REFERENCE: 17BP.8.R.121

PROJECT: N/A

SEE SHEET 3 FOR PLAN SHEET LAYOUT AT TIME OF INVESTIGATION

CONTENTS

LINE	STATION	PLAN	PROFILE
-L-	15+20.00 - 30+15.00	4-5	6

APPENDICES

TITLE	SHEETS
CROSS SECTIONS	7-11
BORE LOGS & CORE REPORTS WITH CORE PHOTOGRAPHS	12-18
SOIL TEST RESULTS	19

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

ROADWAY SUBSURFACE INVESTIGATION

COUNTY *MOORE*

PROJECT DESCRIPTION *REPLACE BRIDGE NO. 63 OVER BUFFALO CREEK ON NC 22*

INVENTORY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.8.R.121	1	22

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

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2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

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SIGNATURE DATE
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PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.121	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 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 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 PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 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 LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

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

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

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	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 SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
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
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [X] CME-45C
- [ ] 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.
- [X] CORE 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: NA

ELEVATION: NA FEET

NOTES:

BORING ELEVATIONS OBTAINED USING 620063_ls_tnl.tin DATED 6-13-2017

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.121	2A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

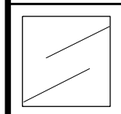
SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

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

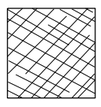
GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)

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.

STRUCTURE

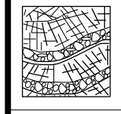


INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities

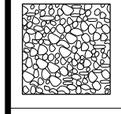


BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets

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

SURFACE CONDITIONS

VERY GOOD — Very rough, fresh unweathered surfaces

GOOD — Rough, slightly weathered, iron stained surfaces

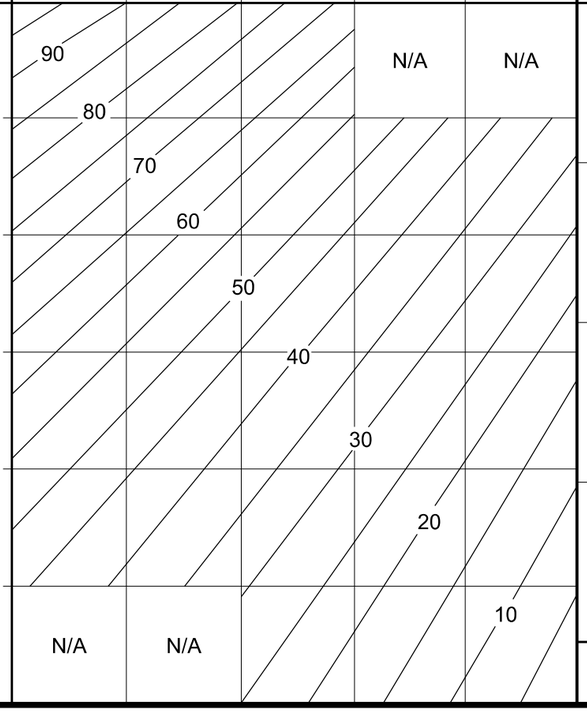
FAIR — Smooth, moderately weathered and altered surfaces

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 ⇒

DECREASING INTERLOCKING OF ROCK PIECES ⇓



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

GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos. P and Hoek E., 2000)

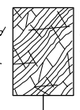
From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be 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.

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 interlayers of siltstone*

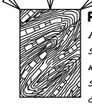
C. *Sandstone and siltstone in similar amounts*



D. *Siltstone or silty shale with sandstone layers*

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

C, D, E, and **G** - may be more or less folded than illustrated but this does not change the strength. Tectonic deformation, faulting and loss of continuity moves these categories to **F** and **H.**



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

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

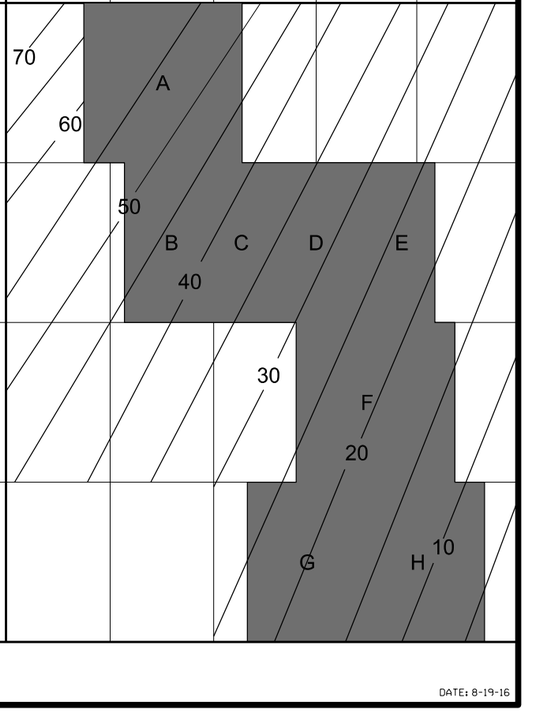
VERY GOOD - Very Rough, fresh unweathered surfaces

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



DATE: 8-19-16

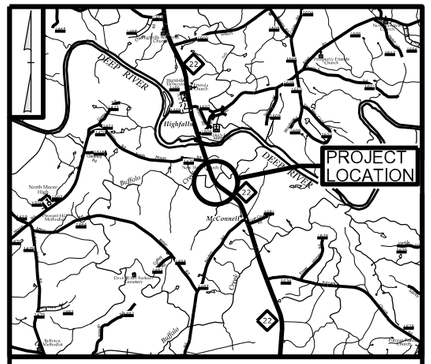
09/08/2017

PROJECT: 17BP.8.R.121

CONTRACT:

ROW PLANS

See Sheet 1A For Index of Sheets
See Sheet 1B For Conventional Symbols



VICINITY MAP

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

MOORE COUNTY

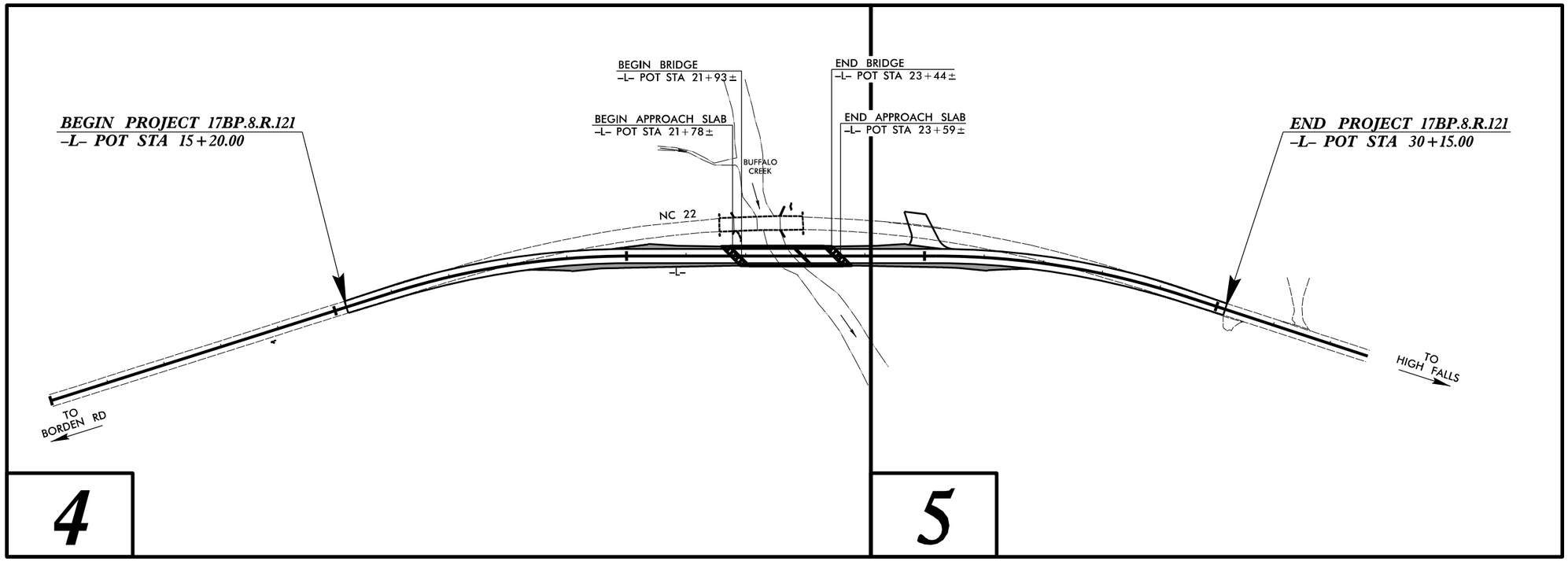
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.8.R.121	3	22

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
17BP.8.R.121		P.E.
17BP.8.R.121		CONSTRUCTION

LOCATION: REPLACE BRIDGE NO. 063 OVER BUFFALO CREEK ON NC 22

TYPE OF WORK: GRADING, PAVING, DRAINAGE AND STRUCTURE

NAD 83
NA 2011



NOTES:

CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD III.

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

GRAPHIC SCALES

50 25 0 50 100
PLANS

50 25 0 50 100
PROFILE (HORIZONTAL)

10 5 0 10 20
PROFILE (VERTICAL)

DESIGN DATA

ADT (2018) = 1950
K = %
D = %
T = 7 %
V = 60 MPH
TTST = % DUAL %

FUNC CLASS=
RURAL COLLECTOR
REGIONAL TIER

PROJECT LENGTH

LENGTH ROADWAY PROJECT 17BP.8.R.121 = 0.254 MILES
LENGTH STRUCTURES PROJECT 17BP.8.R.121 = 0.029 MILES
TOTAL LENGTH PROJECT 17BP.8.R.121 = 0.283 MILES

Prepared for the North Carolina Department of Transportation In the office of:

HDR | ICA

ICA Engineering, Inc.
555 Fayetteville St, Suite 900
Raleigh, NC 27601
NC License No: F-0258

2018 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
NOVEMBER 30, 2017

LETTING DATE:
AUGUST 14, 2018

DENA C. SNEAD, PE
PROJECT ENGINEER

ALEXANDER D. SNIDER, PE
PROJECT DESIGN ENGINEER

TIM WELCH, PE
NCDOT CONTACT
DIV 8 BRIDGE PROGRAM MANAGER

HYDRAULICS ENGINEER

SIGNATURE: *P.E.*

ROADWAY DESIGN ENGINEER

SIGNATURE: *P.E.*

STATE OF NORTH CAROLINA • DEPARTMENT OF TRANSPORTATION •

$$$$SYSTIME$$$$
$$$$DGN$$$$
$$$$FILENAME$$$$

January 29, 2018

PROJECT NUMBER: 17BP.8.R.121
F.A. NUMBER:
COUNTY: Moore
DESCRIPTION: Replace Bridge No. 063 on NC 22 over Buffalo Creek

SUBJECT: Geotechnical Report – Inventory

PROJECT DESCRIPTION

The project is located in north-central Moore County, North Carolina. This project consists of roadway subsurface investigation for a proposed two-lane roadway re-alignment and replacement of Bridge No. 063 on NC 22 over Buffalo Creek.

A CME 45-C drill rig (365794) with an automatic hammer was used for the geotechnical investigation during November 2017. Standard penetration tests (SPT), machine auger advancement, and rock coring were performed with samples extracted for visual classification and/or logging by HDR|ICA Engineering.

Alignment, -L- Sta. 15+20 to Sta. 30+15, totaling 0.28 miles of roadway, was investigated.

AREAS OF SPECIAL GEOTECHNICAL INTEREST

High Plasticity Soils: High plasticity soils with a PI of 26 or greater were encountered in two (2) borings at Sta. 25+50 Centerline and 29+50 Left, respectively, within the project limits. Additional locations were not indicated by advanced borings; however, the presence of unidentified accumulations is possible.

LINE	STATIONS	OFFSETS
-L-	25+50 to 30+00	CL & LT

Weathered Rock / Crystalline Rock: Throughout the project corridor limits, weathered rock (WR) and Crystalline Rock (CR) stratum may occur at or above proposed grade for ditch lines and cut slopes at the following locations:

LINE	STATIONS	OFFSETS
-L-	15+50 to 17+00	LT & RT

PHYSIOGRAPHY AND GEOLOGY

The project site is located within the Piedmont Physiographic Province (Carolina Slate Belt Subprovince). The project corridor is within a rural and woodland setting approximately 1.0 mile south of High Falls, on NC 22 and 5.8 miles east-northeast of Robbins, NC. The general topography of the project area is typical of the Piedmont, with rounded hills and V-shaped valleys. Project area elevations range from 270 feet along the Buffalo Creek to 350 feet on surrounding hilltops, which exhibit moderate to occasionally steep gradient side slopes. The drainage courses are relatively narrow in relation to channel width and drainage flows to the east-northeast away from the project site.

Geologically, the project is located within the Carolina Slate Belt, Litho-Tectonic Province (*Geologic Map of North Carolina, 1985 & Geologic Map of Region G, North Carolina, 1982)*. The underlying bedrock is primarily composed of low-grade metamorphic, volcanic, and sedimentary rocks. Project specific rock core consists of Felsic Metavolcanic Rock of metamorphosed dacitic and rhyolitic flows and tuffs that are interbedded with mafic and intermediate metavolcanic rock of Late Proterozoic to Late Cambrian Age. The overlying residual soils are a product of the physical and chemical weathering of the underlying crystalline rock. Alluvial deposits were not encountered or identified during drilling operations throughout the Buffalo Creek bridge project corridor.

SOIL PROPERTIES

Soil and rock encountered during this investigation are separated into three (3) categories based on origin. The origins consist of residual soils (RES), weathered rock (WR) and recovered crystalline rock (CR). Indicated AASHTO groups are field visual classifications with exception of two (2) bulk samples and one (1) Standard penetration test (SPT) drive sample that were lab verified.

Soil materials interpreted as Residual Soil (RES) were observed throughout -L- alignment and within each boring. All of the intercepted materials belong to the Georgeville Soil Series as indicated by the National Resources Conservation Service (NRCS), which consist of deep, well drained, moderately permeable soils formed on Piedmont uplands from fine crystalline metavolcanic rocks of the Carolina Slate Belt. The NRCS has ranked this soil series as “Good” for road fill and “Moderate” for road construction. The Georgeville Series typically has slopes ranging from 2% to 50% which are gentle to moderately steep.

Residual soils are dominate within the subsurface, throughout the proposed alignment and are derived from weathering of the underlying crystalline rock. Residual soils were penetrated within ten (10) of the advanced borings, without the presence of roadway embankment and/or alluvial deposits. Residual soils were composed of the following:

- moist, medium stiff to stiff, clayey silt and stiff to hard occasionally saprolitic sandy silt with weathered rock fragments (A-4/A-5);
- medium dense to dense, silty clayey sand and fine to very fine grain, clayey sand to silty sand with occasional quartz fragments (A-2-4/A-2-6);
- and soft to stiff, silty clay (A-7-6).

Penetrated residual soil thickness varies within the project corridor from 4.4 feet to 20.0 feet prior to boring termination or initiating rock coring. Weathered rock was intercepted with residual soil strata. Detailed discussion is presented within the following paragraph. Auger refusal or SPT refusal was typically not encountered within residual soils prior to boring terminations, but rather at strata boundaries with weathered rock or crystalline rock.

Weathered Rock was intercepted within three (3) advanced borings either interlayered with residual soils or as a transitional stratum between residual soils and crystalline rock. Weathered rock strata, when present exhibited thickness ranging from 1.1 feet to 5.1 feet. Subsequent advancement of all borings suggests that boulders and/or weathered rock seams, near the ground surface, may be anticipated at any location or any depth throughout the project limits.

Crystalline Rock was penetrated in two (2) borings within the project limits. Felsic Metavolcanic Rock – metamorphosed dacitic to rhyolitic flows and tuffs, interbedded with mafic and intermediate metavolcanic rock. Quartz, orthoclase and plagioclase-feldspars, amphibole, biotite, and hornblende are dominant with a cryptocrystalline appearance that exhibits fresh to moderate weathering and foliated with phyllitic texture throughout. Close to very close fracture spacing was indicated with many discontinuity walls, iron oxide stained, and spotty clay infill. Core run recoveries ranged from 94% to 100% while individual run rock quality designation (RQD) ranged from 15% to 100%.

GROUNDWATER

Groundwater was only encountered (immediate) in one (1) borehole at an elevation of 302.5 feet, and the remaining advanced borings along the proposed alignment were reported as dry. Static or 24 hour measurements were recorded from three (3) borings and varied from 6.2 feet to 21.0 feet below ground surface equating to elevations 266.9 to 302.7 feet while remaining borings were cored or immediately backfilled. Groundwater levels are anticipated to fluctuate with individual precipitation events, seasonal precipitation accumulations, or prolonged drought.

Prepared by,

Kenneth R. Bussey, Jr., PE
Project Engineer

Aaron Niehoff
Geologist

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Suite 900
Raleigh, NC 27601
NC License No: F-0258

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.121	4
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

NAD 83/NA 2011

2
EVIE H. REYNOLDS

3
THOMAS JAMES BREWER

EUGENE V RISHER
MARY ELLEN MCDONALD RISHER

1
EUGENE V RISHER
MARY ELLEN MCDONALD RISHER

4
SHELAH B. OGLETREE

BUFFALO CREEK

ROADWAY EMBANKMENT

BEGIN BRIDGE
-L- POT STA 21+93±

END APPROACH SLAB
-L- POT STA 23+59±

END BRIDGE
-L- POT STA 23+44±

BEGIN APPROACH SLAB
-L- POT STA 21+78±

BRIDGE #63
CONC DECK
ASPH OVERLAY

L_1600L
L_1850
L_1550RI
L_1550R
L_2350R

-L- POT 10+00.00

-L- PC 15+98.42

-L- PT 20+06.15

N 54° 09' 55.0" W
-L-

N 36° 35' 47.5" W
-L-

ROCK OUTCROP

ALLUVIAL

HIGH WATER ELEVATION=277.07'
FIELD OBSERVED
01/20/17

150' UNIFORM TAPER (BOTH SIDES)

BEGIN TIP PROJECT 17BP.8.R.121
-L- POT STA 15+20.00

MATCHLINE -L- STA 24+10
SEE SHEET 5

-L-
PI Sta 18+03.95
Δ = 17° 34' 07.5" (RT)
D = 4° 18' 32.3"
L = 407.73'
T = 205.52'
R = 1,330.00'
SE = 0.06

FOR -L- PROFILE, SEE SHEET 6

PAVEMENT REMOVAL

$DATE$
$FILE$
$$SESSIONNAME$$$$

HDR | ICA
ICA Engineering, Inc.
555 Fayetteville St,
Suite 900
Raleigh, NC 27601
NC License No: F-0258

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.121	5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

NAD 83/NA 2011

MATCHLINE -L- STA 24+10
SEE SHEET 4

3
THOMAS JAMES BREWER

5
JACKIE F UPCHURCH

LARRY VERNON UPCHURCH

GPS 620063-1

10" CONC BLK WALL
42" CONC BLK WALL

BM2

INV=305.13'
TOP=306.79'
INV=305.13'

GRAVEL

GR

EXISTING R/W

20'

MB

15" RCP

INV=306.25'

48" WW (SRW)

27' TYP

+28

GUY(2)

EIP

ROADWAY EMBANKMENT

L_2750L

C

WOODS

+65

150' UNIFORM TAPER (BOTH SIDES)

27' TYP

POST(3)

L_2950LI

R=30'

L_2550

N 36° 35' 47.5" W -L-

L_2750

L_2950L

ALLUVIAL

GREU, TL-3

8:1

GUY(2)

GUY

25+00

L_2700R

NC 22

20' ASPH

WOOD & W.W.

PLANTER

POST

MB(2)

ASPH

EXISTING R/W

TANK

-L- POT 32+67.03

-L-
N 18° 25' 39.5" W

TO HIGH FALLS

SHELAH B. OGLETREE

WOODS

30+00

GR

GPS 620063-2

-L- PT 29+41.52

4
SHELAH B. OGLETREE

-L- PC 25+19.86

-L-
PI Sta 27+32.53
Δ = 18° 10' 08.1" (RT)
D = 4° 18' 32.3"
L = 421.65'
T = 212.66'
R = 1,330.00'
SE = 0.06

6
EDWARD CHARLES ENDERLE
SIDNEY D. ENDERLE

END TIP PROJECT 17BP.8.R.121
-L- POT STA 30+15.00

6
EDWARD CHARLES ENDERLE
SIDNEY D ENDERLE

FOR -L- PROFILE, SEE SHEET 6

PAVEMENT REMOVAL

$DATE$
$FILE$
$$USERNAME$$$$$

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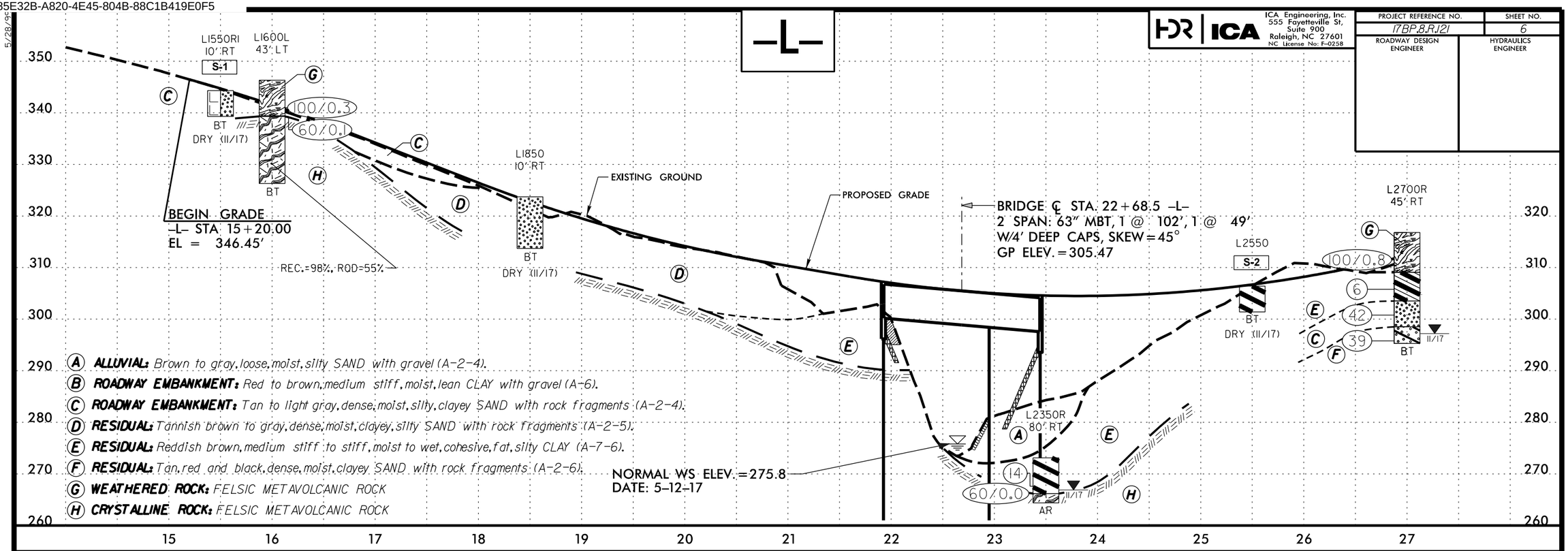
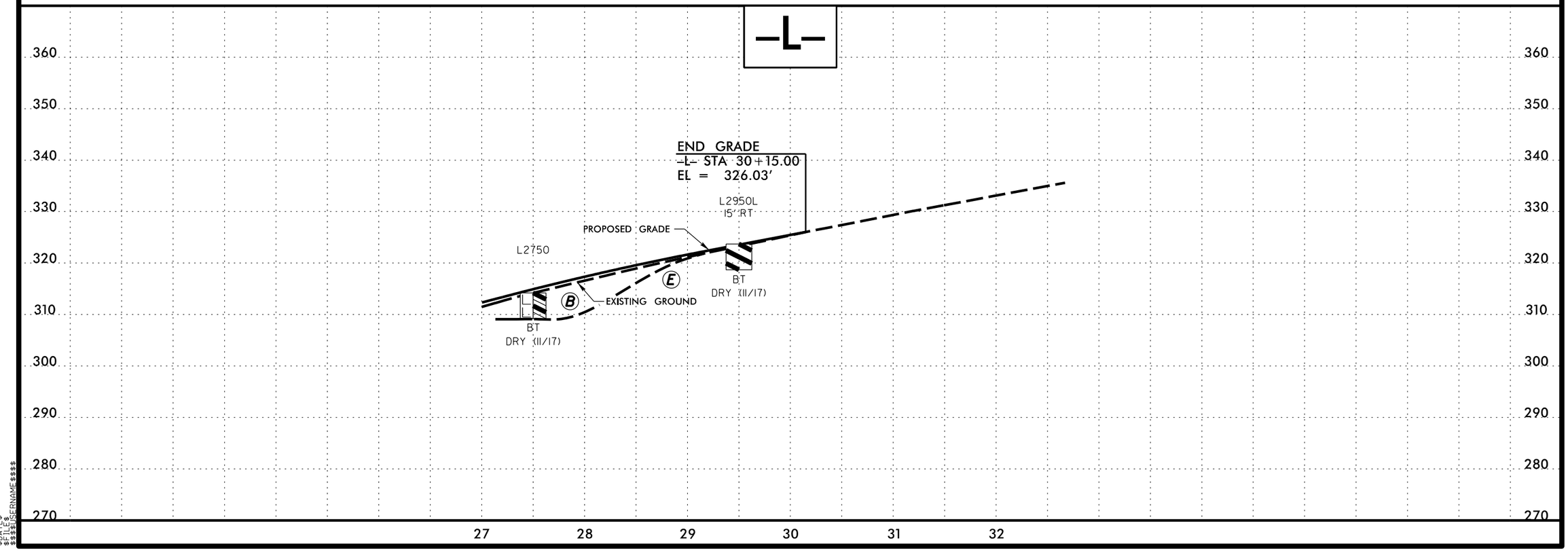
Suite 900
Raleigh, NC 27601
NC License No: F-0258

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.RJ21	6
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER





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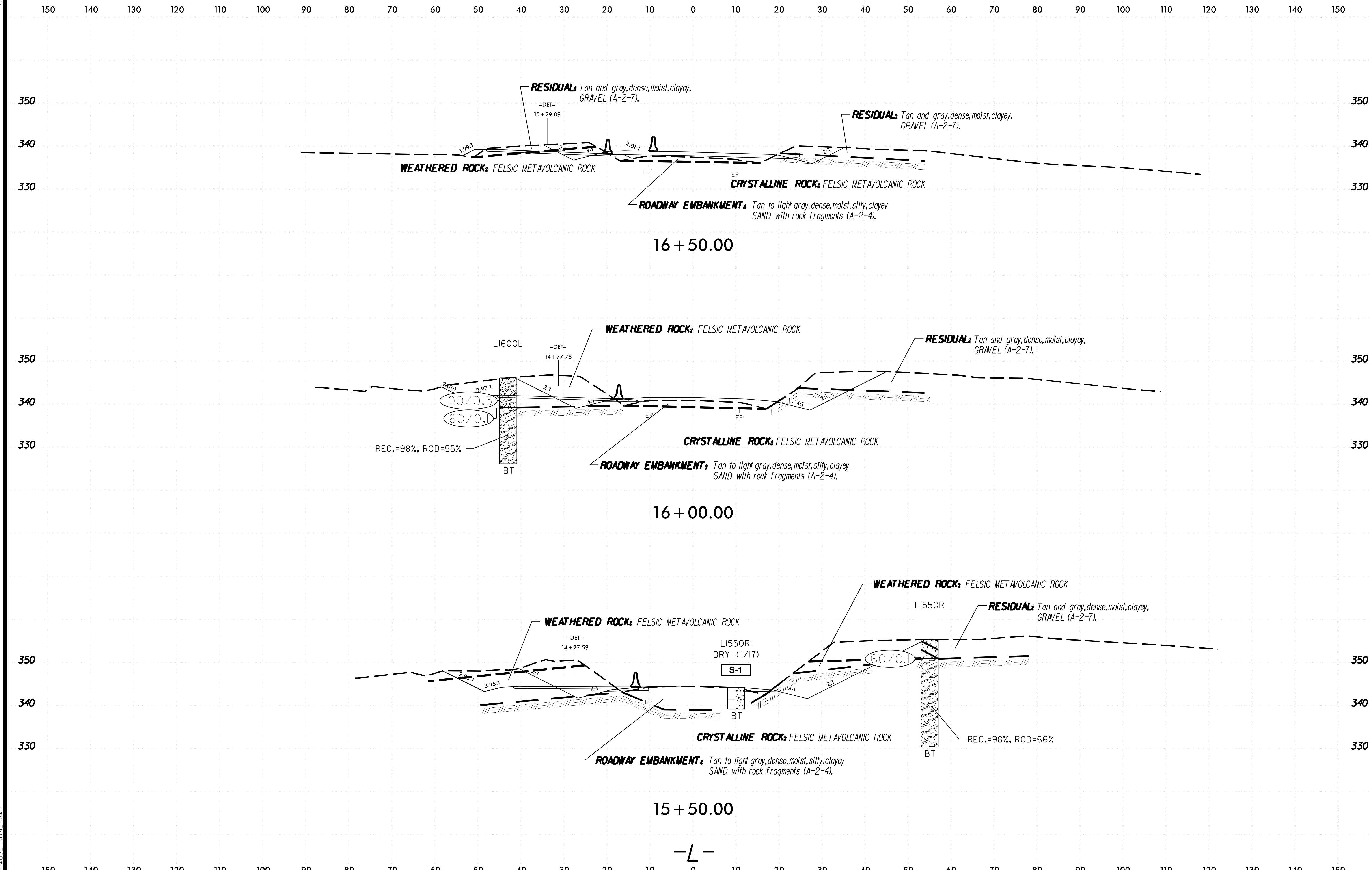
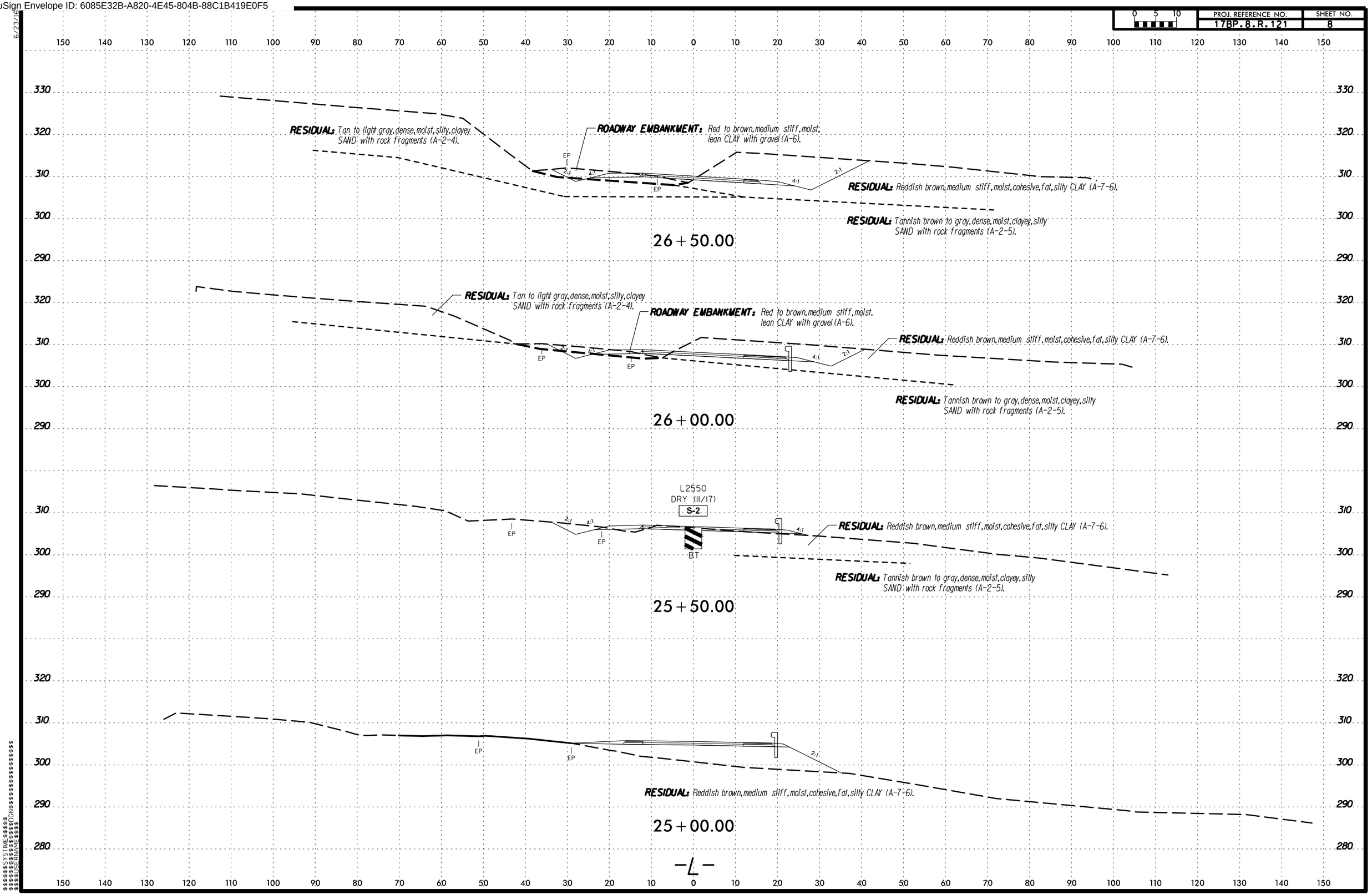
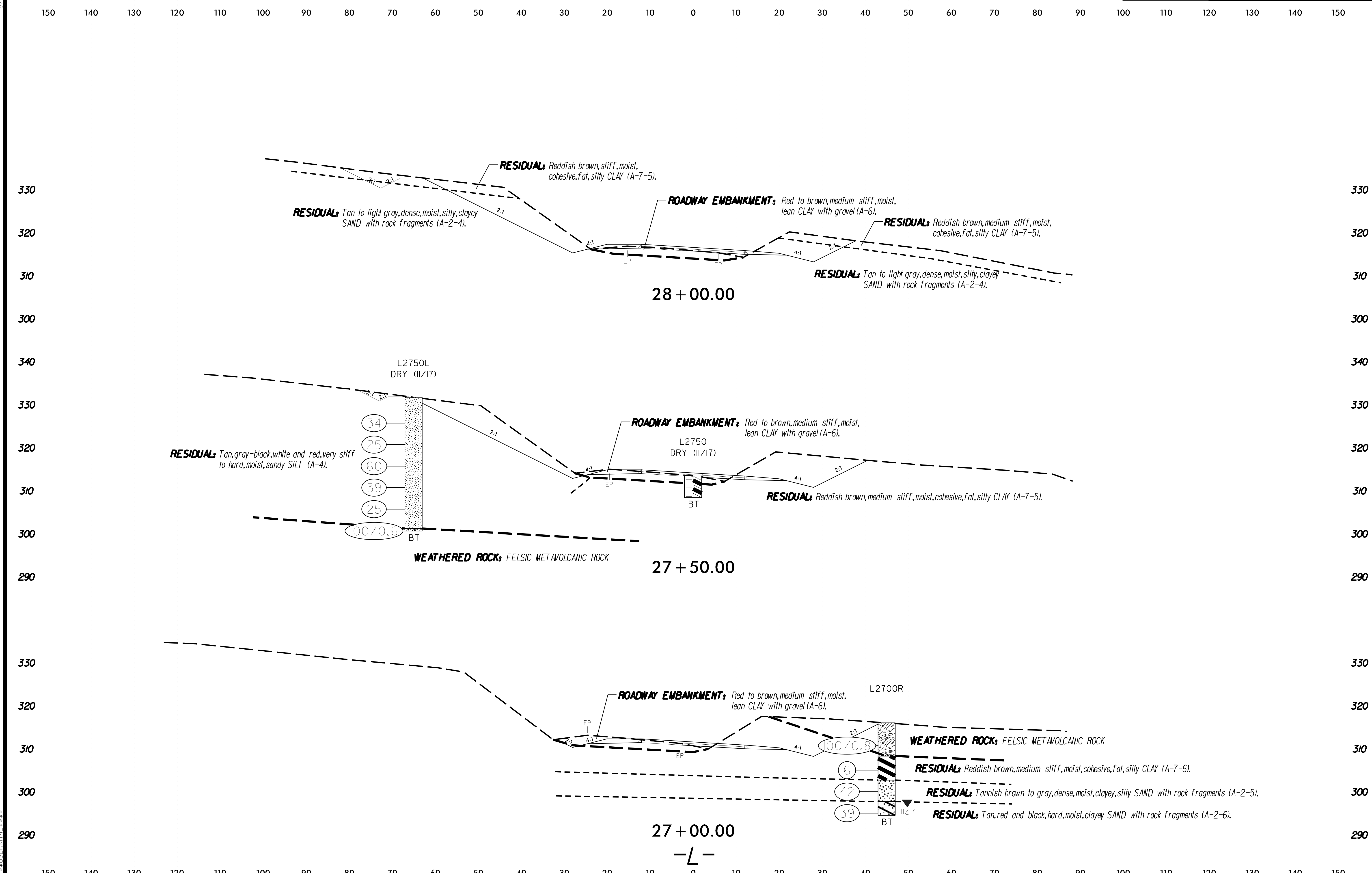


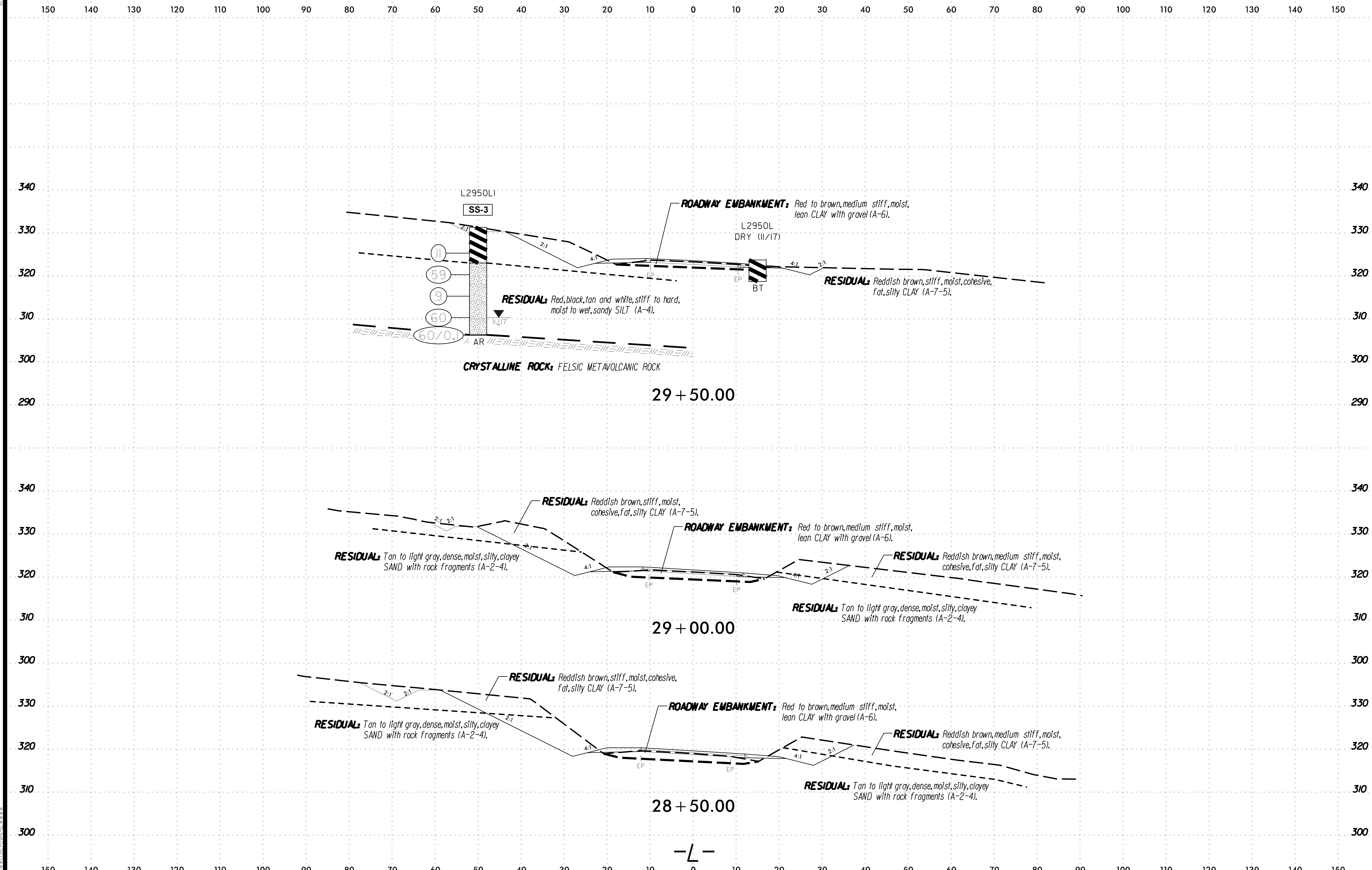


6/23/16

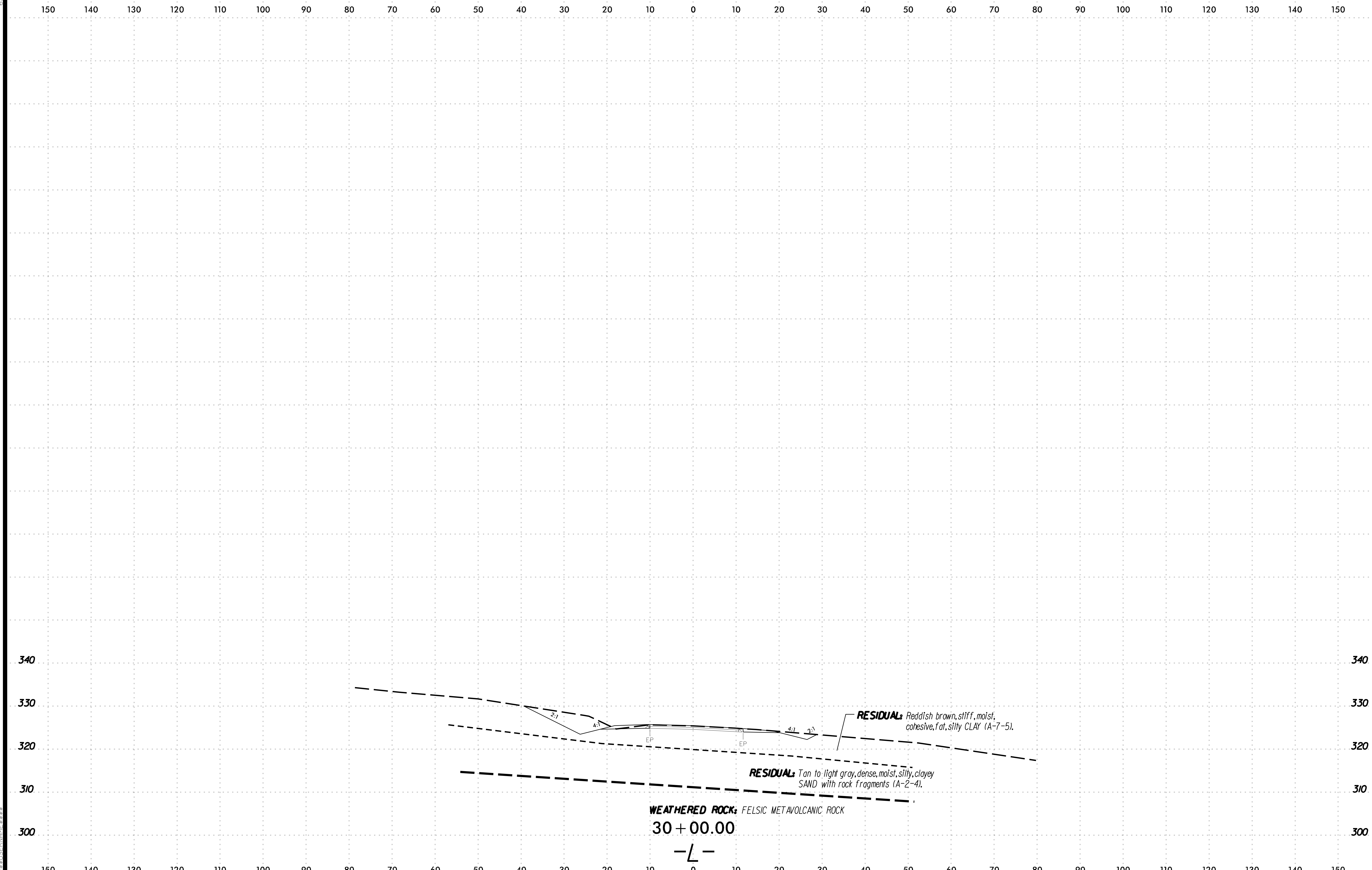
$$$$$$$$SYSTIME$$$$$$
$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$
$$$$$$USERNAME$$$$

PROJ. REFERENCE NO.	SHEET NO.
17BP.8.R.121	9





PROJ. REFERENCE NO.	SHEET NO.
17BP.8.R.121	11



30 + 00.00

-L-

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 17BP.8.R.121	**TIP** 17BP.8.R.121	**COUNTY** MOORE	**GEOLOGIST** Z. Bruce	
SITE DESCRIPTION Replace Bridge No. 63 Over Buffalo Creek on NC 22				**GROUND WTR (ft)**
BORING NO. L1550R	**STATION** 15+50	**OFFSET** 55 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 355.5 ft	**TOTAL DEPTH** 25.0 ft	**NORTHING** 626,222	**EASTING** 1,846,793	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE ICA5794 CME-45C 87% 05/22/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Smith, W.	**START DATE** 11/04/17	**COMP. DATE** 11/04/17	**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)
360											
355										355.5 GROUND SURFACE	0.0
	351.1	4.4	60/0.1			60/0.1				**RESIDUAL** Interpreted as tan and gray, clayey **GRAVEL** (A-2-7). 351.1	4.4
350										351.0 **CRYSTALLINE ROCK** Felsic Metavolcanic	4.5
345										**CRYSTALLINE ROCK** Felsic Metavolcanic	
340											
335										330.5	25.0
										Boring Terminated at Elevation 330.5 ft in Crystalline Rock (Felsic Metavolcanic).	

GEOTECHNICAL BORING REPORT
CORE LOG

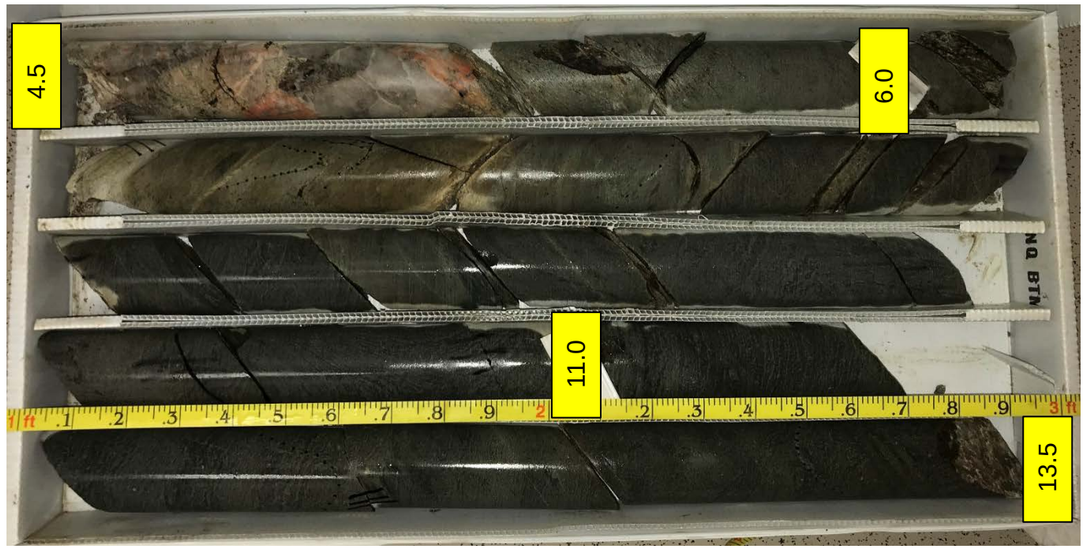
WBS 17BP.8.R.121	**TIP** 17BP.8.R.121	**COUNTY** MOORE	**GEOLOGIST** Z. Bruce	
SITE DESCRIPTION Replace Bridge No. 63 Over Buffalo Creek on NC 22				**GROUND WTR (ft)**
BORING NO. L1550R	**STATION** 15+50	**OFFSET** 55 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 355.5 ft	**TOTAL DEPTH** 25.0 ft	**NORTHING** 626,222	**EASTING** 1,846,793	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE ICA5794 CME-45C 87% 05/22/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Smith, W.	**START DATE** 11/04/17	**COMP. DATE** 11/04/17	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 20.5 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
351											Begin Coring @ 4.5 ft
350	351.0	4.5	1.5	1:43/0.5	(1.5)	(1.0)		(20.0)	(13.5)		**CRYSTALLINE ROCK**
	349.5	6.0		1:56	100%	67%		98%	66%		Light gray to greenish gray, moderately weathered to fresh, iron oxide staining at discontinuities (45°), very hard to hard Felsic Metavolcanic (phyllitic texture), moderately close to close fracture spacing. Quartz Feldspar phenocryst at 4.5'-5.3'; clay parting at 5.3'; moderately weathered interval at 4.5'-8.3'; numerous 70° healed joints at 6.3'-7.3', 7.6'-8.2', 18.6'-19.0', 19.6'-20.5'; numerous 80° stained joints at 16.0'-17.0', 19.4'-20.4' and 22.8'-24.7'; vugular texture at 18.6'-18.2'
			5.0	2:10	(4.7)	(2.0)					
				1:53							
				1:58	94%	40%					
345				2:36							
	344.5	11.0		3:06							
			5.0	3:12	(4.9)	(4.3)					
				4:00							
				3:58	98%	86%					
340				4:02							
	339.5	16.0		4:18							
			5.0	4:10	(5.0)	(4.0)					
				4:12							
				4:10	100%	80%					
335				4:18							
	334.5	21.0		4:02							
			4.0	4:04	(3.9)	(2.2)					
				3:47							
				3:31	98%	55%					
	330.5	25.0		4:08							330.5 / 25.0
											Boring Terminated at Elevation 330.5 ft in Crystalline Rock (Felsic Metavolcanic).

CORE PHOTOGRAPHIC RECORD

Replace Bridge No. 63 Over Buffalo Creek on NC 22

L1550R Box 1 of 3



0.0 1.0 2.0

FEET

L1550R Box 2 of 3

0.0 1.0 2.0

FEET

CORE PHOTOGRAPHIC RECORD

Replace Bridge No. 63 Over Buffalo Creek on NC 22

L1550R Box 3 of 3

0.0 1.0 2.0

FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 17BP.8.R.121	**TIP** 17BP.8.R.121	**COUNTY** MOORE	**GEOLOGIST** Z. Bruce	
SITE DESCRIPTION Replace Bridge No. 63 Over Buffalo Creek on NC 22				**GROUND WTR (ft)**
BORING NO. L1600L	**STATION** 16+00	**OFFSET** 43 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 346.3 ft	**TOTAL DEPTH** 20.0 ft	**NORTHING** 626,172	**EASTING** 1,846,695	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE ICA5794 CME-45C 87% 05/22/2017		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER Smith, W.	**START DATE** 11/05/17	**COMP. DATE** 11/05/17	**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)
350											
										346.3 GROUND SURFACE	0.0
345										**WEATHERED ROCK** Felsic Metavolcanic	
	341.3	5.0	100/0.3			100/0.3					
340	339.4	6.9	60/0.1			60/0.1				339.4	6.9
										339.3 **CRYSTALLINE ROCK** Felsic Metavolcanic	7.0
335										**CRYSTALLINE ROCK** Felsic Metavolcanic	
330											
										326.3	20.0
										Boring Terminated at Elevation 326.3 ft in Crystalline Rock (Felsic Metavolcanic).	

GEOTECHNICAL BORING REPORT
CORE LOG

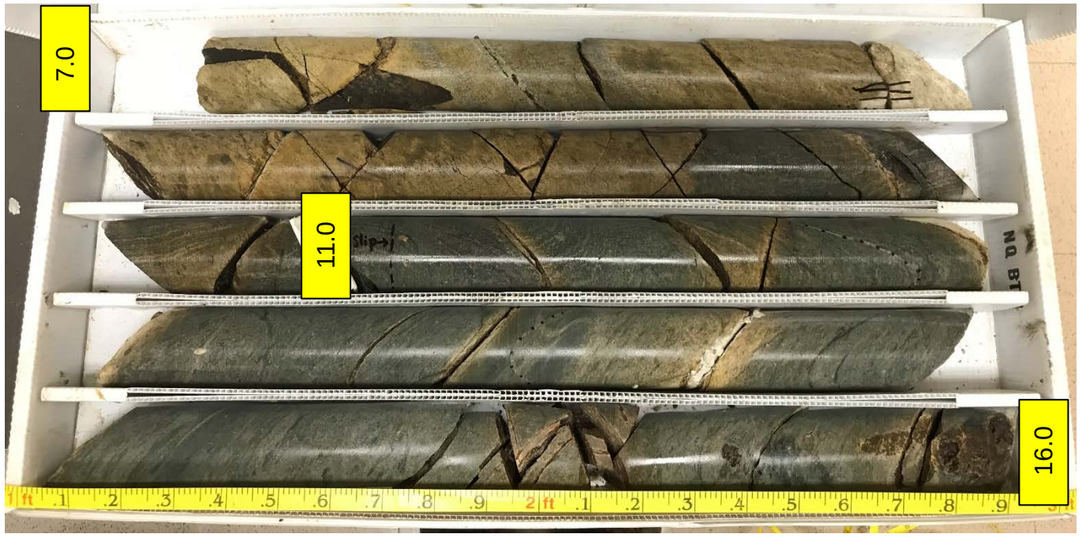
WBS 17BP.8.R.121	**TIP** 17BP.8.R.121	**COUNTY** MOORE	**GEOLOGIST** Z. Bruce
SITE DESCRIPTION Replace Bridge No. 63 Over Buffalo Creek on NC 22			**GROUND WTR (ft)**
BORING NO. L1600L	**STATION** 16+00	**OFFSET** 43 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 346.3 ft	**TOTAL DEPTH** 20.0 ft	**NORTHING** 626,172	**EASTING** 1,846,695	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE ICA5794 CME-45C 87% 05/22/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Smith, W.	**START DATE** 11/05/17	**COMP. DATE** 11/05/17	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 13.0 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
339.3											Begin Coring @ 7.0 ft
	339.3	7.0	4.0	1:02 1:03 1:04 1:51	(3.9) 98%	(0.6) 15%		(12.7) 98%	(7.2) 55%		**CRYSTALLINE ROCK** 7.0 Light tan-brown to light gray-greenish gray, slightly to moderately weathered, very hard to hard Felsic Metavolcanic, very close to moderately close fracture spacing. Core slip at 11.0'; 50° iron stained joints at 8.9'-9.9' and 14.9'-15.3'; 80° iron stained joints at 7.0'-7.6', 15.7'-17.9'; vugular texture at 15.7'-16.0'; numerous 70°-80° healed joints with calcite infill
335	335.3	11.0	5.0	2:03 1:41 1:38 1:52 2:54	(4.8) 96%	(2.9) 58%					
330	330.3	16.0	4.0	2:24 1:37 1:38 1:27	(4.0) 100%	(3.7) 93%					
	326.3	20.0									326.3 20.0 Boring Terminated at Elevation 326.3 ft in Crystalline Rock (Felsic Metavolcanic).

CORE PHOTOGRAPHIC RECORD

Replace Bridge No. 63 Over Buffalo Creek on NC 22

L1600L Box 1 of 2



0.0 1.0 2.0

FEET

L1600L Box 2 of 2

0.0 1.0 2.0

FEET

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.121	19

SOIL LEGEND

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
S-1	10' RT.	15+50	0.0' - 5.0'	A-2-4(0)	22	7	49.2	14.4	25.7	10.7	45.3	27.3	17.4	3.9	-
S-2	CL	25+50	0.0' - 5.0'	A-7-6(25)	57	27	4.9	3.2	37.5	54.4	89.2	85.9	82.8	28.0	-
SS-3	50' LT.	29+50	5.0' - 6.5'	A-7-5(37)	70	29	0.6	3.4	26.7	69.3	99.3	99.0	96.5	46.0	-