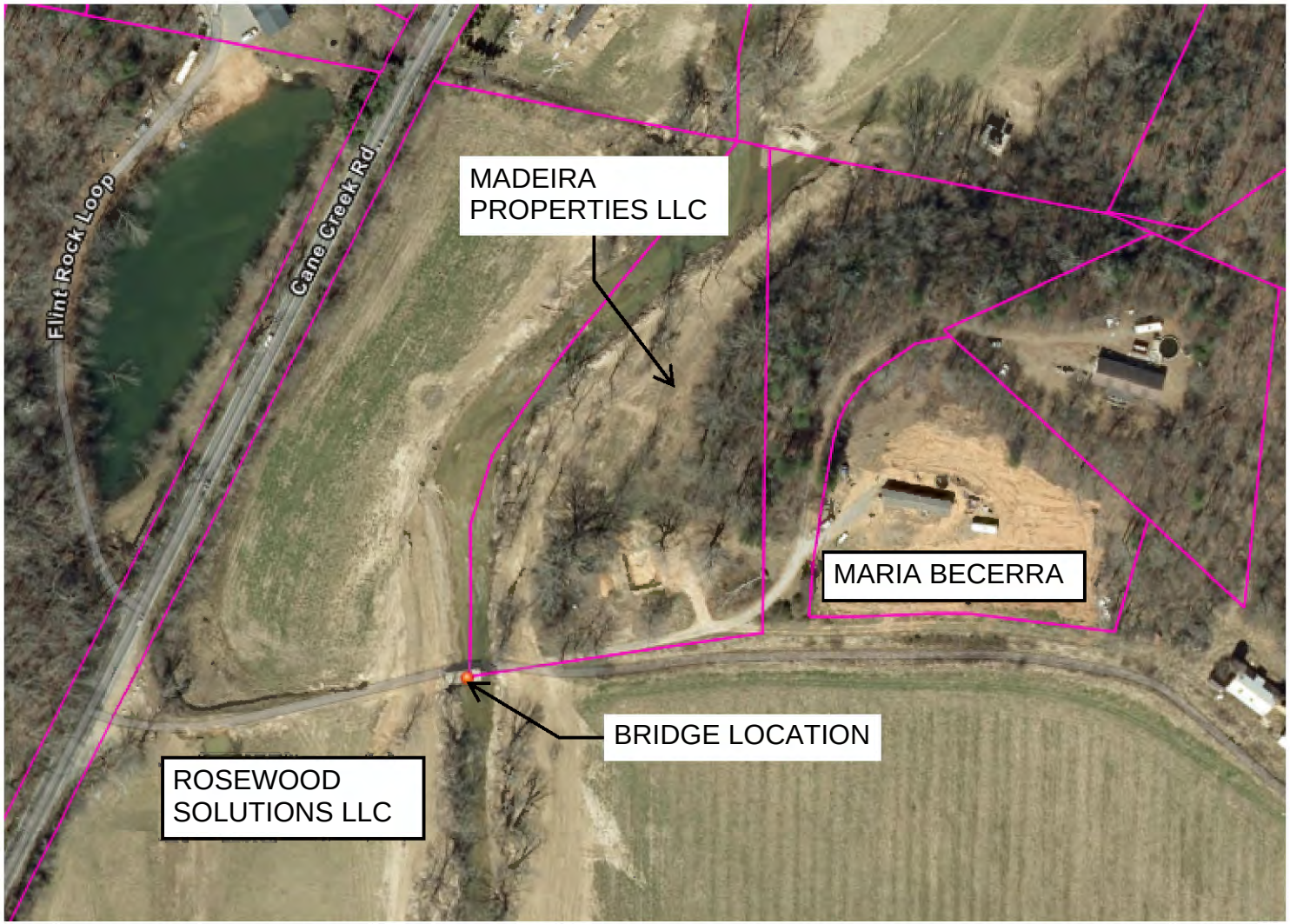


SITE ID: 011-01-10e7e

SITE ADDRESS: 1768 CANE CREEK RD.,
FLETCHER, NC

North Carolina Emergency Management – Private Roads and Bridges

Site Information Form

Site Number: 011-01-10e7e

Site Address: 1768 Cane Creek Rd., Fletcher, NC 28732

GPS Coordinates: 35.4897, -82.4311

County: Buncombe

Bridge Type: Steel I-beam with timber decking

Span Length: 70 feet

Bridge Width: 12'-0" out-to-out, 11'-1" clear width

Substructure Type: Concrete Cap on Drilled-in Piles

Geotechnical Information: See Standard Bridge Plans for Notes

Additional Notes:

Timber bridge railing not required.

Wing walls not required.

The existing bridge is in place and must be removed prior to the start of construction.

The stream contains no debrid or obstructions requiring removal.

BRIDGE SURVEY & HYDRAULIC DESIGN REPORT

NC DEPARTMENT OF EMERGENCY MANAGEMENT
PRIVATE ROADS AND BRIDGES PROGRAM

Site Number 011-01-10e7e Latitude 35.48973 Longitude -82.43114

County Buncombe Address 1722 Cane Creek Road

City Fletcher, NC Zip Code 28732

Recommended Structure 1 @ 70' Steel Girder Bridge with 2'-6" Pier Caps

Recommended Width of Roadway ..... Skew .....

Recommended Location is (At, Upstream, Downstream) of Existing Crossing .....

Temporary Crossing .....

I hereby certify that that I have reviewed the existing hydraulic conveyance at this site which was a 50 ft existing bridge with the proposed conveyance provided by the proposed 70 ft. span bridge.

The proposed bridge low chord for the bridge shall be set in accordance with the the FEMA Disaster Specific Guidance for the Replacement of Private Roads and Bridges issued on 14 February 2025, "to provide bridge/culvert design plans certified (sealed, signed, and dated) by a Professional Engineer licensed in the State of North Carolina demonstrating that the newly designed and installed private bridge/culvert provides conveyance greater than or equal to the original destroyed crossing".

This certification demonstrates that the newly designed and installed private bridge/culvert provides conveyance greater than or equal to the original destroyed crossing. This is based on the best available data provided from post storm evaluations. Portions of the existing structures may have been destroyed, removed, modified or shifted from their original location or elevation.

Designed by .....

Assisted by .....

Date .....

NORTH CAROLINA PROFESSIONAL SEAL 20646 ENGINEER MATTHEW D. FOSTER

Signed by: Matthew D Foster 7B1932BFAFC8472... 4/28/2026 5:33:31 PM EDT

Johnson, Mirmiran, & Thompson Inc.
108 Asheville Commerce Parkway
Candler, NC, 28715
License No: C-3097

Reviewed by ..... Date .....

SITE DATA

Drainage Area ..... Source .....

River Basin French Broad Character .....

Stream Classification (e.g., Trout, High Quality Water) Class C

Debris Potential: Low ☐ Moderate ☒ High ☐

Existing Structure - Source of Available Data NCEM Private Roads and Bridges Inspection Team

Existing Structure - Description 1 @ 50' Steel beams and concrete deck (damaged by Helene)

Estimated Waterway Opening 377.1 ft²

Design Control Elev ..... ft Source .....

Gage Station No ..... Period of Records .....

Max Discharge ..... cfs Date ..... Frequency .....

Historical Flood Information:

Date ..... Elev ..... ft Est Freq ..... yr Source ..... Period of Knowledge ..... yrs

Historical Scour Info: General ..... ft Contraction ..... ft Local ..... ft

Channel Slope ..... ft/ft Source ..... Normal Water Surface Elev ..... ft

Manning's n: Left OB ..... Channel ..... Right OB ..... Source .....

Flood Study / Status FEMA LDS, Cane Creek

Flood Study 100-yr Discharge 7,510 cfs WS Elev: With Floodway 2152.28 ft Without Floodway 2151.98 ft River Station 50297

DESIGN DATA

Hydrological Method .....

Hydraulic Design Method Disaster Specific Guidance for the Replacement of Private Roads and Bridges 2/14/2025

Floods Evaluated	Frequency (year)	Discharge (cfs)	Elevation (ft)	Backwater (ft)	Bridge Opening Velocity (fps)

Waterway Opening Provided Below: Design WS Elev ..... sf 100-yr WS Elev ..... sf Total 392.8 sf

Average Channel Velocity (Design) ..... fps Average Overbank Velocity (Design) ..... fps

Computed Scour: General ..... ft Contraction ..... ft Local ..... ft

INFORMATION TO BE SHOWN ON PLANS

HYDRAULIC DATA

DESIGN DISCHARGE	= 3680 C.F.S.
FREQUENCY OF DESIGN FLOOD	= 10 YRS.
DESIGN HIGH WATER ELEVATION	= _____
DRAINAGE AREA	= 41 SQ. MI.
BASIC DISCHARGE (Q100)	= 7510 C.F.S.
BASIC HIGH WATER ELEVATION	= _____

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= _____ C.F.S.
FREQUENCY OF OVERRTOPPING FLOOD	= _____ YRS.
OVERTOPPING FLOOD ELEVATION	= _____ *

*NOTE LOCATION OF OVERTOPPING

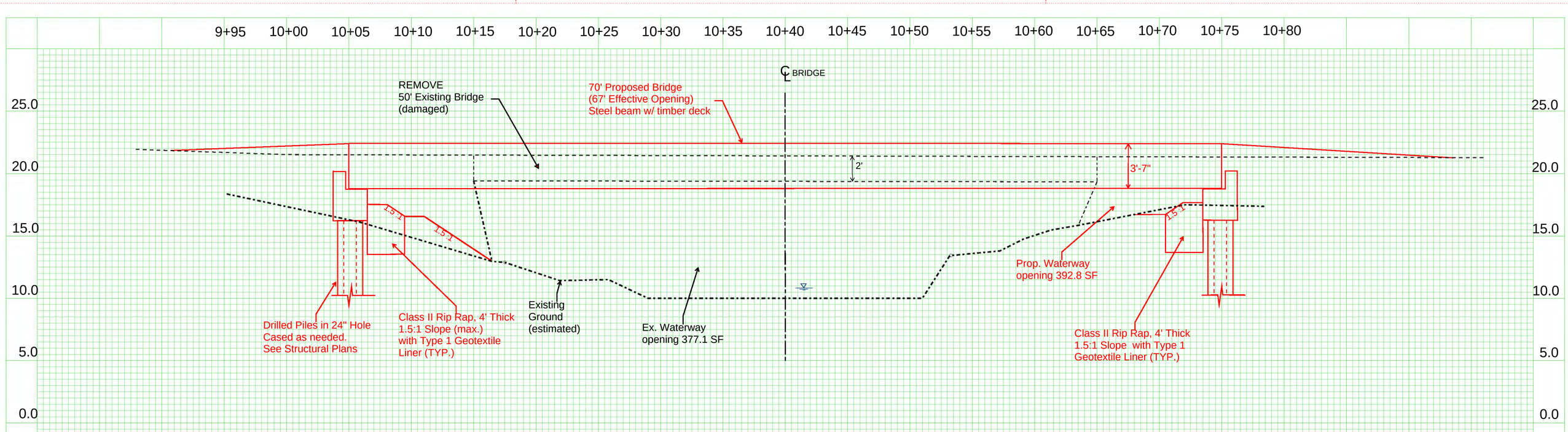
WS EL. Taken @ River Station ?

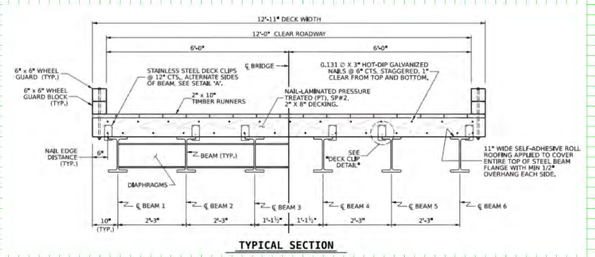
ADDITIONAL INFORMATION AND COMPUTATIONS

Number of Homes	2
Churches Confirmed	Yes
Number of Churches	0
Schools Confirmed	Yes
Number of Schools	0
Recreational/Business Areas Confirmed	Yes
Number of Recreational/Business Areas	0
General Description	Road is not accessible. Bridge collapsed. Bridge approach gravel road is washed away and overtaken with veg. - need road repair in addition to new bridge. Gravel qty for entrance road - will need road repair on other side of bridge too - couldn't access.
Overall Condition	Collapse
Condition Other	
Site Repair Status	No Repair
Condition Description	Bridge collapsed, need replacement. Existing steel superstructure exhibits severe corrosion with section loss. Concrete abutments completely eroded. Bank behind East Abutment eroded - needs fill or extend bridge span. Potential drainage issue at approach
Expected Level of Effort	Full Redesign
Other Level of Effort	
Horizontal Curve	No
Number of Travel Lanes (LOS)	1
Inclination	No
Roadway Divider	No
Road/Bridge Width (ft)	14.00
Span/Gap Estimate (ft)	60.00
Surface to Water (ft)	15.00
Utility/Mechanical	No
Utility Types	
Pipe Needs Sizing	
Depth of Pipe	
Geotechnical	Erosion/scour

Original Assessment listed as 1768 Cane Creek Rd.

33" W33X130 beam
+ 8" Deck
+ 2" Runner
= 43" (3'-7") ft structure depth)





TYPICAL SECTION

Stationing and elevations shown are relative to the site.
Based on an assumed datum.
No survey grade field work was performed.

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	011-01-10e7e	1	

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *BUNCOMBE*

PROJECT DESCRIPTION *NORTH CAROLINA EMERGENCY MANAGEMENT-PRIVATE ROADS, BRIDGE REPAIR AND REPLACEMENT PROGRAM*

SITE DESCRIPTION *1768 CANE CREEK ROAD FOR BRIDGE OVER CANE CREEK*

REFERENCE: N/A

PROJECT: N/A

CONTENTS

PERSONNEL

J. BASKIN, G.I.T.

S. DAVIS

TY. BEARD

INVESTIGATED BY *F&R, Inc.*

DRAWN BY *T.T. WALKER*

CHECKED BY *P. ALTON, P.E.*

SUBMITTED BY *P. ALTON, P.E.*

DATE *APRIL 2026*

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.

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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NOTES:

1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE GEOTECHNICAL ENGINEER AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
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.

SINCE 1881

Prepared in the Office of:

FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881

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NORTH CAROLINA PROFESSIONAL SEAL 033758 ENGINEER W. PATRICK ALTON

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
011-01-10e7e	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS
(PAGE 1 OF 2)

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 (AASHTD 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 RESISTANCE (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) PL — PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
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:
- [ ] CME-45C
- [ ] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [X] CME-750X
- [ ] _____

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q3

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

PROJECT REFERENCE NO.	SHEET NO.
011-01-10e7e	2A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS
(PAGE 2 OF 2)

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

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

AQUIFER - A WATER BEARING FORMATION OR STRATA.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BENCH MARK: N/A

ELEVATION: N/A FEET

NOTES:

FIAD= FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
011–01–10e7e	2B

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 (PAGE 1 OF 2)

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

SURFACE CONDITIONS

VERY GOOD Very rough, fresh unweathered surfaces

GOOD Rough, slightly weathered, iron stained surfaces

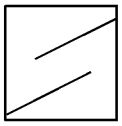
FAIR Smooth, moderately weathered and altered surfaces

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

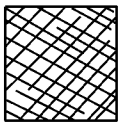
VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings

DECREASING SURFACE QUALITY ⟹

DECREASING INTERLOCKING OF ROCK PIECES ⟱



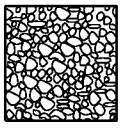
INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities



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

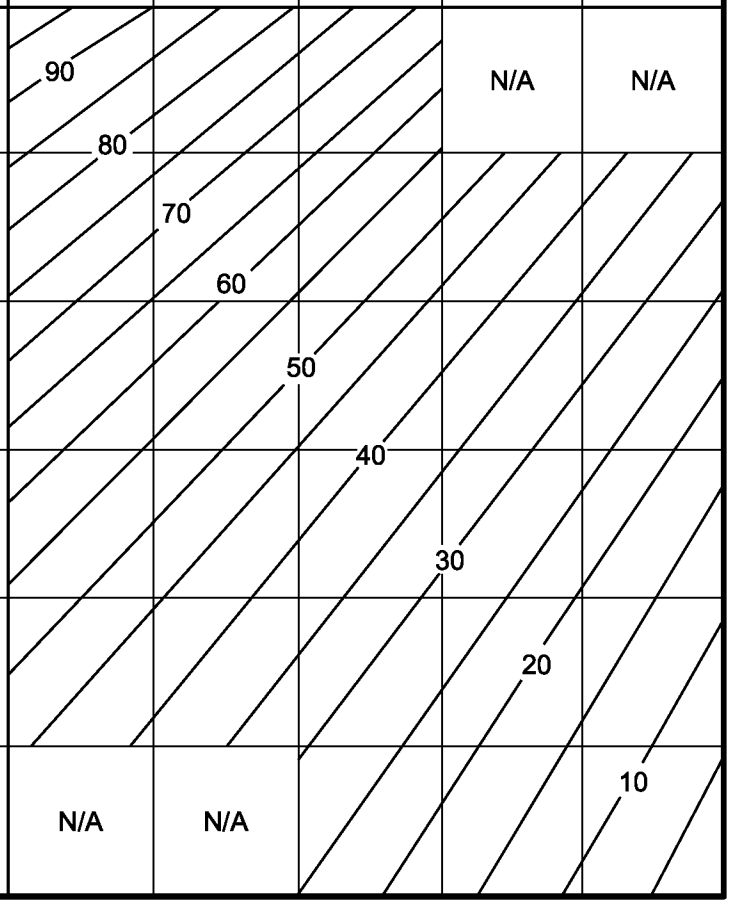
VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets

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



PROJECT REFERENCE NO.	SHEET NO.
011–01–10e7e	2C

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 (PAGE 2 OF 2)

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)

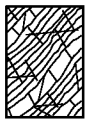
From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be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

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
	70	A			
	60				
		50			
		B	C	D	E
		40			
			30		
				F	
				20	
			G		H
					10

Means deformation after tectonic disturbance

DATE: 8-19-16

PROJECT REFERENCE NO.	SHEET NO.
011-01-10e7e	3

SITE PLAN

0 50 100

FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 011-01-10e7e	**TIP** N/A	**COUNTY** BUNCOMBE	**GEOLOGIST** J. Baskin
SITE DESCRIPTION 1768 Cane Creek Road for Bridge over Cane Creek			**GROUND WTR (ft)**
BORING NO. EB1	**STATION** N/A	**OFFSET** N/A	**ALIGNMENT** -L-	**0 HR.** 5.0
COLLAR ELEV. 0.0 ft	**TOTAL DEPTH** 16.8 ft	**NORTHING** 650,826	**EASTING** 978,812	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R7348 CME-750X 87% 12/20/2024		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 03/04/26	**COMP. DATE** 03/04/26	**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)
0										0.0 GROUND SURFACE 0.0
	0.0	0.0	1	1	3	4		M		**ALLUVIAL** Tan, Clayey Silty Fine to Coarse SAND (A-2-4) with Trace Gravel and Mica
-5	-3.5	3.5	2	1	1	2		M		
	-8.5	8.5	55	45/0.3		100/0.8				-7.0 7.0 **WEATHERED ROCK** Orange-Gray PHYLLITE
-10										
	-13.5	13.5	100/0.3			100/0.3				
-15	-16.7	16.7	60/0.1			60/0.1				-16.8 16.8 Boring Terminated with Standard Penetration Test Refusal at Elevation -16.8 ft in CRYSTALLINE ROCK (PHYLLITE)

Note:
1. Auger Refusal at 16.7'

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 011-01-10e7e	**TIP** N/A	**COUNTY** BUNCOMBE	**GEOLOGIST** J. Baskin	
SITE DESCRIPTION 1768 Cane Creek Road for Bridge over Cane Creek				**GROUND WTR (ft)**
BORING NO. EB2	**STATION** N/A	**OFFSET** N/A	**ALIGNMENT** -L-	**0 HR.** 2.9
COLLAR ELEV. 0.0 ft	**TOTAL DEPTH** 20.6 ft	**NORTHING** 650,829	**EASTING** 978,914	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R7348 CME-750X 87% 12/20/2024		**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 03/04/26	**COMP. DATE** 03/04/26	**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)
0										0.0 GROUND SURFACE	0.0
	0.0	0.0	2	7	12	19		M		**ARTIFICIAL FILL** Tan-Orange, Clayey Silty Fine to Coarse SAND (A-2-4) with Trace Gravel, Roots, Mica, and Apparent Geotextile Fragments -2.0	2.0
-5	-3.5	3.5	3	3	3	6		M		**ALLUVIAL** Orange-Tan, Clayey Fine Sandy SILT (A-4) with Trace Mica -7.0	7.0
	-8.5	8.5						M		Tan-White, Clayey Silty Fine to Coarse SAND (A-2-4) with Trace Gravel and Mica -9.5	9.5
-10	-10.6	10.6	5	13	100/0.4	100/0.4				**WEATHERED ROCK** Orange-Gray PHYLLITE -10.6	10.6
			60/0.0			60/0.0				**CRYSTALLINE ROCK** Slightly to Moderately Severely Weathered, Hard to Very Hard, Orange-Gray PHYLLITE with Very Close to Close Fracture Spacing with Pyrite Observed -12.6	12.6
-15										Fresh to Very Slightly Weathered, Very Hard, Gray PHYLLITE with Close to Wide Fracture Spacing with Pyrite Observed -20.6	20.6
-20										Boring Terminated at Elevation -20.6 ft in CRYSTALLINE ROCK (PHYLLITE)	

Notes:
1. Surficial Organic Soil: 0.0'-0.3'
2. Auger Refusal at 10.6', Start Coring

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 011-01-10e7e	**TIP** N/A	**COUNTY** BUNCOMBE	**GEOLOGIST** J. Baskin	
SITE DESCRIPTION 1768 Cane Creek Road for Bridge over Cane Creek				**GROUND WTR (ft)**
BORING NO. EB2	**STATION** N/A	**OFFSET** N/A	**ALIGNMENT** -L-	**0 HR.** 2.9
COLLAR ELEV. 0.0 ft	**TOTAL DEPTH** 20.6 ft	**NORTHING** 650,829	**EASTING** 978,914	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R7348 CME-750X 87% 12/20/2024		**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 03/04/26	**COMP. DATE** 03/04/26	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 10.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
-10.6											Begin Coring @ 10.6 ft
	-10.6	10.6	5.0	1:30/1.0 2:00/1.0 2:15/1.0 3:30/1.0 2:10/1.0	(4.3) 86%	(2.4) 48%		(1.6) 80%	(0.0) 0%		-10.6 **CRYSTALLINE ROCK** 10.6 -12.6 Slightly to Moderately Severely Weathered, Hard to Very Hard, Orange-Gray PHYLLITE with Very Close to Close Fracture Spacing with Pyrite Observed 12.6
-15	-15.6	15.6						(7.6) 95%	(7.1) 89%		Fresh to Very Slightly Weathered, Very Hard, Gray PHYLLITE with Close to Wide Fracture Spacing with Pyrite Observed
			5.0	2:29/1.0 2:48/1.0 2:30/1.0 2:25/1.0 2:47/1.0	(4.9) 98%	(4.7) 94%					
-20	-20.6	20.6									-20.6 20.6 Boring Terminated at Elevation -20.6 ft in CRYSTALLINE ROCK (PHYLLITE)

Notes:
1. Surficial Organic Soil: 0.0'-0.3'
2. Auger Refusal at 10.6', Start Coring

CORE PHOTOGRAPH (EB-2):
1768 Cane Creek Road for Bridge over Cane Creek

Begin Run 1
10.6 feet

End Run 1,
Begin Run 2
15.6 feet

End Run 2
20.6 feet

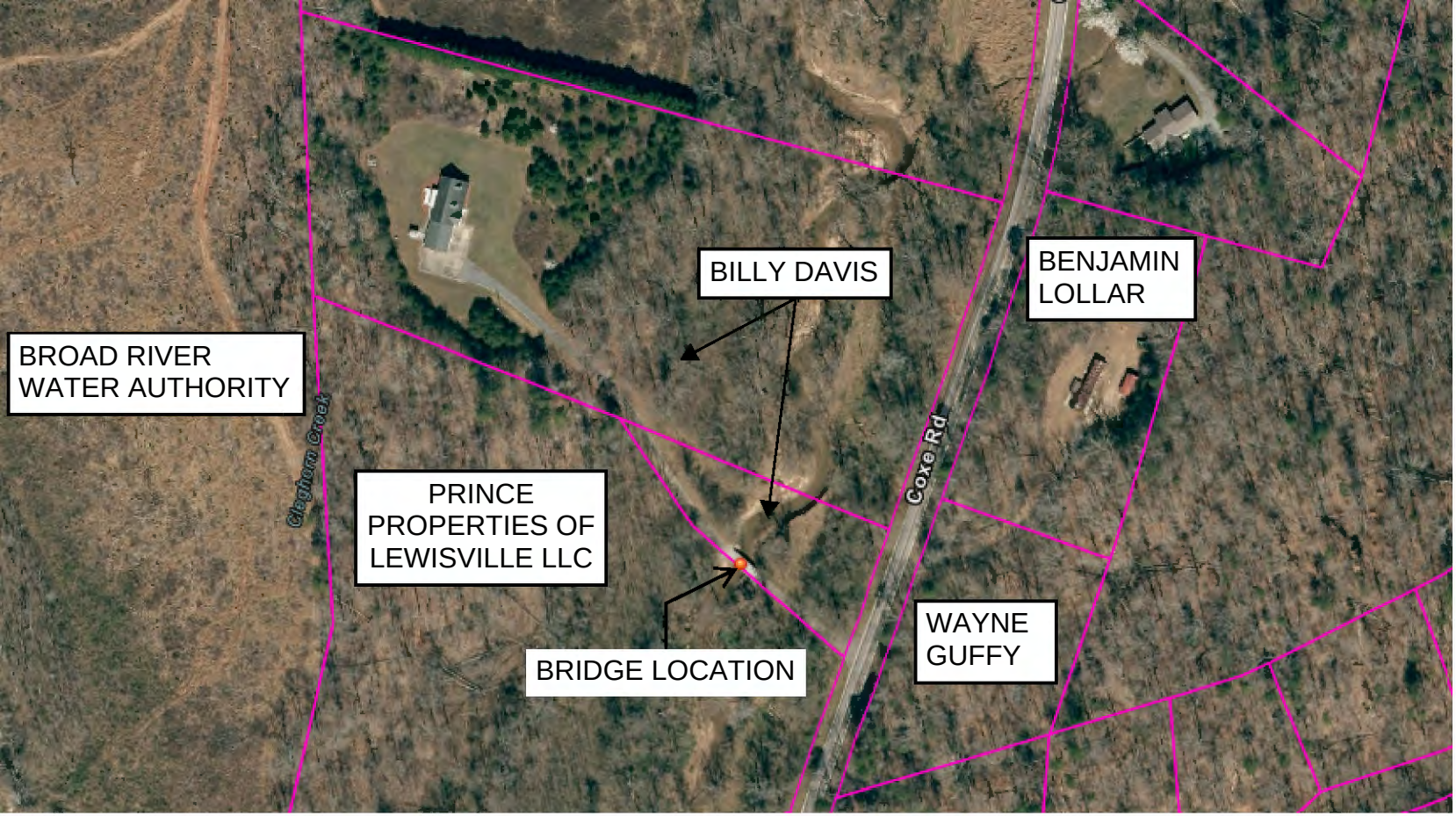
SITE PHOTOGRAPHS:
1768 Cane Creek Road for Bridge over Cane Creek

Photograph No. 1: View looking east

Photograph No. 2: View looking west

Photograph No. 3: View looking upstream

Photograph No. 4: View looking downstream



SITE ID: 081-01-ef85c

SITE ADDRESS: 1738 COXE RD.,
RUTHERFORDTON, NC 28139

North Carolina Emergency Management – Private Roads and Bridges

Site Information Form

Site Number: 081-01-ef85c

Site Address: 1738 Coxe Rd., Rutherfordton, NC 28139

GPS Coordinates: 35.3039, -81.9883

County: Rutherford

Bridge Type: Steel I-beam with timber decking

Span Length: 60 feet

Bridge Width: 12'-0" out-to out, 11'-1" clear width

Substructure Type: Concrete Cap on Drilled in Piles

Geotechnical Information: See Standard Bridge Plans for Notes

Additional Notes:

Timber bridge railing not required.

Wing walls are required.

The existing bridge is in place and must be removed prior to the start of construction.

The stream contains no debris or obstructions requiring removal.

BRIDGE SURVEY & HYDRAULIC DESIGN REPORT

NC DEPARTMENT OF EMERGENCY MANAGEMENT
PRIVATE ROADS AND BRIDGES PROGRAM

Site Number 081-01-ef85c Latitude 35.29802 Longitude -81.987888

County Rutherford Address 1738 Coxe Road

City Rutherfordton Zip Code 28139

Recommended Structure 1 @ 60 ft. Steel Girder Bridge with timber deck and runners

Recommended Width of Roadway ..... Skew .....

Recommended Location is (At, Upstream, Downstream) of Existing Crossing .....

Temporary Crossing .....

I hereby certify that I have reviewed the existing hydraulic conveyance at this site which was a 47 ft existing bridge with the proposed conveyance provided by the proposed 60.0 ft. span bridge.

The proposed bridge low chord for the bridge shall be set in accordance with the the FEMA Disaster Specific Guidance for the Replacement of Private Roads and Bridges issued on 14 February 2025, "to provide bridge/culvert design plans certified (sealed, signed, and dated) by a Professional Engineer licensed in the State of North Carolina demonstrating that the newly designed and installed private bridge/culvert provides conveyance greater than or equal to the original destroyed crossing".

This certification demonstrates that the newly designed and installed private bridge/culvert provides conveyance greater than or equal to the original destroyed crossing. This is based on the best available data provided from post storm evaluations. Portions of the existing structures may have been destroyed, removed, modified or shifted from their original location or elevation.

Designed by .....

Assisted by .....

Date .....

NORTH CAROLINA PROFESSIONAL SEAL 20646 ENGINEER MATTHEW D. FOSTER

Signed by: Matthew D Foster 7B1932BFAFC8472...

5/18/2026 | 6:16:58 PM EDT

Johnson, Mirmiran, & Thompson Inc.
108 Asheville Commerce Parkway
Candler, NC, 28715
License No: C-3097

Reviewed by ..... Date .....

SITE DATA

Drainage Area ..... Source .....

River Basin Broad River Character .....

Stream Classification (e.g., Trout, High Quality Water) WS-IV

Debris Potential: Low ☐ Moderate ☒ High ☐

Existing Structure - Source of Available Data NCEM Private Roads and Bridges Inspection Team

Existing Structure - Description 1 @ 47' bridge with Steel Girder and concrete deck (destroyed by Helene)

Estimated Waterway Opening 312.5 ft²

Design Control Elev ..... ft Source .....

Gage Station No ..... Period of Records .....

Max Discharge ..... cfs Date ..... Frequency .....

Historical Flood Information:

Date ..... Elev ..... ft Est Freq ..... yr Source ..... Period of Knowledge ..... yrs

Historical Scour Info: General ..... ft Contraction ..... ft Local ..... ft

Channel Slope ..... ft/ft Source ..... Normal Water Surface Elev ..... ft

Manning's n: Left OB ..... Channel ..... Right OB ..... Source .....

Flood Study / Status FEMA DS, Cleghorn Creek

Flood Study 100-yr Discharge 4500 cfs WS Elev: With Floodway 741.99 ft Without Floodway 741.46 ft River Station 2072.091

DESIGN DATA

Hydrological Method .....

Hydraulic Design Method Disaster Specific Guidance for the Replacement of Private Roads and Bridges 2/14/2025

Floods Evaluated	Frequency (year)	Discharge (cfs)	Elevation (ft)	Backwater (ft)	Bridge Opening Velocity (fps)

Waterway Opening Provided Below: Design WS Elev ..... sf 100-yr WS Elev ..... sf Total 314.4 sf

Average Channel Velocity (Design) ..... fps Average Overbank Velocity (Design) ..... fps

Computed Scour: General ..... ft Contraction ..... ft Local ..... ft

INFORMATION TO BE SHOWN ON PLANS

HYDRAULIC DATA

DESIGN DISCHARGE	= 2480 C.F.S.
FREQUENCY OF DESIGN FLOOD	= 25 YRS.
DESIGN HIGH WATER ELEVATION	= _____
DRAINAGE AREA	= 13.9 SQ. MI.
BASIC DISCHARGE (Q100)	= 3540 C.F.S.
BASIC HIGH WATER ELEVATION	= _____

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= _____ C.F.S.
FREQUENCY OF OVERRTOPPING FLOOD	= _____ YRS.
OVERTOPPING FLOOD ELEVATION	= _____*

*NOTE LOCATION OF OVERTOPPING

WS EL. Taken @ River Station ?

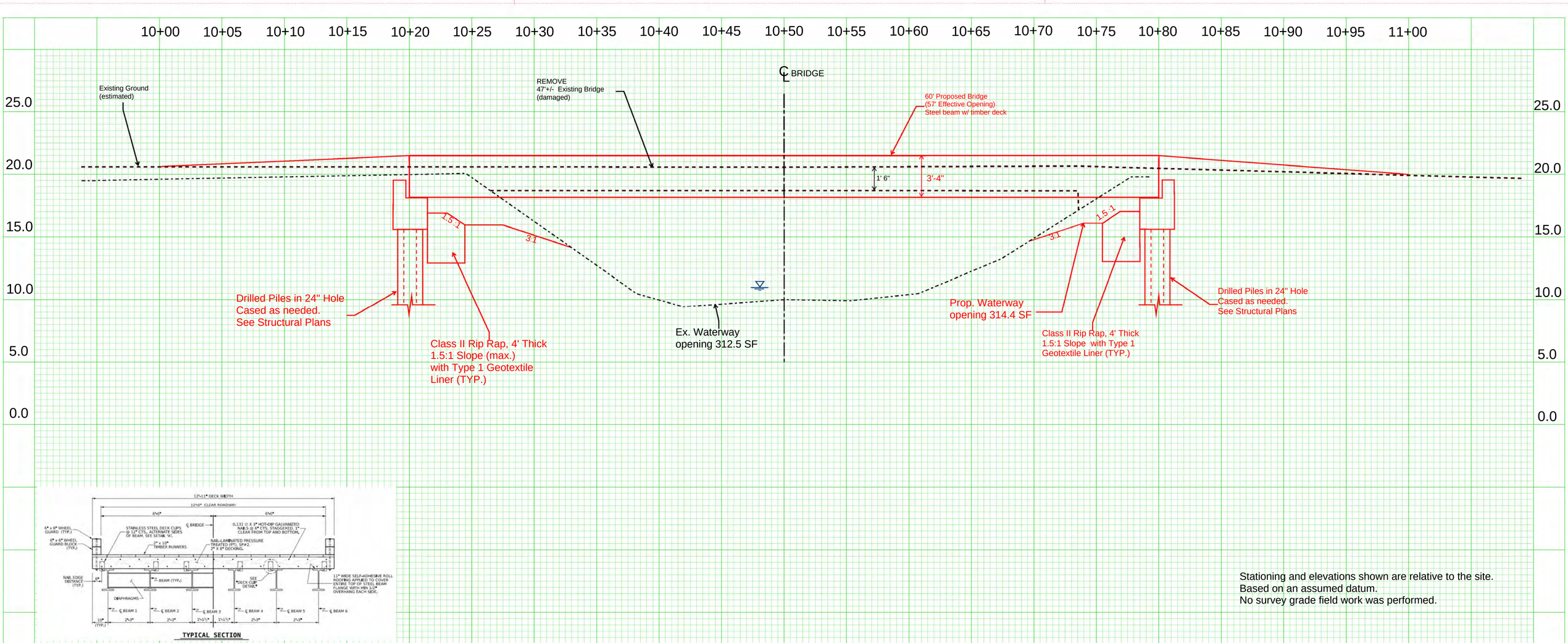
ADDITIONAL INFORMATION AND COMPUTATIONS

Emergency Vehicle Access Possible?	No
Number of Homes Confirmed	Yes
Number of Homes	1
Churches Confirmed	Yes
Number of Churches	0
Schools Confirmed	Yes
Number of Schools	0
Recreational/Business Areas Confirmed	Yes
Number of Recreational/Business Areas	0
General Description	One span bridge with steel beams. 5 piles at abutment towards the house end exposed up to 3'. Steel beams are hanging in air at this end making the whole bridge go down up to 2'. RipRap has been washed at both ends. Temporary repair of asphalt at this end
Overall Condition	Damage
Condition Other	
Site Repair Status	Temporary Repair
Condition Description	House end of the bridge gone down up to 2'. Temporarily repaired here for up to 20' x 10' to access the residence. No heavy vehicles accessing else there is a possibility for the whole bridge to collapse. During Helene, bridge got submerged up to 20'
Expected Level of Effort	Replace
Other Level of Effort	
Horizontal Curve	No
Number of Travel Lanes (LOS)	1
Inclination	No
Roadway Divider	No
Road/Bridge Width (ft)	14.00
Span/Gap Estimate (ft)	45.00
Surface to Water (ft)	11.00
Utility/Mechanical	Yes
Utility Types	Communications

Note Abutment Damage

Note Potential for: Utility line attached to existing bridge

30" W30X116 beam
+ 8" Deck
+ 2" Runner
=40" (3'-4") structure depth)



TYPICAL SECTION

Stationing and elevations shown are relative to the site.
Based on an assumed datum.
No survey grade field work was performed.

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 081-01-ef85c	**TIP** N/A	**COUNTY** RUTHERFORD	**GEOLOGIST** J. Baskin	
SITE DESCRIPTION 1738 Coxe Rd. for Bridge over Cleghorn Creek				**GROUND WTR (ft)**
BORING NO. EB1	**STATION** N/A	**OFFSET** N/A	**ALIGNMENT** -L-	**0 HR.** NM
COLLAR ELEV. 0.0 ft	**TOTAL DEPTH** 23.6 ft	**NORTHING** 578,452	**EASTING** 1,108,981	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R4637 CME-75 78% 03/28/2025		**DRILL METHOD** SPT Core Boring		**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 04/16/26	**COMP. DATE** 04/17/26	**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)
0										0.0 GROUND SURFACE 0.0
	0.0	0.0	2	1	2	3		M		**ARTIFICIAL FILL** Red, Fine to Coarse Sandy Clayey SILT (A-4) with Trace Mica -2.0 / 2.0
-5	-3.5	3.5	3	3	3	6		M		**RESIDUAL** Red, Fine Sandy Silty CLAY (A-6) with Trace Mica
	-8.5	8.5								-9.0 / 9.0
-10	-10.9	10.9	2	4	47	51		M		Gray, Clayey Silty Fine to Coarse SAND (A-2-4) with Trace Mica and Rock Fragments -10.9 / 10.9
			60/0.0			60/0.0				**CRYSTALLINE ROCK** Fresh to Slightly Weathered, Hard to Very Hard White Black BIOTITE GNEISS with Very Close Fracture Spacing With Thick Soil Layers
-15	-15.9	15.9	15	22	30	52		M		-15.9 / 15.9
	-18.5	18.5	11	13	15	28		M		**RESIDUAL** Tan-Black-White, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Mica and Rock Fragments
-20	-23.5	23.5	60/0.1			60/0.1				-23.5 / 23.5
										-23.6 / 23.6 **CRYSTALLINE ROCK** Black BIOTITE GNEISS
										Boring Terminated with Standard Penetration Test Refusal at Elevation -23.6 ft in CRYSTALLINE ROCK (BIOTITE GNEISS)

Notes:
1. Surficial Organic Soil= 0.0'-0.1'
2. Auger Refusal and Began Coring at 10.9'

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 081-01-ef85c	**TIP** N/A	**COUNTY** RUTHERFORD	**GEOLOGIST** J. Baskin
SITE DESCRIPTION 1738 Coxe Rd. for Bridge over Cleghorn Creek			**GROUND WTR (ft)**
BORING NO. EB1	**STATION** N/A	**OFFSET** N/A	**ALIGNMENT** -L-	**0 HR.** NM
COLLAR ELEV. 0.0 ft	**TOTAL DEPTH** 23.6 ft	**NORTHING** 578,452	**EASTING** 1,108,981	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R4637 CME-75 78% 03/28/2025		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 04/16/26	**COMP. DATE** 04/17/26	**SURFACE WATER DEPTH** N/A
CORE SIZE NQ	**TOTAL RUN** 5.0 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
-10.9											Begin Coring @ 10.9 ft
	-10.9	10.9	5.0	N=60/0.0 1:45/1.0 0:19/1.0 0:16/1.0 2:00/1.0 1:15/1.0	(0.8) 16%	(0.0) 0%		(0.8) 16%	(0.0) 0%		**CRYSTALLINE ROCK** Fresh to Slightly Weathered, Hard to Very Hard White Black BIOTITE GNEISS with Very Close Fracture Spacing With Thick Soil Layers
-15	-15.9	15.9		N=52 N=28							**RESIDUAL** Tan-Black-White, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Mica and Rock Fragments
-20				N=60/0.1							**CRYSTALLINE ROCK** Black BIOTITE GNEISS Boring Terminated with Standard Penetration Test Refusal at Elevation -23.6 ft in CRYSTALLINE ROCK (BIOTITE GNEISS)

ELEV. (ft) -10.9 | DEPTH (ft) 10.9
-15.9 | 15.9
-23.5 | 23.5
-23.6 | 23.6

Notes:
1. Surficial Organic Soil= 0.0'-0.1'
2. Auger Refusal and Began Coring at 10.9'