | | | | |
| -25 | | | 7 | 7 | 7 | 14 | | Sat. | | |
| | -27.5 | 27.8 | | | | | | | | -25.7 26.0 |
| -30 | | | 1 | 1 | WOH | 1 | | Sat. | | DARK GRAY, CLAYEY FINE TO COARSE SAND (A-2-6) WITH TRACE SHELL FRAGMENTS |
| | -32.5 | 32.8 | | | | | | | | -30.7 31.0 |
| -35 | | | 7 | 8 | 13 | 21 | | Sat. | | **COASTAL PLAIN SEDIMENTARY ROCK** |
| | -37.5 | 37.8 | | | | | | | | LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) |
| -40 | | | 7 | 10 | 12 | 22 | | Sat. | | |
| | -42.5 | 42.8 | | | | | | | | -40.7 41.0 |
| -45 | | | 4 | 5 | 5 | 10 | | Sat. | | **COASTAL PLAIN** |
| | -47.5 | 47.8 | | | | | | | | GRAY, FINE SAND (A-3) (RIVER BEND FORMATION) |
| -50 | | | 7 | 7 | 10 | 17 | | Sat. | | |
| | -52.5 | 52.8 | | | | | | | | -50.7 51.0 |
| -55 | | | 4 | 4 | 5 | 9 | | Sat. | | GRAY-BROWN, SILTY FINE SAND (A-2-4) (RIVER BEND FORMATION) |
| | -57.5 | 57.8 | | | | | | | | |
| -60 | | | 6 | 5 | 10 | 15 | | Sat. | | |
| | -62.5 | 62.8 | | | | | | | | |
| -65 | | | 3 | 3 | 4 | 7 | | Sat. | | |
| | -67.5 | 67.8 | | | | | | | | |
| -70 | | | 3 | 2 | 3 | 5 | | Sat. | | |
| | -72.5 | 72.8 | | | | | | | | |
| -75 | | | 3 | 2 | 4 | 6 | | Sat. | | |



| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B27-A | **STATION** 55+12 | **OFFSET** 34 ft LT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** 0.3 ft | **TOTAL DEPTH** 139.3 ft | **NORTHING** 249,463 | **EASTING** 2,437,974 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 12/16/15 | **COMP. DATE** 12/17/15 | **SURFACE WATER DEPTH** 0.0ft | |



| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -75 | | | | | | Match Line | | | | |
| | -77.5 | 77.8 | 4 | 7 | 13 | 20 | | Sat. | | GRAY-BROWN, SILTY FINE SAND (A-2-4) (RIVER BEND FORMATION) *(continued)* |
| -80 | | | | | | | | | | |
| | -82.5 | 82.8 | 8 | 8 | 13 | 21 | | Sat. | | |
| -85 | | | | | | | | | | |
| | -87.5 | 87.8 | 5 | 7 | 9 | 16 | | Sat. | | |
| -90 | | | | | | | | | | -92.5 92.8 |
| | -92.5 | 92.8 | 60/0.1 | | | 60/0.1 | | | | **COASTAL PLAIN SEDIMENTARY ROCK** |
| -95 | | | | | | | | | | GRAY, FRIABLE TO MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION) |
| | -97.5 | 97.8 | 100/0.5 | | | 100/0.5 | | | | |
| -100 | | | | | | | | | | THIN LAYERS OF SOFTER DRILLING NOTED FROM 100.3'-101.8' |
| | -102.5 | 102.8 | 89 | 11/0.1 | | 100/0.6 | | | | -103.1 103.4 |
| -105 | | | | | | | | | | **COASTAL PLAIN** |
| | -107.5 | 107.8 | 43 | 18 | 11 | 29 | | Sat. | | LIGHT GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b) (RIVER BEND FORMATION) |
| -110 | | | | | | | | | | |
| | -112.5 | 112.8 | 19 | 8 | 9 | 17 | | Sat. | | |
| -115 | | | | | | | | | | |
| | -117.5 | 117.8 | 27 | 36 | 25 | 61 | | Sat. | | |
| -120 | | | | | | | | | | |
| | -122.5 | 122.8 | 10 | 16 | 25 | 41 | | Sat. | | |
| -125 | | | | | | | | | | -125.7 126.0 |
| | -127.5 | 127.8 | 60/0.0 | | | 60/0.0 | | | | **COASTAL PLAIN SEDIMENTARY ROCK** |
| -130 | | | | | | | | | | GRAY, MODERATELY INDURATED LIMESTONE (RIVER BEND FORMATION) -SOFTER DRILLING NOTED FROM 129.5'-131.6' AND 132.1'-132.5' |
| | -132.5 | 132.8 | 60/0.0 | | | 60/0.0 | | | | |
| -135 | | | | | | | | | | -134.9 135.2 |
| | -137.5 | 137.8 | 7 | 9 | 20 | 29 | | Sat. | | **COASTAL PLAIN** |
| | | | | | | | | | | LIGHT GRAY, CLAYEY FINE TO COARSE SAND (A-2-6) WITH TRACE SHELL FRAGMENTS (RIVER BEND FORMATION) |
| | | | | | | | | | | -139.0 139.3 |
| | | | | | | | | | | Boring Terminated at Elevation -139.0 ft in CLAYEY SAND (RIVER BEND FORMATION) |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B28-B | **STATION** 56+07 | **OFFSET** 32 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -0.1 ft | **TOTAL DEPTH** 114.3 ft | **NORTHING** 249,375 | **EASTING** 2,438,049 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** M. WIGGINS | **START DATE** 12/18/15 | **COMP. DATE** 12/21/15 | **SURFACE WATER DEPTH** 0.1ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) — DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | -0.1 | 0.0 | 1 | 1 | 1 | 2 | | Sat. | | -0.1 — 0.0 GROUND SURFACE |
| | -3.2 | 3.1 | | | | | | | | **ALLUVIAL**<br>DARK BROWN, MUCK |
| -5 | | | 5 | 3 | 5 | 8 | | Sat. | | -2.1 — 2.0 **UNDIVIDED COASTAL PLAIN**<br>GRAY, FINE SAND (A-3) WITH TRACE TO LITTLE SHELL FRAGMENTS AND TRACE ORGANICS |
| | -7.9 | 7.8 | | | | | | | | |
| -10 | | | 3 | 4 | 8 | 12 | | Sat. | | |
| | -12.9 | 12.8 | | | | | | | | |
| -15 | | | 8 | 8 | 7 | 15 | | Sat. | | |
| | -17.9 | 17.8 | | | | | | | | |
| -20 | | | 4 | 4 | 5 | 9 | | Sat. | | |
| | -22.9 | 22.8 | | | | | | | | |
| -25 | | | 5 | 6 | 10 | 16 | | Sat. | | -25.1 — 25.0 DARK GRAY, FINE TO COARSE SANDY CLAY (A-6) WITH TRACE SHELL FRAGMENTS |
| | -27.9 | 27.8 | | | | | | | | |
| -30 | | | WOH | 2 | 1 | 3 | | Sat. | | -30.1 — 30.0 LIGHT GRAY, FINE SAND (A-3) WITH TRACE SHELL FRAGMENTS |
| | -32.9 | 32.8 | | | | | | | | |
| -35 | | | 5 | 7 | 12 | 19 | | Sat. | | -35.1 — 35.0 **COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| | -37.9 | 37.8 | | | | | | | | |
| -40 | | | 12 | 27 | 52 | 79 | | Sat. | | -40.1 — 40.0 **COASTAL PLAIN**<br>GRAY, SILTY FINE SAND (A-2-4)<br>(RIVER BEND FORMATION) |
| | -42.9 | 42.8 | | | | | | | | |
| -45 | | | 8 | 8 | 13 | 21 | | Sat. | | |
| | -47.9 | 47.8 | | | | | | | | |
| -50 | | | 8 | 14 | 17 | 31 | | Sat. | | |
| | -52.9 | 52.8 | | | | | | | | |
| -55 | | | 6 | 7 | 12 | 19 | | Sat. | | |
| | -57.9 | 57.8 | | | | | | | | |
| -60 | | | 3 | 4 | 6 | 10 | | Sat. | | |
| | -62.9 | 62.8 | | | | | | | | |
| -65 | | | 5 | 5 | 7 | 12 | | Sat. | | |
| | -67.9 | 67.8 | | | | | | | | |
| -70 | | | 2 | 1 | 4 | 5 | | Sat. | | |
| | -72.9 | 72.8 | | | | | | | | |
| -75 | | | 6 | 6 | 6 | 12 | | Sat. | | |
| | -77.9 | 77.8 | | | | | | | | |
| -80 | | | 11 | 14 | 17 | 31 | | Sat. | | |

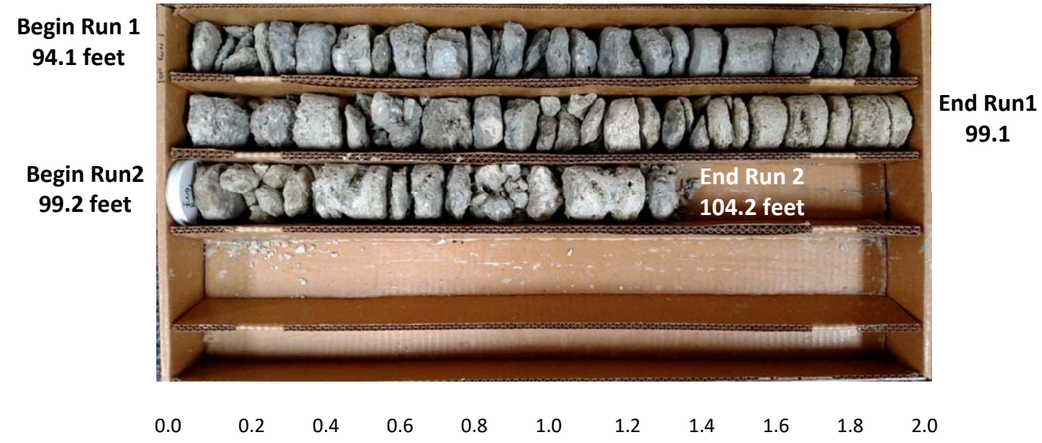
| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -80 | | | | | | Match Line | | | | |
| | -82.9 | 82.8 | 9 | 13 | 17 | 30 | | Sat. | | **COASTAL PLAIN**<br>GRAY, SILTY FINE SAND (A-2-4)<br>(RIVER BEND FORMATION) *(continued)* |
| -85 | | | | | | | | | | |
| | -87.9 | 87.8 | 4 | 4 | 7 | 11 | | Sat. | | |
| -90 | | | | | | | | | | |
| | -92.9 | 92.8 | 12 | 21 | 100/0.3 | 100/0.3 | | | | -91.1 — 91.0 GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| -95 | | | | | | | | | | -93.9 — 93.8 |
| | -99.2 | 99.1 | 60/0.1 | | | 60/0.1 | | | | -94.2 — 94.1 **COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE TO INDURATED<br>LIMESTONE (RIVER BEND FORMATION) |
| -100 | | | | | | | | | | |
| | -104.3 | 104.2 | 71 | 29/0.1 | | 100/0.6 | | | | -104.3 — 104.2 |
| -105 | | | | | | | | | | -105.0 — 104.9 **COASTAL PLAIN**<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| | -107.9 | 107.8 | 26 | 40 | 30 | 70 | | Sat. | | |
| -110 | | | | | | | | | | |
| | -112.9 | 112.8 | 32 | 29 | 39 | 68 | | Sat. | | -114.4 — 114.3 Boring Terminated at Elevation -114.4 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

# GEOTECHNICAL BORING REPORT
# CORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. ELLIS | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** B28-B | **STATION** 56+07 | **OFFSET** 32 ft RT | **ALIGNMENT** -L2- | **0 HR.** N/M |
| **COLLAR ELEV.** -0.1 ft | **TOTAL DEPTH** 114.3 ft | **NORTHING** 249,375 | **EASTING** 2,438,049 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | | **HAMMER TYPE** Automatic |
| **DRILLER** M. WIGGINS | **START DATE** 12/18/15 | **COMP. DATE** 12/21/15 | **SURFACE WATER DEPTH** 0.1ft | |
| **CORE SIZE** NQ2 | **TOTAL RUN** 10.0 ft | | | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -94.2 | | | | | | | | | | | Begin Coring @ 94.1 ft |
| -95 | -94.2 | 94.1 | 5.0 | 1:41/1.0<br>2:12/1.0<br>1:37/1.0<br>3:02/1.0<br>1:39/1.0 | (3.9)<br>78% | (0.0)<br>0% | | (5.2)<br>51% | (0.0)<br>0% | | -94.2 **COASTAL PLAIN SEDIMENTARY ROCK** 94.1<br>GRAY, FRIABLE TO INDURATED LIMESTONE<br>(RIVER BEND FORMATION) |
| -100 | -99.2<br>-99.3 | 99.1<br>99.2 | 5.0 | *N=60/0.1*<br>1:12/1.0<br>1:12/1.0<br>1:20/1.0<br>1:22/1.0<br>1:43/1.0 | (1.3)<br>26% | (0.0)<br>0% | | | | | |
| -105 | -104.3 | 104.2 | | *N=100/0.6* | | | | | | | -104.3 104.2<br>-105.0 104.9<br>**COASTAL PLAIN**<br>GRAY, CEMENTED SAND AND SHELL FRAGMENTS (A-1-b)<br>(RIVER BEND FORMATION) |
| -110 | | | | *N=70*<br><br>*N=68* | | | | | | | -114.4 114.3<br>Boring Terminated at Elevation -114.4 ft in CEMENTED SAND AND SHELL FRAGMENTS (RIVER BEND FORMATION) |

**CORE PHOTOGRAPHS: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach, B28-B: -L2- Station 56+07, 32’ RT**



# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** D. RACEY | |
| **SITE DESCRIPTION** BRIDGE OVER INTRACOASTAL WATERWAY ON NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH | | | | **GROUND WTR (ft)** |
| **BORING NO.** EB2-A | **STATION** 56+88 | **OFFSET** 29 ft LT | **ALIGNMENT** -L2- | **0 HR.** 2.0 |
| **COLLAR ELEV.** 3.3 ft | **TOTAL DEPTH** 89.4 ft | **NORTHING** 249,414 | **EASTING** 2,438,143 | **24 HR.** 3.0 |
| **DRILL RIG/HAMMER EFF./DATE** MID0314 D-25 80% 07/31/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** D. TIGNOR | **START DATE** 10/29/15 | **COMP. DATE** 10/29/15 | **SURFACE WATER DEPTH** N/A | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 3.3 | 0.0 |
| | | | | | | | | | | **GROUND SURFACE** | |
| | | | | | | | | | | 0.3 | 3.0 |
| | | | | | | | | | | **ARTIFICIAL FILL**<br>BROWN, SILTY FINE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS AND ORGANICS | |
| | | | | | | | | | | -1.1 | 4.4 |
| | | | | | | | | | | **UNDIVIDED COASTAL PLAIN**<br>BROWN, SILTY FINE SAND (A-2-4) WITH LITTLE ORGANICS | |
| | | | | | | | | | | -6.4 | 9.7 |
| | | | | | | | | | | GRAY-BROWN TO DARK GRAY, SILTY FINE SAND (A-2-4) WITH TRACE TO SOME SHELL FRAGMENTS | |
| | | | | | | | | | | -7.7 | 11.0 |
| | | | | | | | | | | DARK GRAY, SILTY CLAY (A-7-6) | |
| | | | | | | | | | | DARK GRAY, FINE SAND (A-3) WITH TRACE SILT AND SOME SHELL FRAGMENTS | |
| | | | | | | | | | | -23.7 | 27.0 |
| | | | | | | | | | | DARK GRAY, FINE SANDY SILTY CLAY (A-6) WITH TRACE SHELL FRAGMENTS | |
| | | | | | | | | | | -28.7 | 32.0 |
| | | | | | | | | | | GRAY, SILTY FINE TO COARSE SAND (A-2-4) | |
| | | | | | | | | | | -38.7 | 42.0 |
| | | | | | | | | | | **COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS<br>(RIVER BEND FORMATION) | |
| | | | | | | | | | | -46.3 | 49.6 |
| | | | | | | | | | | **COASTAL PLAIN**<br>GRAY-BROWN, SILTY FINE SAND (A-2-4) WITH TRACE CEMENTED SAND AND SHELL FRAGMENTS<br>(RIVER BEND FORMATION) | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Match Line |
| -75 | -75.2 | 78.5 | 18 | 18 | 24 | 42 | | Sat. | | **COASTAL PLAIN**<br>GRAY-BROWN, SILTY FINE SAND (A-2-4) WITH TRACE CEMENTED SAND AND SHELL FRAGMENTS<br>(RIVER BEND FORMATION) *(continued)* |
| -80 | -80.2 | 83.5 | 21 | 30 | 42 | 72 | | Sat. | | |
| -85 | -85.2 | 88.5 | 18 | 100/0.4 | | 100/0.4 | | | | -85.7 89.0<br>-86.1 89.4<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>GRAY, FRIABLE LIMESTONE<br>(RIVER BEND FORMATION)<br>Boring Terminated at Elevation -86.1 ft in LIMESTONE (RIVER BEND FORMATION)<br><br>TUBES OBTAINED IN OFFSET HOLE<br>-L2- 56+88, 26' LT:<br>ST-3 10.0'-12'<br>ST-4 28.5'-30.5' |

**North Carolina Department of Transportation**
**Division of Highways**
**Materials and Test Unit**
**Soils Laboratory**

T.I.P. ID NO.: B-4929
DESCRIPTION: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach

REPORT ON SAMPLES OF: SOIL FOR QUALITY

PROJECT: 40233.1.1
DATE SAMPLED: 10/15 to 12/15
SAMPLED FROM: -L2-
SUBMITTED BY: P. Alton, PE

COUNTY: Pender
RECEIVED: 11/15 to 12/15
REPORTED: 11/15 to 12/15
BY: D. Jenks
Cert No. 101-02-0603

**TEST RESULTS**

| PROJ. SAMPLE NO. | ST-2 | SS-31 | SS-537 | ST-4 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BORING NO. | EB1-A | B15-B | B22-B | EB2-A | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| Retained #4 Sieve % | 0.0 | 4.9 | 0.0 | 0.0 | | | | | | | | | | | |
| Passing #10 Sieve % | 100.0 | 92.2 | 99.4 | 100.0 | | | | | | | | | | | |
| Passing #40 Sieve % | 100.0 | 73.6 | 85.9 | 98.5 | | | | | | | | | | | |
| Passing #200 Sieve % | 92.3 | 50.4 | 58.6 | 75.9 | | | | | | | | | | | |
| SOIL MORTAR - 100% | | | | | | | | | | | | | | | |
| Coarse Sand Ret - #60 % | 0.2 | 30.0 | 21.6 | 5.4 | | | | | | | | | | | |
| Fine Sand Ret - #270 % | 8.4 | 17.4 | 22.6 | 19.8 | | | | | | | | | | | |
| Silt 0.053 - 0.010 mm % | 30.7 | 24.5 | 24.9 | 41.1 | | | | | | | | | | | |
| Clay < 0.010 mm % | 60.7 | 28.1 | 30.9 | 33.7 | | | | | | | | | | | |
| L.L. | 53 | 20 | 26 | 31 | | | | | | | | | | | |
| P.L. | 28 | NP | 22 | 16 | | | | | | | | | | | |
| P.I. | 25 | NP | 4 | 15 | | | | | | | | | | | |
| AASHTO Classification | A-7-6 (26) | A-4 (0) | A-4 (0) | A-6 (10) | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| Station (-L2-) | 19+23 | 37+83 | 48+28 | 56+88 | | | | | | | | | | | |
| Offset | 19' Lt. | 21' Rt. | 18' Rt. | 26' Lt. | | | | | | | | | | | |
| Depth (ft) | 9.8 | 114.0 | 133.0 | 28.5 | | | | | | | | | | | |
| to | 10.4 | 115.5 | 134.5 | 29.0 | | | | | | | | | | | |
| Moisture Content (%) | 60.1 | 28.9 | 30.8 | 26.8 | | | | | | | | | | | |
| Organic Content (%) | NT | NT | NT | NT | | | | | | | | | | | |
| Specific Gravity | NT | NT | NT | NT | | | | | | | | | | | |

NP=Not plastic
NT=Not tested
ND = Not Determined
CL = Centerline

W.P. Alton, PE
Soils Engineer

# LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES

**PROJECT NO.:** 40233.1.1
**TIP NO.:** B-4929
**COUNTY:** Pender
**DESCRIPTION:** Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach

| Sample # | Boring # | Alignment | Station | Offset | Depth (ft) | Rock Type | Geologic Map Unit | Run RQD | Length (in) | Diameter (in) | Unit Weight (pcf) | Unconfined Compressive Strength (psi) | Young's Modulus, E (ksf) | RMR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RS-1 | B15-B | -L2- | 37+83 | 21' Rt. | 73.9 - 74.2 | Limestone | Qp | 16% | 4.11 | 1.98 | 140.2 | 1,403 | 26,443 | 9 |
| RS-2 | B15-B | -L2- | 37+83 | 21' Rt. | 105.1 - 105.4 | Limestone | Qp | 20% | 4.02 | 1.97 | 150.4 | 2,717 | 92,974 | 10 |
| RS-3 | B15-B | -L2- | 37+83 | 21' Rt. | 109.9 - 110.2 | Limestone | Qp | 8% | 3.79 | 1.98 | 155.9 | 5,422 | 184,241 | 12 |
| RS-4 | B12-A | -L2- | 33+41 | 30' Lt. | 91.6 - 91.9 | Limestone | Qp | 10% | 4.40 | 1.99 | 137.4 | 1,472 | 66,916 | 10 |
| RS-5 | B17-A | -L2- | 40+77 | 28' Lt. | 83.0 - 83.3 | Limestone | Qp | 32% | 3.87 | 1.99 | 143.5 | 3,920 | 77,383 | 12 |
| RS-6 | B17-A | -L2- | 40+77 | 28' Lt. | 84.2 - 84.5 | Limestone | Qp | 32% | 4.34 | 2.00 | 158.6 | 8,292 | 170,955 | 15 |
| RS-7 | B3-B | -L2- | 22+05 | 21' Rt. | 92.1 - 92.4 | Limestone | QP | 17% | 3.95 | 2.00 | 136.8 | 1,667 | 30,708 | 10 |
| RS-8 | B3-B | -L2- | 22+05 | 21' Rt. | 97.5- 97.8 | Limestone | QP | 18% | 3.99 | 1.99 | 124.4 | 660 | 12,896 | 9 |
| RS-9 | B9-B | -L2- | 29+16 | 19' Rt. | 92.7 - 93.0 | Limestone | QP | 45% | 3.75 | 2.01 | 133.6 | 1,149 | 14,854 | 19 |
| RS-10 | B9-B | -L2- | 29+16 | 19' Rt. | 96.7 - 97.0 | Limestone | QP | 27% | 3.93 | 2.00 | 117.3 | 538 | 5,972 | 14 |
| RS-11 | B26-B | -L2- | 54+16 | 31' Rt. | 99.0 - 99.3 | Limestone | QP | 8% | 3.75 | 2.00 | 142.6 | 2,593 | 77,706 | 10 |

ND = Not Determined

*Note: Length to diameter ratio of sample RS-3 is 1.91, which is below the minimum requirement of 2.0.
*Note: Length to diameter ratio of sample RS-5 is 1.94, which is below the minimum requirement of 2.0.
*Note: Length to diameter ratio of sample RS-7 is 1.98, which is below the minimum requirement of 2.0.
*Note: Length to diameter ratio of sample RS-9 is 1.87, which is below the minimum requirement of 2.0.
*Note: Length to diameter ratio of sample RS-10 is 1.97, which is below the minimum requirement of 2.0.
*Note: Length to diameter ratio of sample RS-11 is 1.88, which is below the minimum requirement of 2.0.

| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|
| N.C. | B-4929 | 1 | 13 |

REFERENCE: B-4929

PROJECT: 40233

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

# STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *PENDER*

PROJECT DESCRIPTION *BRIDGE OVER INTRACOASTAL WATERWAY ON HIGHWAY NC 50/210 BETWEEN US 17 AND TOPSAIL BEACH*

SITE DESCRIPTION *RETAINING WALL 1 ON -L2- FROM FROM 18+37.17 TO 19+27.06, LEFT; RETAINING WALL 2 ON -L2- FROM 18+24.60 TO 19+27.06, RIGHT; RETAINING WALL 3 ON -L2- FROM 57+00.56 TO 57+36.29, LEFT; AND RETAINING WALL 4 ON -L2- FROM 57+00.56 TO 57+71.67, RIGHT*

## CONTENTS


| SHEET NO. | DESCRIPTION |
|---|---|
| 1 | TITLE SHEET |
| 2 | LEGEND |
| 3-4 | SITE PLAN |
| 5 | PROFILE(S) |
| 6-12 | BORE LOG(S) |
| 13 | SOIL TEST RESULTS |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PERSONNEL

*D. RACEY*

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*T. SHARPE*

INVESTIGATED BY *F&R, Inc.*

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CHECKED BY *P. ALTON*

SUBMITTED BY *P. ALTON*

DATE *FEBRUARY 2016*

NORTH CAROLINA PROFESSIONAL SEAL 033758 ENGINEER W. PATRICK ALTON

DocuSigned by:
W. Patrick Alton
A270EF78A6DF442...
SIGNATURE

3/18/2016
DATE

**DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED**

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| B-4929 | 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 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 THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR 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<br>A-3 | A-4, A-5<br>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,<br>A-7-6 | | | |
| SYMBOL | | | | | | | | | | | | | | |
| % PASSING<br>#10<br>#40<br>#200 | 50 MX<br>30 MX<br>15 MX | 50 MX<br>25 MX | 51 MN<br>10 MX | 35 MX | 35 MX | 35 MX | 35 MX | 36 MN | 36 MN | 36 MN | 36 MN | GRANULAR SOILS | SILT-CLAY SOILS | MUCK, PEAT |
| MATERIAL PASSING #40<br>LL<br>PI | —<br>6 MX | | —<br>NP | 40 MX<br>10 MX | 41 MN<br>10 MX | 40 MX<br>11 MN | 41 MN<br>11 MN | 40 MX<br>10 MX | 41 MN<br>10 MX | 40 MX<br>11 MN | 41 MN<br>11 MN | SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER | | HIGHLY ORGANIC SOILS |
| 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 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<br>LOOSE<br>MEDIUM DENSE<br>DENSE<br>VERY DENSE | < 4<br>4 TO 10<br>10 TO 30<br>30 TO 50<br>> 50 | N/A |
| GENERALLY SILT-CLAY MATERIAL (COHESIVE) | VERY SOFT<br>SOFT<br>MEDIUM STIFF<br>STIFF<br>VERY STIFF<br>HARD | < 2<br>2 TO 4<br>4 TO 8<br>8 TO 15<br>15 TO 30<br>> 30 | < 0.25<br>0.25 TO 0.5<br>0.5 TO 1.0<br>1 TO 2<br>2 TO 4<br>> 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 |
|---|---|---|---|---|---|---|---|
| | 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) | - WET - (W) | SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE |
| PL — PLASTIC LIMIT | | |
| OM — OPTIMUM MOISTURE | - MOIST - (M) | SOLID; AT OR NEAR OPTIMUM MOISTURE |
| SL — SHRINKAGE LIMIT | | |
| | - DRY - (D) | REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE |

## PLASTICITY

| | PLASTICITY INDEX (PI) | DRY STRENGTH |
|---|---|---|
| NON PLASTIC | 0-5 | VERY LOW |
| SLIGHTLY PLASTIC | 6-15 | SLIGHT |
| MODERATELY PLASTIC | 16-25 | MEDIUM |
| HIGHLY PLASTIC | 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.
UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES 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 WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.

## COMPRESSIBILITY

| | |
|---|---|
| SLIGHTLY COMPRESSIBLE | LL < 31 |
| MODERATELY COMPRESSIBLE | LL = 31 - 50 |
| HIGHLY COMPRESSIBLE | LL > 50 |

## PERCENTAGE OF MATERIAL

| ORGANIC MATERIAL | GRANULAR SOILS | SILT - CLAY SOILS | OTHER MATERIAL | |
|---|---|---|---|---|
| TRACE OF ORGANIC MATTER | 2 - 3% | 3 - 5% | TRACE | 1 - 10% |
| LITTLE ORGANIC MATTER | 3 - 5% | 5 - 12% | LITTLE | 10 - 20% |
| MODERATELY ORGANIC | 5 - 10% | 12 - 20% | SOME | 20 - 35% |
| HIGHLY ORGANIC | > 10% | > 20% | 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, CPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

## RECOMMENDATION SYMBOLS

- UNDERCUT
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

## 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
$\gamma$ - UNIT WEIGHT
$\gamma_d$ - 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:
- [ ] CME-45C
- [X] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [X] DRAG BIT

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [ ] -N _____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

## ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. 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 (CP) | 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, WOULD YIELD SPT N VALUES > 100 BPF* |
| VERY SEVERE (V SEV.) | ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD 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 FOOT |
| 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 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, SUCH 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: N/A

ELEVATION: N/A FEET

NOTES:

RETAINING WALL STATION, OFFSET, AND ELEVATIONS OBTAINED USING A SURVEY GRADE GPS UNIT

FIAD= FILLED IMMEDIATELY AFTER DRILLING

NM= NOT MEASURED

DATE: 8-15-14

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| B-4929 | 3 |

# SITE PLAN

NC HWY 50 & NC 210

SUTL

W

FSS

EIP

END PERMANENT
RETAINING WALL –RW1–
–RW1– STA. 20+23.36
(–L2– 18+37.17, 49.77' LT.)

BEGIN PERMANENT
RETAINING WALL –RW1–
–RW1– STA. 19+27.06
(–L2– 19+27.06, 37.13' LT.)

NC GRID
NAD 83 NA 2011

–RW1– STA. 19+99.93
(–L2– 18+55.03, 37.24' LT.)

RW1–3

–RW1–

RW1–2

EB1–A

23

19

20

18

–L2–

RW2–1

–RW2–

RW2–2

RW2–3

BEGIN BRIDGE
–L2– STA. 19+27.06

–RW2– STA. 18+65.01
(–L2– 18+65.01, 26.29' RT.)

END PERMANENT
RETAINING WALL –RW2–
–RW2– STA. 19+27.06
(–L2– 19+27.06, 26.29' RT.)

BEGIN PERMANENT
RETAINING WALL –RW2–
–RW2– STA. 18+27.04
(–L2– 18+24.60, 32.30' RT.)

PLAN

PROPOSED RETAINING WALL –RW1– L=96.30'

PROPOSED RETAINING WALL –RW2– L=100.02'

GRAPHIC SCALE
10 5 0 10 20
PLANS

REVISIONS

8/17/99

13-JAN-2016 09:10
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Walker A. Bagnall

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| B-4929 | 4 |

# SITE PLAN

PLAN

PROPOSED RETAINING WALL –RW3– L=45.37'

PROPOSED RETAINING WALL –RW4– L=86.34'

–RW3– STA. 56+87.82
(–L2– 57+13.30, 37.29' LT.)

END PERMANENT
RETAINING WALL –RW3–
–RW3– STA. 57+00.56
(–L2– 57+00.56, 37.13' LT.)

END BRIDGE
–L2– STA. 57+00.56

BEGIN PERMANENT
RETAINING WALL –RW3–
–RW3– STA. 56+55.19
(–L2– 57+36.29, 60.45' LT.)

NC GRID
NAD 83 NA 2011

RW3–1

RW3–2

–RW3–

SEA WALL

EXISTING R/W

S NEW RIVER RD

–L2–

56

57

58

–L1–

–RA2–

–SL2–

ROPE 11

TYPE–III

–RW4–

RW4–1

RW4–2

RW4–3

BEGIN PERMANENT
RETAINING WALL –RW4–
–RW4– STA. 57+00.56
(–L2– 57+00.56, 40.79' RT.)

–RW4– STA. 57+50.00
(–L2– 57+50.00, 40.79' RT.)

END PERMANENT
RETAINING WALL –RW4–
–RW4– STA. 57+86.90
(–L2– 57+71.67, 70.66' RT.)

8' BLK WALL

GRAPHIC SCALE
10 5 0 10 20
PLANS

REVISIONS

8/17/99

13-JAN-2016 09:09
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Walker, AT B6B1A0B3

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| B-4929 | 5 |
| ROADWAY DESIGN ENGINEER | HYDRAULICS ENGINEER |

**PRELIMINARY PLANS**
DO NOT USE FOR CONSTRUCTION

# –RW1–

EB1–A 19+31 15' LT | RW1–2 19+75 7' LT | RW1–3 20+16 3' RT

BEGIN GRADE –RW1– STA.19+27.06 EL=10.20' = –L2– STA.19+27.06

BEGIN –RW1– PROP BOTTOM OF WALL STA.19+27.06 EL=1.90'

END GRADE –RW1– STA.20+23.36 EL=3.92' = –L2– STA.18+37.17

SS-948 SS-950

PROP. GRADE

BOTTOM OF WALL

WATER SURFACE

LIGHT GRAY, FRIABLE LIMESTONE WITH SHELL FRAGMENTS (RIVER BEND FORMATION) –COASTAL PLAIN– SEDIMENTARY ROCK–

MEDIUM DENSE TO VERY DENSE, GRAY-BROWN, SATURATED, SILTY FINE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS (RIVER BEND FORMATION) –COASTAL PLAIN–

VERY DENSE, LIGHT GRAY, SATURATED, SILTY FINE TO COARSE SAND (A-2-4) WITH SOME CEMENTED SAND FRAGMENTS (RIVER BEND FORMATION) –COASTAL PLAIN–

Ⓐ VERY LOOSE, BLACK, SATURATED, MUCK –ALLUVIAL–

Ⓑ VERY LOOSE, BLACK, SATURATED, SILTY FINE SAND (A-2-4) WITH LITTLE ORGANICS (4.8%) –UNDIVIDED COASTAL PLAIN–

Ⓒ VERY LOOSE TO MEDIUM DENSE, DARK GRAY-BROWN, WET TO SATURATED, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS AND VERY LOOSE, SATURATED, DARK BROWN TO GRAY, CLAYEY FINE SAND (A-2-6) –UNDIVIDED COASTAL PLAIN–

Ⓓ VERY SOFT, GRAY, SATURATED, FINE TO COARSE SANDY CLAY (A-6) –UNDIVIDED COASTAL PLAIN–

Ⓔ VERY SOFT, DARK GRAY AND GRAY, SATURATED, SILTY CLAY WITH TRACE FINE SAND (A-7-6) –UNDIVIDED COASTAL PLAIN–

Ⓕ VERY LOOSE TO LOOSE, DARK GRAY, SATURATED, SILTY, FINE SAND (A-2-4) AND VERY LOOSE TO LOOSE, LIGHT GRAY-BROWN, SATURATED, FINE SAND (A-3) WITH TRACE ORGANICS –UNDIVIDED COASTAL PLAIN–

19+00 20+00

Ⓖ VERY LOOSE TO LOOSE, BROWN AND BLACK, MOIST TO WET, FINE SAND (A-3) WITH TRACE ORGANICS AND WOOD FRAGMENTS AND VERY LOOSE TO MEDIUM DENSE, GRAY TO BLACK-BROWN, WET TO SATURATED, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE ORGANICS AND VERY LOOSE, GRAY, SATURATED, CLAYEY FINE SAND (A-2-6) –UNDIVIDED COASTAL PLAIN–

Ⓗ VERY SOFT, DARK GRAY AND GRAY-BROWN, SATURATED, SILTY CLAY (A-7-6) WITH TRACE ORGANICS AND VERY SOFT, DARK GRAY, SATURATED, CLAYEY SILT (A-5) WITH LITTLE ORGANICS AND TRACE FINE SAND –UNDIVIDED COASTAL PLAIN–

# –RW2–

RW2–1 18+31 ℄ | RW2–2 18+83 2' RT | RW2–3 19+29 1' LT

BEGIN GRADE –RW2– STA.18+27.04 EL=5.62' = –L2– STA.18+24.60

END GRADE –RW2– STA.19+27.06 EL=10.45' = –L2– STA.19+27.06

PROP GRADE

BOTTOM OF WALL

END –RW2– PROP BOTTOM OF WALL STA.19+27.06 EL=2.71'

VERY LOOSE TO MEDIUM DENSE, GRAY, BROWN, AND BLACK, SATURATED, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE ORGANICS AND CEMENTED SAND –UNDIVIDED COASTAL PLAIN–

18+00 19+00

# –RW3–

RW3–1 56+58 1' LT | RW3–2 57+00 2' RT

BEGIN GRADE –RW3– STA.56+55.19 EL=3.75' = –L2– STA.57+36.29

SS-919

END GRADE –RW3– STA.57+00.56 EL=12.50' = –L2– STA.57+00.56

PROP GRADE

BOTTOM OF WALL

END –RW3– PROP BOTTOM OF WALL STA.57+00.56 EL=3.99'

VERY LOOSE TO DENSE, GRAY, FINE TO COARSE SAND AND SHELL FRAGMENTS AND MEDIUM DENSE, GRAY, SATURATED, WET TO SATURATED, (A-3) WITH TRACE ORGANICS AND WET, SILTY FINE SHELL FRAGMENTS SILTY FINE TO COARSE SAND AND SHELL FRAGMENTS (A-1-b) –UNDIVIDED COASTAL PLAIN–

Ⓘ GRAVEL (A-1-a) AND VERY LOOSE TO LOOSE, BROWN TO GRAY, MOIST, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS AND VERY LOOSE, BROWN, SATURATED, SILTY FINE SAND (A-2-4) MODERATELY ORGANIC (7.5%) –ARTIFICIAL FILL–

56+00 57+00

# –RW4–

RW4–1 57+18 2' LT | RW4–2 57+48 ℄ | RW4–3 57+86 1' RT

BEGIN GRADE –RW4– STA.57+00.56 EL=12.46' = –L2– STA.57+00.56

END GRADE –RW4– STA.57+86.90 EL=4.50' = –L2– STA.57+71.67

PROP GRADE

BOTTOM OF WALL

BEGIN GRADE –RW4– PROP BOTTOM OF WALL STA.57+00.56 EL=4.05'

LOOSE TO MEDIUM DENSE, GRAY, WET TO SATURATED, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS AND ORGANICS AND LOOSE TO MEDIUM DENSE, LIGHT GRAY, SATURATED, FINE TO COARSE SAND (A-3) WITH TRACE SHELL FRAGMENTS AND LOOSE TO MEDIUM DENSE, GRAY, SATURATED, SILTY FINE TO COARSE SAND AND SHELL FRAGMENTS (A-1-b) –UNDIVIDED COASTAL PLAIN–

Ⓙ VERY LOOSE TO LOOSE, GRAY, BLACK AND BROWN, MOIST TO WET, SILTY, FINE TO COARSE SAND (A-2-4) WITH TRACE ORGANICS (WOOD FRAGMENTS) AND SHELL FRAGMENTS –ARTIFICIAL FILL–

57+00 58+00

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** D. Racey | |
| **SITE DESCRIPTION** Bridge over Intracoastal Waterway on NC 50/210 - Retaining Wall 1 | | | | **GROUND WTR (ft)** |
| **BORING NO.** EB1-A | **STATION** 19+31 | **OFFSET** 15 ft LT | **ALIGNMENT** -RW1- | **0 HR.** N/M |
| **COLLAR ELEV.** 1.5 ft | **TOTAL DEPTH** 110.0 ft | **NORTHING** 252,215 | **EASTING** 2,436,409 | **24 HR.** N/M |
| **DRILL RIG/HAMMER EFF./DATE** F&R3495 CME-55 73% 02/15/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** D. Tignor | **START DATE** 10/26/15 | **COMP. DATE** 10/28/15 | **SURFACE WATER DEPTH** 0.9ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| | 1.5 | 0.0 | | | | | | | | GROUND SURFACE 0.0 |
| 0 | | | WOH | WOH | 2 | 2 | | Sat. | | 1.5 **ALLUVIAL** 0.9<br>BLACK, MUCK |
| | -2.0 | 3.5 | 5 | 5 | 4 | 9 | | Sat. | | **UNDIVIDED COASTAL PLAIN**<br>DARK GRAY-BROWN, SILTY FINE SAND<br>(A-2-4) WITH TRACE ORGANICS |
| -5 | | | | | | | | | | |
| | -7.0 | 8.5 | WOH | WOH | 1 | 1 | | Sat. | | -7.0 8.5<br>DARK GRAY, SILTY CLAY (A-7-6) WITH<br>TRACE FINE SAND |
| -10 | | | | | | | | | | -9.0 10.5<br>DARK GRAY, SILTY FINE SAND (A-2-4) |
| | -12.0 | 13.5 | 1 | 1 | 1 | 2 | | Sat. | | |
| -15 | | | | | | | | | | |
| | -17.0 | 18.5 | 7 | 18 | 14 | 32 | | Sat. | | -16.5 18.0<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, FRIABLE LIMESTONE WITH<br>SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -20 | | | | | | | | | | |
| | -22.0 | 23.5 | 13 | 17 | 13 | 30 | | Sat. | | |
| -25 | | | | | | | | | | |
| | -27.0 | 28.5 | 14 | 14 | 21 | 35 | | Sat. | | |
| -30 | | | | | | | | | | |
| | -32.0 | 33.5 | 11 | 15 | 21 | 36 | | Sat. | | |
| -35 | | | | | | | | | | |
| | -37.0 | 38.5 | 4 | 7 | 10 | 17 | | Sat. | | -36.5 38.0<br>**COASTAL PLAIN**<br>GRAY-BROWN, SILTY FINE SAND (A-2-4)<br>WITH TRACE SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -40 | | | | | | | | | | |
| | -42.0 | 43.5 | 29 | 31 | 41 | 72 | | Sat. | | |
| -45 | | | | | | | | | | |
| | -47.0 | 48.5 | 17 | 25 | 29 | 54 | | Sat. | | |
| -50 | | | | | | | | | | |
| | -52.0 | 53.5 | 27 | 19 | 14 | 33 | | Sat. | | -HARD DRILLING NOTED FROM 51.0'-51.3' |
| -55 | | | | | | | | | | |
| | -57.0 | 58.5 | 7 | 18 | 30 | 48 | | Sat. | | |
| -60 | | | | | | | | | | |
| | -62.0 | 63.5 | 7 | 6 | 9 | 15 | | Sat. | | |
| -65 | | | | | | | | | | |
| | -67.0 | 68.5 | 8 | 24 | 33 | 57 | | Sat. | | |
| -70 | | | | | | | | | | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| -70 | | | | | | Match Line | | | | |
| | -72.0 | 73.5 | 23 | 28 | 34 | 62 | | Sat. | | **COASTAL PLAIN**<br>GRAY-BROWN, SILTY FINE SAND (A-2-4)<br>WITH TRACE SHELL FRAGMENTS<br>(RIVER BEND FORMATION) |
| -75 | | | | | | | | | | |
| | -77.0 | 78.5 | 5 | 6 | 9 | 15 | | Sat. | | |
| -80 | | | | | | | | | | |
| | -82.0 | 83.5 | 4 | 4 | 9 | 13 | | Sat. | | |
| -85 | | | | | | | | | | |
| | -87.0 | 88.5 | 100/0.3 | | | 100/0.3 | | | | -HARD DRILLING NOTED FROM 51.0'-51.3'<br>*(continued)* |
| -90 | | | | | | | | | | -86.6 88.1<br>**COASTAL PLAIN SEDIMENTARY ROCK**<br>LIGHT GRAY, MODERATELY INDURATED<br>TO FRIABLE LIMESTONE<br>(RIVER BEND FORMATION) |
| | -92.0 | 93.5 | 32 | 100/0.5 | | 100/0.5 | | | | |
| -95 | | | | | | | | | | -SOFT DRILLING NOTED FROM 91.5'-94.0' |
| | -97.0 | 98.5 | 60/0.1 | | | 60/0.1 | | | | -SOFT DRILLING NOTED FROM 96.5'-98.5' |
| -100 | | | | | | | | | | -SOFT DRILLING NOTED FROM<br>100.0'-101.7' AND FROM 102.5'-104.0' |
| | -102.0 | 103.5 | 35 | 100/0.2 | | 100/0.2 | | | | |
| -105 | | | | | | | | | | |
| | -107.0 | 108.5 | 26 | 24 | 29 | 53 | | Sat. | | -106.0 107.5<br>**COASTAL PLAIN**<br>LIGHT GRAY, SILTY FINE TO COARSE<br>SAND (A-2-4) WITH SOME CEMENTED<br>SAND FRAGMENTS<br>(RIVER BEND FORMATION)<br>-108.5 110.0<br>Boring Terminated at Elevation -108.5 ft in<br>SAND (RIVER BEND FORMATION)<br><br>TUBES OBTAINED IN OFFSET HOLE<br>-RW1- 19+31, 18' LT:<br>ST-1 7.0'-9.0'<br>ST-2 9.0'-11.0' |

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. Ellis | |
| **SITE DESCRIPTION** Bridge over Intracoastal Waterway on NC 50/210 - Retaining Wall 1 | | | | **GROUND WTR (ft)** |
| **BORING NO.** RW1-2 | **STATION** 19+75 | **OFFSET** 7 ft LT | **ALIGNMENT** -RW1- | **0 HR.** 1.2 |
| **COLLAR ELEV.** 2.7 ft | **TOTAL DEPTH** 15.0 ft | **NORTHING** 252,260 | **EASTING** 2,436,412 | **24 HR.** 0.8 |
| **DRILL RIG/HAMMER EFF./DATE** F&R3495 CME-55 73% 02/15/2015 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Automatic | |
| **DRILLER** D. Tignor | **START DATE** 12/10/15 | **COMP. DATE** 12/10/15 | **SURFACE WATER DEPTH** N/A | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | | |
| | 2.7 | 0.0 | WOH | WOH | 1 | 1 | | | | 2.7 GROUND SURFACE | 0.0 |
| | 0.7 | 2.0 | 6 | 5 | 5 | 10 | SS-948 | 38% W | | **UNDIVIDED COASTAL PLAIN** Black, silty fine SAND (A-2-4) with little organics (4.8%) 0.7 | 2.0 |
| 0 | -0.8 | 3.5 | 2 | 3 | 4 | 7 | | Sat. | | Dark brown, silty fine SAND (A-2-4) with trace organics -2.8 | 5.5 |
| | -3.3 | 6.0 | WOH | WOH | WOH | 0 | SS-950 | 22% | | Gray, fine to coarse sandy CLAY (A-6) | |
| -5 | -5.8 | 8.5 | 2 | 1 | 1 | 2 | | Sat. | | -6.5 | 9.2 |
| | -8.3 | 11.0 | 2 | 2 | 2 | 4 | | Sat. | | Gray, silty fine SAND (A-2-4). -8.3 Gray, silty CLAY (A-7-6). -8.6 | 11.0 11.3 |
| -10 | -10.8 | 13.5 | WOH | 1 | WOH | 1 | | Sat. | | Dark gray, silty fine SAND (A-2-4). -12.3 | 15.0 |

Boring Terminated at Elevation -12.3 ft in SAND (UNDIVIDED COASTAL PLAIN)

NOTES:

1) 0.0-0.5'=Surficial Organic Soils

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. Ellis | |
| **SITE DESCRIPTION** Bridge over Intracoastal Waterway on NC 50/210 - Retaining Wall 1 | | | | **GROUND WTR (ft)** |
| **BORING NO.** RW1-3 | **STATION** 20+16 | **OFFSET** 3 ft RT | **ALIGNMENT** -RW1- | **0 HR.** 1.1 |
| **COLLAR ELEV.** 3.2 ft | **TOTAL DEPTH** 15.0 ft | **NORTHING** 252,299 | **EASTING** 2,436,426 | **24 HR.** 0.8 |
| **DRILL RIG/HAMMER EFF./DATE** F&R3495 CME-55 73% 02/15/2015 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Automatic | |
| **DRILLER** D. Tignor | **START DATE** 12/10/15 | **COMP. DATE** 12/10/15 | **SURFACE WATER DEPTH** N/A | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | |
| | 3.2 | 0.0 | WOH | 1 | 1 | 2 | | | | 3.2 GROUND SURFACE 0.0 |
| | 1.2 | 2.0 | 3 | 2 | 3 | 5 | | W | | **UNDIVIDED COASTAL PLAIN** Black-gray-brown, silty fine SAND (A-2-4), with trace organic matter & clay. |
| 0 | -0.3 | 3.5 | 3 | 4 | 6 | 10 | | Sat. | | |
| | -2.8 | 6.0 | WOH | WOH | 1 | 1 | | Sat. | | -4.8 8.0 |
| -5 | -5.3 | 8.5 | 2 | WOH | WOH | 0 | | Sat. | | -6.1 Dark brown to gray, clayey fine SAND (A-2-6). 9.3 |
| | -7.8 | 11.0 | 3 | 4 | 5 | 9 | | Sat. | | -7.3 Gray, silty CLAY (A-7-6). 10.5 Light gray-brown, fine SAND (A-3), with trace organics. |
| -10 | -10.3 | 13.5 | 2 | 2 | 2 | 4 | | Sat. | | -11.8 15.0 |

Boring Terminated at Elevation -11.8 ft in SAND (UNDIVIDED COASTAL PLAIN)

# GEOTECHNICAL BORING REPORT
# BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** M. Ellis | |
| **SITE DESCRIPTION** Bridge over Intracoastal Waterway on NC 50/210 - Retaining Wall 2 | | | | **GROUND WTR (ft)** |
| **BORING NO.** RW2-1 | **STATION** 18+31 | **OFFSET** CL | **ALIGNMENT** -RW2- | **0 HR.** 3.3 |
| **COLLAR ELEV.** 5.7 ft | **TOTAL DEPTH** 20.0 ft | **NORTHING** 252,301 | **EASTING** 2,436,345 | **24 HR.** 3.0 |
| **DRILL RIG/HAMMER EFF./DATE** F&R3495 CME-55 73% 02/15/2015 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Automatic | |
| **DRILLER** D. Tignor | **START DATE** 12/10/15 | **COMP. DATE** 12/10/15 | **SURFACE WATER DEPTH** N/A | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 | | | | | | | | | | |
| 5 | 5.7 | 0.0 | 1 | 1 | 3 | 4 8 | | M | | 5.7 GROUND SURFACE 0.0<br>**UNDIVIDED COASTAL PLAIN** |
| | 3.7 | 2.0 | 3 | 3 | 5 | | | W | | 4.2 Brown, fine SAND (A-3), with trace organics. 1.5 |
| | 2.2 | 3.5 | 4 | 3 | 2 | 5 | | W | | Gray-black to brown, silty fine SAND (A-2-4), with trace organics & clay. |
| 0 | -0.3 | 6.0 | 2 | 2 | 4 | 6 | | Sat. | | |
| | -2.8 | 8.5 | 4 | 6 | 5 | 11 | | Sat. | | -4.8 Dark gray, silty CLAY (A-7-6), with trace fine sand & organics. 10.5 |
| -5 | -5.3 | 11.0 | WOH | WOH | WOH | 0 | | Sat. | | |
| | -7.8 | 13.5 | WOH | WOH | 1 | 1 | | Sat. | | -9.8 15.5 |
| | -10.3 | 16.0 | 3 | WOH | 1 | 1 | | Sat. | | -10.7 Dark gray, clayey SILT (A-5), with little organics, trace fine sand. 16.4 |
| -10 | -12.8 | 18.5 | 1 | 1 | 1 | 2 | | Sat. | | Gray, silty fine SAND (A-2-4), with trace organics. |
| | | | | | | | | | | -14.3 20.0 |
| | | | | | | | | | | Boring Terminated at Elevation -14.3 ft in SAND (UNDIVIDED COASTAL PLAIN) |

NOTES:

1) 0.0-0.2'=Surficial Organic Soils

TUBES OBTAINED IN OFFSET HOLE
18+30, 3' RT:
ST-1a 7.0'-9.0'
ST-2a 9.0'-11.0'

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. Wang | |
| **SITE DESCRIPTION** Bridge over Intracoastal Waterway on NC 50/210 - Retaining Wall 2 | | | | **GROUND WTR (ft)** |
| **BORING NO.** RW2-2 | **STATION** 18+83 | **OFFSET** 2 ft RT | **ALIGNMENT** -RW2- | **0 HR.** 0.8 |
| **COLLAR ELEV.** 2.5 ft | **TOTAL DEPTH** 15.0 ft | **NORTHING** 252,250 | **EASTING** 2,436,355 | **24 HR.** 0.5 |
| **DRILL RIG/HAMMER EFF./DATE** F&R3495 CME-55 73% 02/15/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** D. Tignor | **START DATE** 12/09/15 | **COMP. DATE** 12/09/15 | **SURFACE WATER DEPTH** N/A | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | |
| | 2.5 | 0.0 | WOH | 1 | 1 | 2 | | W | | 2.5 GROUND SURFACE 0.0 |
| 0 | 0.5 | 2.0 | 3 | 3 | 2 | 5 | | Sat. | | **UNDIVIDED COASTAL PLAIN**<br>Gray to brown, silty fine to coarse SAND (A-2-4), with trace organics. |
| | -1.0 | 3.5 | 3 | 2 | 3 | 5 | | Sat. | | |
| -5 | -3.5 | 6.0 | 1 | 2 | WOH | 2 | | Sat. | | -4.5 7.0 |
| | -6.0 | 8.5 | 1 | 1 | 0 | 1 | | Sat. | | -6.0 Gray, clayey fine SAND (A-2-6). 8.5 |
| -10 | -8.5 | 11.0 | WOH | WOH | 1 | 1 | | Sat. | | Gray-brown, silty fine to coarse SAND (A-2-4). |
| | -11.0 | 13.5 | 1 | 1 | WOH | 1 | | Sat. | | -8.5 11.0 |
| | | | | | | | | | | Gray-brown, fine sandy silty CLAY (A-7-5), interlayered with silty fine sand. |
| | | | | | | | | | | -11.0 13.5 |
| | | | | | | | | | | -12.5 Brown, clayey silty fine to coarse SAND (A-2-4). 15.0 |
| | | | | | | | | | | Boring Terminated at Elevation -12.5 ft in SAND (UNDIVIDED COASTAL PLAIN) |

NOTES:

1) 0.0-0.5'=Surficial Organic Soils

| | | | |
|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. Wang |
| **SITE DESCRIPTION** Bridge over Intracoastal Waterway on NC 50/210 - Retaining Wall 2 | | | **GROUND WTR (ft)** |
| **BORING NO.** RW2-3 | **STATION** 19+29 | **OFFSET** 1 ft LT | **ALIGNMENT** -RW2- | **0 HR.** 0.9 |
| **COLLAR ELEV.** 1.8 ft | **TOTAL DEPTH** 20.0 ft | **NORTHING** 252,205 | **EASTING** 2,436,362 | **24 HR.** 0.5 |
| **DRILL RIG/HAMMER EFF./DATE** F&R3495 CME-55 73% 02/15/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic |
| **DRILLER** D. Tignor | **START DATE** 12/09/15 | **COMP. DATE** 12/09/15 | **SURFACE WATER DEPTH** N/A |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.8 | 0.0 | | | | | | | | 1.8 GROUND SURFACE 0.0 |
| 0 | -0.2 | 2.0 | 2 | 1 | 1 | 2 | | W | | **UNDIVIDED COASTAL PLAIN** |
| | -1.7 | 3.5 | 5 | 2 | 3 | 5 | | W | | -0.2 Black, fine SAND (A-3), with trace organics (wood fragments). 2.0 |
| -5 | -4.2 | 6.0 | 2 | WOH | 1 | 1 | | Sat. | | Black, silty fine SAND (A-2-4), with trace organics. |
| | -6.7 | 8.5 | WOH | WOH | 1 | 1 | | Sat. | | -4.2 Gray, silty CLAY (A-7-6). 6.0 |
| | -9.2 | 11.0 | WOH | WOH | 1 | 1 | | Sat. | | -7.2 9.0 |
| -10 | -11.7 | 13.5 | 1 | WOH | 1 | 1 | | Sat. | | Gray and black, silty fine to coarse SAND (A-2-4), with trace organics and trace cemented sand from 18.5'-20.0'. |
| | -14.2 | 16.0 | WOH | 1 | 1 | 2 | | Sat. | | |
| -15 | -16.7 | 18.5 | 2 | 4 | 6 | 10 | | Sat. | | |
| | | | 2 | 5 | 11 | 16 | | Sat. | | -18.2 20.0 |
| | | | | | | | | | | Boring Terminated at Elevation -18.2 ft in SAND (UNDIVIDED COASTAL PLAIN) |

NOTES:

1) 0.0-0.5'=Surficial Organic Soils

# GEOTECHNICAL BORING REPORT
## BORE LOG

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. Wang | |
| **SITE DESCRIPTION** Bridge over Intracoastal Waterway on NC 50/210 - Retaining Wall 3 | | | | **GROUND WTR (ft)** |
| **BORING NO.** RW3-1 | **STATION** 56+58 | **OFFSET** 1 ft LT | **ALIGNMENT** -RW3- | **0 HR.** N/A |
| **COLLAR ELEV.** 3.6 ft | **TOTAL DEPTH** 15.0 ft | **NORTHING** 249,430 | **EASTING** 2,438,196 | **24 HR.** FIAD |
| **DRILL RIG/HAMMER EFF./DATE** F&R3495 CME-55 73% 02/15/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** D. Tignor | **START DATE** 12/08/15 | **COMP. DATE** 12/08/15 | **SURFACE WATER DEPTH** N/A | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION<br>ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | | |
| | 3.6 | 0.0 | 3 | 5 | 5 | 10 | | M | | 3.6 GROUND SURFACE | 0.0 |
| | 1.6 | 2.0 | 6 | 4 | 1 | 5 | | M | | 2.6 **ARTIFICIAL FILL**<br>GRAVEL (A-1-a) | 1.0 |
| 0 | 0.1 | 3.5 | 1 | 2 | 4 | 6 | | W | | 0.1 Brown to gray, silty fine SAND (A-2-4). | 3.5 |
| | -2.4 | 6.0 | 6 | 6 | 5 | 11 | | W | | **UNDIVIDED COASTAL PLAIN**<br>Gray, fine to coarse SAND (A-3), with trace shell fragments & organics. | |
| -5 | -4.9 | 8.5 | 4 | 4 | 2 | 6 | | Sat. | | | |
| | -7.4 | 11.0 | 11 | 15 | 17 | 32 | | Sat. | | | |
| -10 | -9.9 | 13.5 | 7 | 7 | 9 | 16 | | Sat. | | -11.4 Boring Terminated at Elevation -11.4 ft in SAND (UNDIVIDED COASTAL PLAIN) | 15.0 |

| | | | | |
|---|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. Wang | |
| **SITE DESCRIPTION** Bridge over Intracoastal Waterway on NC 50/210 - Retaining Wall 3 | | | | **GROUND WTR (ft)** |
| **BORING NO.** RW3-2 | **STATION** 57+00 | **OFFSET** 2 ft RT | **ALIGNMENT** -RW3- | **0 HR.** 0.5 |
| **COLLAR ELEV.** 3.4 ft | **TOTAL DEPTH** 20.0 ft | **NORTHING** 249,420 | **EASTING** 2,438,158 | **24 HR.** 0.2 |
| **DRILL RIG/HAMMER EFF./DATE** F&R3495 CME-55 73% 02/15/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic | |
| **DRILLER** D. Tignor | **START DATE** 12/08/15 | **COMP. DATE** 12/08/15 | **SURFACE WATER DEPTH** N/A | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | |
| | 3.4 | 0.0 | WOH | 1 | 1 | 2 | | M | | 3.4 GROUND SURFACE 0.0 |
| | 1.4 | 2.0 | 3 | WOH | 1 | 1 | | M | | **ARTIFICIAL FILL**<br>Brown, silty fine SAND (A-2-4), with trace organics. 2.0 |
| 0 | -0.1 | 3.5 | 1 | 1 | 4 | 5 | SS-919 | 77% | | -0.1 Brown, silty fine SAND (A-2-4), moderately organic (7.5%) 3.5 |
| | -2.6 | 6.0 | 4 | 5 | 6 | 11 | | W | | -2.6 **UNDIVIDED COASTAL PLAIN** 6.0 |
| -5 | -5.1 | 8.5 | 2 | 2 | 1 | 3 | | Sat. | | -4.6 Gray, fine to coarse SAND (A-3), with trace shell fragments & organics. 8.0 |
| | -7.6 | 11.0 | 10 | 17 | 13 | 30 | | Sat. | | Gray, silty fine to coarse SAND (A-2-4), with trace shell fragments. |
| -10 | -10.1 | 13.5 | 6 | 6 | 8 | 14 | | Sat. | | Gray, fine to coarse SAND (A-3), with trace to little shell fragments. |
| | -12.6 | 16.0 | 5 | 5 | 6 | 11 | | Sat. | | -12.6 16.0 |
| -15 | -15.1 | 18.5 | 5 | 10 | 12 | 22 | | Sat. | | Gray, silty fine to coarse SAND and shell fragments (A-1-b). |
| | | | | | | | | | | -16.6 20.0 |
| | | | | | | | | | | Boring Terminated at Elevation -16.6 ft in SAND (UNDIVIDED COASTAL PLAIN) |

# GEOTECHNICAL BORING REPORT
# BORE LOG

**WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. Wang

**SITE DESCRIPTION** Bridge over Intracoastal Waterway on NC 50/210 - Retaining Wall 4 | **GROUND WTR (ft)**

**BORING NO.** RW4-1 | **STATION** 57+18 | **OFFSET** 2 ft LT | **ALIGNMENT** -RW4- | **0 HR.** 0.5

**COLLAR ELEV.** 3.8 ft | **TOTAL DEPTH** 20.0 ft | **NORTHING** 249,341 | **EASTING** 2,438,155 | **24 HR.** 0.3

**DRILL RIG/HAMMER EFF./DATE** F&R3495 CME-55 73% 02/15/2015 | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic

**DRILLER** D. Tignor | **START DATE** 12/08/15 | **COMP. DATE** 12/08/15 | **SURFACE WATER DEPTH** N/A

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | GROUND SURFACE | 3.8 | 0.0 |
| | 1.8 | 2.0 | 1 | 2 | 5 | 7 | | M | | **ARTIFICIAL FILL**<br>Gray-black, silty fine SAND (A-2-4), with trace organics (wood fragments). | -0.2 | 4.0 |
| 0 | 0.3 | 3.5 | 2 | 2 | 1 | 3 | | M | | **UNDIVIDED COASTAL PLAIN**<br>Gray, silty fine to coarse SAND (A-2-4), with trace shell fragments & organics. | -2.2 | 6.0 |
| | -2.2 | 6.0 | 1 | 2 | 4 | 6 | | Sat. | | Light gray, fine to coarse SAND (A-3), with trace shell fragments. | -4.7 | 8.5 |
| -5 | -4.7 | 8.5 | 3 | 8 | 7 | 15 | | Sat. | | Gray, silty fine to coarse SAND (A-2-4), with trace shell fragments. | -9.2 | 13.0 |
| | -7.2 | 11.0 | 4 | 5 | 5 | 10 | | Sat. | | Gray, silty fine to coarse SAND and shell fragments (A-1-b). | -16.2 | 20.0 |
| -10 | -9.7 | 13.5 | 4 | 7 | 10 | 17 | | Sat. | | Boring Terminated at Elevation -16.2 ft in SAND (UNDIVIDED COASTAL PLAIN) | | |
| | -12.2 | 16.0 | 6 | 5 | 4 | 9 | | Sat. | | | | |
| -15 | -14.7 | 18.5 | 6 | 8 | 8 | 16 | | Sat. | | | | |
| | | | 6 | 9 | 9 | 18 | | Sat. | | | | |

**WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. Wang

**SITE DESCRIPTION** Bridge over Intracoastal Waterway on NC 50/210 - Retaining Wall 4 | **GROUND WTR (ft)**

**BORING NO.** RW4-2 | **STATION** 57+48 | **OFFSET** CL | **ALIGNMENT** -RW4- | **0 HR.** 0.8

**COLLAR ELEV.** 3.9 ft | **TOTAL DEPTH** 15.0 ft | **NORTHING** 249,331 | **EASTING** 2,438,184 | **24 HR.** 0.3

**DRILL RIG/HAMMER EFF./DATE** F&R3495 CME-55 73% 02/15/2015 | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic

**DRILLER** D. Tignor | **START DATE** 12/08/15 | **COMP. DATE** 12/08/15 | **SURFACE WATER DEPTH** N/A

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | GROUND SURFACE | 3.9 | 0.0 |
| | 1.9 | 2.0 | 1 | 1 | 1 | 2 | | M | | **ARTIFICIAL FILL**<br>Dark brown to black, silty fine SAND (A-2-4), with trace organics (wood fragments). | 0.4 | 3.5 |
| 0 | 0.4 | 3.5 | 3 | 2 | 2 | 4 | | M | | **UNDIVIDED COASTAL PLAIN**<br>Dark gray, silty fine SAND (A-2-4), with trace organics & shell fragments. | -2.1 | 6.0 |
| | -2.1 | 6.0 | 2 | 2 | 3 | 5 | | W | | Light gray, fine to coarse SAND (A-3), with trace shell fragments. | -7.1 | 11.0 |
| -5 | -4.6 | 8.5 | 5 | 8 | 7 | 15 | | Sat. | | Gray, silty fine to coarse SAND (A-2-4), with trace shell fragments. | -9.1 | 13.0 |
| | -7.1 | 11.0 | 4 | 4 | 7 | 11 | | Sat. | | Gray, silty fine to coarse SAND and shell fragments (A-1-b). | -11.1 | 15.0 |
| -10 | -9.6 | 13.5 | 4 | 8 | 10 | 18 | | Sat. | | Boring Terminated at Elevation -11.1 ft in SAND (UNDIVIDED COASTAL PLAIN) | | |
| | | | 4 | 6 | 4 | 10 | | Sat. | | | | |

| | | | |
|---|---|---|---|
| **WBS** 40233.1.1 | **TIP** B-4929 | **COUNTY** PENDER | **GEOLOGIST** C. Wang |
| **SITE DESCRIPTION** Bridge over Intracoastal Waterway on NC 50/210 - Retaining Wall 4 | | | **GROUND WTR (ft)** |
| **BORING NO.** RW4-3 | **STATION** 57+86 | **OFFSET** 1 ft RT | **ALIGNMENT** -RW4- | **0 HR.** 0.8 |
| **COLLAR ELEV.** 4.1 ft | **TOTAL DEPTH** 15.0 ft | **NORTHING** 249,297 | **EASTING** 2,438,198 | **24 HR.** 0.3 |
| **DRILL RIG/HAMMER EFF./DATE** F&R3495 CME-55 73% 02/15/2015 | | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic |
| **DRILLER** D. Tignor | **START DATE** 12/08/15 | **COMP. DATE** 12/08/15 | **SURFACE WATER DEPTH** N/A |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | |
| | 4.1 | 0.0 | 1 | 2 | 1 | 3 | | M | | 4.1 GROUND SURFACE 0.0 |
| | 2.1 | 2.0 | 2 | 3 | 3 | 6 | | W | | **ARTIFICIAL FILL** Dark brown to gray, silty fine to coarse SAND (A-2-4), with trace organics & shell fragments. 1.1 — 3.0 |
| 0 | 0.6 | 3.5 | 1 | 2 | 3 | 5 | | W | | **UNDIVIDED COASTAL PLAIN** Gray, silty fine to coarse SAND (A-2-4), with trace shell fragments & organics. -1.9 — 6.0 |
| | -1.9 | 6.0 | 3 | 8 | 6 | 14 | | Sat. | | Light gray, fine to coarse SAND (A-3), with trace shell fragments. |
| -5 | -4.4 | 8.5 | 3 | 3 | 5 | 8 | | Sat. | | Gray, silty fine SAND (A-2-4), with trace shell fragments. -6.9 — 11.0 |
| | -6.9 | 11.0 | 2 | 1 | 6 | 7 | | Sat. | | Gray, silty fine to coarse SAND and shell fragments (A-1-b). -8.9 — 13.0 |
| -10 | -9.4 | 13.5 | 3 | 8 | 10 | 18 | | Sat. | | Boring Terminated at Elevation -10.9 ft in SAND (UNDIVIDED COASTAL PLAIN) -10.9 — 15.0 |

**North Carolina Department of Transportation**
**Division of Highways**
**Materials and Test Unit**
**Soils Laboratory**

T.I.P. ID NO.: B-4929
DESCRIPTION: Bridge over Intracoastal Waterway on NC 50/210 between US 17 and Topsail Beach
Retaining Walls 1 through 4

REPORT ON SAMPLES OF: SOIL FOR QUALITY

PROJECT: 40233.1.1
DATE SAMPLED: 12/15
SAMPLED FROM: -L2-
SUBMITTED BY: P. Alton, PE

COUNTY: Pender
RECEIVED: 12/15
REPORTED: 1/16
BY: M. Grabski
53698

**TEST RESULTS**

| PROJ. SAMPLE NO. | ST-2 | SS-948 | SS-950 | SS-919 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BORING NO. | EB1-A | RW1-2 | RW1-2 | RW3-2 | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Retained #4 Sieve % | 0.0 | NT | 0.0 | NT | | | | | | | | | | |
| Passing #10 Sieve % | 100.0 | NT | 100.0 | NT | | | | | | | | | | |
| Passing #40 Sieve % | 100.0 | NT | 93.3 | NT | | | | | | | | | | |
| Passing #200 Sieve % | 92.3 | NT | 38.6 | NT | | | | | | | | | | |
| SOIL MORTAR - 100% | | | | | | | | | | | | | | |
| Coarse Sand Ret - #60 % | 0.2 | NT | 22.2 | NT | | | | | | | | | | |
| Fine Sand Ret - #270 % | 8.4 | NT | 42.2 | NT | | | | | | | | | | |
| Silt 0.053 - 0.010 mm % | 30.7 | NT | 12.1 | NT | | | | | | | | | | |
| Clay < 0.010 mm % | 60.7 | NT | 23.5 | NT | | | | | | | | | | |
| L.L. | 53 | NT | 29 | NT | | | | | | | | | | |
| P.L. | 28 | NT | 15 | NT | | | | | | | | | | |
| P.I. | 25 | NT | 14 | NT | | | | | | | | | | |
| AASHTO Classification | A-7-6 (26) | ND | A-6 (2) | ND | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Station | -RW1- 19+31 | -RW1- 19+75 | -RW1- 19+75 | -RW3- 57+00 | | | | | | | | | | |
| Offset | 18' Lt. | 7' Lt. | 7' Lt. | 2' Rt. | | | | | | | | | | |
| Depth (ft) | 9.8 | 0.5 | 6.0 | 2.0 | | | | | | | | | | |
| to | 10.4 | 1.5 | 7.5 | 3.5 | | | | | | | | | | |
| Moisture Content (%) | 60.1 | 37.7 | 22.1 | 76.7 | | | | | | | | | | |
| Organic Content (%) | NT | 4.8 | NT | 7.5 | | | | | | | | | | |
| Specific Gravity | NT | NT | NT | NT | | | | | | | | | | |

NP=Not plastic
NT=Not tested
ND = Not Determined
CL = Centerline

W.P. Alton, PE
Soils Engineer