

REFERENCE: B-5818

PROJECT: 45771

SEE SHEET 3 FOR PLAN SHEET LAYOUT AT TIME OF INVESTIGATION

CONTENTS

LINE	STATION	PLAN	SECTIONS
-L-	14+50 TO 40+50	4-9	10-23

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

**ROADWAY  
 SUBSURFACE INVESTIGATION**

COUNTY ANSON  
 PROJECT DESCRIPTION BRIDGE NO. 11 ON NC 109  
OVER DEADFALL CREEK  
**INVENTORY**

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5818	1	23

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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										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS									
<p>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, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i></p>										<p>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.</p>										<p>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:</p>										<p>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 DISLOGGED 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 (ROQ) - 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 (SROQ) - 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.</p>									
SOIL LEGEND AND AASHTO CLASSIFICATION										MINERALOGICAL COMPOSITION										WEATHERING										COMPRESSION									
<p>GENERAL CLASS. GRANULAR MATERIALS (&lt;= 35% PASSING #200) SILT-CLAY MATERIALS (&gt; 35% PASSING #200) ORGANIC MATERIALS</p>										<p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.</p>										<p>WEATHERED ROCK (WR) NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</p>										<p>SLIGHTLY COMPRESSIBLE LL &lt; 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL &gt; 50</p>									
<p>GROUP CLASS. A-1, A-1-b, A-1-c, A-2, A-2-4, A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, A-7-5, A-7-6, A-1, A-2, A-3, A-4, A-5, A-6, A-7</p>										<p>PERCENTAGE OF MATERIAL</p>										<p>FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p>										<p>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.</p>									
<p>SYMBOL</p>										<p>ORGANIC MATERIAL GRANULAR SOILS SILT-CLAY SOILS OTHER MATERIAL</p>										<p>VERY SLIGHT 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.</p>										<p>NON-CRYSTALLINE ROCK (NCR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>									
<p>% PASSING #10 #40 #200</p>										<p>GROUND WATER</p>										<p>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.</p>										<p>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.</p>									
<p>MATERIAL PASSING #40 LL PI</p>										<p>MISCELLANEOUS SYMBOLS</p>										<p>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.</p>										<p>CRUSTALINE ROCK (CR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>									
<p>GROUP INDEX</p>										<p>RECOMMENDATION SYMBOLS</p>										<p>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</p>										<p>CRUSTALINE ROCK (CR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>									
<p>USUAL TYPES OF MAJOR MATERIALS</p>										<p>ABBREVIATIONS</p>										<p>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 &lt; 100 BPF</p>										<p>CRUSTALINE ROCK (CR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>									
<p>GEN. RATING AS SUBGRADE</p>										<p>EQUIPMENT USED ON SUBJECT PROJECT</p>										<p>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.</p>										<p>CRUSTALINE ROCK (CR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>									
<p>CONSISTENCY OR DENSENESS</p>										<p>TEXTURE OR GRAIN SIZE</p>										<p>ROCK HARDNESS</p>										<p>COMPRESSION</p>									
<p>PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT<sup>2</sup>)</p>										<p>U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053</p>										<p>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.</p>										<p>SLIGHTLY COMPRESSIBLE LL &lt; 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL &gt; 50</p>									
<p>GENERAL GRANULAR MATERIAL (NON-COHESIVE)</p>										<p>BOULDER (BLDR.) COBBLE (COB.) GRAVEL (GR.) COARSE SAND (CSE, SD.) FINE SAND (F SD.) SILT (SL.) CLAY (CL.)</p>										<p>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.</p>										<p>CRUSTALINE ROCK (CR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>									
<p>GENERAL SILT-CLAY MATERIAL (COHESIVE)</p>										<p>GRAIN SIZE MM 305 75 2.0 0.25 0.05 0.005 IN. 12 3</p>										<p>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 PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.</p>										<p>CRUSTALINE ROCK (CR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>									
<p>SOIL MOISTURE - CORRELATION OF TERMS</p>										<p>SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION</p>										<p>SOFT CAN BE GROOVED 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.</p>										<p>CRUSTALINE ROCK (CR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>									
<p>PLASTICITY</p>										<p>PLASTICITY INDEX (PI) DRY STRENGTH</p>										<p>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.</p>										<p>CRUSTALINE ROCK (CR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>									
<p>COLOR</p>										<p>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.</p>										<p>INDURATION</p>										<p>CRUSTALINE ROCK (CR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>									

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
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# SUBSURFACE INVESTIGATION

**SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES  
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS**

AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

**GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)**

From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.

SURFACE CONDITIONS

**VERY GOOD**  
Very rough, fresh unweathered surfaces

**GOOD**  
Rough, slightly weathered, iron stained surfaces

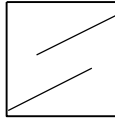
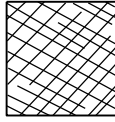
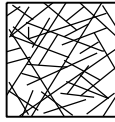
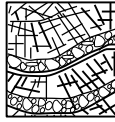
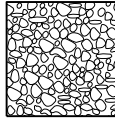
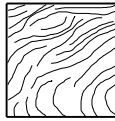
**FAIR**  
Smooth, moderately weathered and altered surfaces

**POOR**  
Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments

**VERY POOR**  
Slickensided, highly weathered surfaces with soft clay coatings or fillings

DECREASING SURFACE QUALITY →

**STRUCTURE**

-  **INTACT OR MASSIVE** - intact rock specimens or massive in situ rock with few widely spaced discontinuities
-  **BLOCKY** - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets
-  **VERY BLOCKY** - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets
-  **BLOCKY/DISTURBED/SEAMY** - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity
-  **DISINTEGRATED** - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces
-  **LAMINATED/SHEARED** - Lack of blockiness due to close spacing of weak schistosity or shear planes

DECREASING INTERLOCKING OF ROCK PIECES ↓

90	80	70	60	50	40	30	20	10	N/A	N/A
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**GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)**

From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

**VERY GOOD** - Very Rough, fresh unweathered surfaces

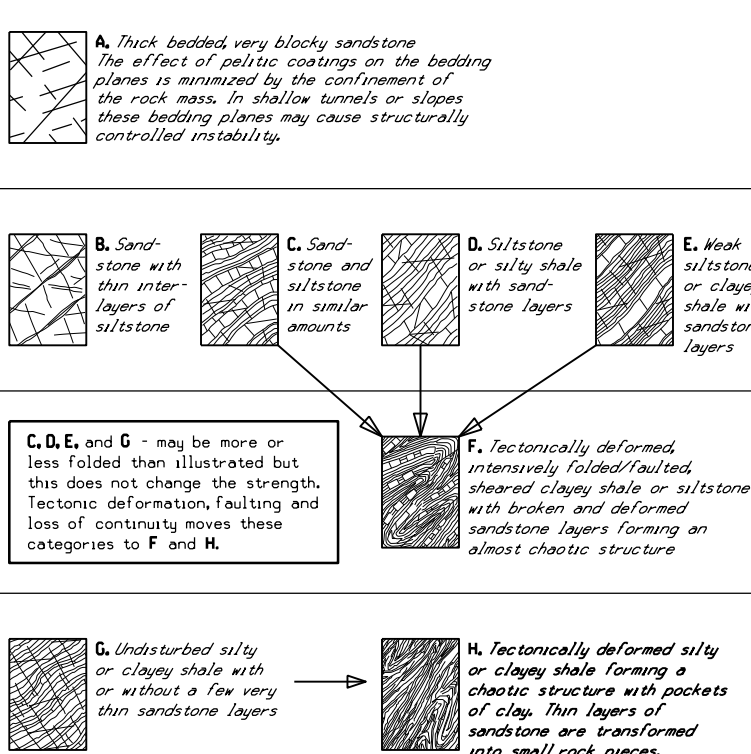
**GOOD** - Rough, slightly weathered surfaces

**FAIR** - Smooth, moderately weathered and altered surfaces

**POOR** - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments

**VERY POOR** - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings

**COMPOSITION AND STRUCTURE**



**A. Thick bedded, very blocky sandstone**  
The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability.

**B. Sandstone with thin inter-layers of siltstone**

**C. Sandstone and siltstone in similar amounts**

**D. Siltstone or silty shale with sandstone layers**

**E. Weak siltstone or clayey shale with sandstone layers**

**F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure**

**G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers**

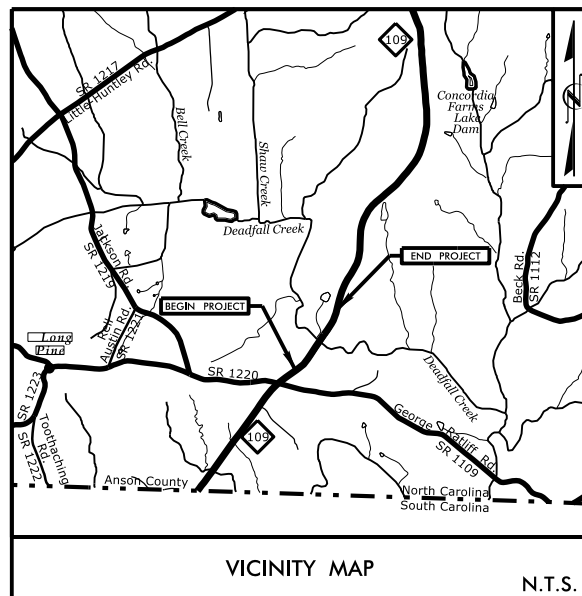
**H. Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.**

→ Means deformation after tectonic disturbance

70	60	50	40	30	20	10
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**TIP PROJECT: B-5818**

See Sheet 1A For Index of Sheets  
See Sheet 1B For Standard Symbology Sheet



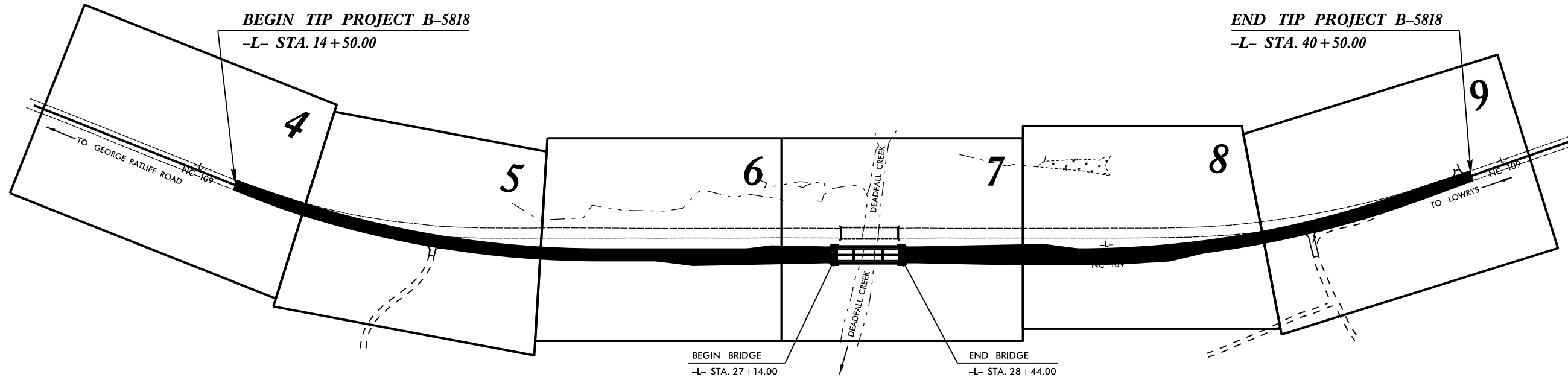
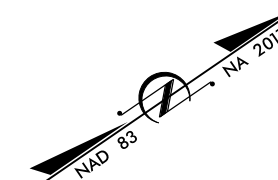
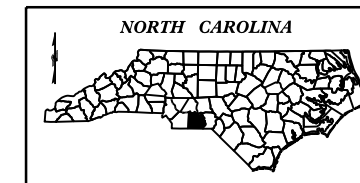
**PRELIMINARY PLANS**

STATE OF NORTH CAROLINA  
DIVISION OF HIGHWAYS

**ANSON COUNTY**

**LOCATION: BRIDGE #011 OVER DEADFALL CREEK ON NC 109**  
**TYPE OF WORK: GRADING, DRAINAGE, PAVING & STRUCTURE**

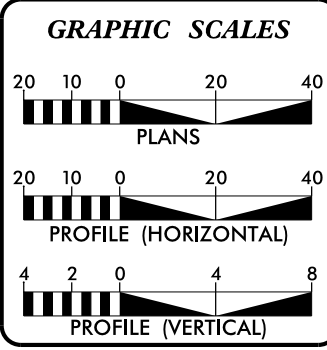
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5818	3	23
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
45771.1.1		P.E.	



**THIS PROJECT IS NOT WITHIN ANY MUNICIPAL BOUNDARIES.**  
**CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD \_\_\_\_\_.**

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

**CONTRACT:**



**DESIGN DATA**

ADT 2018	= 1,320
ADT 2043	= 2,640
K	= 9%
D	= 60%
T	= 22%*
V	= 55 MPH
<b>FUNC. CLASSIFICATION:</b>	
MAJOR COLLECTOR	
* (TTST 15% + DUALS 7%)	
<b>REGIONAL TIER</b>	

**PROJECT LENGTH**

LENGTH OF ROADWAY TIP PROJECT B-5818	= 0.467 MILES
LENGTH OF STRUCTURE TIP PROJECT B-5818	= 0.025 MILES
TOTAL LENGTH OF TIP PROJECT B-5818	= 0.492 MILES

NCDOT CONTACT: KEITH PASCHAL, PE  
Structure Management Unit

**PLANS PREPARED FOR THE NCDOT BY:**

STV Engineers, Inc.  
900 West Trade St., Suite 715  
Charlotte, NC 28202  
NC License Number F-0991

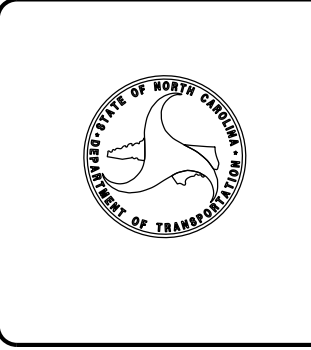
2018 STANDARD SPECIFICATIONS	
<b>RIGHT OF WAY DATE:</b> NOVEMBER 22, 2019	<b>NIKKI T. HONEYCUTT, PE</b> PROJECT ENGINEER
<b>LETTING DATE:</b> NOVEMBER 18, 2020	<b>MAAMOON K. ABDELAZIZ</b> PROJECT DESIGNER

**HYDRAULICS ENGINEER**

SIGNATURE: \_\_\_\_\_ P.E.

**ROADWAY DESIGN ENGINEER**

SIGNATURE: \_\_\_\_\_ P.E.



25-NOV-2019 11:37  
F:\Projects\66X\66X-0257 (NCDOT-B5818) Anson Co\B-5818\_GEO\_RDWY\CADD\_GEO\TECH\PlanProf\B5818\_geo\_sub\_inv.dgn  
Drocey AT 66026109



November 26, 2019

State Project No.: 45771.1.1  
 TIP No.: B-5818  
 Project ID: 35915  
 County: Anson  
 Description: Bridge No. 11 on NC 109 over Deadfall Creek

**SUBJECT: Geotechnical Report – Inventory**

**Project Description**

This project primarily involves replacing existing Bridge 11 on NC 109 (-L-) over Deadfall Creek in Peachland, Anson County, North Carolina. The proposed bridge will be located about 40 feet east of the existing bridge, which will necessitate a realignment of the existing road. The existing roadway consists of one northbound and one southbound lane. The new alignment primarily extends through wooded and undeveloped property.

As shown on plan sheets received on 9/10/19, the project consists of the realignment on NC 109 (-L-) from station 14+50, which is approximately 1,250 lf south of the proposed bridge, and ends at station 40+50, which is approximately 1,200 lf north of the proposed bridge – a distance of 2,600 lf (0.49 miles).

The typical proposed section for the project will include one northbound and one southbound lane. More-specifically, the typical section will incorporate 12-foot lanes, and 8-foot grassed shoulders. The proposed bridge will consist of a 2-lane, single-span bridge over Deadfall Creek. The bridge will be approximately 130 feet in length.

The boring locations were selected by F&R based on the plans dated 9/10/19, and the geotechnical field investigation was performed in September 2019. A total of 27 Standard Penetration Test (SPT) borings were advanced with an ATV-mounted CME-55 drill rig with an automatic hammer. Representative soil samples were collected from the split spoon for visual classification in the field and for analysis by F&R's testing laboratory.

Generally the following alignment was investigated, the limits of which were determined by the attached plan sheets. The bridge inventory report is being issued under separate cover:

<u>Alignment</u>	<u>Station (±)</u>
-L-	14+50 to 40+50

**Areas of Special Geotechnical Interest**

1) Non-Crystalline Rock: The following area was found to contain non-crystalline rock above or within six feet of the proposed grade and will likely require ripping or blasting for removal:

<u>Alignment</u>	<u>Station (±)</u>
-L-	20+25 to 21+25
-L-	21+75 to 25+75

2) Weathered Rock: The following areas were found to contain weathered rock above or within six feet of the proposed grade and have a potential to require ripping or blasting for removal:

<u>Alignment</u>	<u>Station (±)</u>
-L-	17+25 to 22+25
-L-	22+75 to 25+75
-L-	35+25 to 37+25

3) Cohesive Soils: The following areas contain cohesive soils (AASHTO A-5, A-6 & A-7 soils) at existing subgrade in fill areas or at/near proposed subgrade that have the potential to cause subgrade problems during construction:

<u>Alignment</u>	<u>Station (±)</u>
-L-	15+25 to 15+75
-L-	25+75 to 26+25
-L-	30+25 to 32+75
-L-	34+25 to 38+75

**Physiography and Geology**

The proposed roadway will consist of one northbound and one southbound lane. The new alignment primarily extends through wooded and undeveloped property. At the beginning of the project at -L- station 14+50, the roadway elevation (EL) starts at EL ±328 feet and gradually descends to EL ±296 feet at about -L- station 22+00. From this point the roadway elevation ascends to EL ±308 feet at about -L- station 25+00, and then descends again to EL ±261 feet at about -L- station 28+00. From this point the remainder of the existing roadway grade gradually ascends to the highest elevation of the project, EL ±311 at -L- station 40+50, the end of the project. The lowest elevation of the project is the Deadfall Creek bed at about -L- station 27+80, estimated at about EL ±254.

The surface water across the project is generally drained by Deadfall Creek. A small, unnamed drainage feature runs along the west side of the existing road in a north/south direction, left of about -L- station 20+50 to Deadfall Creek. Another similar drainage feature runs from Deadfall Creek to about -L- station

33+00. A small wetland feature is shown on the provided plan sheet 8 on the west side of the existing road from about -L- station 31+50 to 33+50; however, this is located beyond the project construction limits.

The project is located in the Piedmont Physiographic Province of North Carolina within the Carolina Slate Belt. More-specifically, it is located in an area mapped as metamudstone and meta-argillite (CZmd<sub>1</sub>). Typical weathered rock samples recovered from our borings primarily exhibit the characteristics of meta-argillite. Soils weathered from the parent rock generally consist of sandy and clayey silts, along with some silty and sandy clays. The in-situ soils are the residual product of in-place chemical weathering of rock that was similar to the rock presently underlying the site.

### Soils Properties

The subsurface conditions discussed below and those shown on the attached drawings represent an estimate of the subsurface conditions based on interpretation of the boring data using normally-accepted geotechnical engineering judgments. The transitions between different soil strata are usually less distinct than those shown on the boring logs and cross sections. Sometimes the relatively small sample obtained in the field is insufficient to definitively describe the origin of the subsurface material. Although individual soil test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times.

Soils within the area of this project have been divided into three categories: roadway embankment, alluvial soils, and residual soils.

**Roadway Embankment:** Roadway embankment (RE) soils were encountered at the surface in boring EB2-A. The RE extended to a depth of about 2 feet. The fill was described as moist, medium dense, clayey SAND (A-2-6) with little gravel.

**Alluvial Soil:** Alluvial soils were encountered in 4 borings. The alluvial soils were encountered at the ground surface in borings B2-A, B2-B, and EB2-B, and beneath RE in boring EB2-A. The alluvial soils extended to depths up to 12 feet with an average depth of about 10 feet. The alluvial soil types were typically described as moist to wet, loose to medium dense, silty and clayey SAND (A-2-4 & A-2-6) with trace organic matter.

**Residual Soil:** A majority of the soils encountered on this project were residual soils. Residual soils were encountered at the surface of 25 borings. No residual soils were encountered in borings B2-A and B2-B. The residual soils were variable and typically described as moist, stiff to hard, sandy SILT (A-4), and silty and sandy CLAY (A-6 & A-7). A majority of the samples contained varying amounts of rock fragments.

### Rock Properties

Weathered Rock (WR) was encountered in 20 borings. Of these 20 borings, 6 of the borings terminated in WR, and 14 terminated in or on Non-Crystalline Rock (NCR). Boring L1750R encountered an intermediate layer of WR before re-encountering WR to boring termination. The intermediate zone of WR was about 5

feet thick. Excluding the intermediate zone of WR, the WR was encountered at depths ranging from about 2 to 17 feet and elevations ranging from about 248 to 313 feet.

NCR was encountered in 20 borings as indicated by SPT refusal and typically auger refusal. Borings L1550R and L1750R encountered an intermediate layer of NCR before encountering weathered rock to termination below this layer. The intermediate zones of NCR were about 3.5 to 5 feet thick. The remaining 18 borings were terminated in or on NCR. Of these 18 borings, 1 transitioned from alluvial soils to NCR, 3 transitioned directly from residual soils to NCR, and 14 encountered WR before being terminated. The NCR was encountered at depths ranging from about 7 to 21 feet, or elevations ranging from about 242 to 306 feet. The rock typically consisted of meta-argillite. Refusal is a designation applied to any material that cannot be penetrated by the soil auger, and is typically caused by encountering boulders, hard rock lenses/ledges or bedrock. The nature of the materials causing refusal was not explored in the majority of these borings, but is anticipated to represent the NCR level.

Rock coring was performed in borings B1-A, B1-B, B2-A, and B2-B after encountering auger refusal. The coring extended to depths of 34.5, 32.8, 27.7, and 31.6 feet, respectively, after SPT refusal was achieved. The rock generally consisted of very slightly to completely weathered, hard to very soft, meta-argillite. The strata recovery and RQD are indicated on the cross sections. Strata recovery ranged from 25% to 100%, and strata RQD ranged from 0% to 94%.

### Groundwater Properties

Generally, groundwater measurements were attempted in a majority of the 27 borings along the project immediately upon their completion and after a stabilization period of approximately 24 hours. Three borings were backfilled immediately upon their completion. Groundwater was not encountered in any of the borings immediately upon completion. Stabilized groundwater was encountered in 8 borings at depths ranging from 4 to 14 feet, and elevations ranging from about 252 to 260 feet. Groundwater was not encountered in the remaining 16 borings. The recovered soil samples were generally described as moist above the groundwater level and wet below the groundwater level. It should be noted that the groundwater levels fluctuate depending upon seasonal factors such as precipitation and temperature. As such, soil moisture and groundwater conditions at other times may vary or be different from those described in this report.

We appreciate the opportunity to work with you on this project. Please contact us if you have any questions regarding this report or if we may be of further service.

Sincerely,  
**FROEHLING & ROBERTSON, INC.**

DocuSigned by:  
  
1C9DED1446894D7...  
 Derick Racey  
 Geotechnical Project Manager

DocuSigned by:  
  
A270EF78A6DF442...  
 W. Patrick Alton, P.E.  
 Transportation Services Manager

**Appendix A**

**Bulk Samples**

The following bulk sample was obtained and transported to our laboratory for testing to determine the engineering properties of the soil:

Sample No.	Boring No.	Line	Station	Offset	Depth (ft)	Test(s) Performed
CBR-1	L2450R1	-L-	24+50	5' Rt.	2.0-5.0	Standard Proctor, CBR

**Undisturbed Samples**

Undisturbed Shelby tube samples were not collected as part of this investigation.

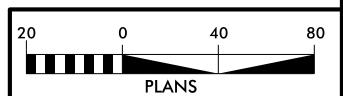
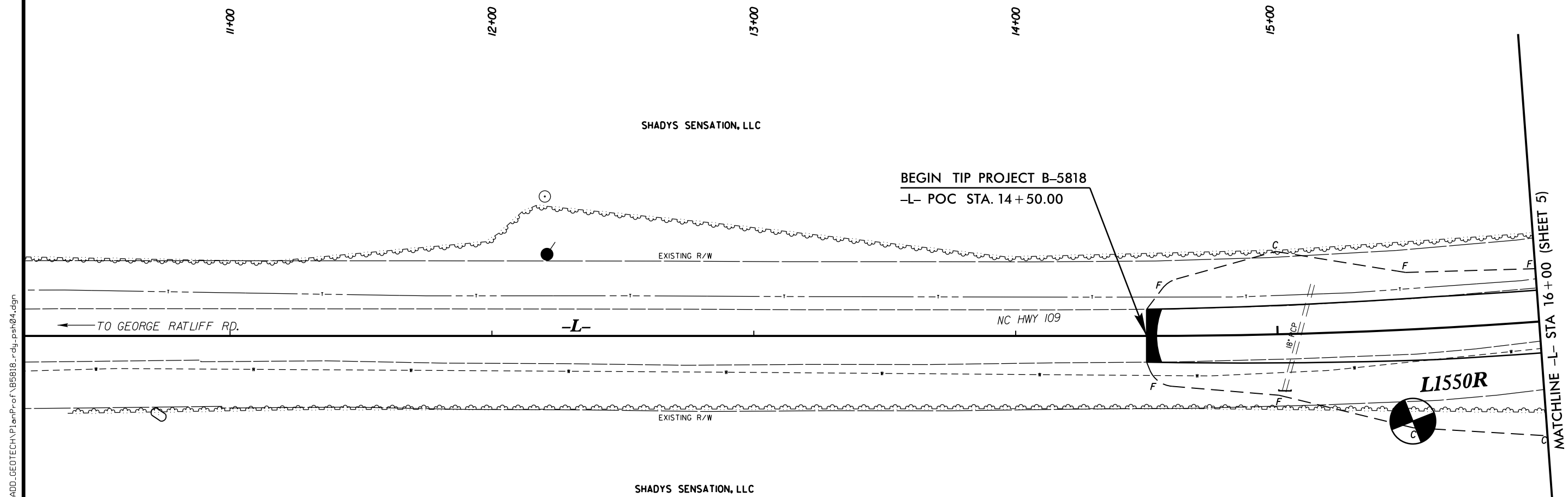
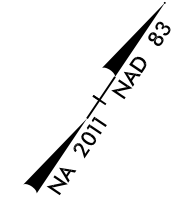


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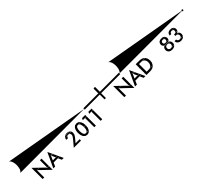
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RW SHEET NO.	
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DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



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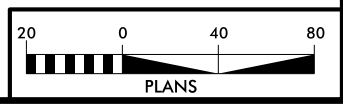
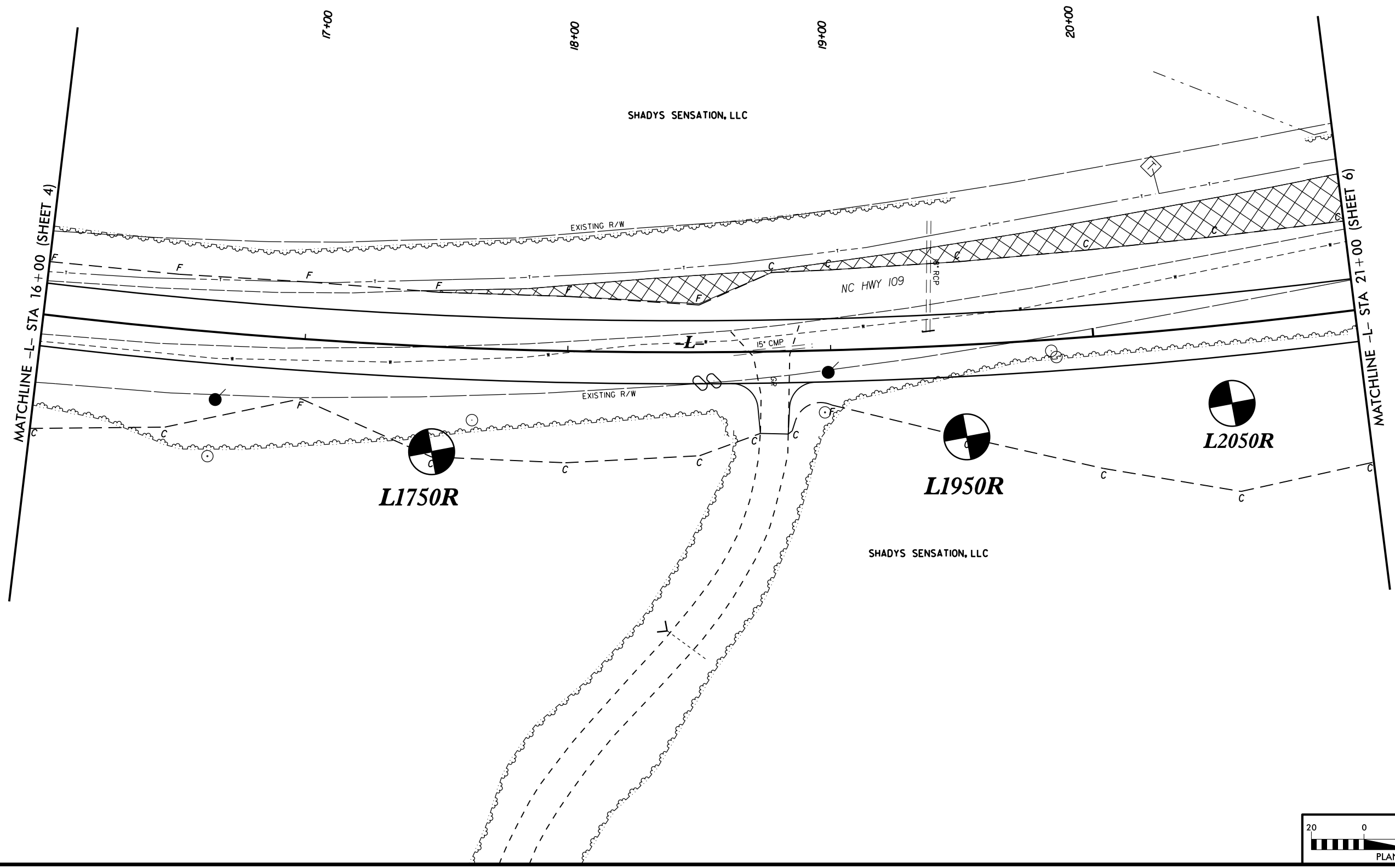
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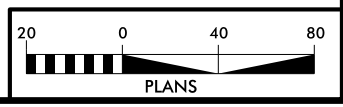
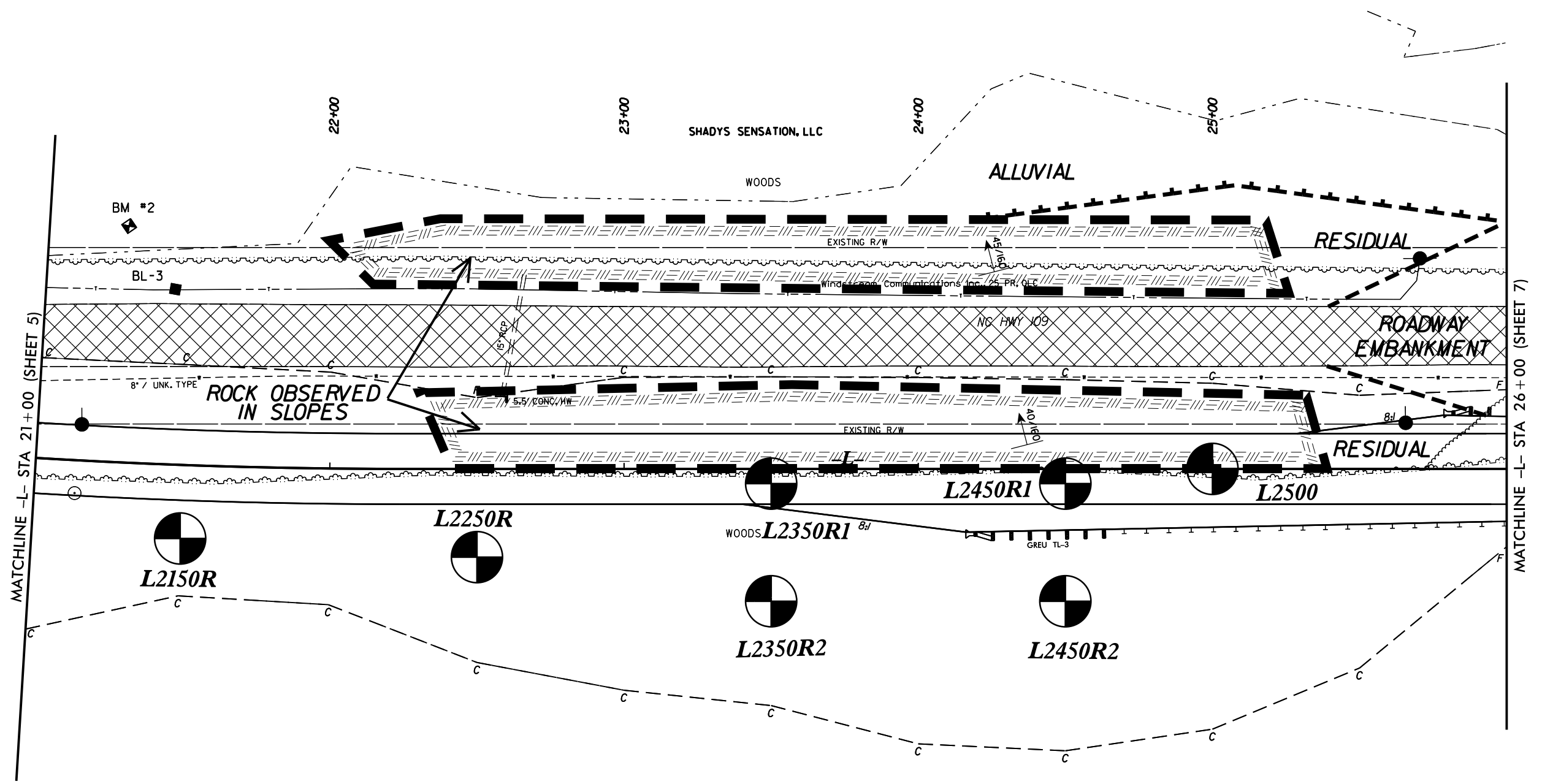
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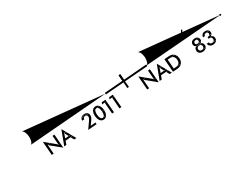


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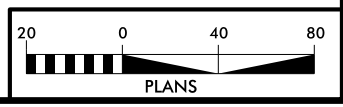
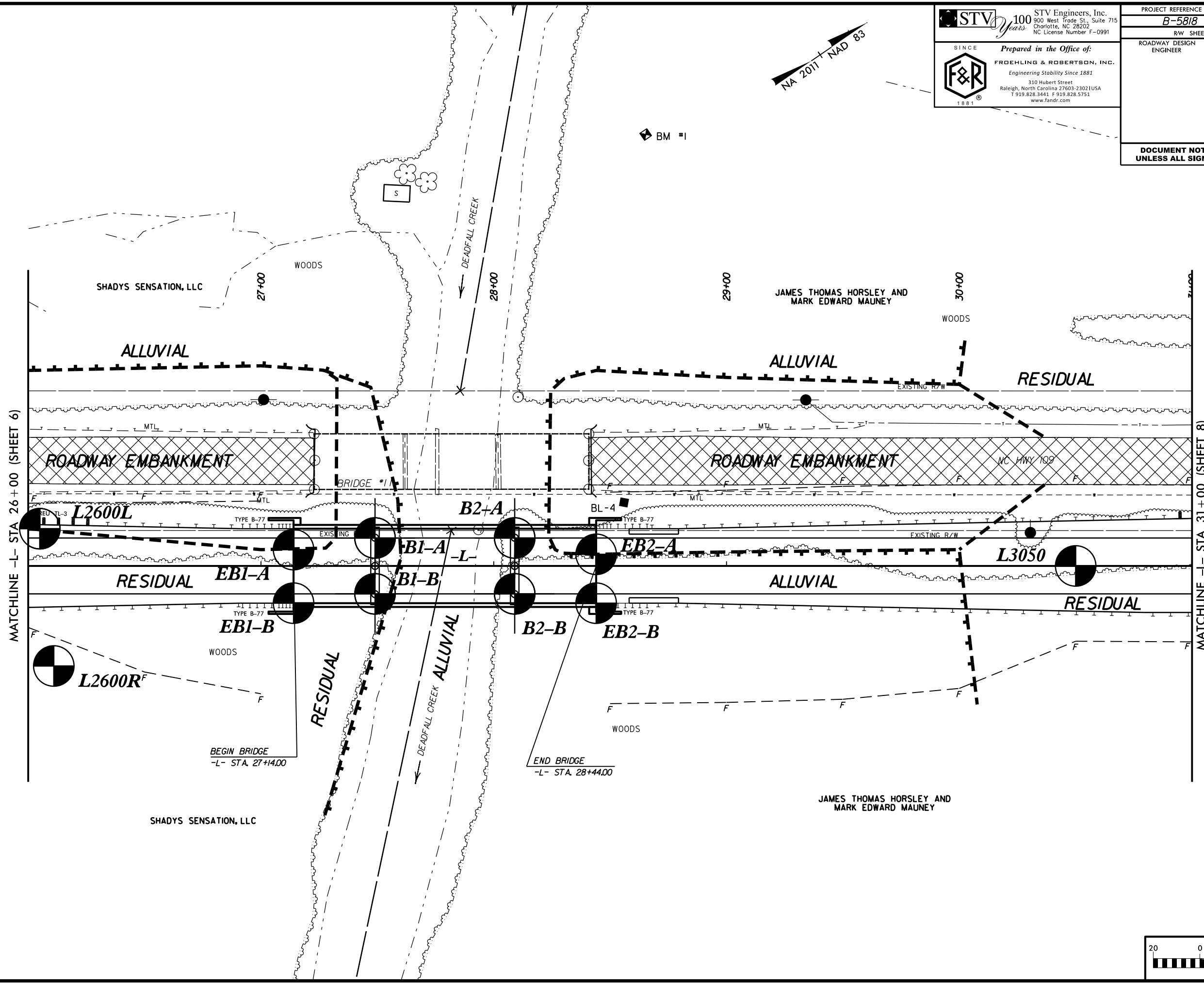
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BM #1



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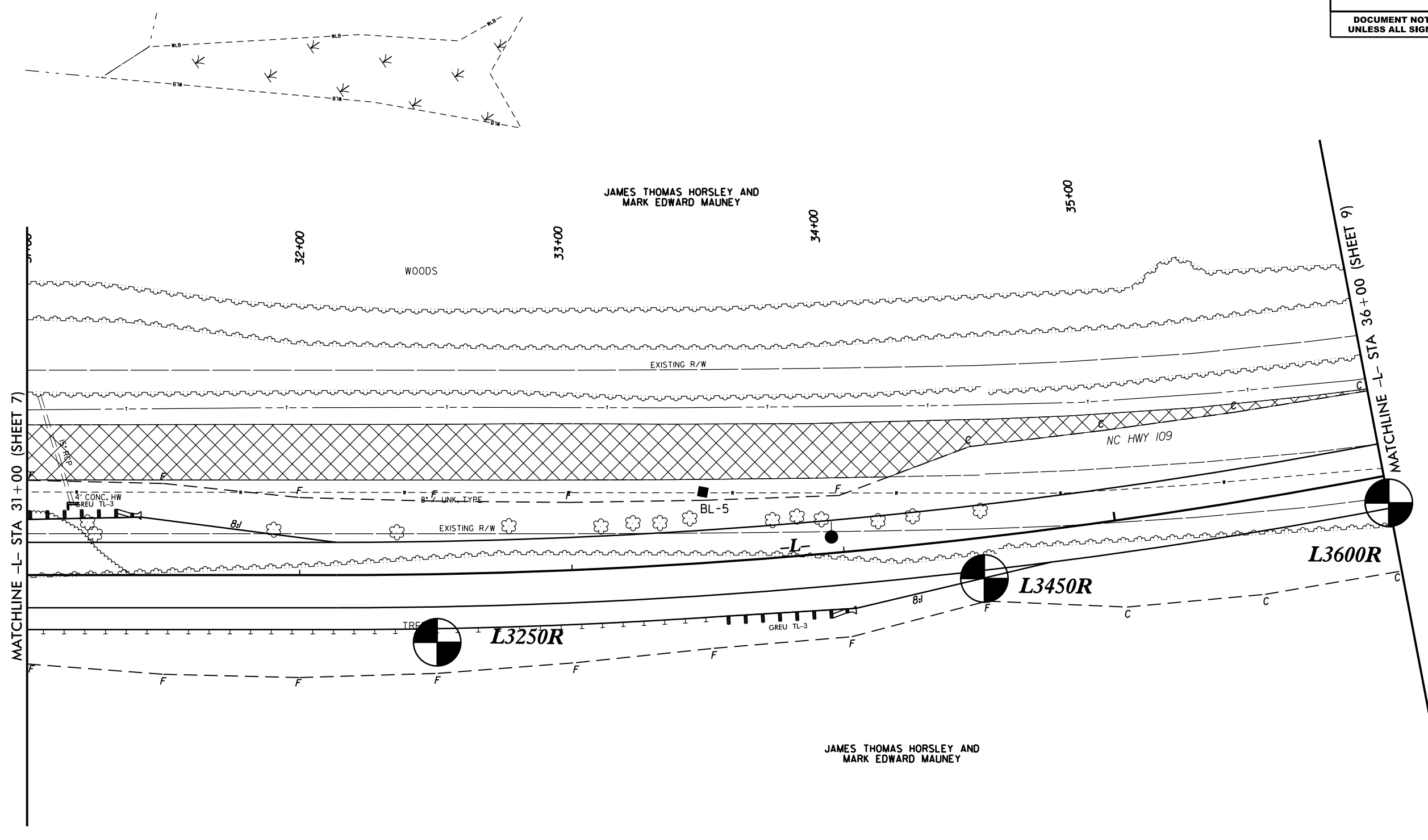
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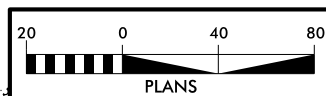
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JAMES THOMAS HORSLEY AND  
MARK EDWARD MAUNEY

JAMES THOMAS HORSLEY AND  
MARK EDWARD MAUNEY



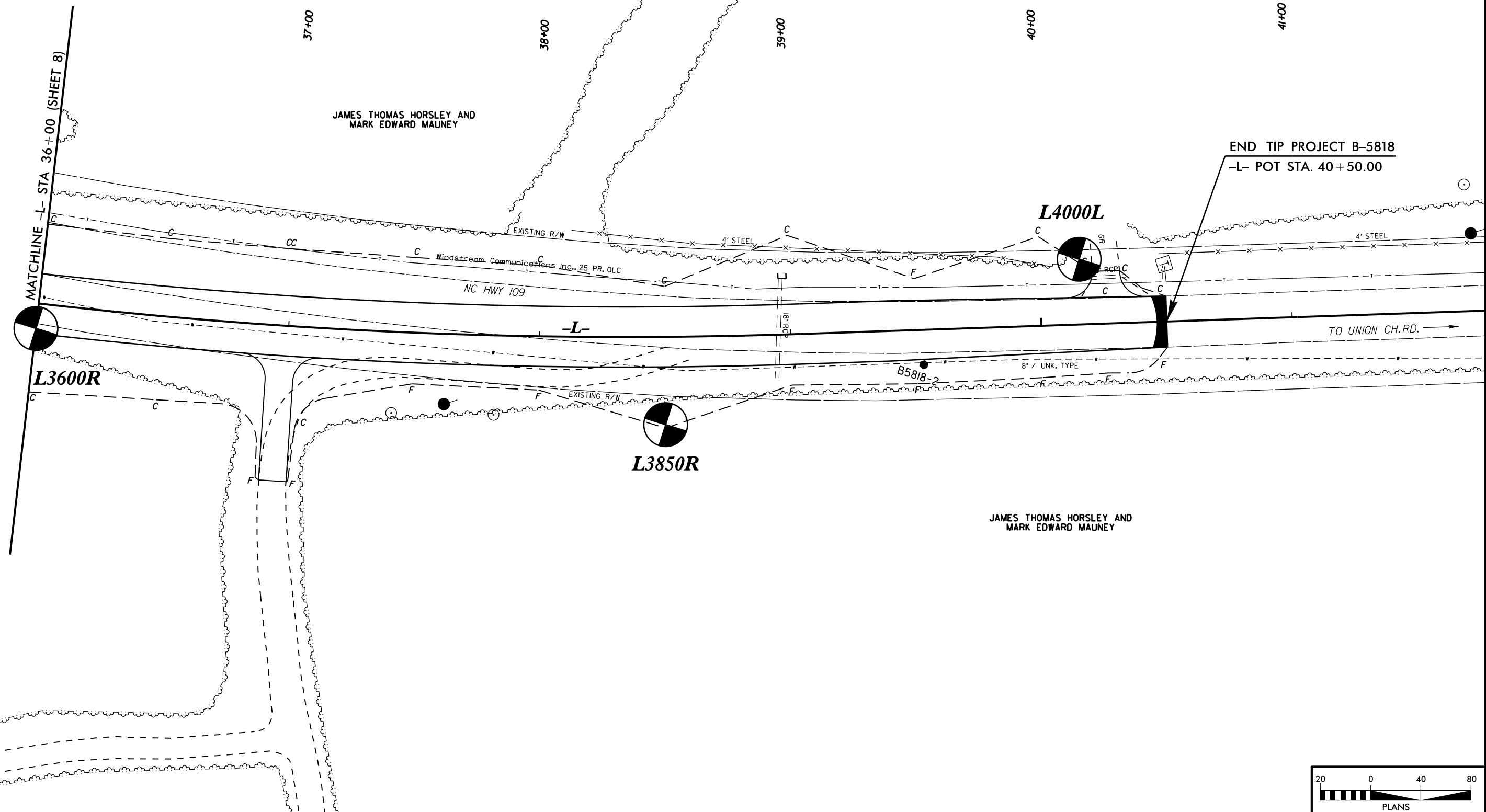
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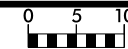
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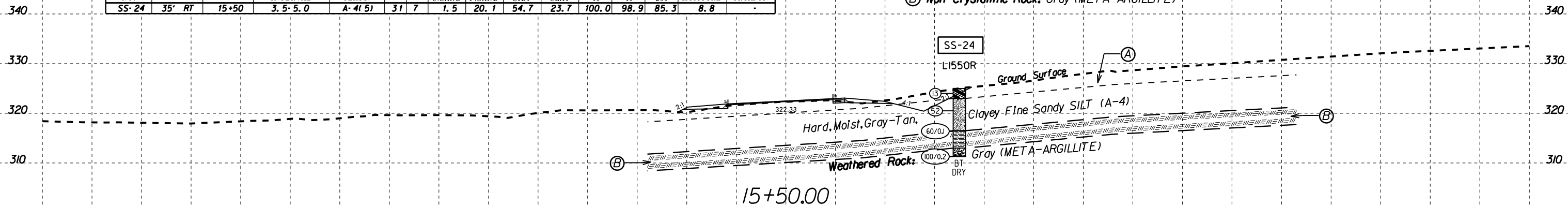




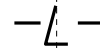
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							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-24	35' RT	15+50	3.5-5.0	A-4(5)	31	7	1.5	20.1	54.7	23.7	100.0	98.9	85.3	8.8	-

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- (B) Non-Crystalline Rock: Gray (META-ARGILLITE)

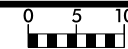


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6/23/16



PROJ. REFERENCE NO.  
B-5818

SHEET NO.  
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140

120

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340

330

320

310

300

340

330

320

310

300

Ground Surface

Ground Surface

(A) Residual: Stiff, Moist, Tan-Red, Silty Fine Sandy CLAY (A-6) with Trace Organics

L1750R

12

64

100/0.4

60/0.1

100/0.2

B1  
DRY

Hard, Moist, Gray, Fine Sandy SILT (A-4)

Gray (META-ARGILLITE)

Gray (META-ARGILLITE)

Gray (META-ARGILLITE)

Weathered Rock:

Non-Crystalline Rock:

Weathered Rock:

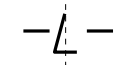
17+50.00

4.7

313.16

4.1

GROUNDLINE TAKEN FROM TIN FILE RECEIVED FROM NCDOT DATED 09092019.  
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
PROJECTED ONTO THE CROSS SECTION.



140

120

100

80

60

40

20

0

20

40

60

80

100

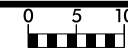
120

140

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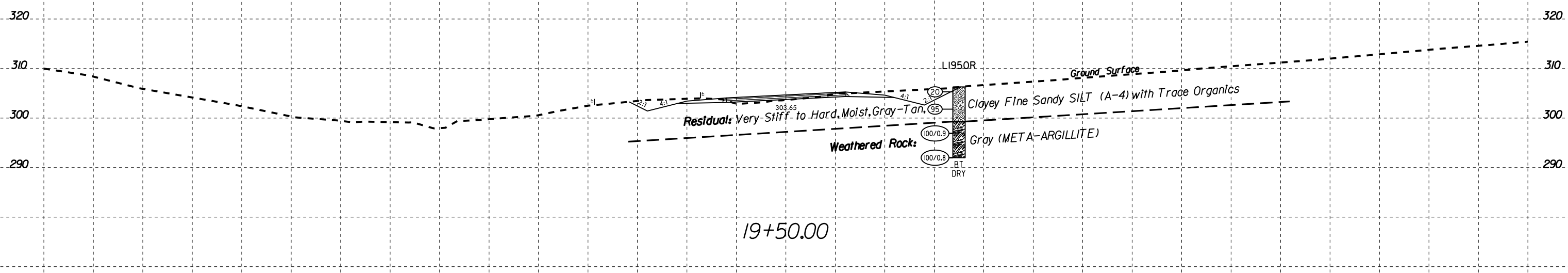
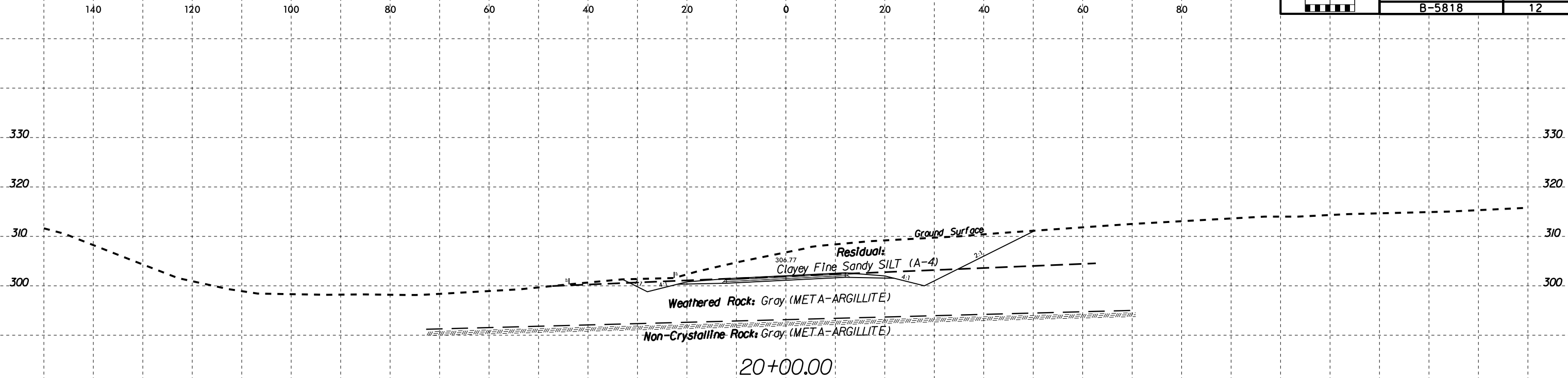


6/23/16



PROJ. REFERENCE NO.  
B-5818

SHEET NO.  
12

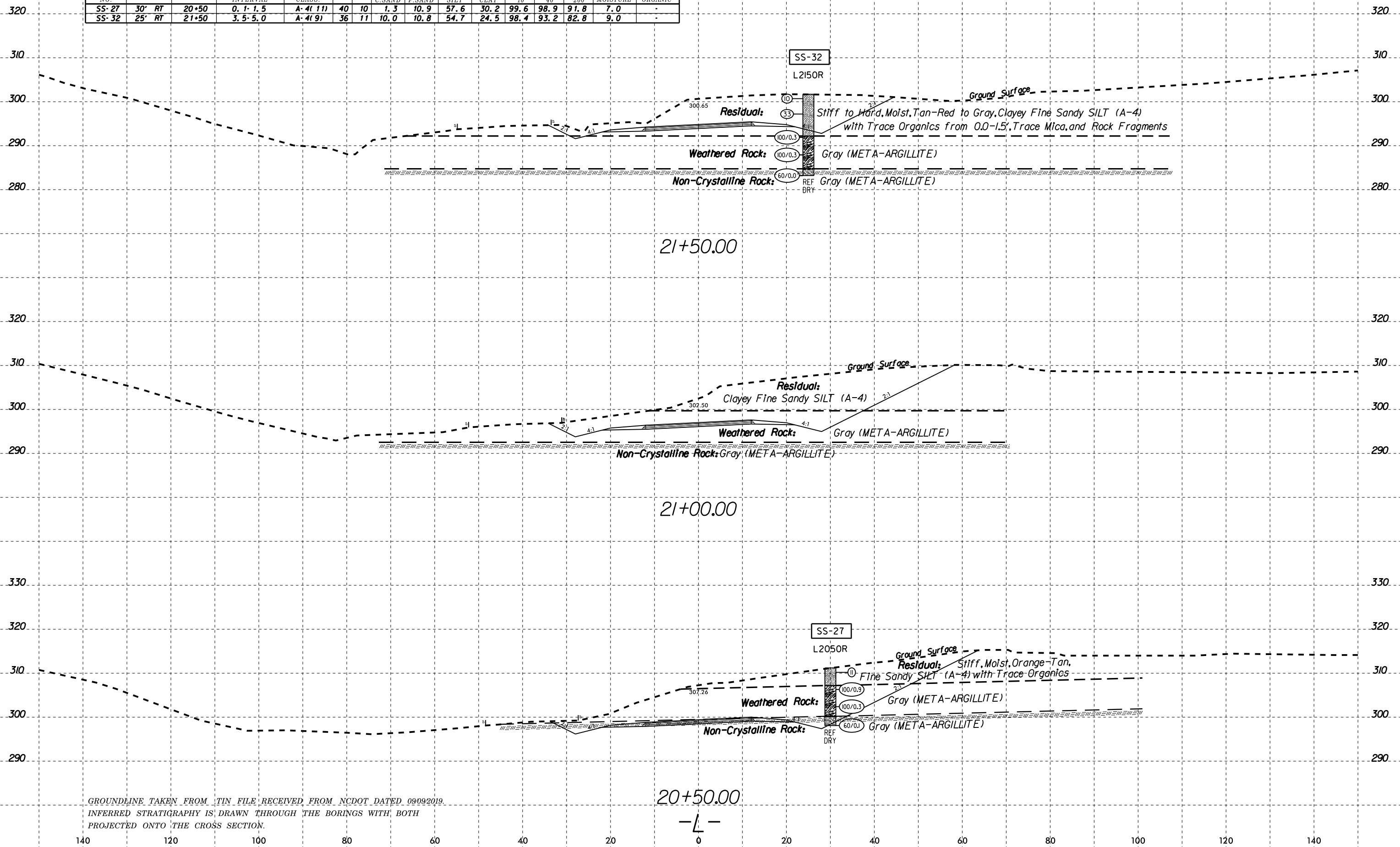


GROUNDLINE TAKEN FROM TIN FILE RECEIVED FROM NCDOT DATED 09/09/2019.  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
 PROJECTED ONTO THE CROSS SECTION.



15-NOV-2019 14:29  
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 Date: 6/23/16

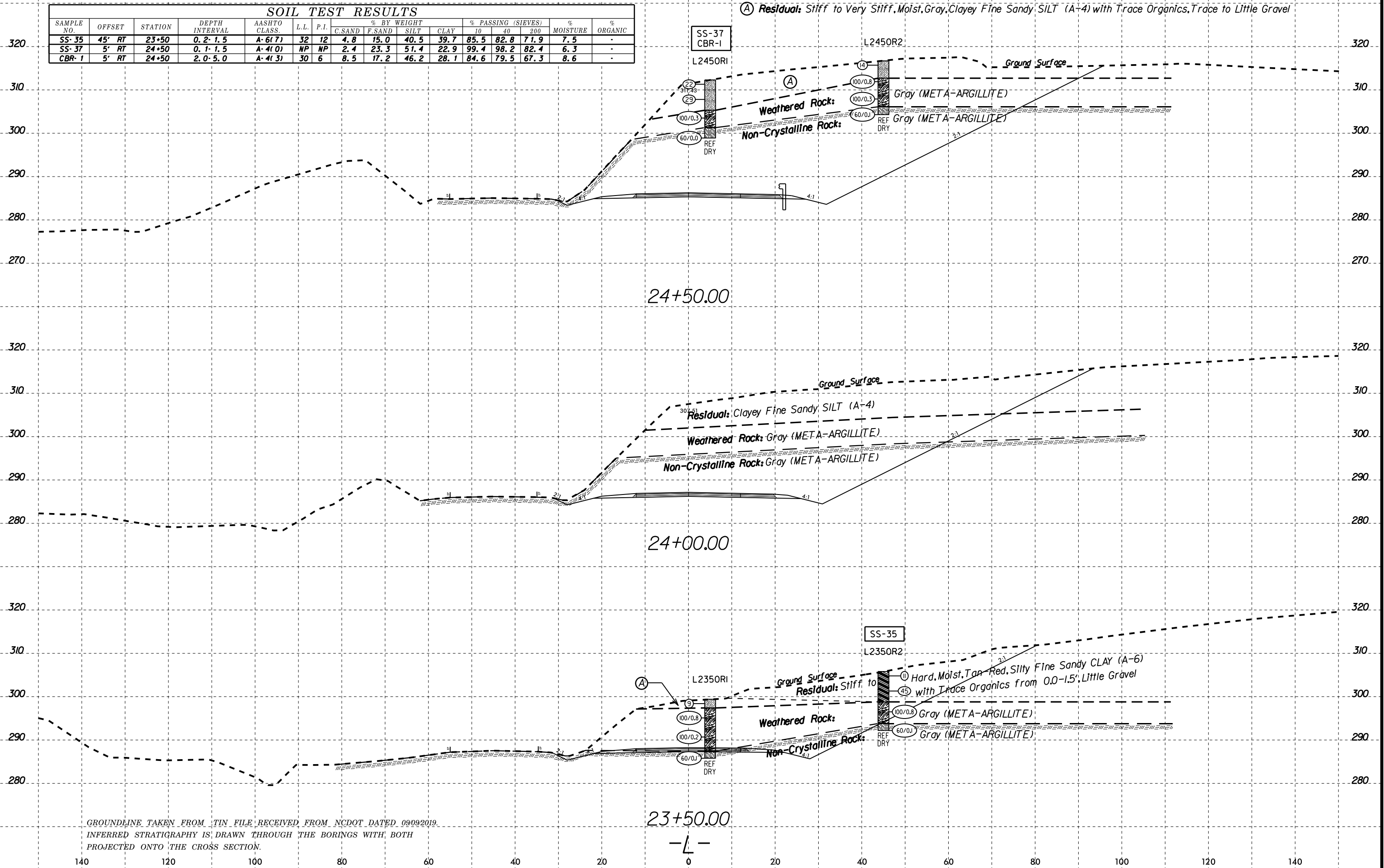
SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-27	30' RT	20+50	0.1-1.5	A-4(11)	40	10	1.3	10.9	57.6	30.2	99.6	98.9	91.8	7.0	-
SS-32	25' RT	21+50	3.5-5.0	A-4(9)	36	11	10.0	10.8	54.7	24.5	98.4	93.2	82.8	9.0	-



GROUNDLINE TAKEN FROM TIN FILE RECEIVED FROM NCDOT DATED 09/09/2019.  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
 PROJECTED ONTO THE CROSS SECTION.

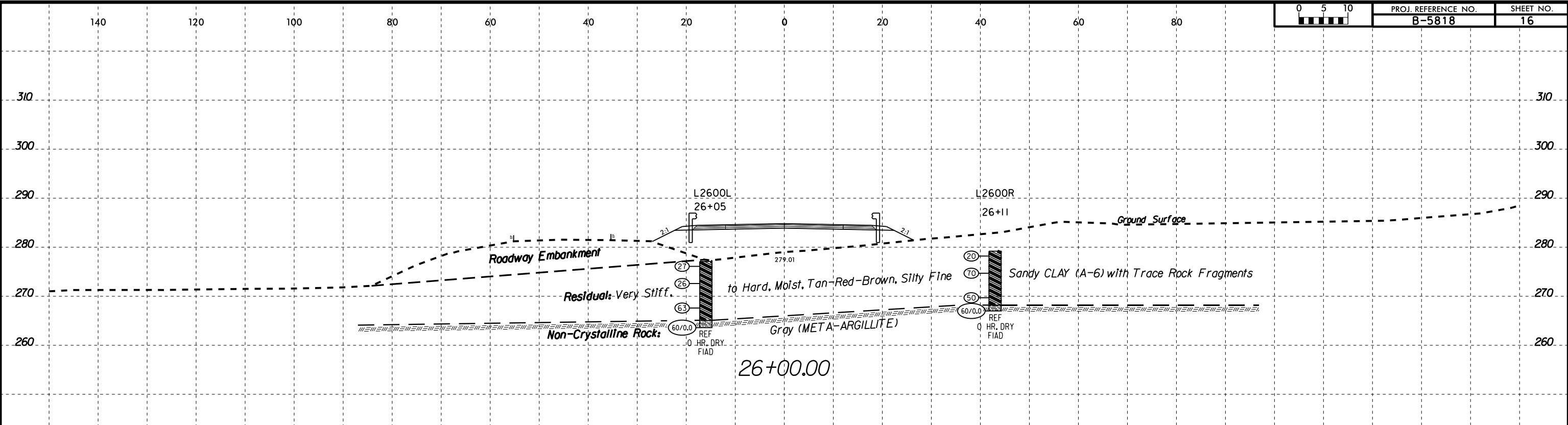


SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-35	45' RT	23+50	0.2-1.5	A-6(7)	32	12	4.8	15.0	40.5	39.7	85.5	82.8	71.9	7.5	-
SS-37	5' RT	24+50	0.1-1.5	A-4(0)	NP	NP	2.4	23.3	51.4	22.9	99.4	98.2	82.4	6.3	-
CBR-1	5' RT	24+50	2.0-5.0	A-4(3)	30	6	8.5	17.2	46.2	28.1	84.6	79.5	67.3	8.6	-

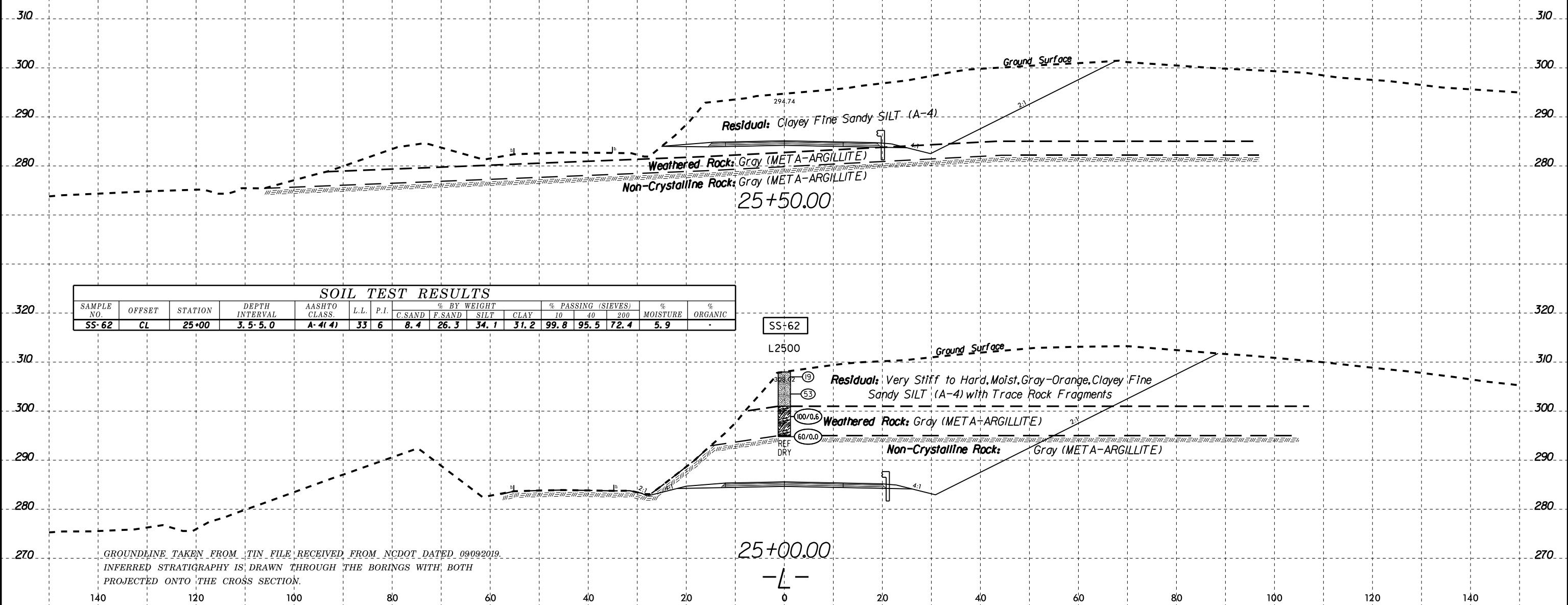


GROUNDLINE TAKEN FROM TIN FILE RECEIVED FROM NCDOT DATED 09/09/2019.  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
 PROJECTED ONTO THE CROSS SECTION.

15-NOV-2019 10:29  
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 10/23/16



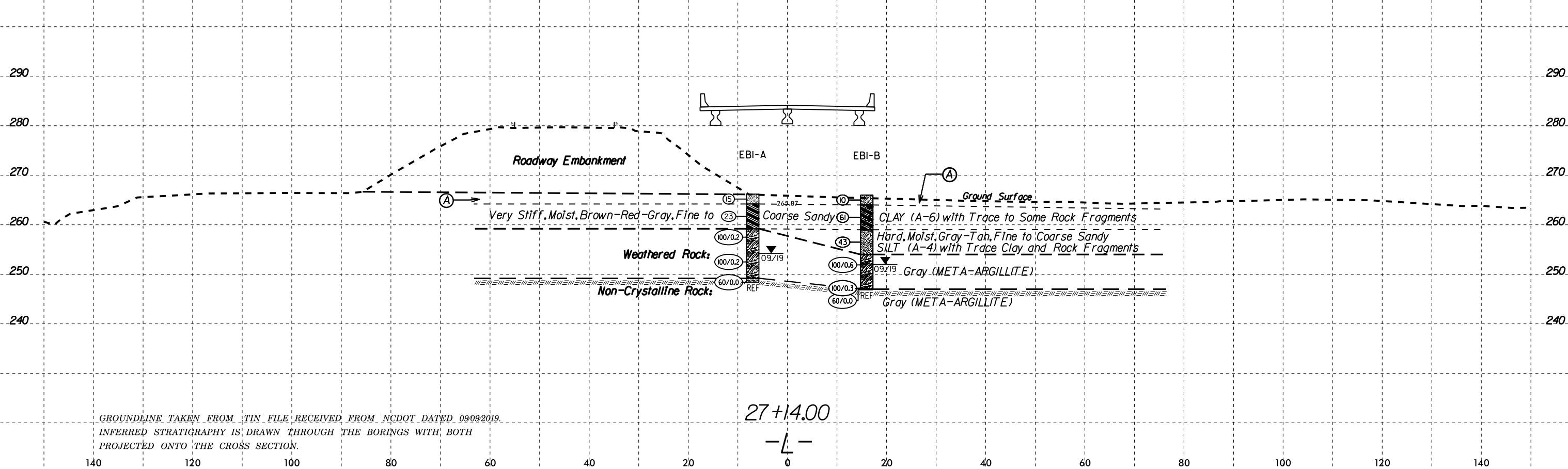
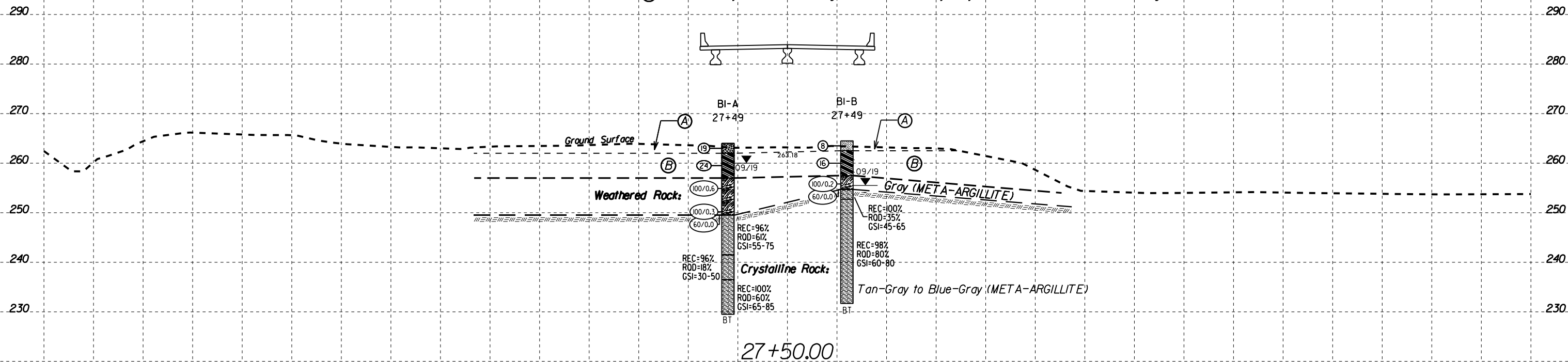
SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-62	CL	25+00	3.5-5.0	A-4(1)	33	6	8.4	26.3	34.1	31.2	99.8	95.5	72.4	5.9	-



GROUNDLINE TAKEN FROM TIN FILE RECEIVED FROM NCDOT DATED 09/09/2019.  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
 PROJECTED ONTO THE CROSS SECTION.

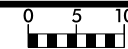
NOTE: See Structure Inventory Report for more details about bridge borings

- (A) Residual: Medium Stiff, to Very Stiff, Moist, Tan-Orange-Brown, Fine Sandy SILT (A-4) with Trace Organics and Clay, Trace to Some Rock Fragments
- (B) Residual: Very Stiff, Moist, Orange-Brown, Fine Sandy Silty CLAY (A-6) with Trace Rock Fragments



GROUNDLINE TAKEN FROM TIN FILE RECEIVED FROM NCDOT DATED 09/09/2019.  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
 PROJECTED ONTO THE CROSS SECTION.

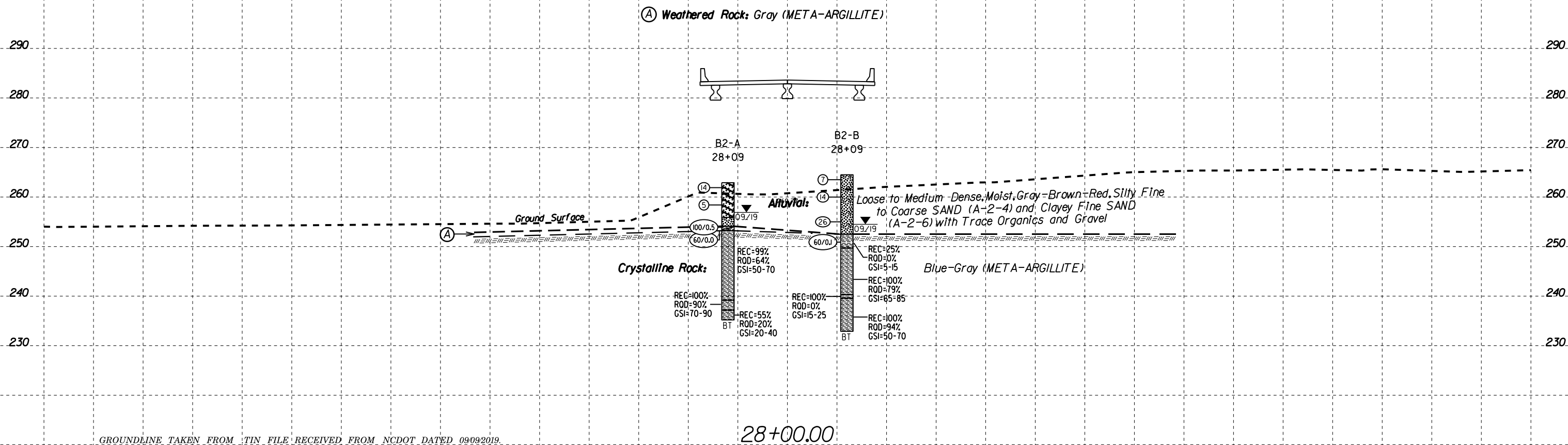
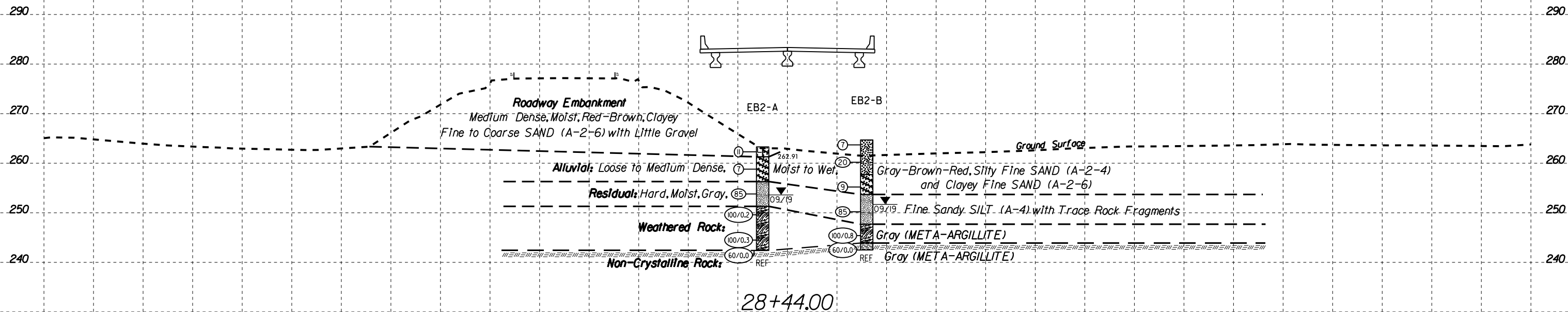
6/23/16



PROJ. REFERENCE NO.  
B-5818

SHEET NO.  
18

NOTE: See Structure Inventory Report for more details about bridge borings



GROUNDLINE TAKEN FROM TIN FILE RECEIVED FROM NCDOT DATED 09/09/2019.  
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
PROJECTED ONTO THE CROSS SECTION.

25-NOV-2019 11:29  
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Date: 11/25/2019

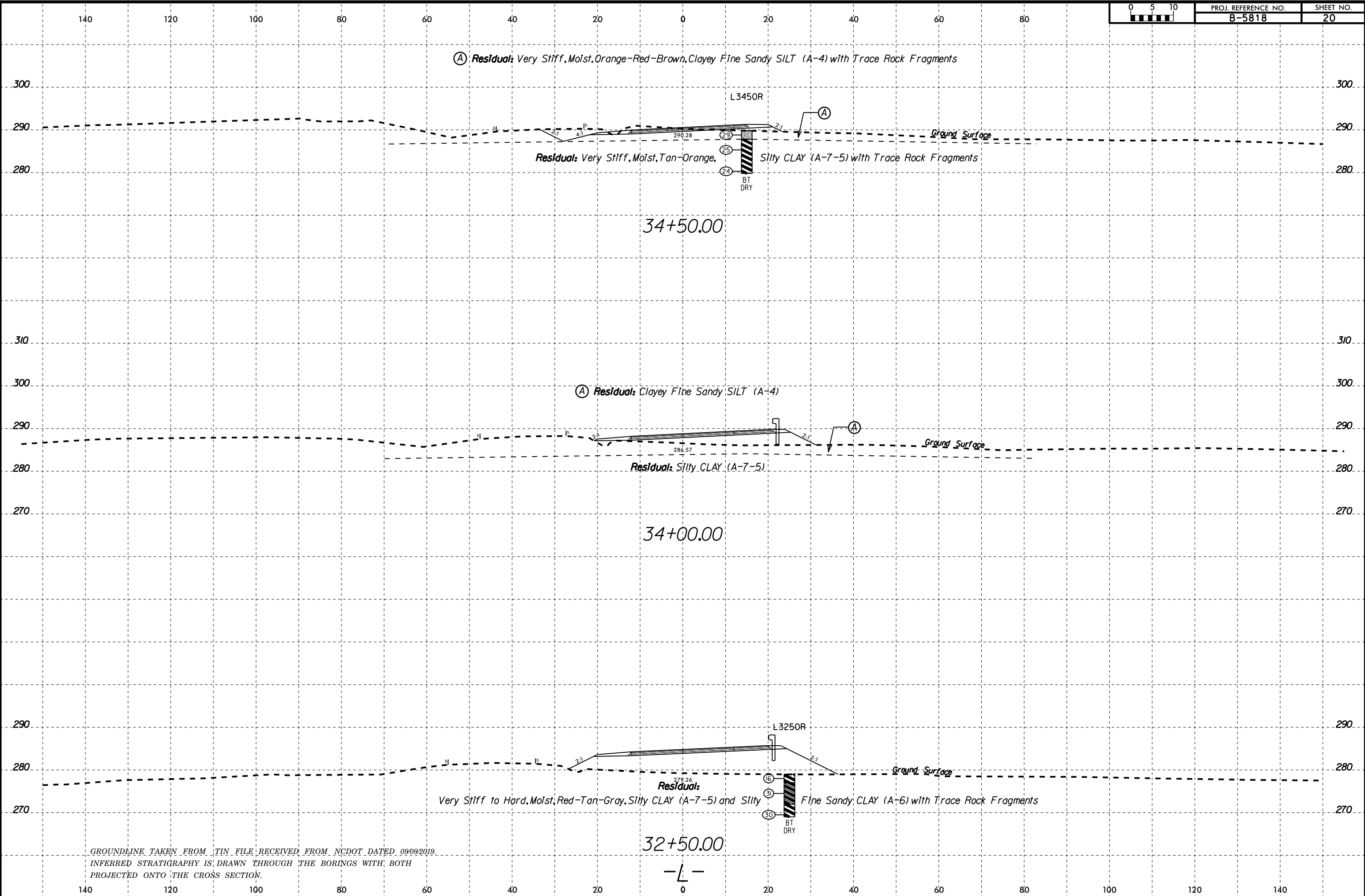




6/23/16



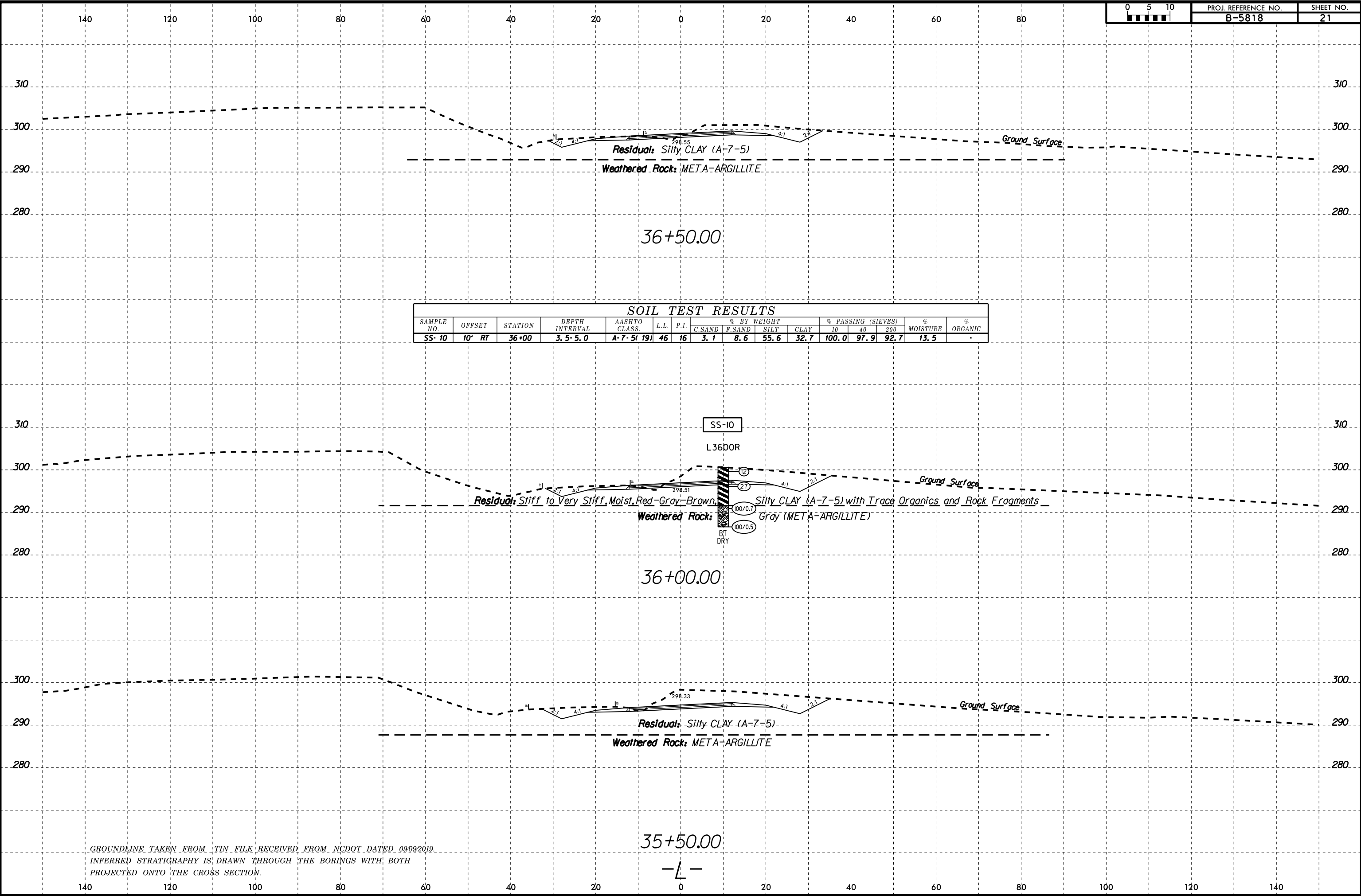
PROJ. REFERENCE NO.	SHEET NO.
B-5818	20



GROUNDLINE TAKEN FROM TIN FILE RECEIVED FROM NCDOT DATED 09/09/2019.  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
 PROJECTED ONTO THE CROSS SECTION.

15-NOV-2019 15:26  
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 Date: 11/15/2019

15-NOV-2019 14:21  
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 6/23/16  
 662656  
 662656



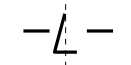
SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-10	10' RT	36+00	3.5-5.0	A-7-5(19)	46	16	3.1	8.6	55.6	32.7	100.0	97.9	92.7	13.5	-

35+50.00

36+00.00

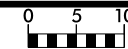
36+50.00

GROUNDLINE TAKEN FROM TIN FILE RECEIVED FROM NCDOT DATED 09/09/2019.  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
 PROJECTED ONTO THE CROSS SECTION.





6/23/16



PROJ. REFERENCE NO.  
B-5818

SHEET NO.  
23

140 120 100 80 60 40 20 0 20 40 60 80

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
SS-2	26' LT	40+16	3.5'-5.0'	A-5(1)	41	9	C.SAND	F.SAND	SILT	CLAY	10	40	200		
							3.1	7.3	56.5	33.1	100.0	98.3	92.6	21.0	-

SS-2

L4000L  
40+16

DRIVEWAY

Roadway Embankment

Residual:

Very Stiff to Hard, Moist, Tan-Orange-Gray.

Clayey Fine Sandy SILT (A-4) and Clayey SILT (A-5)  
with Trace Organics from 3.5'-5.0', Trace Rock Fragments



Ground Surface

40+26.00

Residual:

Clayey Fine Sandy SILT (A-4) and Clayey SILT (A-5)

39+00.00

GROUNDLINE TAKEN FROM TIN FILE RECEIVED FROM NCDOT DATED 09/09/2019.  
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
PROJECTED ONTO THE CROSS SECTION.

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15-NOV-2019 14:26  
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