| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|
| N.C. | 45355.1.21 (BD-5109U) | 1 | 9 |

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

# STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 45355.1.21 (BD-5109U) F.A. PROJ. BRZ-2320(6)

COUNTY ROWAN

PROJECT DESCRIPTION REPLACE BRIDGE 185 OVER SECOND CREEK ON SR 2320 (FISHER RD.)

SITE DESCRIPTION

PROJECT: 45355.1.21 ID: BD-5109U

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PERSONNEL

J.K. STICKNEY

C.L. SMITH

INVESTIGATED BY J.E. BEVERLY

CHECKED BY C.B. LITTLE

SUBMITTED BY C.B. LITTLE

DATE APRIL 2012

NORTH CAROLINA LICENSED 1104 GEOLOGIST CLINTON B. LITTLE

4.11.12

DRAWN BY: J.K. McCLURE

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| PROJECT REFERENCE NO. | SHEET NO. |
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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 TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

### SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

### CONSISTENCY OR DENSENESS

| PRIMARY SOIL TYPE | COMPACTNESS OR CONSISTENCY | RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE) | RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²) |
|---|---|---|---|
| GENERALLY GRANULAR MATERIAL (NON-COHESIVE) | VERY LOOSE | <4 | N/A |
| | LOOSE | 4 TO 10 | |
| | MEDIUM DENSE | 10 TO 30 | |
| | DENSE | 30 TO 50 | |
| | VERY DENSE | >50 | |
| GENERALLY SILT-CLAY MATERIAL (COHESIVE) | VERY SOFT | <2 | <0.25 |
| | SOFT | 2 TO 4 | 0.25 TO 0.50 |
| | 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 |
|---|---|---|
| NONPLASTIC | 0-5 | VERY LOW |
| LOW PLASTICITY | 6-15 | SLIGHT |
| MED. PLASTICITY | 16-25 | MEDIUM |
| HIGH PLASTICITY | 26 OR MORE | HIGH |

### COLOR

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

### GRADATION

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

### ANGULARITY OF GRAINS

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

### MINERALOGICAL COMPOSITION

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

### COMPRESSIBILITY

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

### PERCENTAGE OF MATERIAL

| ORGANIC MATERIAL | GRANULAR SOILS | SILT - CLAY SOILS | 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 W/ CORE
- SPT N-VALUE
- REF — SPT REFUSAL

### ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
$\gamma$ - 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:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [X] CME-550
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

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

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

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

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

### ROCK DESCRIPTION

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

| | |
|---|---|
| WEATHERED ROCK (WR) | NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED. |
| CRYSTALLINE ROCK (CR) | FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. |
| NON-CRYSTALLINE ROCK (NCR) | FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC. |
| COASTAL PLAIN SEDIMENTARY ROCK (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, YIELDS SPT N VALUES > 100 BPF* |
| VERY SEVERE (V SEV.) | ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, YIELDS SPT N VALUES < 100 BPF* |
| COMPLETE | ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE. |

### ROCK HARDNESS

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

### FRACTURE SPACING

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

### BEDDING

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

### INDURATION

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

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

### TERMS AND DEFINITIONS

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

AQUIFER - A WATER BEARING FORMATION OR STRATA.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BENCH MARK: BD5109U-2
STA. 13+28.77 -EL- 14.81 RT.
N 661345.0230 E 1571179.3710 ELEVATION: 739.90 FT.

NOTES:
SOIL STRATIGRAPHY IS THROUGH THE BORINGS FOR PROFILE & CROSS-SECTIONS.

REVISED 09/23/09

| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 45355.1.21 (BD-5109U) | 3 |

# SITE PLAN

0 50 100
FEET

# ROWAN COUNTY
# LOW IMPACT BRIDGE
## STRUCTURE 0185

NC GRID NAD 83/NSRS 2007

10

15

POT Sta. 10+00.00

POT Sta. 15+96.72

ROBERT LEE PATES III

BETTY BASSINGER KLUTTZ

BRENDA K. FISHER

BD5109U-2

DUKE POWER -P-

DUKE POWER -P,C- GA4

GRN

SEAT=739.10'

SEAT=739.12' EXISTING R/W

60.00'

12" RCP

BST

EB2-A

EB1-A

EB1-B

EB2-B

BRIDGE No. 185

TO NC 152

SR 2320 FISHER RD. 20.5' BST

-EL-

TO CRESCENT RD.

N 6° 37' 41.4" E

N 11° 03' 55.4" E

VAR HT BK

VAR HT BK

EXISTING R/W

60' R/W PER PB 9995 PG 7035

ALLTEL -T- 7101 017

ALLTEL -T- 019

ALLTEL -T- 018

SEAT=738.97'

SEAT=739.05'

SECOND CREEK

5 S BW

BM2
N=661334
E=1571278
ELEV=737.67

VIRGINIA S KLUTTZ

BRENDA K. FISHER

**********

BM1 ELEVATION - 758.15
N 660570 E 1571028
COURSE FROM -EL- STATION 10+00.00
S 10°30'17" W
BM1-BD5109U-1
REBAR AND ALUMINUM CAP LOCATED
OFF WESTERN EOP OF FISHER ROAD
AND BEING 759.00' FROM SOUTHWEST
CORNER OF BRIDGE

**********

**********

BM2 ELEVATION - 737.67
N 661334 E 1571278
EL STATION 13+34.00 114 RIGHT
R/R SPIKE IN ROOT OF 12" OAK TREE

**********

## DATUM DESCRIPTION

THE LOCALIZED COORDINATE SYSTEM DEVELOPED FOR THIS PROJECT IS BASED ON THE STATE PLANE COORDINATES ESTABLISHED BY NCGS FOR MONUMENT "BD5109U-1" WITH NAD 83/NSRS 2007 STATE PLANE GRID COORDINATES OF NORTHING: 660570.396(ft) EASTING: 1571027.881(ft) ELEVATION: 758.15(ft)
THE AVERAGE COMBINED GRID FACTOR USED ON THIS PROJECT (GROUND TO GRID) IS: 0.9998553083
THE N.C. LAMBERT GRID BEARING AND LOCALIZED HORIZONTAL GROUND DISTANCE FROM "BD5109U-1" TO -L- STATION IS

ALL LINEAR DIMENSIONS ARE LOCALIZED HORIZONTAL DISTANCES
VERTICAL DATUM USED IS NAVD 88

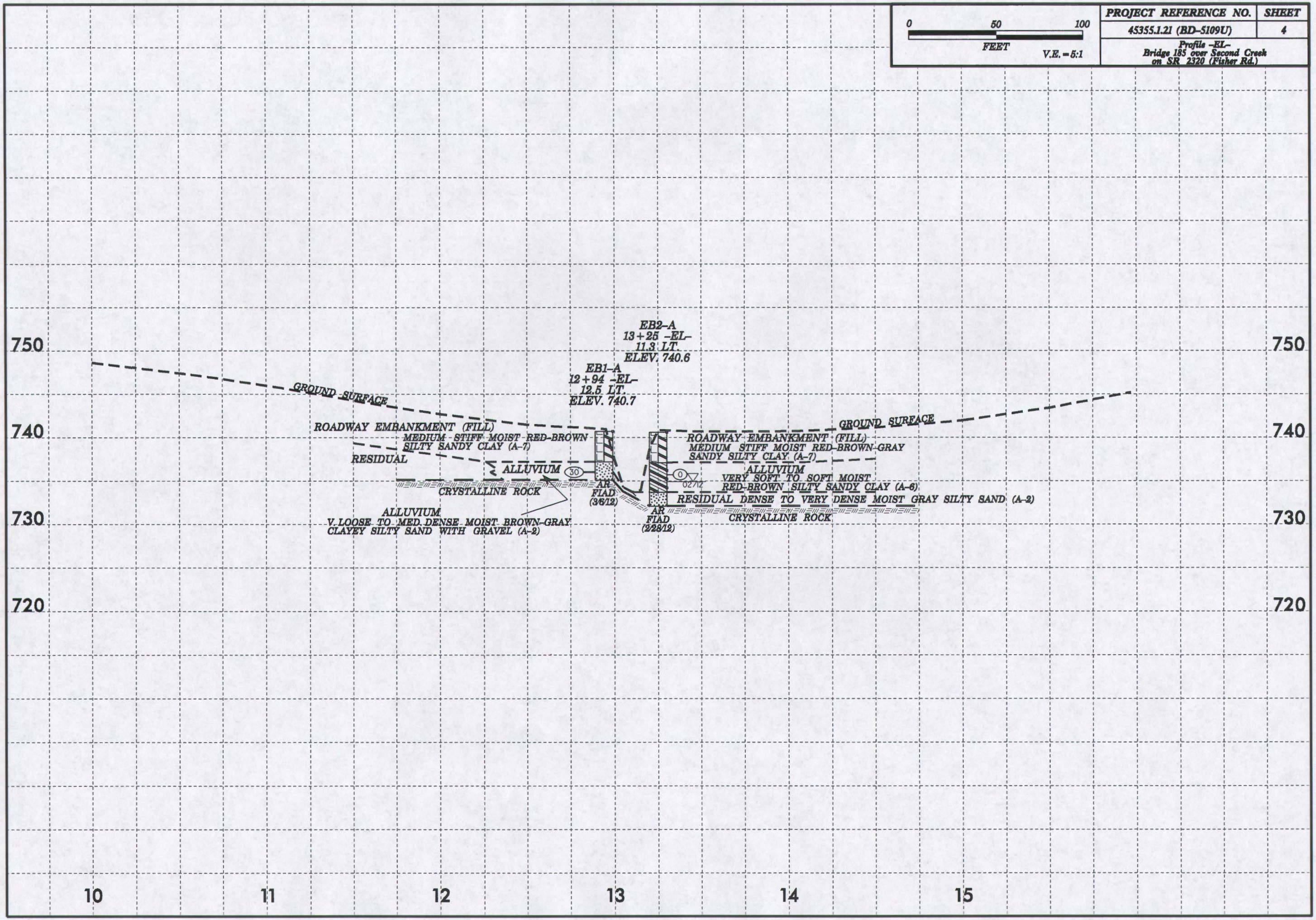
BL

| POINT | DESC. | NORTH | EAST | ELEVATION | EL STATION | OFFSET |
|---|---|---|---|---|---|---|
| 1 | BD5109U-1 | 660570.3960 | 1571027.8810 | 758.15 | OUTSIDE PROJECT LIMITS | |
| 2 | BD5109U-2 | 661345.0230 | 1571179.3710 | 739.90 | 13+28.77 | 14.81 RT |
| 3 | BL-3 | 661948.2639 | 1571249.4690 | 756.51 | OUTSIDE PROJECT LIMITS | |

| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 45355.1.21 (BD-5109U) | 4 |

Profile -EL-
Bridge 185 over Second Creek
on SR 2320 (Fisher Rd.)

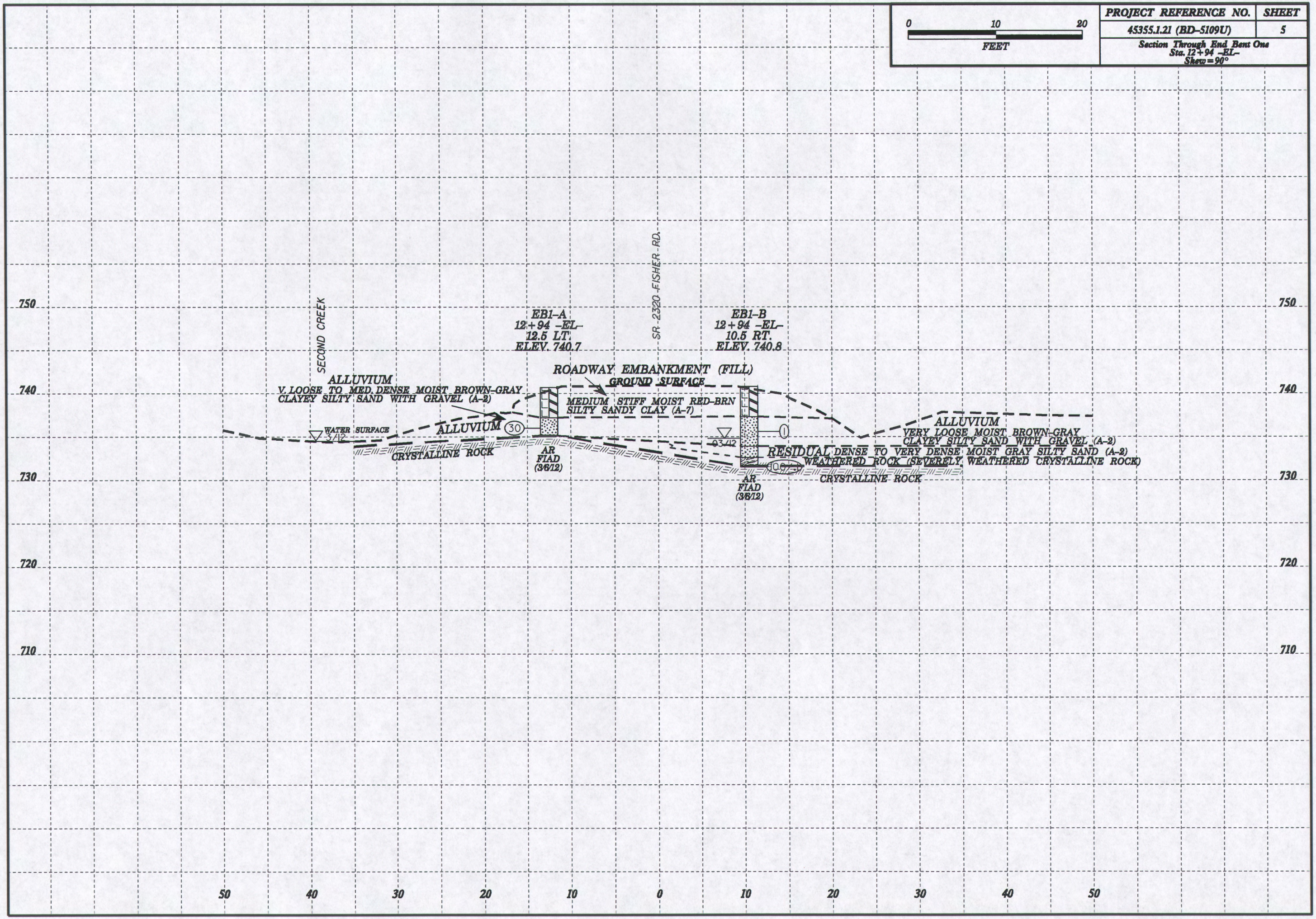
0 50 100
FEET
V.E. = 5:1



| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 45355.1.21 (BD-5109U) | 5 |

Section Through End Bent One
Sta. 12+94 -EL-
Skew = 90°

0 10 20
FEET



| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 45355.1.21 (BD-5109U) | 6 |

Section Through End Bent Two
Sta. 13+24 -RL-
Skew = 90°

0 10 20
FEET

EB2-A
13+25 -RL-
11.3 LT.
ELEV. 740.6

EB2-B
13+24 -RL-
10.5 RT.
ELEV. 740.6

SR 2320 FISHER RD.

ROADWAY EMBANKMENT (FILL)
MEDIUM STIFF MOIST RED-BROWN-GRAY SANDY SILTY CLAY (A-7)

ROADWAY EMBANKMENT (FILL)
MEDIUM STIFF MOIST RED-BROWN SANDY SILTY CLAY (A-7)

GROUND SURFACE

ROADWAY EMBANKMENT (FILL)

VERY SOFT TO SOFT MOIST RED-BROWN SILTY SANDY CLAY (A-6)

ALLUVIUM

SOFT MOIST RED-BROWN SILTY SANDY CLAY (A-6)

DENSE TO VERY DENSE MOIST GRAY SILTY SAND (A-2)

RESIDUAL

DENSE TO VERY DENSE MOIST GRAY SILTY SAND (A-2)

CRYSTALLINE ROCK

CRYSTALLINE ROCK

0 2/12

2 2/12

AR
FIAD
(2/28/12)

AR
FIAD
(2/28/12)

750
740
730
720
710

50 40 30 20 10 0 10 20 30 40 50

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | | |
|---|---|---|---|---|
| **WBS** 45355.1.21 | **TIP** BD-5109U | **COUNTY** ROWAN | **GEOLOGIST** Stickney, J. K. | |
| **SITE DESCRIPTION** Bridge No. 185 over Second Creek on SR 2320 (FISHER RD.) | | | | **GROUND WTR (ft)** |
| **BORING NO.** EB1-A | **STATION** 12+94 | **OFFSET** 13 ft LT | **ALIGNMENT** -EL- | **0 HR.** Dry |
| **COLLAR ELEV.** 740.7 ft | **TOTAL DEPTH** 5.6 ft | **NORTHING** 661,315 | **EASTING** 1,571,147 | **24 HR.** FIAD |
| **DRILL RIG/HAMMER EFF./DATE** HFO0064 CME-550 88% 09/02/2009 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Automatic | |
| **DRILLER** Smith, C.L. | **START DATE** 03/06/12 | **COMP. DATE** 03/06/12 | **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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 745 | | | | | | | | | | | |
| 740 | | | | | | | | M | | 740.7 GROUND SURFACE | 0.0 |
| | | | | | | | | | | **ROADWAY EMBANKMENT** MEDIUM STIFF MOIST RED-BROWN SILTY SANDY CLAY (A-7) | |
| | 737.0 | 3.7 | 1 | 1 | 29 | 30 | | M | | 737.2 | 3.5 |
| | | | | | | | | | | **ALLUVIAL** V. LOOSE TO MED. DENSE MOIST BROWN-GRAY CLAYEY SILTY SAND WITH GRAVEL (A-2) | |
| | | | | | | | | | | 735.1 Boring Terminated by Auger Refusal at Elevation 735.1 ft On Crystalline Rock | 5.6 |

| | | | | |
|---|---|---|---|---|
| **WBS** 45355.1.21 | **TIP** BD-5109U | **COUNTY** ROWAN | **GEOLOGIST** Stickney, J. K. | |
| **SITE DESCRIPTION** Bridge No. 185 over Second Creek on SR 2320 (FISHER RD.) | | | | **GROUND WTR (ft)** |
| **BORING NO.** EB1-B | **STATION** 12+94 | **OFFSET** 11 ft RT | **ALIGNMENT** -EL- | **0 HR.** 6.0 |
| **COLLAR ELEV.** 740.8 ft | **TOTAL DEPTH** 9.3 ft | **NORTHING** 661,311 | **EASTING** 1,571,170 | **24 HR.** FIAD |
| **DRILL RIG/HAMMER EFF./DATE** HFO0064 CME-550 88% 09/02/2009 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Automatic | |
| **DRILLER** Smith, C.L. | **START DATE** 03/06/12 | **COMP. DATE** 03/06/12 | **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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 745 | | | | | | | | | | | |
| 740 | | | | | | | | M | | 740.8 GROUND SURFACE | 0.0 |
| | | | | | | | | | | **ROADWAY EMBANKMENT** MEDIUM STIFF MOIST RED-BROWN SILTY SANDY CLAY (A-7) | |
| | | | | | | | | | | 737.3 | 3.5 |
| | 736.6 | 4.2 | 0 | 1 | 0 | 1 | | M | | **ALLUVIAL** VERY LOOSE MOIST BROWN-GRAY CLAYEY SILTY SAND WITH GRAVEL (A-2) | |
| 735 | | | | | | | | | | 733.9 | 6.9 |
| | | | | | | | | | | 732.6 | 8.2 |
| | 731.6 | 9.2 | 100/.1 | | | 100/.1 | | | | **RESIDUAL** DENSE TO VERY DENSE MOIST GRAY SILTY SAND (A-2) | |
| | | | | | | | | | | 731.5 | 9.3 |
| | | | | | | | | | | **WEATHERED ROCK** SEVERELY WEATHERED CRYSTALLINE ROCK | |
| | | | | | | | | | | **CRYSTALLINE ROCK** Boring Terminated by Auger Refusal at Elevation 731.5 ft On Crystalline Rock | |

NCDOT BORE DOUBLE BD5109U_GEO_BH_BRDG0185_ROWAN.GPJ NC_DOT.GDT 4/2/12

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | | |
|---|---|---|---|---|
| **WBS** 45355.1.21 | **TIP** BD-5109U | **COUNTY** ROWAN | **GEOLOGIST** Stickney, J. K. | |
| **SITE DESCRIPTION** Bridge No. 185 over Second Creek on SR 2320 (FISHER RD.) | | | | **GROUND WTR (ft)** |
| **BORING NO.** EB2-A | **STATION** 13+25 | **OFFSET** 11 ft LT | **ALIGNMENT** -EL- | **0 HR.** 5.7 |
| **COLLAR ELEV.** 740.6 ft | **TOTAL DEPTH** 8.5 ft | **NORTHING** 661,346 | **EASTING** 1,571,153 | **24 HR.** FIAD |
| **DRILL RIG/HAMMER EFF./DATE** HFO0064 CME-550 88% 09/02/2009 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Automatic | |
| **DRILLER** Smith, C.L. | **START DATE** 02/28/12 | **COMP. DATE** 02/28/12 | **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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 745 | | | | | | | | | | | |
| 740 | | | | | | | | M | | 740.6 GROUND SURFACE | 0.0 |
| | | | | | | | | | | **ROADWAY EMBANKMENT** MEDIUM STIFF MOIST RED-BROWN-GRAY SANDY SILTY CLAY (A-7) | |
| | 736.7 | 3.9 | | | | | | | | 737.1 | 3.5 |
| 735 | | | 0 | 0 | 0 WOH | 0 | | M | | **ALLUVIAL** VERY SOFT TO SOFT MOIST RED-BROWN SILTY SANDY CLAY (A-6) | |
| | | | | | | | | | | 733.7 | 6.9 |
| | | | | | | | | | | **RESIDUAL** DENSE TO VERY DENSE MOIST GRAY SILTY SAND (A-2) | |
| | | | | | | | | | | 732.1 | 8.5 |
| | | | | | | | | | | Boring Terminated by Auger Refusal at Elevation 732.1 ft On Crystalline Rock | |

| | | | | |
|---|---|---|---|---|
| **WBS** 45355.1.21 | **TIP** BD-5109U | **COUNTY** ROWAN | **GEOLOGIST** Stickney, J. K. | |
| **SITE DESCRIPTION** Bridge No. 185 over Second Creek on SR 2320 (FISHER RD.) | | | | **GROUND WTR (ft)** |
| **BORING NO.** EB2-B | **STATION** 13+24 | **OFFSET** 11 ft RT | **ALIGNMENT** -EL- | **0 HR.** 5.8 |
| **COLLAR ELEV.** 740.6 ft | **TOTAL DEPTH** 7.7 ft | **NORTHING** 661,341 | **EASTING** 1,571,174 | **24 HR.** FIAD |
| **DRILL RIG/HAMMER EFF./DATE** HFO0064 CME-550 88% 09/02/2009 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Automatic | |
| **DRILLER** Smith, C.L. | **START DATE** 02/28/12 | **COMP. DATE** 02/28/12 | **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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 745 | | | | | | | | | | |
| 740 | | | | | | | | M | | 740.6 GROUND SURFACE 0.0 |
| | | | | | | | | | | **ROADWAY EMBANKMENT** MEDIUM STIFF MOIST RED-BROWN SANDY SILTY CLAY (A-7) |
| | 736.7 | 3.9 | | | | | | | | 737.1 3.5 |
| 735 | | | 1 | 1 | 1 | 2 | | M | | **ALLUVIAL** SOFT MOIST RED-BROWN SILTY SANDY CLAY (A-6) |
| | | | | | | | | | | 734.0 6.6 |
| | | | | | | | | | | **RESIDUAL** DENSE TO VERY DENSE MOIST GRAY SILTY SAND (A-2) |
| | | | | | | | | | | 732.9 7.7 |
| | | | | | | | | | | Boring Terminated by Auger Refusal at Elevation 732.9 ft On Crystalline Rock |

| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 45355.1.21 (BD-5109U) | 9 |

# AERIAL PHOTO

0 50 100
FEET

BM1 ELEVATION = 758.15
N 660570 E 1571028
COURSE FROM -EL- STATION 10+00.00
S 10°30'17" W
BM1=BD5109U-1
REBAR AND ALUMINUM CAP LOCATED
OFF WESTERN EOP OF FISHER ROAD
AND BEING 759.00' FROM SOUTHWEST
CORNER OF BRIDGE

BM2 ELEVATION = 737.67
N 661334 E 1571278
EL STATION 13+34.00 114 RIGHT
R/R SPIKE IN ROOT OF 12" OAK TREE

## DATUM DESCRIPTION

THE LOCALIZED COORDINATE SYSTEM DEVELOPED FOR THIS PROJECT IS BASED ON THE STATE PLANE COORDINATES ESTABLISHED BY NCGS FOR MONUMENT "BD5109U-1"
WITH NAD 83/NSRS 2007 STATE PLANE GRID COORDINATES OF NORTHING: 660570.396(ft) EASTING: 1571027.881(ft)
ELEVATION: 758.15(ft)
THE AVERAGE COMBINED GRID FACTOR USED ON THIS PROJECT (GROUND TO GRID) IS: 0.9998553083
THE N.C. LAMBERT GRID BEARING AND LOCALIZED HORIZONTAL GROUND DISTANCE FROM "BD5109U-1" TO -L- STATION 15

ALL LINEAR DIMENSIONS ARE LOCALIZED HORIZONTAL DISTANCES
VERTICAL DATUM USED IS NAVD 88

BL

| POINT | DESC. | NORTH | EAST | ELEVATION | EL STATION | OFFSET |
|---|---|---|---|---|---|---|
| 1 | BD5109U-1 | 660570.3960 | 1571027.8810 | 758.15 | OUTSIDE PROJECT LIMITS | |
| 2 | BD5109U-2 | 661345.0230 | 1571179.3710 | 739.90 | 13+28.77 | 14.81 RT |
| 3 | BL-3 | 661948.2639 | 1571249.4690 | 756.51 | OUTSIDE PROJECT LIMITS | |