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REFERENCE: B-5351

PROJECT: 46065

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY GUILFORD
PROJECT DESCRIPTION REPLACE BRIDGES NO. 0237 &
0242 ON US 29-70 & I-85 BUSINESS OVER DEEP
RIVER
SITE DESCRIPTION STA. 23+26 -L-

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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5351	1	36

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PERSONNEL

M. PURCELL

O. F. WOODARD

INVESTIGATED BY D. M. GRAGG

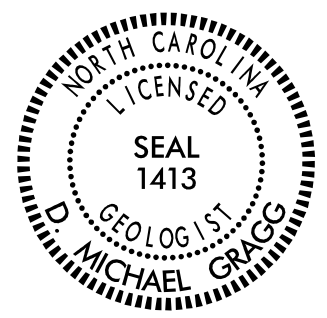
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DATE SEPTEMBER, 2017

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D. Michael Gragg 10/5/2017

SIGNATURE DATE

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SUBSURFACE INVESTIGATION
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION
Table with columns for General Class, Group Class, Symbol, % Passing, Material, Group Index, and Usual Types of Major Materials. Includes patterns for Granular Materials (A-1 to A-7), Silty-Clay Materials (A-4 to A-7), and Organic Materials (A-1 to A-7).

CONSISTENCY OR DENSENESS
Table with columns for Primary Soil Type, Compactness or Consistency, Range of Standard Penetration Resistance (N-value), and Range of Unconfined Compressive Strength (Tons/ft²).

TEXTURE OR GRAIN SIZE
Table with columns for U.S. Std. Sieve Size (mm), Boulder (BLDR.), Cobble (COB.), Gravel (GR.), Coarse Sand (CSE. SD.), Fine Sand (F SD.), Silty (SL.), and Clay (CL.).

SOIL MOISTURE - CORRELATION OF TERMS
Table with columns for Soil Moisture Scale (Atterberg Limits), Field Moisture Description, and Guide for Field Moisture Description. Includes Liquid Limit (LL), Plastic Limit (PL), and Optimum Moisture Shrinkage Limit (OM).

PLASTICITY
Table with columns for Plasticity Index (PI) and Dry Strength. Includes categories for Non Plastic, Slightly Plastic, Moderately Plastic, and Highly Plastic.

COLOR
DESCRIPTORS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-BROWN). 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.

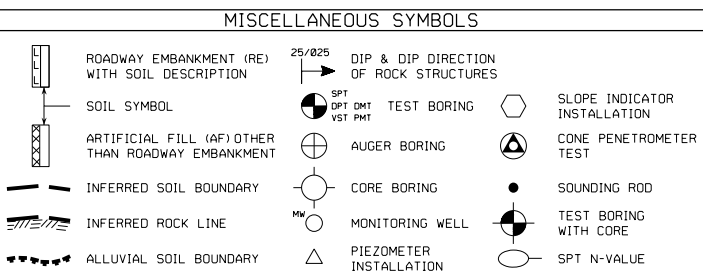
ANGULARITY OF GRAINS
THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

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
Table with columns for Organic Material, Granular Soils, Silty-Clay Soils, and Other Material. Includes categories like Trace of Organic Matter, Little Organic Matter, Moderately Organic, and Highly Organic.

GROUND WATER
WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
STATIC WATER LEVEL AFTER 24 HOURS
PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
SPRING OR SEEP



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. - SAPROLITE, SD. - SAND, SANDY, SL. - SILTY, SILTY, SLI. - SLIGHTLY, TCR - TRIAXIAL REFUSAL, w - MOISTURE CONTENT, V - VERY, VST - VANE SHEAR TEST, WE. - WEATHERED, UNIT WEIGHT, 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
Table with columns for Drill Units (CME-45C, CME-55, CME-550, Vane Shear Test, Portable Hoist), Advancing Tools (Clay Bits, 6" Continuous Flight Auger, 8" Hollow Augers, Hard Faced Finger Bits, Tung-Carbide Inserts, Casing w/ Advancer, Tricone *Steel Teeth, Tricone *Tung-Carb., Core Bit), Hammer Type (Automatic, Manual), Core Size (-B, -H, -N Q2), and 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:

Table for Rock Types: WEATHERED ROCK (WR), CRYSTALLINE ROCK (CR), NON-CRYSTALLINE ROCK (NCR), COASTAL PLAIN SEDIMENTARY ROCK (CP). Includes descriptions and SPT values.

WEATHERING
FRESH: ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SL.): 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 (SL.): 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 GROUDED OR GOUGED 0.25 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT: CAN BE GROUDED 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 FINGER NAIL.

FRACTURE SPACING and **BEDDING**
Table with columns for Term and Spacing/Thickness. Categories include Very Wide, Wide, Moderately Close, Close, Very Close for spacing; and Very Thickly Bedded, Thickly Bedded, Thinly Bedded, Very Thinly Bedded, Thickly Laminated, Thinly Laminated for bedding.

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 (ROD) - 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 (SROD) - 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: BMI
N 810126.4331E 1728643.9520 BL STATION 29+67.207' RT.
RR SPIKE IN 12" SYCAMORE ELEVATION: 692.52 FEET

NOTES:
BORING ELEVATIONS OBTAINED BY SURVEY CONDUCTED 7-20-2017

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)

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

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

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

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
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DECREASING SURFACE QUALITY →

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

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

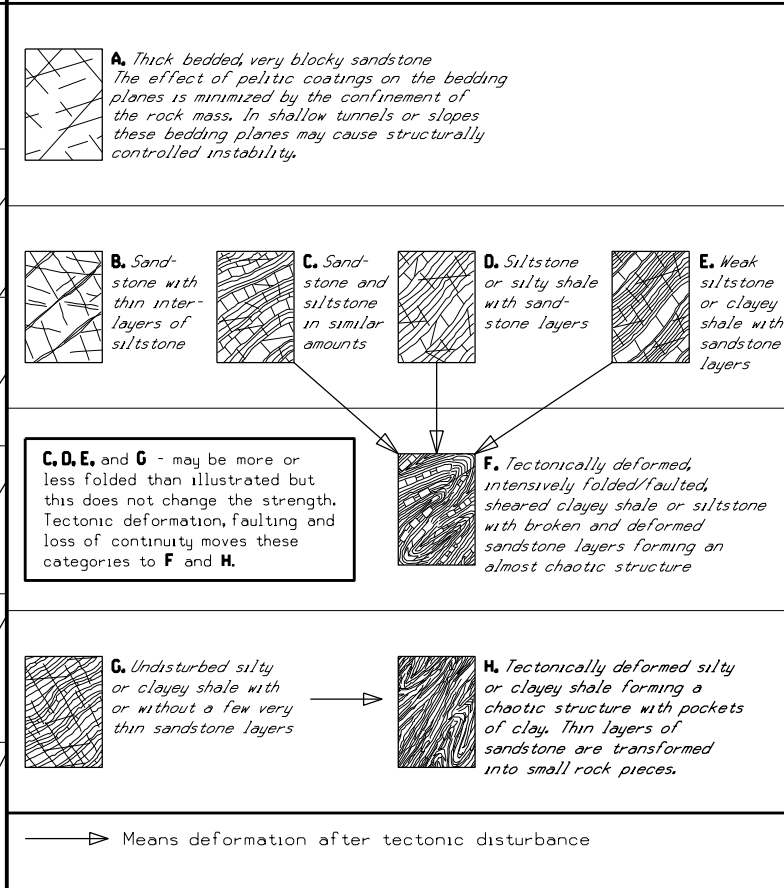
VERY GOOD - Very Rough, fresh unweathered surfaces	GOOD - Rough, slightly weathered surfaces	FAIR - Smooth, moderately weathered and altered surfaces	POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments	VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings
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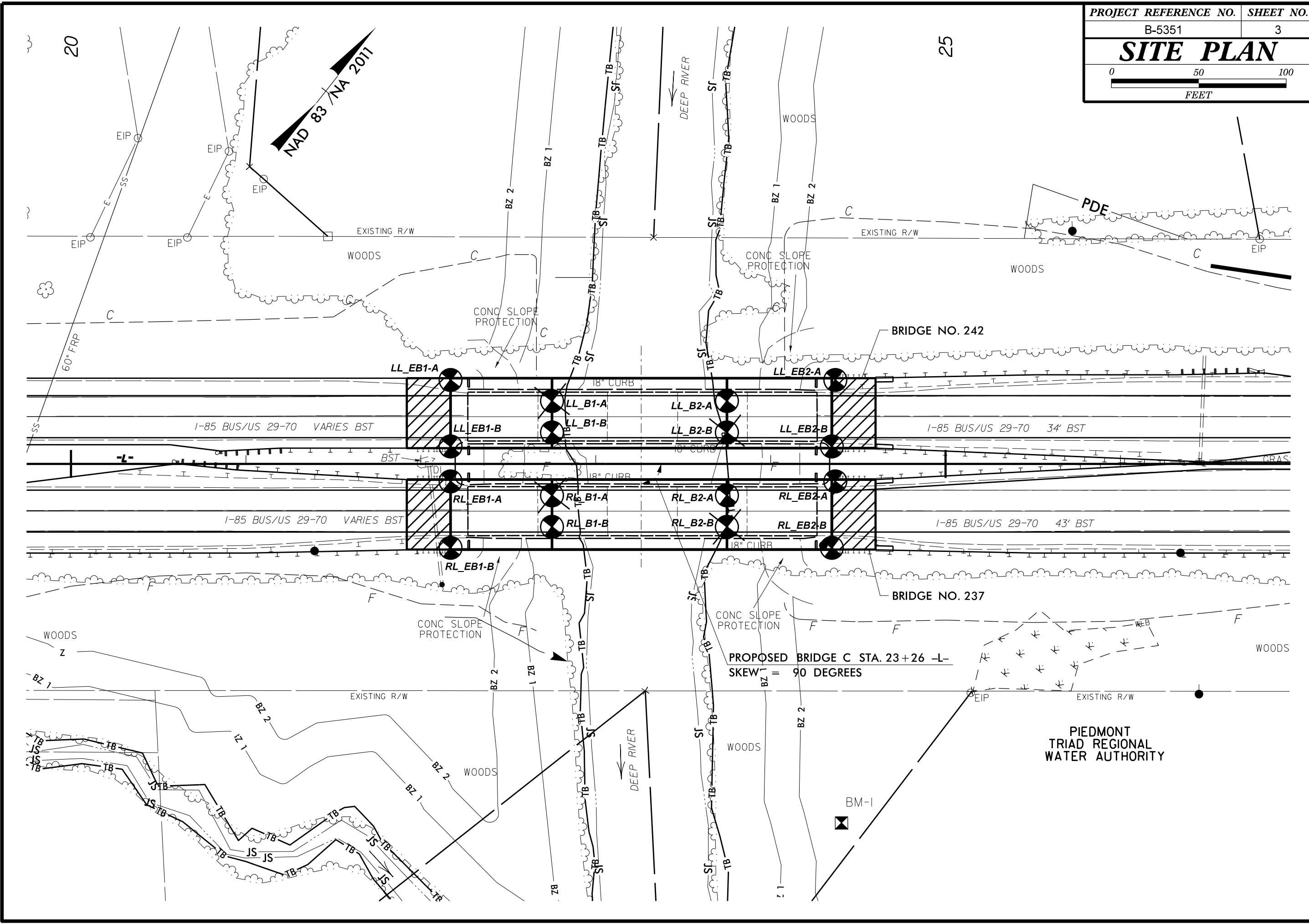
DECREASING INTERLOCKING OF ROCK PIECES

INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities	90				N/A	N/A
BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets	80	70				
VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets		60	50			
BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity			40			
DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces				30		
LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes					20	
						10
	N/A	N/A				

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.	70					
B. Sandstone with thin inter-layers of siltstone	60					
C. Sandstone and siltstone in similar amounts	50					
D. Siltstone or silty shale with sandstone layers	40					
E. Weak siltstone or clayey shale with sandstone layers	30					
F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure	20					
G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers	10					
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





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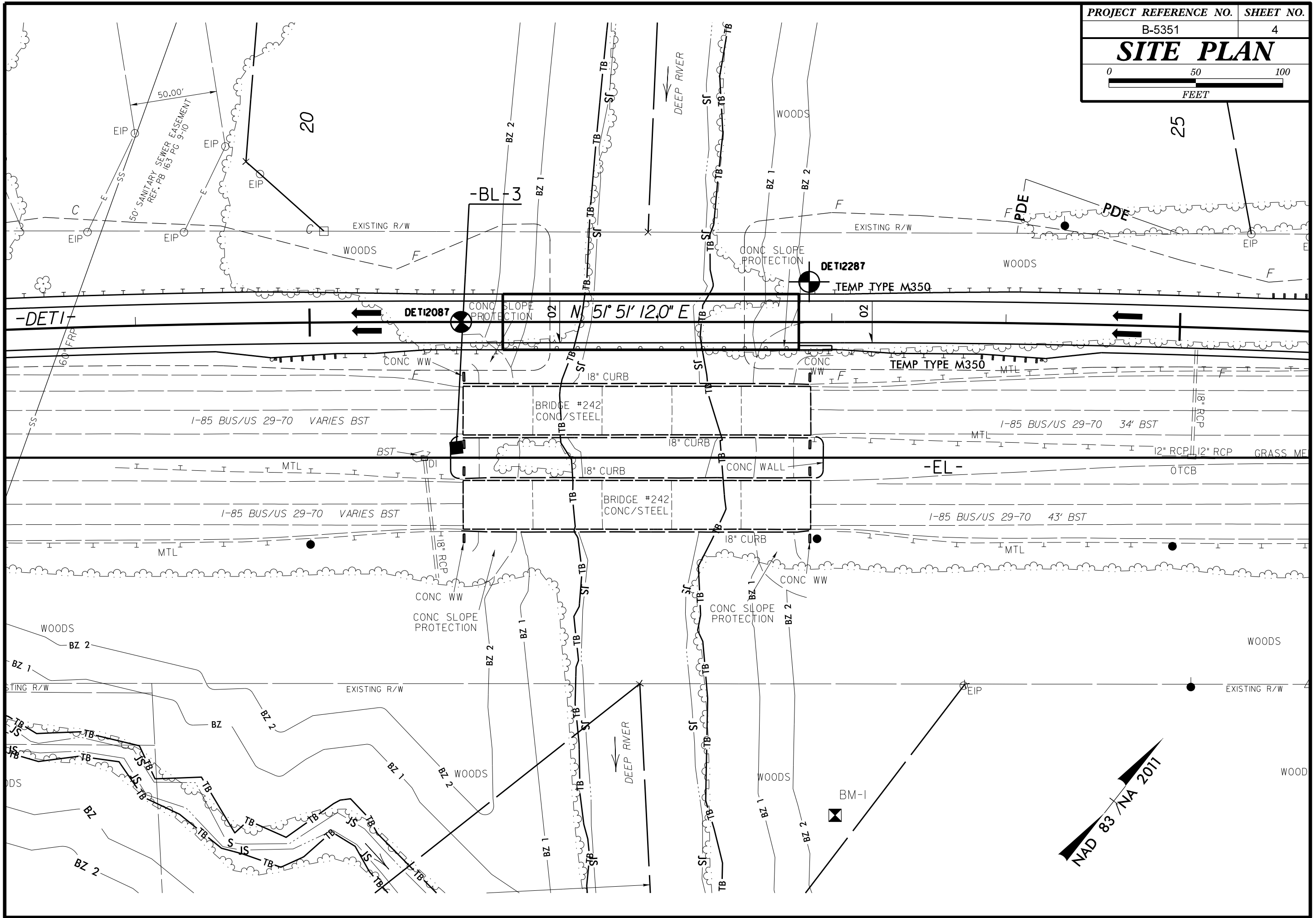
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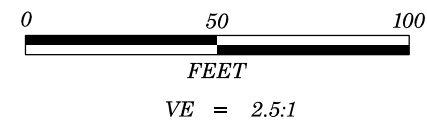
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PROPOSED BRIDGE C STA. 23+26 -L-
SKEW = 90 DEGREES

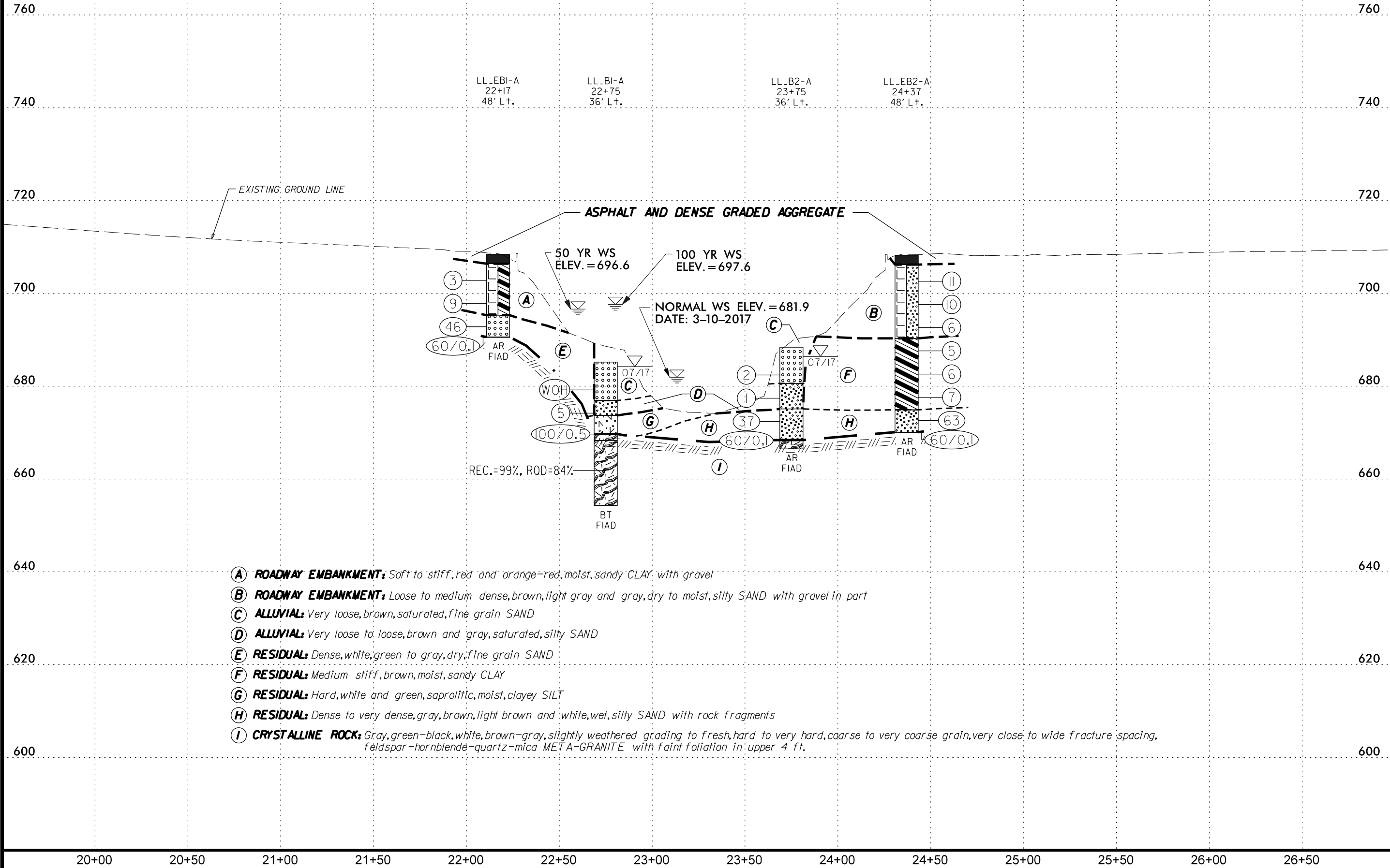
PIEDMONT
TRIAD REGIONAL
WATER AUTHORITY



GROUNDLINE PROFILE CREATED FROM b5351_ls_tin.tin FILE RECEIVED FROM NCDOT DATED 6-2-2017
 INFERRED STRATIGRAPHY IS DRAWN AT THE PROFILE OFFSET WITH THE BORINGS PROJECTED ONTO THE PROFILE

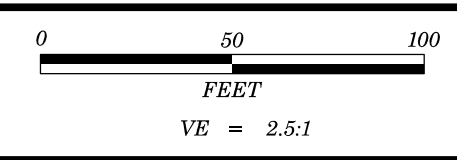


PROJECT REFERENCE NO.	SHEET NO.
B-5351	5
BRIDGE NO. 242 PROFILE 48' LT. OF -L-	

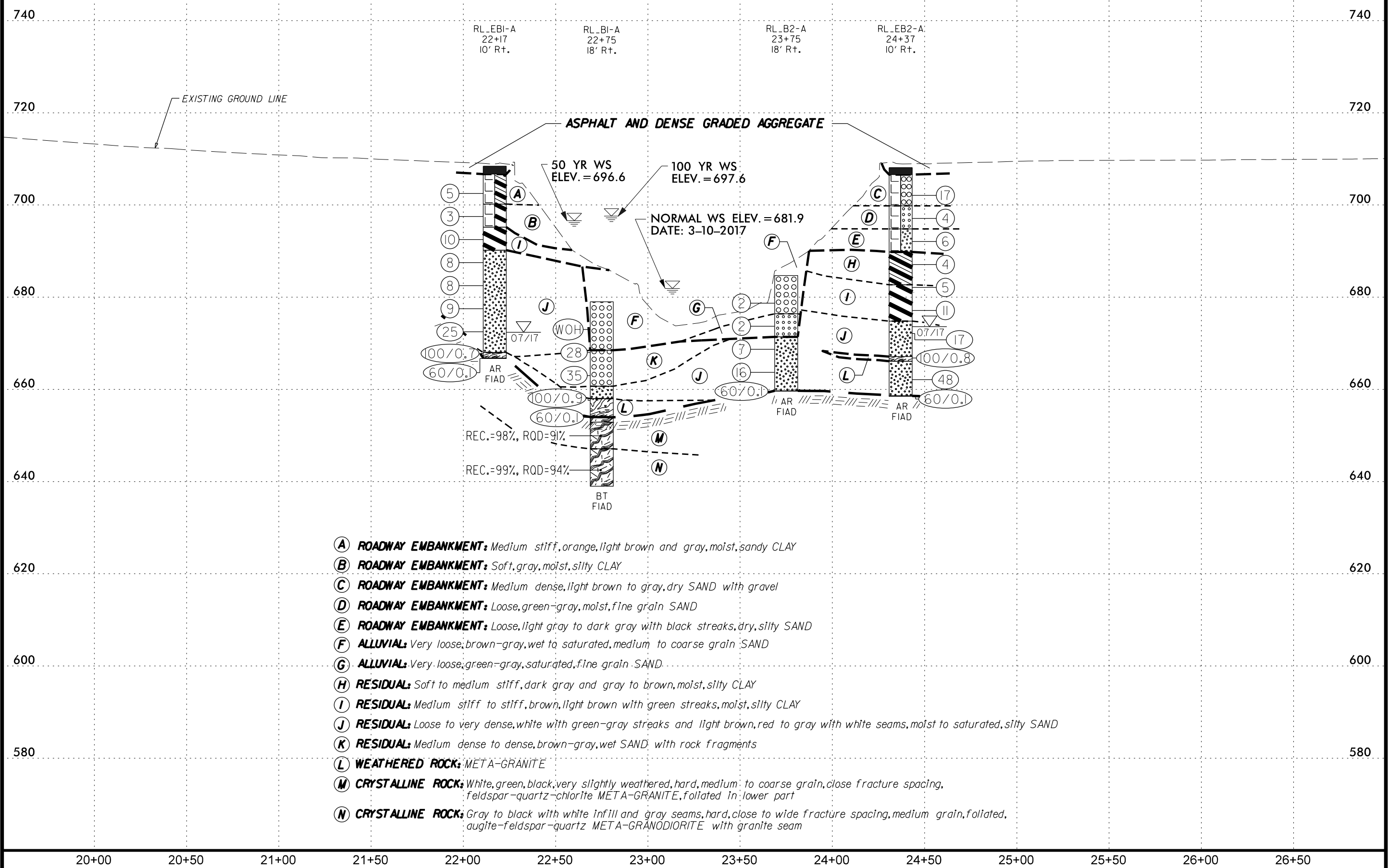


- (A) **ROADWAY EMBANKMENT:** Soft to stiff, red and orange-red, moist, sandy CLAY with gravel
- (B) **ROADWAY EMBANKMENT:** Loose to medium dense, brown, light gray and gray, dry to moist, silty SAND with gravel in part
- (C) **ALLUVIAL:** Very loose, brown, saturated, fine grain SAND
- (D) **ALLUVIAL:** Very loose to loose, brown and gray, saturated, silty SAND
- (E) **RESIDUAL:** Dense, white, green to gray, dry, fine grain SAND
- (F) **RESIDUAL:** Medium stiff, brown, moist, sandy CLAY
- (G) **RESIDUAL:** Hard, white and green, saprolitic, moist, clayey SILT
- (H) **RESIDUAL:** Dense to very dense, gray, brown, light brown and white, wet, silty SAND with rock fragments
- (I) **CRYSTALLINE ROCK:** Gray, green-black, white, brown-gray, slightly weathered grading to fresh, hard to very hard, coarse to very coarse grain, very close to wide fracture spacing, feldspar-hornblende-quartz-mica META-GRANITE with faint foliation in upper 4 ft.

GROUNDLINE PROFILE CREATED FROM b5351_ls_tin.tin FILE RECEIVED FROM NCDOT DATED 6-2-2017
 INFERRED STRATIGRAPHY IS DRAWN AT THE PROFILE OFFSET WITH THE BORINGS PROJECTED ONTO THE PROFILE



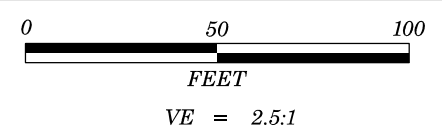
PROJECT REFERENCE NO.	SHEET NO.
B-5351	6
BRIDGE NO. 237 PROFILE 10' RT. OF -L-	



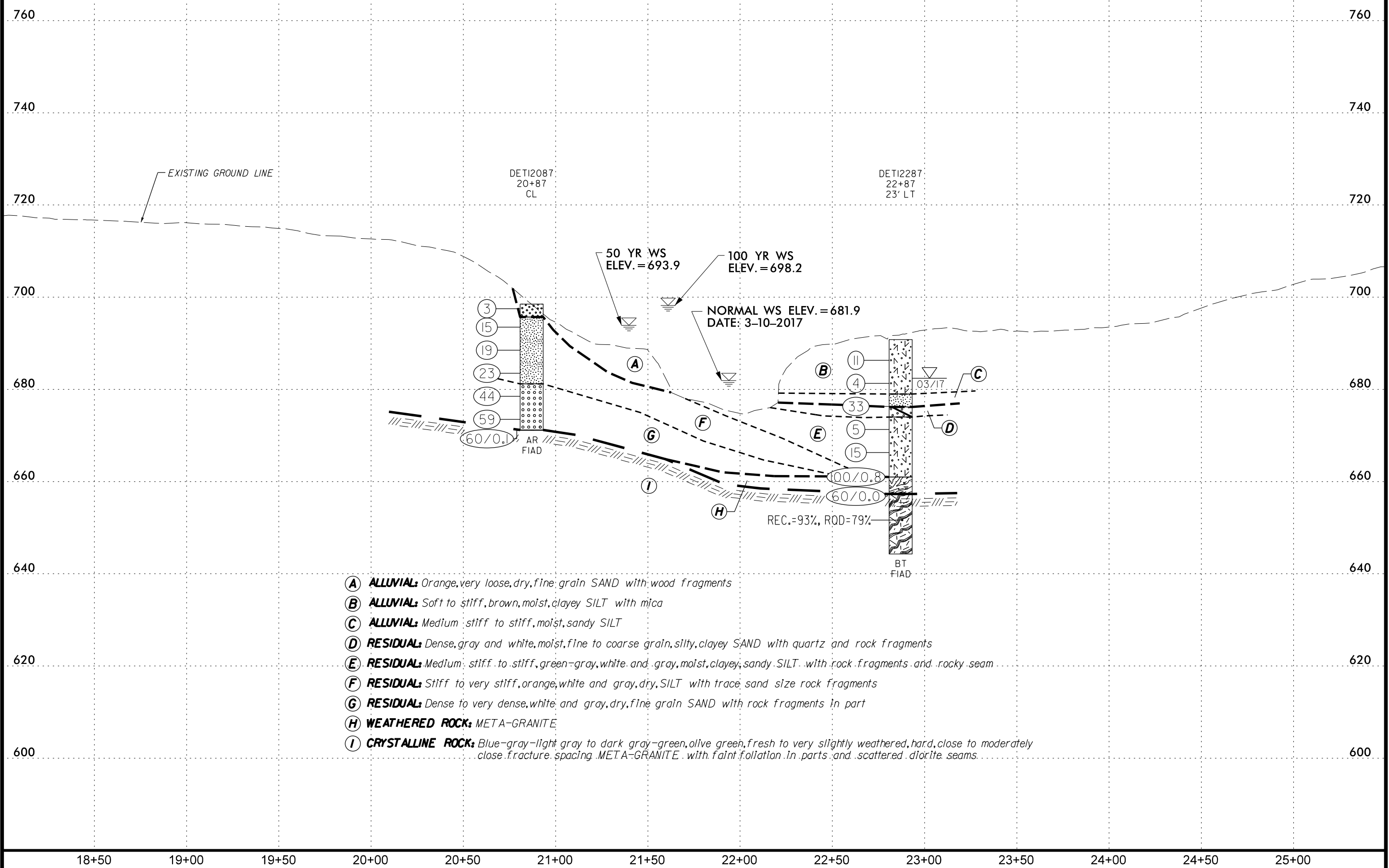
- (A) **ROADWAY EMBANKMENT:** Medium stiff, orange, light brown and gray, moist, sandy CLAY
- (B) **ROADWAY EMBANKMENT:** Soft, gray, moist, silty CLAY
- (C) **ROADWAY EMBANKMENT:** Medium dense, light brown to gray, dry SAND with gravel
- (D) **ROADWAY EMBANKMENT:** Loose, green-gray, moist, fine grain SAND
- (E) **ROADWAY EMBANKMENT:** Loose, light gray to dark gray with black streaks, dry, silty SAND
- (F) **ALLUVIAL:** Very loose, brown-gray, wet to saturated, medium to coarse grain SAND
- (G) **ALLUVIAL:** Very loose, green-gray, saturated, fine grain SAND
- (H) **RESIDUAL:** Soft to medium stiff, dark gray and gray to brown, moist, silty CLAY
- (I) **RESIDUAL:** Medium stiff to stiff, brown, light brown with green streaks, moist, silty CLAY
- (J) **RESIDUAL:** Loose to very dense, white with green-gray streaks and light brown, red to gray with white seams, moist to saturated, silty SAND
- (K) **RESIDUAL:** Medium dense to dense, brown-gray, wet SAND with rock fragments
- (L) **WEATHERED ROCK:** META-GRANITE
- (M) **CRYSTALLINE ROCK:** White, green, black, very slightly weathered, hard, medium to coarse grain, close fracture spacing, feldspar-quartz-chlorite META-GRANITE, foliated in lower part
- (N) **CRYSTALLINE ROCK:** Gray to black with white infill and gray seams, hard, close to wide fracture spacing, medium grain, foliated, augite-feldspar-quartz META-GRANODIORITE with granite seam

20+00 20+50 21+00 21+50 22+00 22+50 23+00 23+50 24+00 24+50 25+00 25+50 26+00 26+50

GROUNDLINE PROFILE CREATED FROM b5351_ls_tin.tin FILE RECEIVED FROM NCDOT DATED 6-2-2017
 INFERRED STRATIGRAPHY IS DRAWN AT THE PROFILE OFFSET WITH THE BORINGS PROJECTED ONTO THE PROFILE

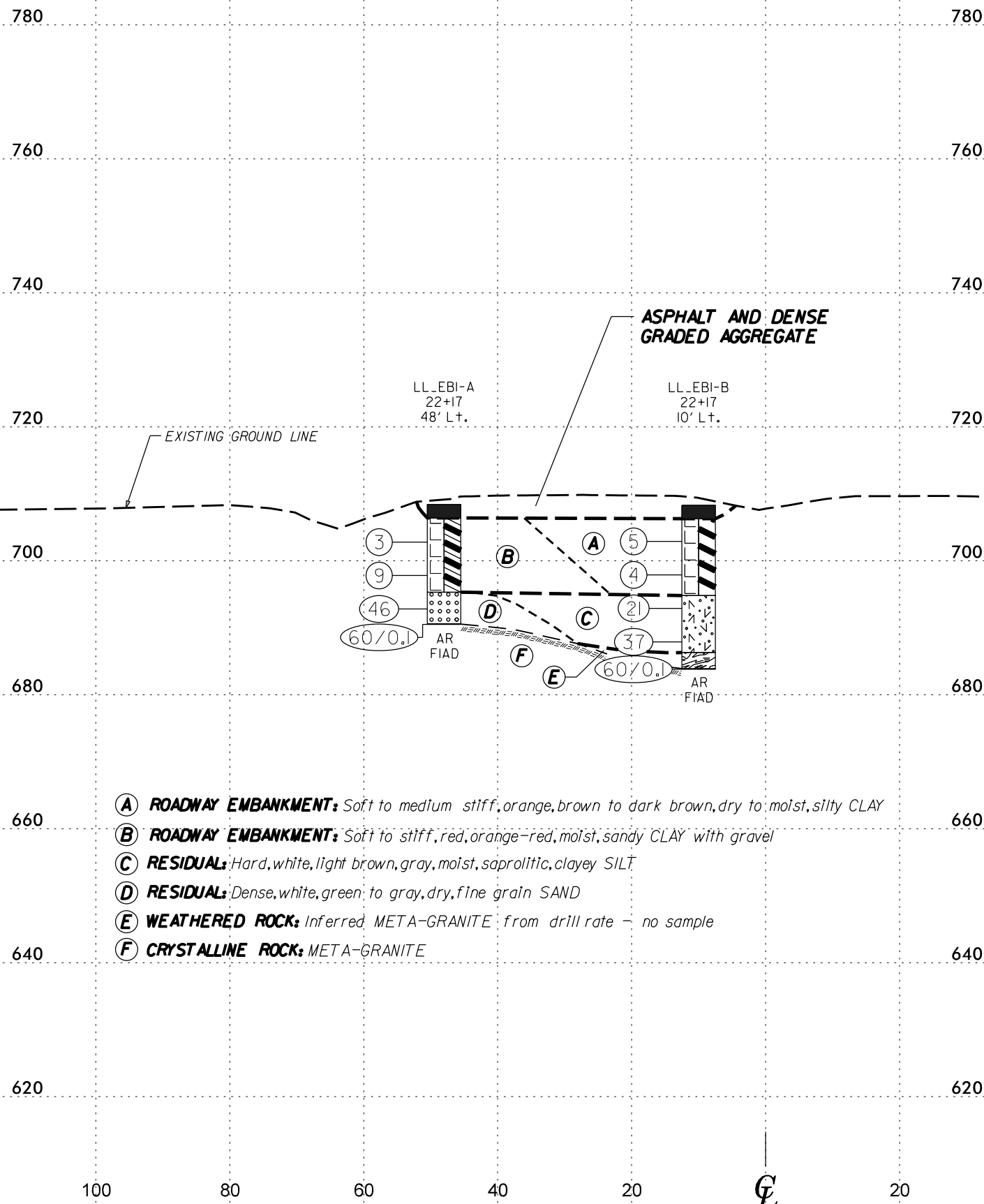


PROJECT REFERENCE NO.	SHEET NO.
B-5351	7
DETOUR BRIDGE PROFILE CL OF -DETI-	



- (A) **ALLUVIAL:** Orange, very loose, dry, fine grain SAND with wood fragments
- (B) **ALLUVIAL:** Soft to stiff, brown, moist, clayey SILT with mica
- (C) **ALLUVIAL:** Medium stiff to stiff, moist, sandy SILT
- (D) **RESIDUAL:** Dense, gray and white, moist, fine to coarse grain, silty, clayey SAND with quartz and rock fragments
- (E) **RESIDUAL:** Medium stiff to stiff, green-gray, white and gray, moist, clayey, sandy SILT with rock fragments and rocky seam
- (F) **RESIDUAL:** Stiff to very stiff, orange, white and gray, dry, SILT with trace sand size rock fragments
- (G) **RESIDUAL:** Dense to very dense, white and gray, dry, fine grain SAND with rock fragments in part
- (H) **WEATHERED ROCK:** META-GRANITE
- (I) **CRYSTALLINE ROCK:** Blue-gray-light gray to dark gray-green, olive green, fresh to very slightly weathered, hard, close to moderately close fracture spacing. META-GRANITE with faint foliation in parts and scattered diorite seams

CROSS SECTION CREATED FROM b5351_ls_fin.tin FILE RECEIVED FROM NCDOT DATED 6-2-2017
90° SKEW
-L-



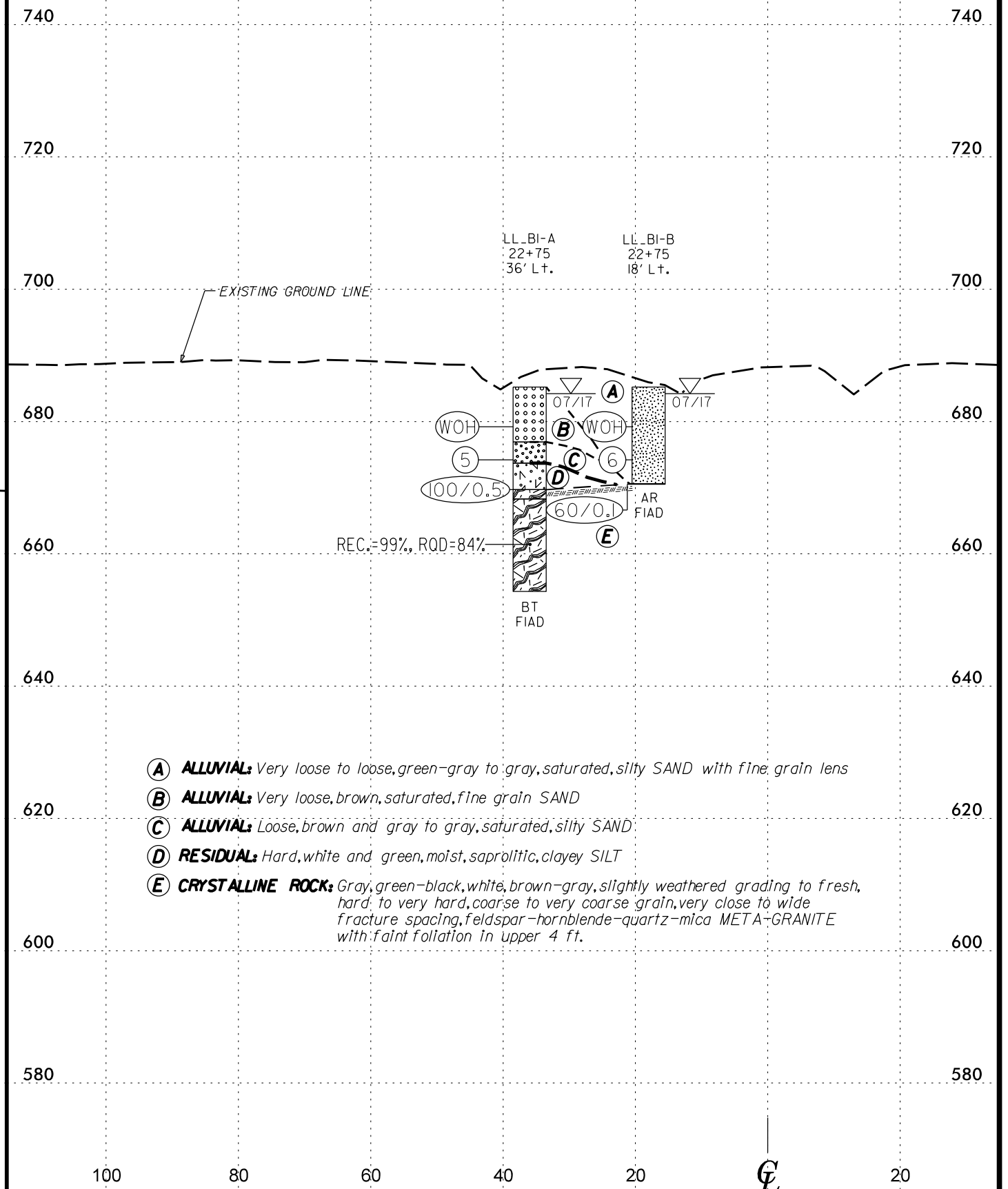
- (A) ROADWAY EMBANKMENT: Soft to medium stiff, orange, brown to dark brown, dry to moist, silty CLAY
- (B) ROADWAY EMBANKMENT: Soft to stiff, red, orange-red, moist, sandy CLAY with gravel
- (C) RESIDUAL: Hard, white, light brown, gray, moist, saprolitic, clayey SILT
- (D) RESIDUAL: Dense, white, green to gray, dry, fine grain SAND
- (E) WEATHERED ROCK: Inferred META-GRANITE from drill rate - no sample
- (F) CRYSTALLINE ROCK: META-GRANITE

HORIZ. SCALE 0 20 40 (FEET)

VE = NA

BRIDGE NO. 242 - END BENT 1
CROSS SECTION - STA. 21+92.00

CROSS SECTION CREATED FROM b5351_ls_fin.tin FILE RECEIVED FROM NCDOT DATED 6-2-2017
90° SKEW
-L-



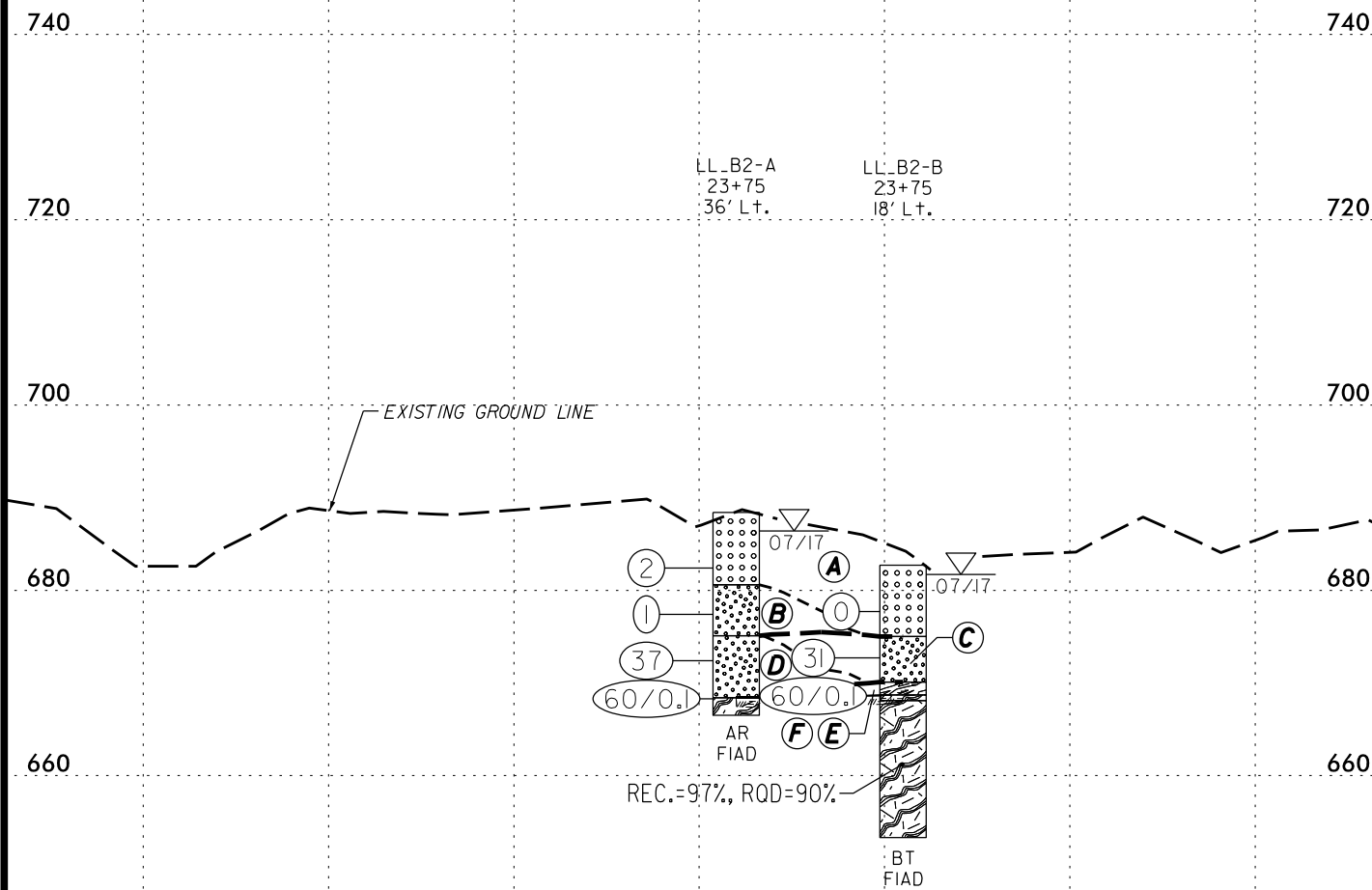
- (A) ALLUVIAL: Very loose to loose, green-gray to gray, saturated, silty SAND with fine grain lens
- (B) ALLUVIAL: Very loose, brown, saturated, fine grain SAND
- (C) ALLUVIAL: Loose, brown and gray to gray, saturated, silty SAND
- (D) RESIDUAL: Hard, white and green, moist, saprolitic, clayey SILT
- (E) CRYSTALLINE ROCK: Gray, green-black, white, brown-gray, slightly weathered grading to fresh, hard to very hard, coarse to very coarse grain, very close to wide fracture spacing, feldspar-hornblende-quartz-mica META-GRANITE with faint foliation in upper 4 ft.

HORIZ. SCALE 0 20 40 (FEET)

VE = NA

BRIDGE NO. 242 - BENT 1
CROSS SECTION - STA. 22+75.00

CROSS SECTION CREATED FROM b5351_ls_fin.tin FILE RECEIVED FROM NCDOT DATED 6-2-2017
90° SKEW
-L-



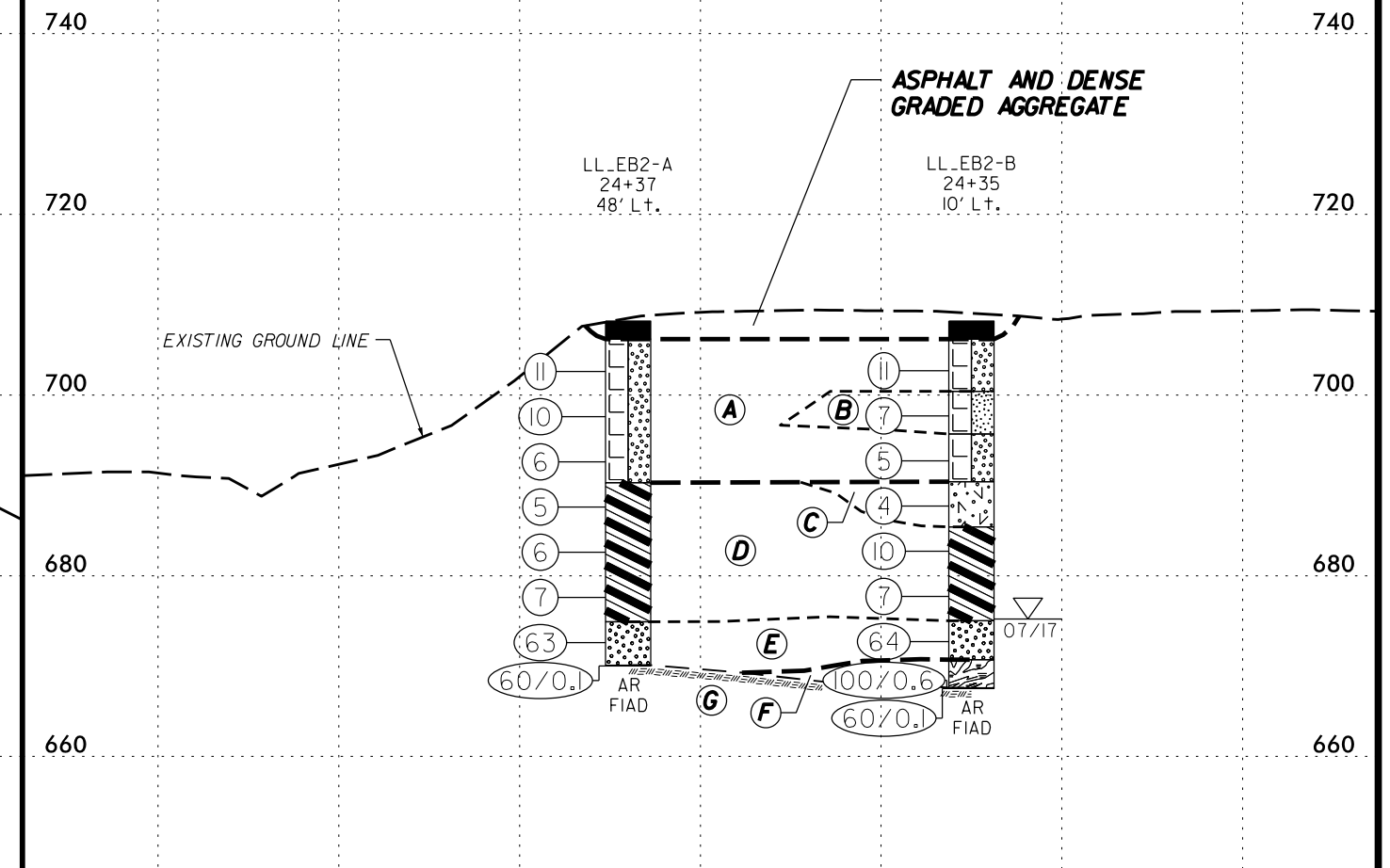
- (A) **ALLUVIAL:** Very loose, gray-brown, brown, saturated, fine grain SAND
- (B) **ALLUVIAL:** Very loose, brown, saturated, silty SAND
- (C) **RESIDUAL:** Dense, gray, saturated, silty SAND with white rock fragments
- (D) **RESIDUAL:** Dense, gray, wet, silty SAND with rock fragments
- (E) **WEATHERED ROCK:** Inferred META-GRANITE
- (F) **CRYSTALLINE ROCK:** Gray, white, black-green, brown-orange stain, very slightly weathered to fresh with seams; severely weathered, faintly foliated in parts, close to wide fracture spacing, coarse grain META-GRANITE with quartz vein

HORIZ. SCALE 0 20 40
(FEET)

VE = NA

BRIDGE NO. 242 - BENT 2
CROSS SECTION - STA. 23+75.00

CROSS SECTION CREATED FROM b5351_ls_fin.tin FILE RECEIVED FROM NCDOT DATED 6-2-2017
90° SKEW
-L-



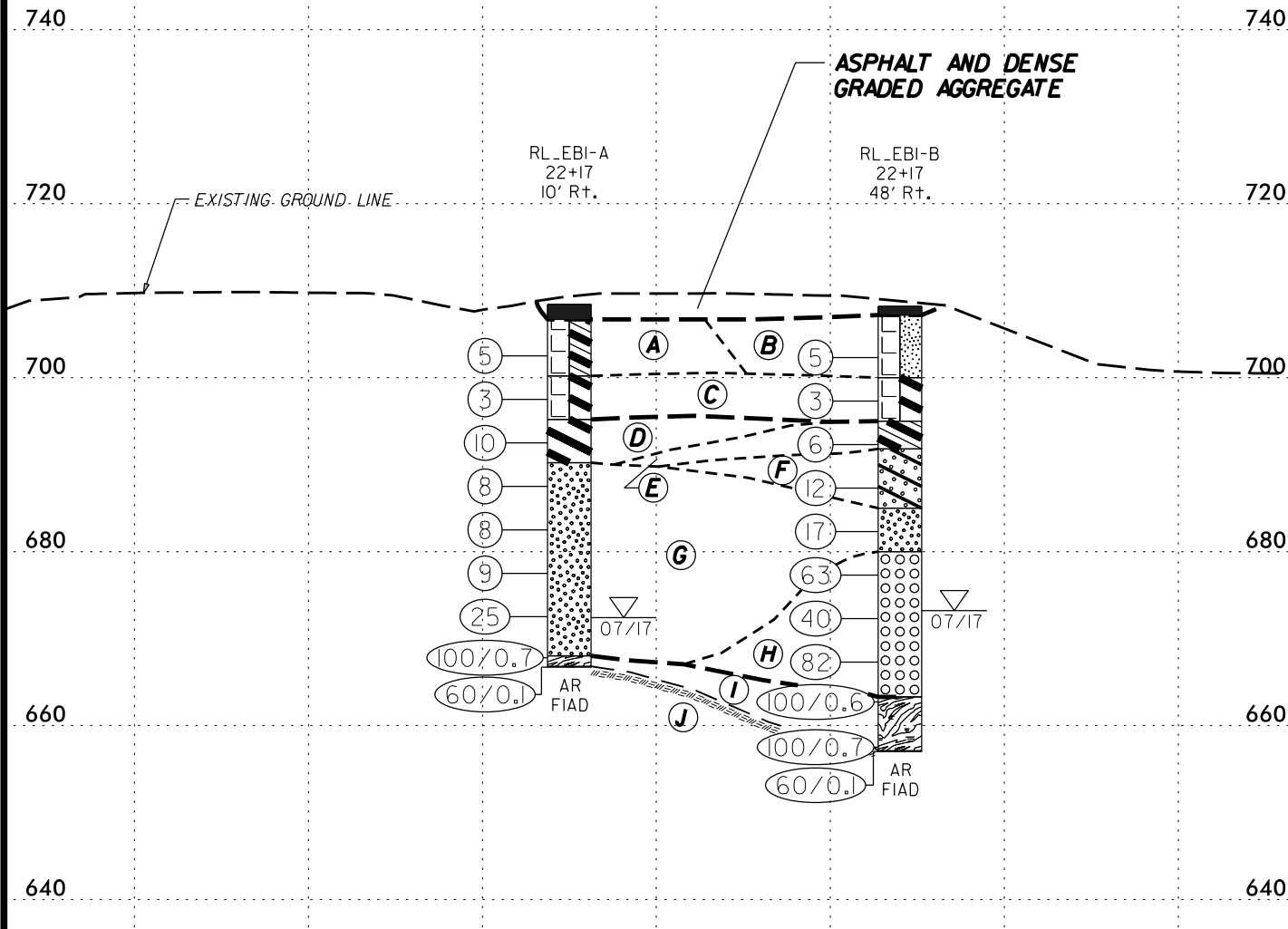
- (A) **ROADWAY EMBANKMENT:** Loose to medium dense, gray, brown to light gray, dry to moist, silty SAND with gravel in parts
- (B) **ROADWAY EMBANKMENT:** Medium stiff, white and gray, moist, sandy SILT
- (C) **RESIDUAL:** Soft to medium stiff, gray-brown, wet, clayey SILT
- (D) **RESIDUAL:** Soft to stiff, brown, moist to wet, sandy CLAY
- (E) **RESIDUAL:** Very dense, gray, brown, light brown, white, silty SAND with rock fragments
- (F) **WEATHERED ROCK:** META-GRANITE
- (G) **CRYSTALLINE ROCK:** META-GRANITE

HORIZ. SCALE 0 20 40
(FEET)

VE = NA

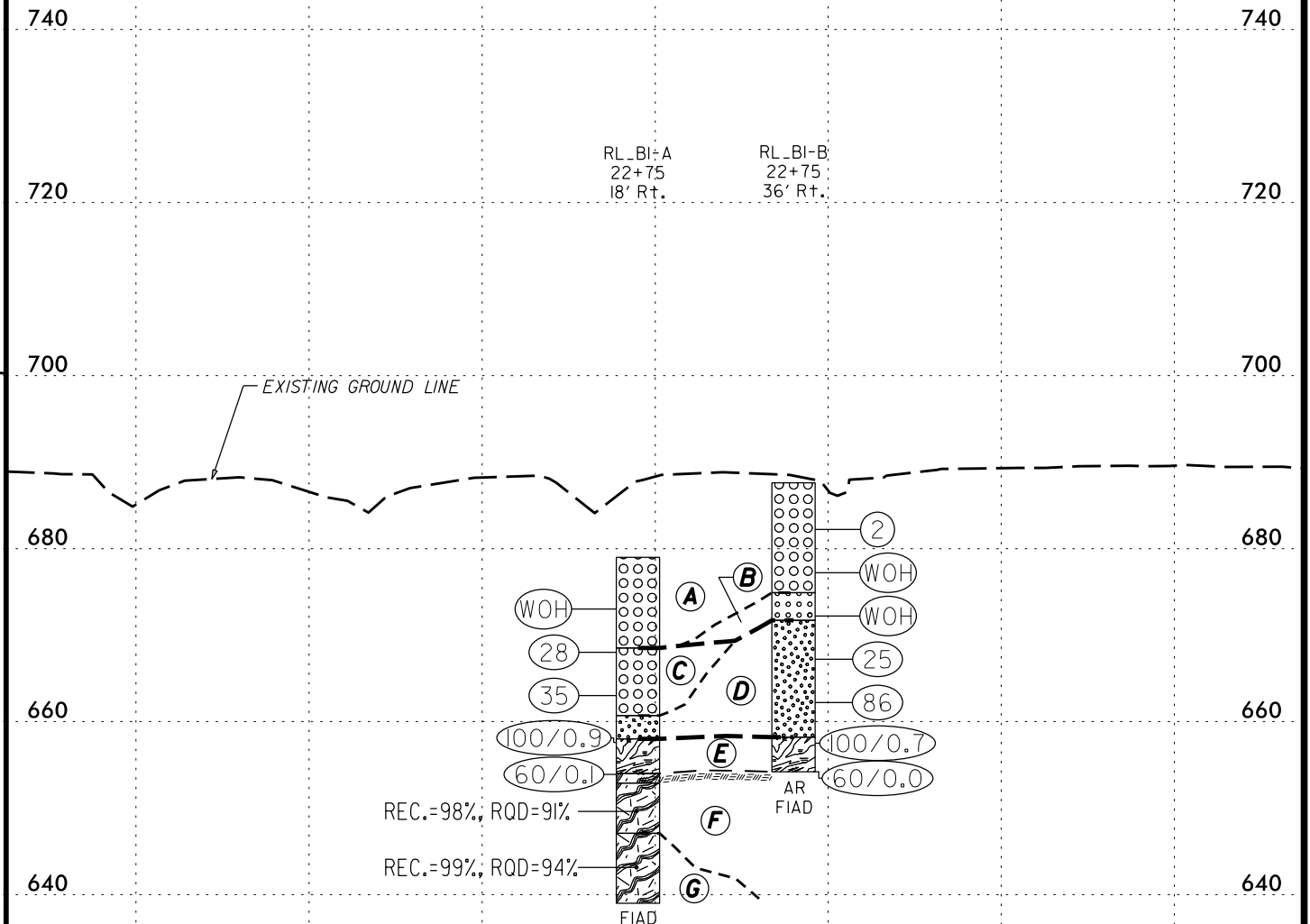
BRIDGE NO. 242 - END BENT 2
CROSS SECTION - STA. 24+59.99

CROSS SECTION CREATED FROM b5351_ls_fin.tin FILE RECEIVED FROM NCDOT DATED 6-2-2017
90° SKEW
-L-



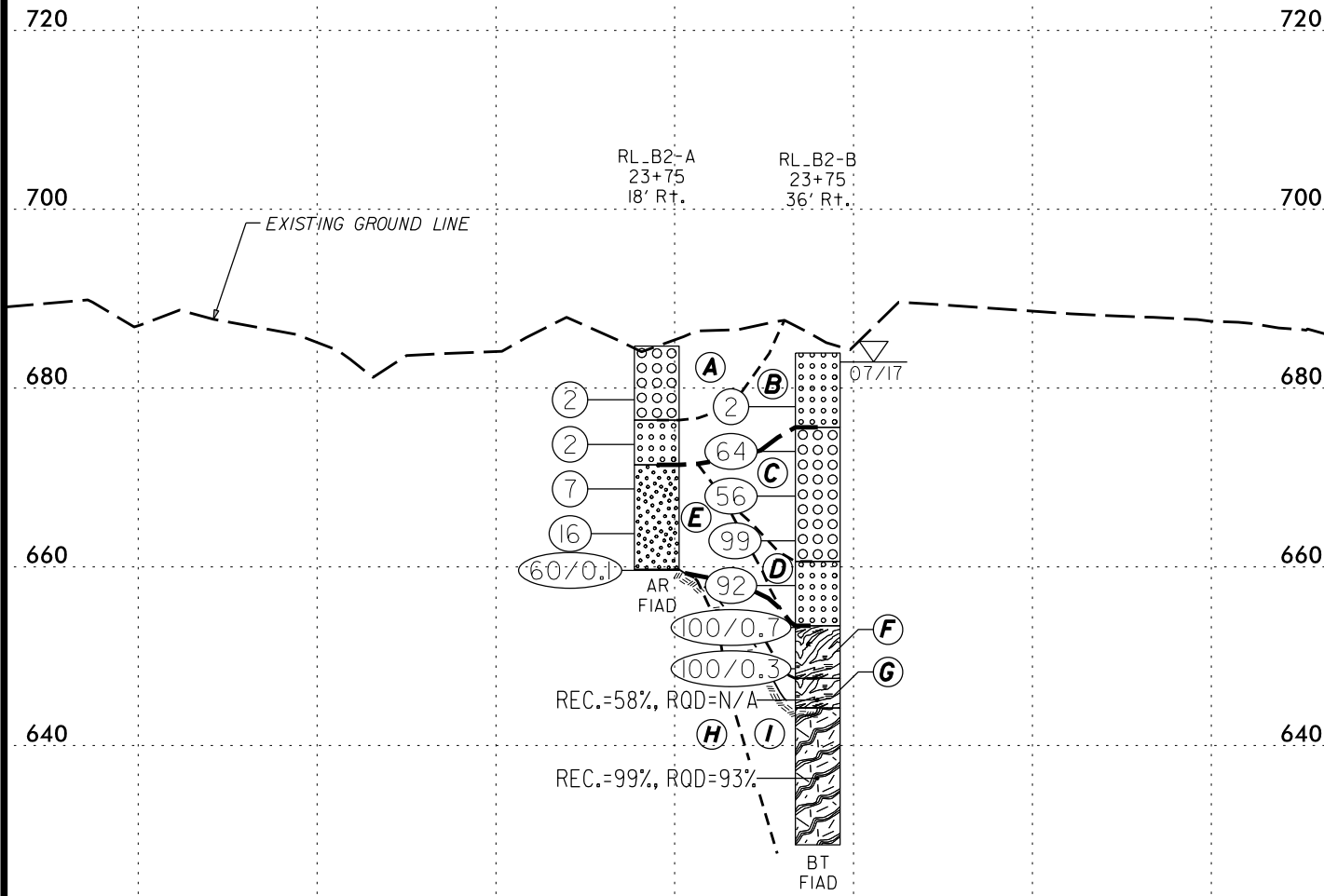
- (A) ROADWAY EMBANKMENT: Medium stiff, orange, light brown, gray, moist, sandy CLAY
- (B) ROADWAY EMBANKMENT: Medium stiff, red-brown, tan, dry, sandy SILT
- (C) ROADWAY EMBANKMENT: Soft, gray, red, brown, moist, silty CLAY
- (D) RESIDUAL: Stiff, light brown with green streaks, moist, silty CLAY
- (E) RESIDUAL: Medium stiff, red-brown, moist, CLAY with rock fragments
- (F) RESIDUAL: Medium dense, red-brown to tan, dry, clayey SAND
- (G) RESIDUAL: Loose to medium dense, white with green-gray streaks, brown-gray to tan, dry to moist, silty SAND
- (H) RESIDUAL: Dense to very dense, white to tan with red streaks and red to white with green streaks, dry to wet SAND with rock fragments
- (I) WEATHERED ROCK: META-GRANITE
- (J) CRYSTALLINE ROCK: META-GRANITE

CROSS SECTION CREATED FROM b5351_ls_fin.tin FILE RECEIVED FROM NCDOT DATED 6-2-2017
90° SKEW
-L-



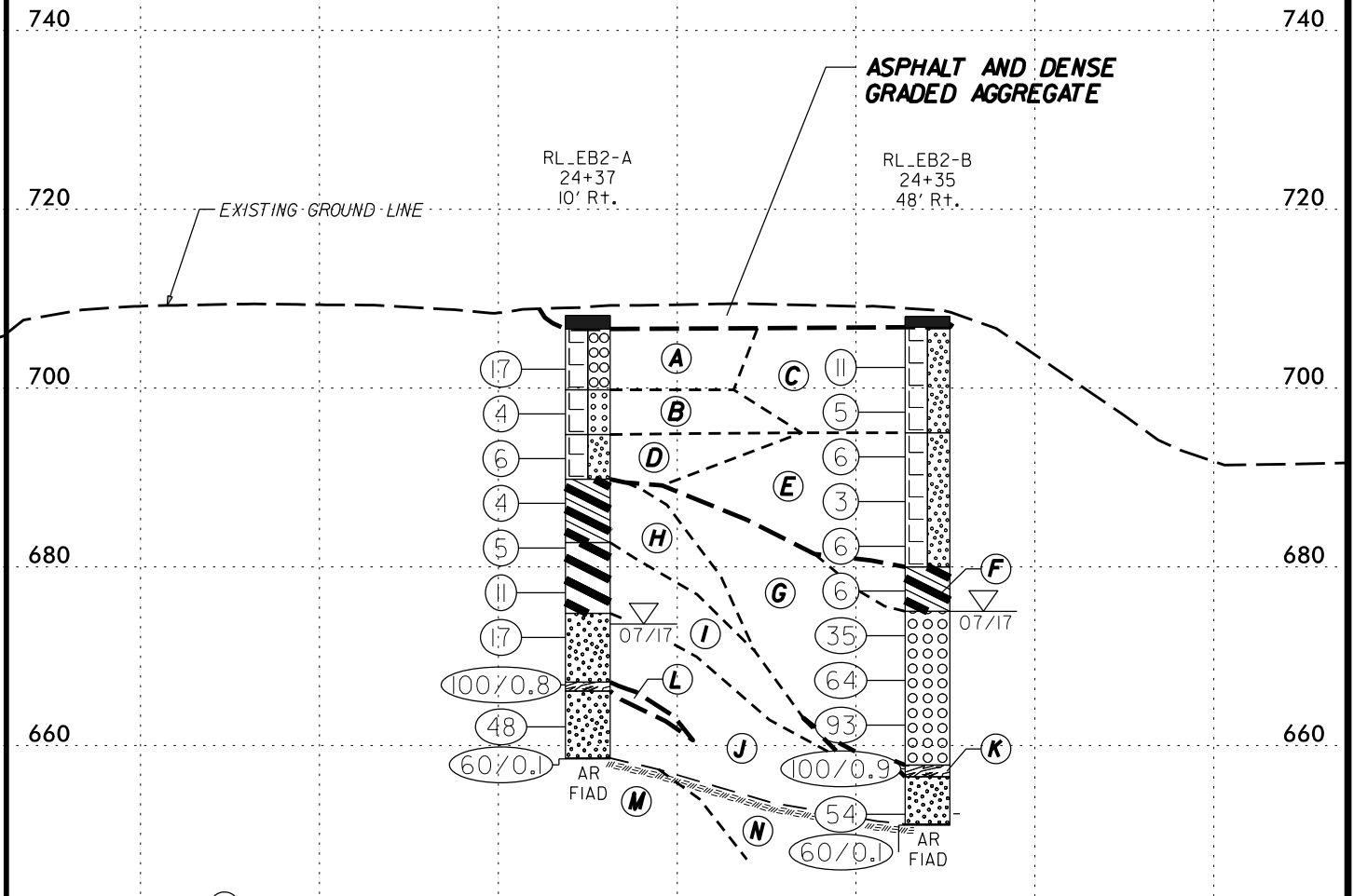
- (A) ALLUVIAL: Very loose, brown-gray to dark gray, wet, medium to coarse grain SAND with gravel
- (B) ALLUVIAL: Very loose, dark gray, wet, fine grain SAND
- (C) RESIDUAL: Medium dense to dense, brown-gray, wet, SAND with rock fragments
- (D) RESIDUAL: Medium dense to very dense, green to brown, light brown, moist, silty SAND with rock fragments
- (E) WEATHERED ROCK: META-GRANITE
- (F) CRYSTALLINE ROCK: White, green, black, very slightly weathered, hard, medium to coarse grain, close fracture spacing, feldspar-quartz-chlorite META-GRANITE foliated in lower part
- (G) CRYSTALLINE ROCK: Gray to black with white infill and gray seams, hard, close to wide fracture spacing, medium grain, foliated, augite-feldspar-quartz META-GRANODIORITE with granite seam

CROSS SECTION CREATED FROM b5351_ls_fin.tin FILE RECEIVED FROM NCDOT DATED 6-2-2017
90° SKEW
-L-



- (A) **ALLUVIAL:** Very loose, brown to gray, saturated SAND
- (B) **ALLUVIAL:** Very loose, green, gray and brown, wet to saturated, fine grain SAND
- (C) **RESIDUAL:** Very dense, brown and gray with black streaks, saturated to moist, SAND with rock fragments
- (D) **RESIDUAL:** Very dense, brown-gray, dry, fine grain SAND
- (E) **RESIDUAL:** Loose to medium dense, gray with green, saturated, silty SAND
- (F) **WEATHERED ROCK:** Inferred as META-GRANODIORITE
- (G) **WEATHERED ROCK:** Brown, dark brown, gray, brown-orange, severely weathered with seams very severely weathered, moderately hard with few hard fragments, very close to close fracture spacing, fine to medium grain, heavily stained META-GRANODIORITE with some foliation
- (H) **CRYSTALLINE ROCK:** META-GRANITE
- (I) **CRYSTALLINE ROCK:** Gray, black, scattered light gray, traces pink, fresh to very slightly weathered, hard to occasionally very hard, medium grain with inclusions coarse grain, close to wide fracture spacing, META-GRANODIORITE with quartz veining and healed joints, traces pyrite

CROSS SECTION CREATED FROM b5351_ls_fin.tin FILE RECEIVED FROM NCDOT DATED 6-2-2017
90° SKEW
-L-



- (A) **ROADWAY EMBANKMENT:** Medium dense, light brown to gray, dry, SAND with gravel
- (B) **ROADWAY EMBANKMENT:** Loose, green-gray, moist, fine grain SAND
- (C) **ROADWAY EMBANKMENT:** Loose to medium dense, light gray with green, gray with brown streaks, dry to moist, silty SAND
- (D) **ROADWAY EMBANKMENT:** Loose, light gray to dark gray with black streaks, dry, silty SAND
- (E) **ROADWAY EMBANKMENT:** Very loose to loose, gray, dark gray, brown, dry to wet, silty SAND
- (F) **RESIDUAL:** Medium stiff, brown, wet, sandy CLAY
- (G) **RESIDUAL:** Dense to very dense, brown with black streaks, green-black, saturated to moist, SAND with rock fragments
- (H) **RESIDUAL:** Soft to medium stiff, dark gray and gray to brown, moist, sandy CLAY
- (I) **RESIDUAL:** Medium stiff to stiff, brown, moist, silty CLAY
- (J) **RESIDUAL:** Medium dense to very dense, red to gray with white seams, green-black, moist to wet, silty SAND with rock fragments
- (K) **WEATHERED ROCK:** META-GRANODIORITE
- (L) **WEATHERED ROCK:** META-GRANITE
- (M) **CRYSTALLINE ROCK:** META-GRANITE
- (N) **CRYSTALLINE ROCK:** META-GRANODIORITE

GEOTECHNICAL BORING REPORT BORE LOG

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.										
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)									
BORING NO. LL_EB1-A		STATION 22+17		OFFSET 48 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 708.4 ft		TOTAL DEPTH 17.9 ft		NORTHING 810,188		EASTING 1,728,312										
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Woodard, O. F.		START DATE 07/12/17		COMP. DATE 07/12/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
710														708.4	0.0	GROUND SURFACE
														706.4	2.0	1.0' of asphalt and 1.0' of dense graded aggregate.
705	703.8	4.6	2	2	1								M			ROADWAY EMBANKMENT Soft to stiff, red & orange-red, sandy CLAY with gravel (A-6).
700	698.8	9.6	3	3	6								M			
695	693.8	14.6	8	16	30								D			RESIDUAL Dense, white, green to gray, fine grain SAND (A-3).
	690.6	17.8												690.6	17.8	CRYSTALLINE ROCK Meta-Granite
														690.5	17.9	Boring Terminated with Standard Penetration Test Refusal at Elevation 690.5 ft in Crystalline Rock (Meta-Granite).

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.										
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)									
BORING NO. LL_EB1-B		STATION 22+17		OFFSET 10 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 708.3 ft		TOTAL DEPTH 24.5 ft		NORTHING 810,158		EASTING 1,728,335										
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Woodard, O. F.		START DATE 07/11/17		COMP. DATE 07/11/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
710														708.3	0.0	GROUND SURFACE
														706.3	2.0	1.0' of asphalt and 1.0' of dense graded aggregate.
705	703.9	4.4	1	2	3								D			ROADWAY EMBANKMENT Soft to medium stiff, orange-brown to dark brown, silty CLAY (A-7-5).
700	698.9	9.4	1	2	2								M			
695	693.9	14.4	4	14	7								M			RESIDUAL Very stiff to hard, white, light brown and gray, saprolitic, clayey SILT (A-5).
690	688.9	19.4	4	13	24								M			
685	683.9	24.4												683.9	24.4	WEATHERED ROCK Meta-Granite
														683.8	24.5	Inferred from drill rate - no sample.
																CRYSTALLINE ROCK Meta-Granite
																Boring Terminated with Standard Penetration Test Refusal at Elevation 683.8 ft in Crystalline Rock (Meta-Granite).

NCDOT BORE DOUBLE B5351_GEO_BRDG_237 & 242 OVER DEEP RIVER.GPJ NC_DOT.GDT 10/2/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.									
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)								
BORING NO. LL_B1-A		STATION 22+75		OFFSET 36 ft LT		ALIGNMENT -L-									
COLLAR ELEV. 685.2 ft		TOTAL DEPTH 30.9 ft		NORTHING 810,214		EASTING 1,728,365									
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic									
DRILLER Woodard, O. F.		START DATE 07/10/17		COMP. DATE 07/10/17		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)	
690															
685														685.2	GROUND SURFACE 0.0
680	680.2	5.0	WOH	WOH	WOH							Sat.			
675	675.2	10.0	2	2	3							Sat.		676.9	Loose, brown and gray to gray, silty SAND (A-2-5). 8.3
670	670.2	15.0	35	65/0.0								M		673.7	White and green, hard, saprolitic, clayey SILT (A-5). 11.5
665														669.7	CRYSTALLINE ROCK 15.5
660														668.3	Advanced casing to seat in rock - inferred as Meta-Granite. 16.9
655														654.3	CRYSTALLINE ROCK Meta-Granite 30.9
															Boring Terminated at Elevation 654.3 ft in Crystalline Rock (Meta-Granite).

NCDOT BORE DOUBLE B5351_GEO_BRDG_237 & 242 OVER DEEP RIVER.GPJ NC_DOT_GDT_10/2/17

GEOTECHNICAL BORING REPORT

CORE LOG

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.						
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)					
BORING NO. LL_B1-A		STATION 22+75		OFFSET 36 ft LT		ALIGNMENT -L-						
COLLAR ELEV. 685.2 ft		TOTAL DEPTH 30.9 ft		NORTHING 810,214		EASTING 1,728,365						
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic						
DRILLER Woodard, O. F.		START DATE 07/10/17		COMP. DATE 07/10/17		SURFACE WATER DEPTH N/A						
CORE SIZE NQ2		TOTAL RUN 14.0 ft										
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)	
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %				
668.3	668.3	16.9	4.0	2:56	(3.8)	(3.1)	(13.8)	(11.8)		<p style="text-align: center;">Begin Coring @ 16.9 ft</p> <p style="text-align: center;">CRYSTALLINE ROCK</p> <p>Gray, green-black, white, brown-gray, slightly weathered grading to fresh, hard to very hard, coarse to very coarse grain, very close to wide fracture spacing, feldspar-hornblende-quartz-mica Meta-Granite with faint foliation in upper 4'.</p> <p>10 10°-30° joints tight to clay and calcite infill 1-2mm; 3 40°-45° joints tight to 8mm sphalerite/barite; 3 70°-80° joints iron oxide stain, patchy clay/calcite <1mm; 1 90° healed joint with mica and quartz infill to 2mm; 1 brecciated shear zone with mica, quartz vein</p> <p style="text-align: center;">GSI=62-67</p>	16.9	
665	664.3	20.9		2:25 2:41 2:14	95%	78%	99%	84%			668.3	
			5.0	2:18 2:36 2:17 2:11 2:23	(5.0)	(3.7)						
660	659.3	25.9			100%	74%					RS-1	
			5.0	2:01 2:05 2:16 2:26 2:31	(5.0)	(5.0)	100%	100%				
655	654.3	30.9								654.3		
Boring Terminated at Elevation 654.3 ft in Crystalline Rock (Meta-Granite).												

NCDOT CORE DOUBLE B5351_GEO_BRDG_237 & 242 OVER DEEP RIVER.GPJ NC_DOT_GDT_10/2/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.									
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)								
BORING NO. LL_B1-B		STATION 22+75		OFFSET 18 ft LT		ALIGNMENT -L-									
COLLAR ELEV. 685.2 ft		TOTAL DEPTH 14.7 ft		NORTHING 810,200		EASTING 1,728,376									
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017			DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic										
DRILLER Woodard, O. F.		START DATE 07/10/17		COMP. DATE 07/11/17		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
690															
685														685.2	GROUND SURFACE 0.0
680	680.2	5.0	WOH	WOH	WOH								Sat.	ALLUVIAL Very loose to loose, gray and green-gray, silty SAND to fine sand (A-2-4).	
675	675.2	10.0	WOH	2	4								Sat.		
	670.6	14.6												670.6	14.6
		60/0.1												670.5	14.7
															CRYSTALLINE ROCK Meta-Granite Boring Terminated with Standard Penetration Test Refusal at Elevation 670.5 ft in Crystalline Rock (Meta-Granite).

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.									
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)								
BORING NO. LL_B2-A		STATION 23+75		OFFSET 36 ft LT		ALIGNMENT -L-									
COLLAR ELEV. 688.4 ft		TOTAL DEPTH 21.9 ft		NORTHING 810,276		EASTING 1,728,443									
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017			DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic										
DRILLER Woodard, O. F.		START DATE 07/10/17		COMP. DATE 07/10/17		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
690															
685														688.4	GROUND SURFACE 0.0
680	683.4	5.0	WOH	WOH	2								Sat.	ALLUVIAL Very loose, brown, fine grain SAND (A-3).	
675	678.4	10.0	1	0	1								Sat.	Very loose, brown, silty SAND (A-2-5).	
670	673.4	15.0	2	14	23								W	675.1	13.3
	668.4	20.0												670.6	14.6
		60/0.1												668.4	20.0
														666.5	21.9
															CRYSTALLINE ROCK Inferred from SPT recovery as white and green Meta-Granite Boring Terminated with Casing Advancer Refusal at Elevation 666.5 ft in Crystalline Rock (Meta-Granite). Drove rock in tip of splitspoon at 20.0', attempted to advance casing resulting in additional 1.9' before refusal.

NCDOT BORE DOUBLE B5351_GEO_BRDG_237 & 242 OVER DEEP RIVER.GPJ NC_DOT.GDT 10/2/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.										
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)									
BORING NO. LL_B2-B		STATION 23+75		OFFSET 18 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 682.7 ft		TOTAL DEPTH 29.4 ft		NORTHING 810,262		EASTING 1,728,454										
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic										
DRILLER Woodard, O. F.		START DATE 07/11/17		COMP. DATE 07/11/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
685														682.7	0.0	GROUND SURFACE
680	678.7	4.0	WOH	WOH	WOH							Sat.				ALLUVIAL Very loose, gray-brown, fine grain SAND (A-3).
675	673.7	9.0	2	5	26							Sat.		675.0	7.7	RESIDUAL Dense, gray, silty SAND with white rock fragmty (A-2-5).
670	668.7	14.0												670.1	12.6	WEATHERED ROCK Inferred Meta-Granite
665														668.7 668.1	14.0 14.6	CRYSTALLINE ROCK Advanced casing to seat in rock - inferred as Meta-Granite.
660												RS-2				CRYSTALLINE ROCK Meta-Granite
655														653.3	29.4	Boring Terminated at Elevation 653.3 ft in Crystalline Rock (Meta-Granite).

NCDOT BORE DOUBLE B5351_GEO_BRDG_237 & 242 OVER DEEP RIVER.GPJ NC_DOT_GDT 10/2/17

GEOTECHNICAL BORING REPORT

CORE LOG

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.					
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)				
BORING NO. LL_B2-B		STATION 23+75		OFFSET 18 ft LT		ALIGNMENT -L-					
COLLAR ELEV. 682.7 ft		TOTAL DEPTH 29.4 ft		NORTHING 810,262		EASTING 1,728,454					
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic					
DRILLER Woodard, O. F.		START DATE 07/11/17		COMP. DATE 07/11/17		SURFACE WATER DEPTH N/A					
CORE SIZE NQ2		TOTAL RUN 14.8 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
668.1	668.1	14.6	4.8	2:16 1:54 1:31 1:53	(4.7) 98%	(4.2) 88%	(14.3) 97%	(13.3) 90%		Begin Coring @ 14.6 ft CRYSTALLINE ROCK Gray, white, black-green, brown-orange stain, very slightly weathered to fresh with seams severely weathered (17.1'-17.2', 22.6'-23.3'), faintly foliated in parts, close to wide fracture spacing, coarse grain meta-granite with quartz vein (28.9'-29.1'). 10 10°-30° joints some with iron stain and clay film-some tight; 4 50° joints with clay <1mm, iron oxide stain, moderately severely weathered walls. GSI=68-72	14.6
665	663.3	19.4	5.0	1:47/0.8 2:05 2:13 2:11	(4.6) 92%	(4.1) 82%					668.1
660	658.3	24.4	5.0	0:59 1:42 1:45	(5.0) 100%	(5.0) 100%					
655	653.3	29.4		1:34 1:33 1:41							
Boring Terminated at Elevation 653.3 ft in Crystalline Rock (Meta-Granite).											

NCDOT CORE DOUBLE B5351_GEO_BRDG_237 & 242 OVER DEEP RIVER.GPJ NC_DOT_GDT_10/2/17

GEOTECHNICAL BORING REPORT

BORE LOG

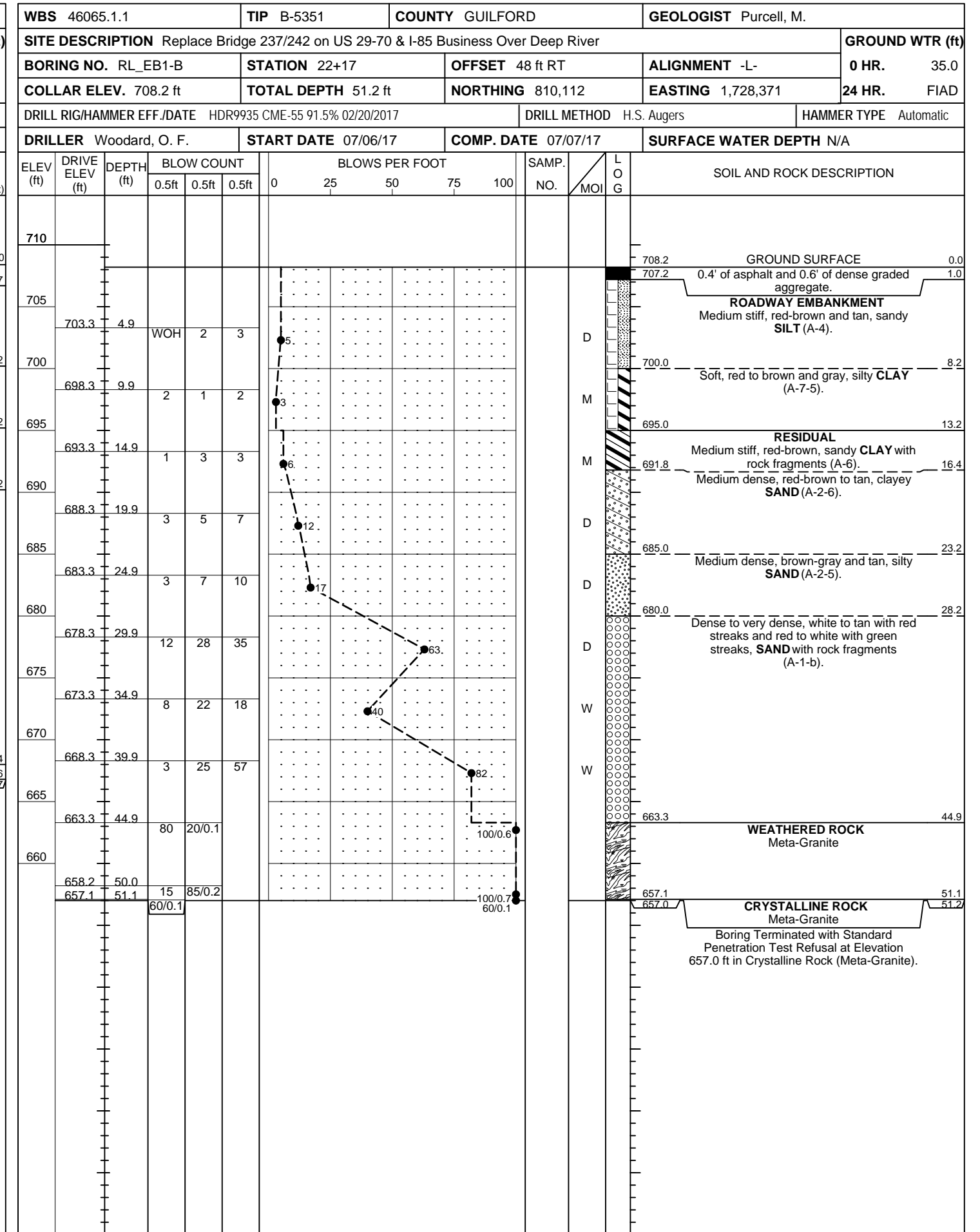
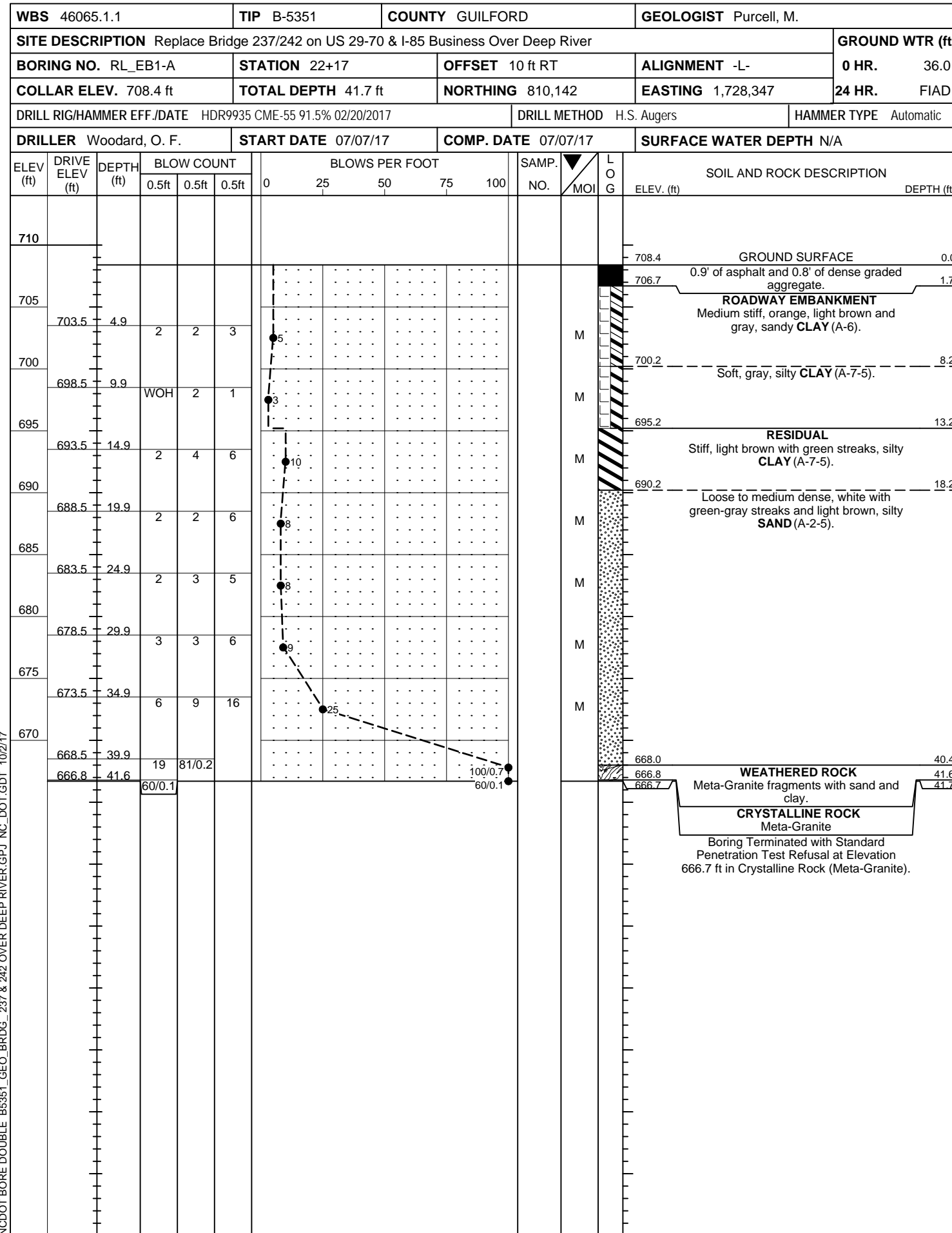
WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.										
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)									
BORING NO. LL_EB2-A		STATION 24+37		OFFSET 48 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 708.2 ft		TOTAL DEPTH 38.2 ft		NORTHING 810,322		EASTING 1,728,483										
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Woodard, O. F.		START DATE 07/11/17		COMP. DATE 07/12/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
710														708.2	GROUND SURFACE	0.0
														706.2	1.0' of asphalt and 1.0' of dense graded aggregate.	2.0
705	703.6	4.6	4	5	6										ROADWAY EMBANKMENT Loose to medium dense, brown, light gray and gray, silty SAND with gravel (A-2-5).	
700	698.6	9.6	5	5	5											
695	693.6	14.6	6	3	3											
690	688.6	19.6	2	2	3									690.3	RESIDUAL Medium stiff, brown, sandy CLAY (A-6).	17.9
685	683.6	24.6	2	2	4											
680	678.6	29.6	2	3	4											
675	673.6	34.6	6	18	45									674.9	Very dense, brown, light brown and white, silty SAND with rock fragments (A-2-4).	33.3
670	670.1	38.1												670.1	CRYSTALLINE ROCK Meta-Granite	38.1
														670.0	Boring Terminated with Standard Penetration Test Refusal at Elevation 670.0 ft in Crystalline Rock (Meta-Granite).	38.2

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.										
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)									
BORING NO. LL_EB2-B		STATION 24+35		OFFSET 10 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 708.2 ft		TOTAL DEPTH 40.7 ft		NORTHING 810,294		EASTING 1,728,508										
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Woodard, O. F.		START DATE 07/11/17		COMP. DATE 07/11/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
710														708.2	GROUND SURFACE	0.0
														706.2	1.0' of asphalt and 1.0' of dense graded aggregate.	2.0
705	703.7	4.5	3	4	7										ROADWAY EMBANKMENT Medium dense, gray, silty SAND (A-2-5).	
700	698.7	9.5	2	3	4									700.4	Medium stiff, white and gray, sandy SILT (A-4).	7.8
695	693.7	14.5	2	2	3									695.7	Loose, gray, silty SAND (A-2-5).	12.5
690	688.7	19.5	2	2	2									690.4	RESIDUAL Soft to medium stiff, gray-brown, clayey SILT (A-5).	17.8
685	683.7	24.5	2	3	7									685.4	Medium stiff to stiff, brown, sandy CLAY (A-6).	22.8
680	678.7	29.5	2	3	4											
675	673.7	34.5	6	34	30									675.0	Very dense, gray to brown, silty SAND with rock fragments (A-2-4).	33.2
670	668.7	39.5												670.7	WEATHERED ROCK Meta-Granite	37.5
	667.6	40.6	8	60	40/0.1									667.6	CRYSTALLINE ROCK Meta-Granite	40.6
														667.5	Boring Terminated with Standard Penetration Test Refusal at Elevation 667.5 ft in Crystalline Rock (Meta-Granite).	40.7

NCDOT BORE DOUBLE B5351_GEO_BRDG_237 & 242 OVER DEEP RIVER.GPJ NC_DOT.GDT 10/2/17

GEOTECHNICAL BORING REPORT

BORE LOG



NCDOT BORE DOUBLE B5351_GEO_BRDG_237 & 242 OVER DEEP RIVER.GPJ NC_DOT.GDT 10/2/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.										
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)									
BORING NO. RL_B1-A		STATION 22+75		OFFSET 18 ft RT		ALIGNMENT -L-	0 HR. N/A									
COLLAR ELEV. 679.0 ft		TOTAL DEPTH 40.0 ft		NORTHING 810,172		EASTING 1,728,398	24 HR. FIAD									
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic										
DRILLER Woodard, O. F.		START DATE 07/08/17		COMP. DATE 07/08/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
680														679.0	0.0	GROUND SURFACE
675	674.0	5.0	WOH	WOH	WOH							W				ALLUVIAL Very loose, brown-gray, medium to coarse grain SAND (A-1-b).
670	669.0	10.0	1	10	18							W		668.5	10.5	RESIDUAL Medium dense to dense, brown-gray, SAND with rock fragments (A-1-b).
665	664.0	15.0	10	15	20							W				
660	659.0	20.0	35	42	58/0.4							M		660.7	18.3	Very dense, light brown, silty SAND (A-2-5).
655	654.0	25.0	60/0.1											658.0	21.0	WEATHERED ROCK Meta-Granite
650														654.0	25.0	CRYSTALLINE ROCK Advanced casing to seat in rock - inferred as Meta-Granite.
														652.9	26.1	CRYSTALLINE ROCK Meta-Granite
645														647.1	31.9	Meta-Granodiorite
640														639.0	40.0	Boring Terminated at Elevation 639.0 ft in Crystalline Rock (Meta-Granodiorite).

NCDOT BORE DOUBLE B5351_GEO_BRDG_237 & 242 OVER DEEP RIVER.GPJ NC_DOT_GDT 10/2/17

GEOTECHNICAL BORING REPORT

CORE LOG

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.						
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)					
BORING NO. RL_B1-A		STATION 22+75		OFFSET 18 ft RT		ALIGNMENT -L-						
COLLAR ELEV. 679.0 ft		TOTAL DEPTH 40.0 ft		NORTHING 810,172		EASTING 1,728,398						
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic						
DRILLER Woodard, O. F.		START DATE 07/08/17		COMP. DATE 07/08/17		SURFACE WATER DEPTH N/A						
CORE SIZE NQ2		TOTAL RUN 13.9 ft										
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)	
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %				
652.9	652.9	26.1	3.9	1:23/0.9 1:39 1:51 2:16	(3.8) 97%	(3.4) 87%	(5.7) 98%	(5.3) 91%		Begin Coring @ 26.1 ft	26.1	
650	649.0	30.0	5.0	3:18 2:18 2:17 2:26 2:29	(4.9) 98%	(4.8) 96%	(8.0) 99%	(7.6) 94%		652.9 647.1	CRYSTALLINE ROCK White, green, black, very slightly weathered, hard, medium to coarse grain, close fracture spacing, feldspar-quartz-chlorite Meta-Granite, foliated in lower part. 1 30° joint with faint iron oxide stain; 4 40°-50° joints with iron oxide stain, clay film and calcite fill; 1 75° joint with iron oxide stain and clay film GSI=58-62	31.9
645	644.0	35.0	5.0	1:19 1:45 1:16 1:35 1:42	(5.0) 100%	(4.7) 94%				647.1	Gray to black with white infill and gray seams, very slightly weathered, hard, close to wide fracture spacing, medium grain, foliated, augite-feldspar-quartz Meta-Granodiorite with granite seam (38.4'-38.9'). 3 30°-45° joints with calcite infill to 3mm; 2 75° joints with calcite infill to 3mm GSI=68-73	40.0
640	639.0	40.0								639.0	Boring Terminated at Elevation 639.0 ft in Crystalline Rock (Meta-Granodiorite).	

NCDOT CORE DOUBLE B6351_GEO_BRDG_237 & 242 OVER DEEP RIVER.GPJ NC_DOT_GDT_10/2/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.											
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)										
BORING NO. RL_B1-B		STATION 22+75		OFFSET 36 ft RT		ALIGNMENT -L-											
COLLAR ELEV. 687.6 ft		TOTAL DEPTH 33.4 ft		NORTHING 810,157		EASTING 1,728,409											
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017			DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic												
DRILLER Woodard, O. F.		START DATE 07/09/17		COMP. DATE 07/09/17		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG SOIL AND ROCK DESCRIPTION	DEPTH (ft)			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
690															687.6	GROUND SURFACE	0.0
685	683.2	4.4	1	1	1								W	ALLUVIAL Very loose, brown and dark gray, SAND with gravel (A-1-b).			
680	678.2	9.4	WOH	WOH	WOH								W				
675	673.2	14.4	WOH	WOH	WOH								W	Very loose, dark gray, fine grain SAND (A-3).	12.7		
670	668.2	19.4	9	10	15								M	RESIDUAL Medium dense to very dense, white and green to brown, silty SAND with rock fragments (A-2-5).	15.9		
665	663.2	24.4	24	32	54								M				
660	658.2	29.4	67	33/0.2													
655	654.2	33.4	60/0.0														

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.											
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)										
BORING NO. RL_B2-A		STATION 23+75		OFFSET 18 ft RT		ALIGNMENT -L-											
COLLAR ELEV. 684.7 ft		TOTAL DEPTH 25.1 ft		NORTHING 810,233		EASTING 1,728,477											
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017			DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic												
DRILLER Woodard, O. F.		START DATE 07/07/17		COMP. DATE 07/08/17		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG SOIL AND ROCK DESCRIPTION	DEPTH (ft)			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
685															684.7	GROUND SURFACE	0.0
680	679.7	5.0	3	1	1								Sat.	ALLUVIAL Very loose, brown to gray SAND (A-1-b).			
675	674.7	10.0	WOH	WOH	2								Sat.	Very loose, green-gray, fine grain SAND (A-3).	8.3		
670	669.7	15.0	WOH	2	5								Sat.	RESIDUAL Loose to medium dense, gray with green, silty SAND (A-2-5).	13.3		
665	664.7	20.0	5	8	8								Sat.				
660	659.7	25.0	60/0.1														

NCDOT BORE DOUBLE B5351_GEO_BRDG_237 & 242 OVER DEEP RIVER.GPJ NC_DOT.GDT 10/2/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.										
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)									
BORING NO. RL_B2-B		STATION 23+75		OFFSET 36 ft RT		ALIGNMENT -L-	0 HR. 1.0									
COLLAR ELEV. 683.9 ft		TOTAL DEPTH 55.0 ft		NORTHING 810,219		EASTING 1,728,488	24 HR. FIAD									
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic										
DRILLER Woodard, O. F.		START DATE 07/09/17		COMP. DATE 07/09/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
685														683.9	0.0	GROUND SURFACE
680	678.9	5.0	1	1	1							W				ALLUVIAL Very loose, brown, fine grain SAND (A-3).
675	673.9	10.0	1	14	50							Sat.		675.6	8.3	RESIDUAL Very dense, brown and gray with black streaks, SAND with rock fragments (A-1-a).
670	668.9	15.0	14	32	24							W				
665	663.9	20.0	14	40	59							M				
660	658.9	25.0	25	45	47							M		660.6	23.3	Very dense, brown-gray, brown and gray, fine grain SAND (A-3).
655	653.9	30.0	45	55/0.2								D		653.4	30.5	WEATHERED ROCK Advanced casing to seat in rock - inferred as Meta-Granodiorite.
650	648.9	35.0	100/0.3											647.5	36.4	WEATHERED ROCK Meta-Granodiorite
645														644.2	39.7	CRYSTALLINE ROCK Meta-Granodiorite
640												RS-4				
635																
630														628.9	55.0	Boring Terminated at Elevation 628.9 ft in Crystalline Rock (Meta-Granodiorite).

NCDOT BORE DOUBLE B5351_GEO_BRDG_237 & 242 OVER DEEP RIVER.GPJ NC_DOT.GDT 10/2/17

GEOTECHNICAL BORING REPORT

CORE LOG

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.					
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)				
BORING NO. RL_B2-B		STATION 23+75		OFFSET 36 ft RT		ALIGNMENT -L-					
COLLAR ELEV. 683.9 ft		TOTAL DEPTH 55.0 ft		NORTHING 810,219		EASTING 1,728,488					
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic					
DRILLER Woodard, O. F.		START DATE 07/09/17		COMP. DATE 07/09/17		SURFACE WATER DEPTH N/A					
CORE SIZE NQ2		TOTAL RUN 18.6 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
647.5										Begin Coring @ 36.4 ft	
645	647.5	36.4	3.6	1:24/0.6 2:14 0:59	(2.2) 61%	(0.4) 11%	(1.9) 58%	N/A	WEATHERED ROCK	Brown, dark brown, gray, brown-orange, severely weathered with seams very severely weathered, moderately hard with few hard fragments, close to very close fracture spacing, fine to medium grain, heavily stained, Meta-Granodiorite with some foliation. GSI=27-30	36.4
	643.9	40.0	5.0	2:53 2:49 2:40 2:25 2:31	(5.0) 100%	(4.8) 96%	(15.1) 99%	(14.2) 93%	CRYSTALLINE ROCK	Gray, black, scattered light gray, trace pink, fresh to very slightly weathered, hard to occasionally very hard, medium grain with inclusion coarse grain, close to wide fracture spacing, Meta-Granodiorite with quartz veining and healed joints, traces pyrite. 6 20°-35° joints with calcite infill <1mm and traces iron oxide stain; 6 50°-60° joints with calcite and clay <1mm, one joint with scapolite infill to 1mm (53.0°); 1 70° joint weathered, traces pyrite GSI=66-70	39.7
640	638.9	45.0	5.0	1:42 1:58 2:13 2:28 2:17	(5.0) 100%	(4.4) 88%					
635	633.9	50.0	5.0	2:10 2:30 2:46 3:01 2:12	(4.8) 96%	(4.6) 92%					
630	628.9	55.0								Boring Terminated at Elevation 628.9 ft in Crystalline Rock (Meta-Granodiorite).	55.0

NCDOT CORE DOUBLE B6351_GEO_BRDG_237 & 242 OVER DEEP RIVER.GPJ NC_DOT_GDT_10/2/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.	
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)
BORING NO. RL_EB2-A		STATION 24+37		OFFSET 10 ft RT		ALIGNMENT -L-	
COLLAR ELEV. 708.1 ft		TOTAL DEPTH 49.6 ft		NORTHING 810,278		EASTING 1,728,521	
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic		
DRILLER Woodard, O. F.		START DATE 07/07/17		COMP. DATE 07/07/17		SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)		
710															708.1	GROUND SURFACE	0.0
															706.6	0.9' of asphalt and 0.6' of dense graded aggregate.	1.5
705																ROADWAY EMBANKMENT Medium dense, light brown to gray, SAND with gravel (A-1-b).	
	703.1	5.0		6	7	10											
700																	
	698.1	10.0		2	2	2									699.8	Loose, green-gray, fine grain SAND (A-3).	8.3
695																	
	693.1	15.0		2	3	3									694.8	Loose, light gray to dark gray with black streaks, silty SAND (A-2-4).	13.3
690																	
	688.1	20.0		1	2	2									689.8	RESIDUAL Soft to medium stiff, dark gray and gray to brown, sandy CLAY (A-6).	18.3
685																	
	683.1	25.0		2	2	3									682.7	Medium stiff to stiff, brown, silty CLAY (A-7-5).	25.4
680																	
	678.1	30.0		2	6	5									674.8	Medium dense, red to gray with white seams, silty SAND with rock fragments (A-2-5).	33.3
675																	
	673.1	35.0		6	7	10											
670																	
	668.1	40.0		40	46	54/0.3									667.1	WEATHERED ROCK Meta-Granite	41.0
665															666.1	RESIDUAL Dense, gray and white, silty SAND with rock fragments (A-2-5).	42.0
	663.1	45.0		10	14	34											
660															658.6	CRYSTALLINE ROCK Meta-Granite	49.5
	658.6	49.5	60/0.1												658.5	Boring Terminated with Standard Penetration Test Refusal at Elevation 658.5 ft in Crystalline Rock (Meta-Granite).	49.5

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Purcell, M.	
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business Over Deep River							GROUND WTR (ft)
BORING NO. RL_EB2-B		STATION 24+35		OFFSET 48 ft RT		ALIGNMENT -L-	
COLLAR ELEV. 708.0 ft		TOTAL DEPTH 56.9 ft		NORTHING 810,247		EASTING 1,728,542	
DRILL RIG/HAMMER EFF./DATE HDR9935 CME-55 91.5% 02/20/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic		
DRILLER Woodard, O. F.		START DATE 07/07/17		COMP. DATE 07/07/17		SURFACE WATER DEPTH N/A	

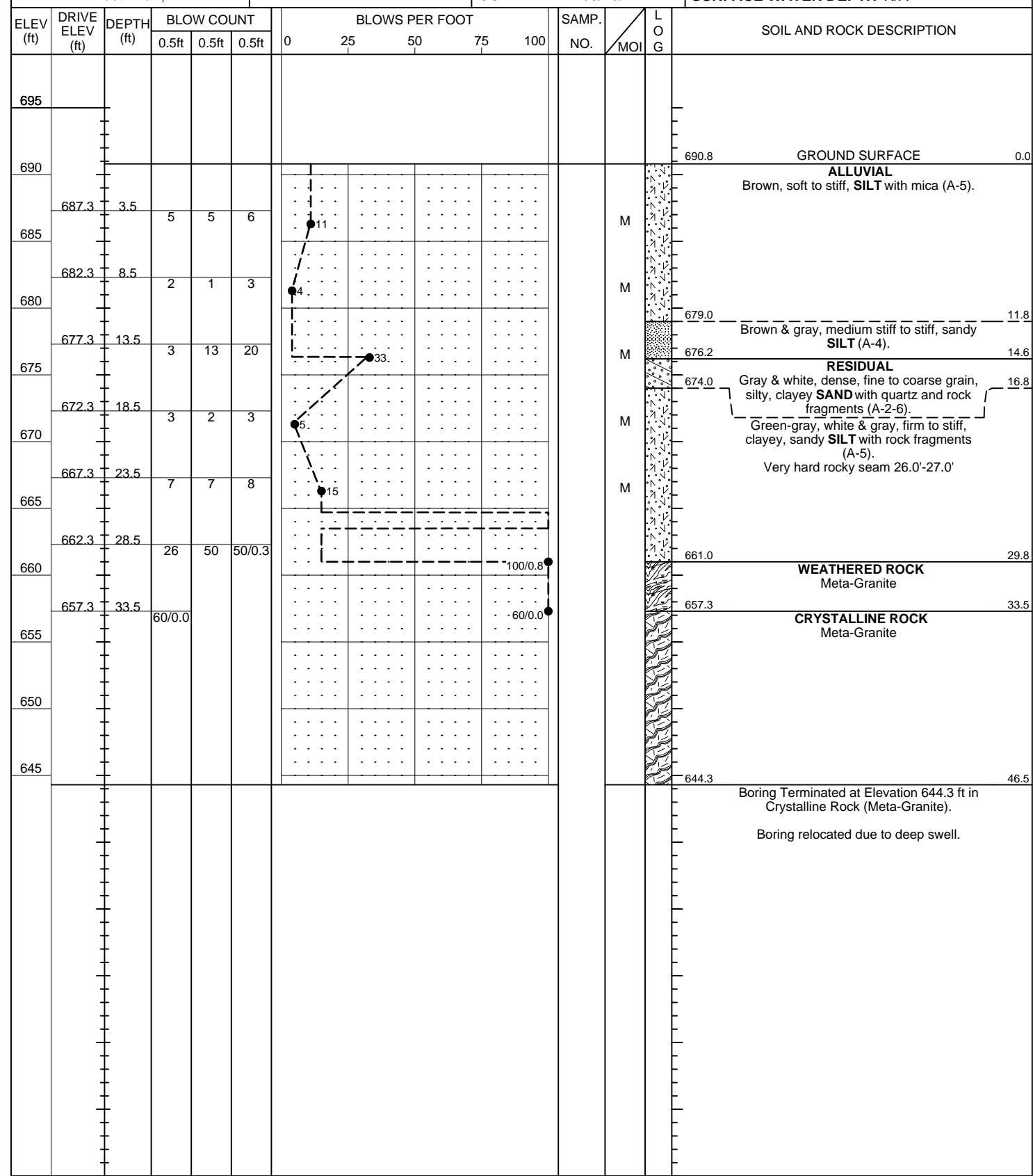
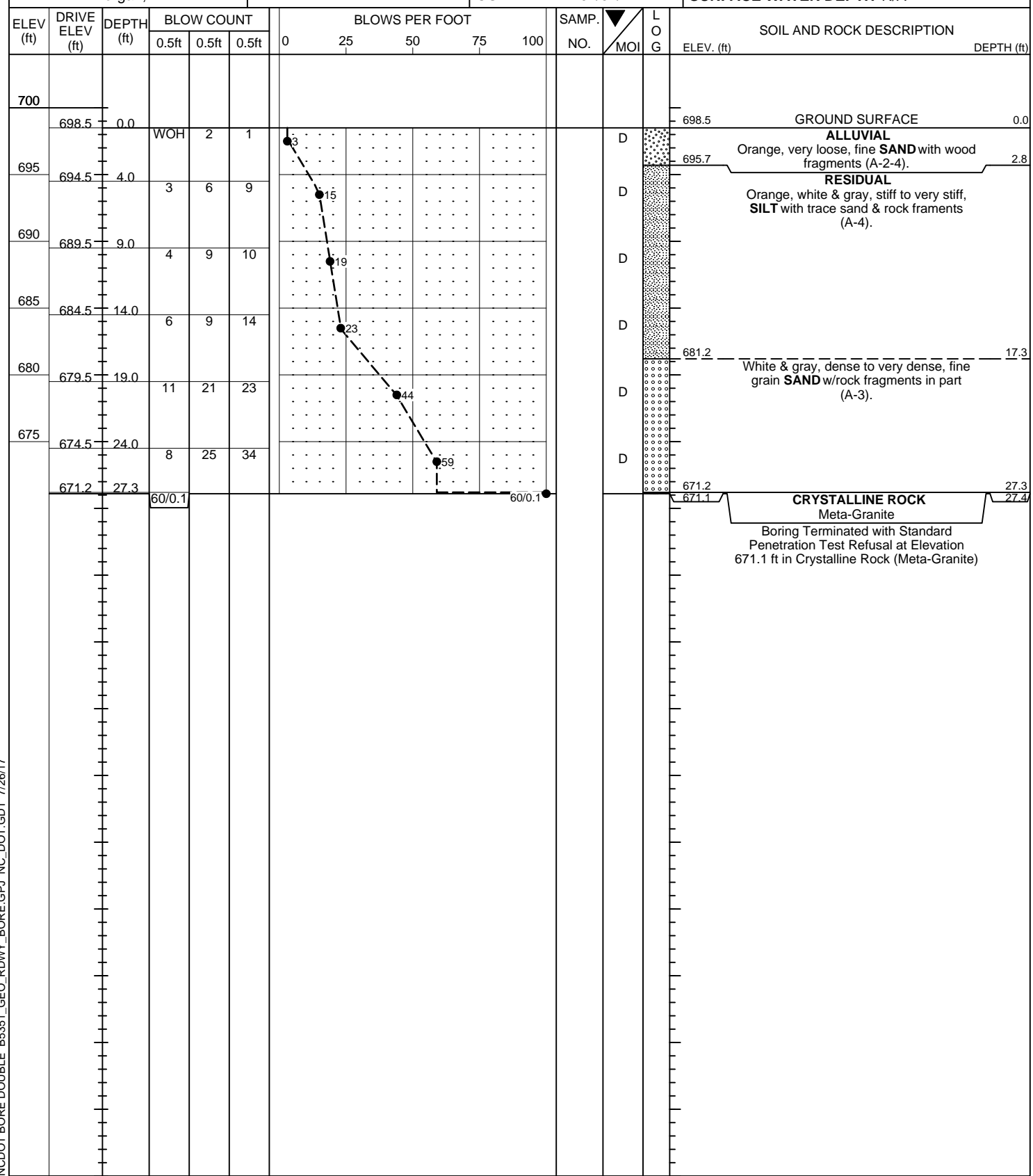
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)		
710															708.0	GROUND SURFACE	0.0
															706.8	0.7' of asphalt and 0.5' of dense graded aggregate.	1.2
705																ROADWAY EMBANKMENT Loose to medium dense, light gray, green and gray with brown streaks, silty SAND (A-2-4).	
	703.3	4.7		4	5	6											
700																	
	698.3	9.7		3	3	2									695.0	Very loose to loose, gray, brown and dark gray, silty SAND (A-2-5).	13.0
695																	
	693.3	14.7		1	2	4											
690																	
	688.3	19.7		1	1	2											
685																	
	683.3	24.7		2	3	3											
680																	
	678.3	29.7		1	3	3									680.0	RESIDUAL Medium stiff, brown, sandy CLAY (A-6).	28.0
675																	
	673.3	34.7		7	21	14									675.0	Dense to very dense, brown, dark brown with black streaks and green-black, SAND with rock fragments (A-1-b).	33.0
670																	
	668.3	39.7		9	30	34											
665																	
	663.3	44.7		19	30	63											
660																	
	658.3	49.7		33	67/0.4										657.8	WEATHERED ROCK Meta-Granodiorite	50.2
655															656.5	RESIDUAL Very dense, gray, green and black, silty SAND with rock fragments (A-2-5).	51.5
	653.3	54.7		18	30	24											
	651.2	56.8	60/0.1												651.2	CRYSTALLINE ROCK Meta-Granodiorite	56.8
															651.1	Boring Terminated with Standard Penetration Test Refusal at Elevation 651.1 ft in Crystalline Rock (Meta-Granodiorite).	56.9

NCDOT BORE DOUBLE B5351_GEO_BRDG_237 & 242 OVER DEEP RIVER.GPJ NC_DOT.GDT 10/2/17

GEOTECHNICAL BORING REPORT BORE LOG

WBS 46065.1.1		TIP B-5351	COUNTY GUILFORD	GEOLOGIST Crenshaw, J.	
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business over Deep River					GROUND WTR (ft)
BORING NO. DET12087	STATION 20+87	OFFSET CL	ALIGNMENT -DET1-	0 HR.	N/A
COLLAR ELEV. 698.5 ft	TOTAL DEPTH 27.4 ft	NORTHING 810,217	EASTING 1,728,300	24 HR.	N/A
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90.7% 01/17/2017			DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	START DATE 04/03/17	COMP. DATE 04/04/17	SURFACE WATER DEPTH N/A		

WBS 46065.1.1		TIP B-5351	COUNTY GUILFORD	GEOLOGIST Taylor, C.	
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business over Deep River					GROUND WTR (ft)
BORING NO. DET12287	STATION 22+87	OFFSET 23 ft LT	ALIGNMENT -DET1-	0 HR.	8.4
COLLAR ELEV. 690.8 ft	TOTAL DEPTH 46.5 ft	NORTHING 810,211	EASTING 1,728,382	24 HR.	N/A
DRILL RIG/HAMMER EFF./DATE TRI0055 CME-55 81% 02/20/2017			DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic	
DRILLER Toothman, R.	START DATE 03/19/17	COMP. DATE 03/20/17	SURFACE WATER DEPTH N/A		



NCDOT BORE DOUBLE B5351_GEO_RDWY_BORE.GPJ NC_DOT.GDT 7/26/17

GEOTECHNICAL BORING REPORT

CORE LOG

WBS 46065.1.1		TIP B-5351		COUNTY GUILFORD		GEOLOGIST Taylor, C.					
SITE DESCRIPTION Replace Bridge 237/242 on US 29-70 & I-85 Business over Deep River							GROUND WTR (ft)				
BORING NO. DET12287		STATION 22+87		OFFSET 23 ft LT		ALIGNMENT -DET1-					
COLLAR ELEV. 690.8 ft		TOTAL DEPTH 46.5 ft		NORTHING 810,211		EASTING 1,728,382					
DRILL RIG/HAMMER EFF./DATE TRI0055 CME-55 81% 02/20/2017				DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic					
DRILLER Toothman, R.		START DATE 03/19/17		COMP. DATE 03/20/17		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		STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	SAMP. NO.	REC. (ft) %			
657.3										Begin Coring @ 33.5 ft	
	657.3	33.5	3.0	N=60/0.0	(3.0)	(2.2)				CRYSTALLINE ROCK	33.5
655	654.3	36.5	2.4	3:40 3:43 3:30	100%	73%				Blue-gray-light gray to dark gray-green, olive green, fresh to very slight weathering, hard, close to moderately close fracture spacing, Meta-Granite with faint foliation in parts & scattered Diorite seams. 2 60°-70° joints w/slickensides; 2 60° intersecting joints-healed; 4 45° joints w/iron stain & traces clay; 4 10°-25° joints w/traces clay & iron stain Note: Slipped from 35.5'-36.5', had to return and ream to 36.5' causing mechanical fractures and more weathered appearance; core loss within interval 36.5'-38.9' interpreted as mechanical failure.	
	651.9	38.9	2.6	2:27 3:07 3:18/0.4	71%	67%					
650	649.3	41.5	5.0	1:41/0.6 2:15 3:21	92%	58%					
	645	46.5		2:42 2:59 3:10 3:51 4:33	100%	100%					
	644.3	46.5								Boring Terminated at Elevation 644.3 ft in Crystalline Rock (Meta-Granite). Boring relocated due to deep swell.	46.5

NCDOT CORE DOUBLE B5351_GEO_RDWY_BORE.GPJ NC_DOT.GDT 7/25/17

LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES

WBS NO.: 46065.1.1

SHEET 28

TIP NO.: B-5351

ProjectID: 30464

COUNTY: GUILFORD

BRIDGE 237/242 ON US 29-70 & I-85 BUSINESS OVER DEEP RIVER

Sample #	Boring #	Depth (ft)	Rock Type	Geologic Map Unit	Run RQD	Length (ft)	Diameter (ft)	Unit Weight (PCF)	Unconfined Compressive Strength (PSI)	Young's Modulus (PSI)	Splitting Tensile Strength (PSI)	Remarks
RS-1	LL B1-A	24.1-24.5	Meta-Granite	CZg	74%	0.353	0.163	184	13,454			fresh
RS-2	LL B2-B	21.3-21.6	Meta-Granite	CZg	88%	0.348	0.165	179	14,805			fresh
RS-3	RL B1-A	33.0-33.3	Meta-Granodiorite	CZg	96%	0.352	0.165	176	9,369			v. sli. weathered
RS-4	RL B2-B	42.7-43.0	Meta-Granodiorite	CZg	96%	0.351	0.165	175	11,066			v. sli. weathered

HDR, CERT. No. 102-0603

Don Schmidt, CERT. No. 102-03-0603

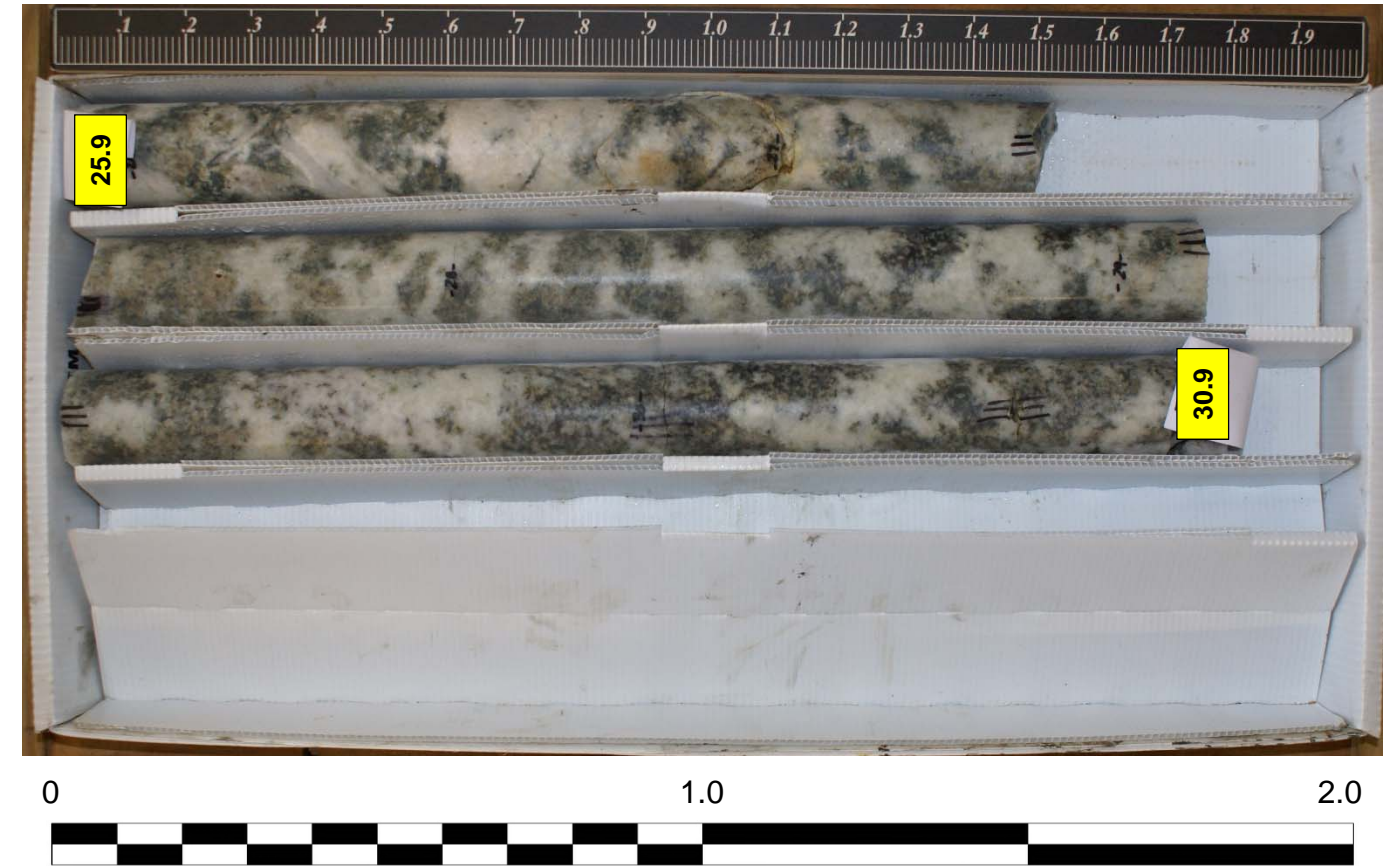
Michael Garrison, CERT. No. 102-02-0603

CORE PHOTOGRAPHIC RECORD

Replace Bridge 237/242 on US 29-70 & I-85 Business over Deep River

LL B1-A
STA. 22+75 @ 36' LT.
Box 1 of 2: 16.9' – 25.9'

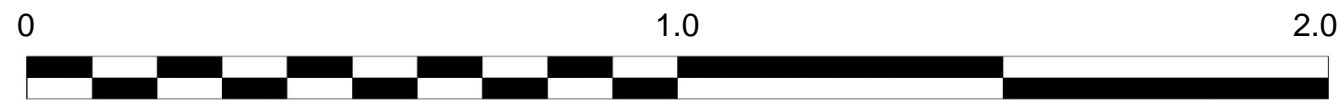
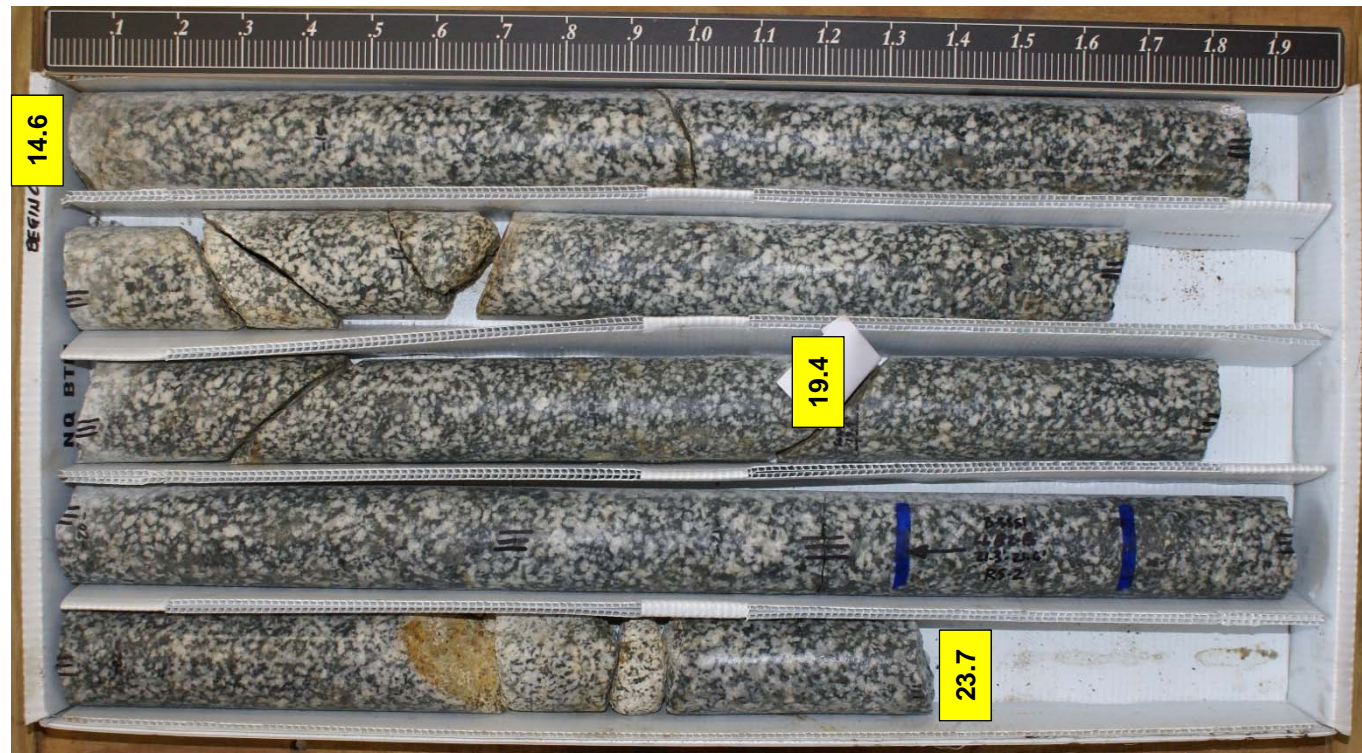
LL B1-A
STA. 22+75 @ 36' LT.
Box 2 of 2: 25.9' – 30.9'



CORE PHOTOGRAPHIC RECORD

Replace Bridge 237/242 on US 29-70 & I-85 Business over Deep River

LL B2-B
STA. 23+75 @ 18' LT.
Box 1 of 2: 14.6' – 23.7'



LL B2-B
STA. 23+75 @ 18' LT.
Box 2 of 2: 14.6' – 23.7'



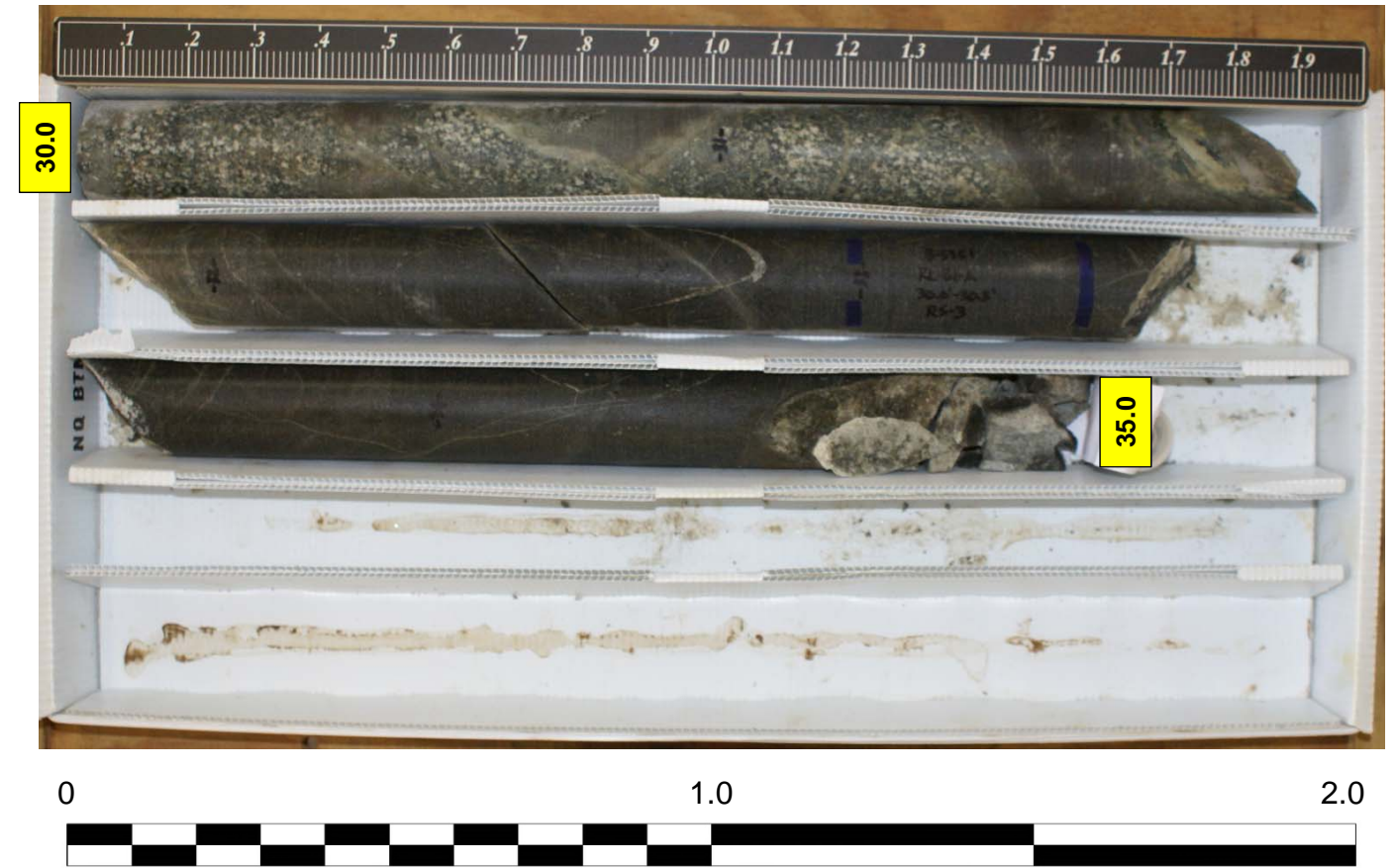
CORE PHOTOGRAPHIC RECORD

Replace Bridge 237/242 on US 29-70 & I-85 Business over Deep River

RL B1-A
STA. 22+75 @ 18' RT.
Box 1 of 3: 26.1' – 30.0'



RL B1-A
STA. 22+75 @ 18' RT.
Box 2 of 3: 30.0' – 35.0'



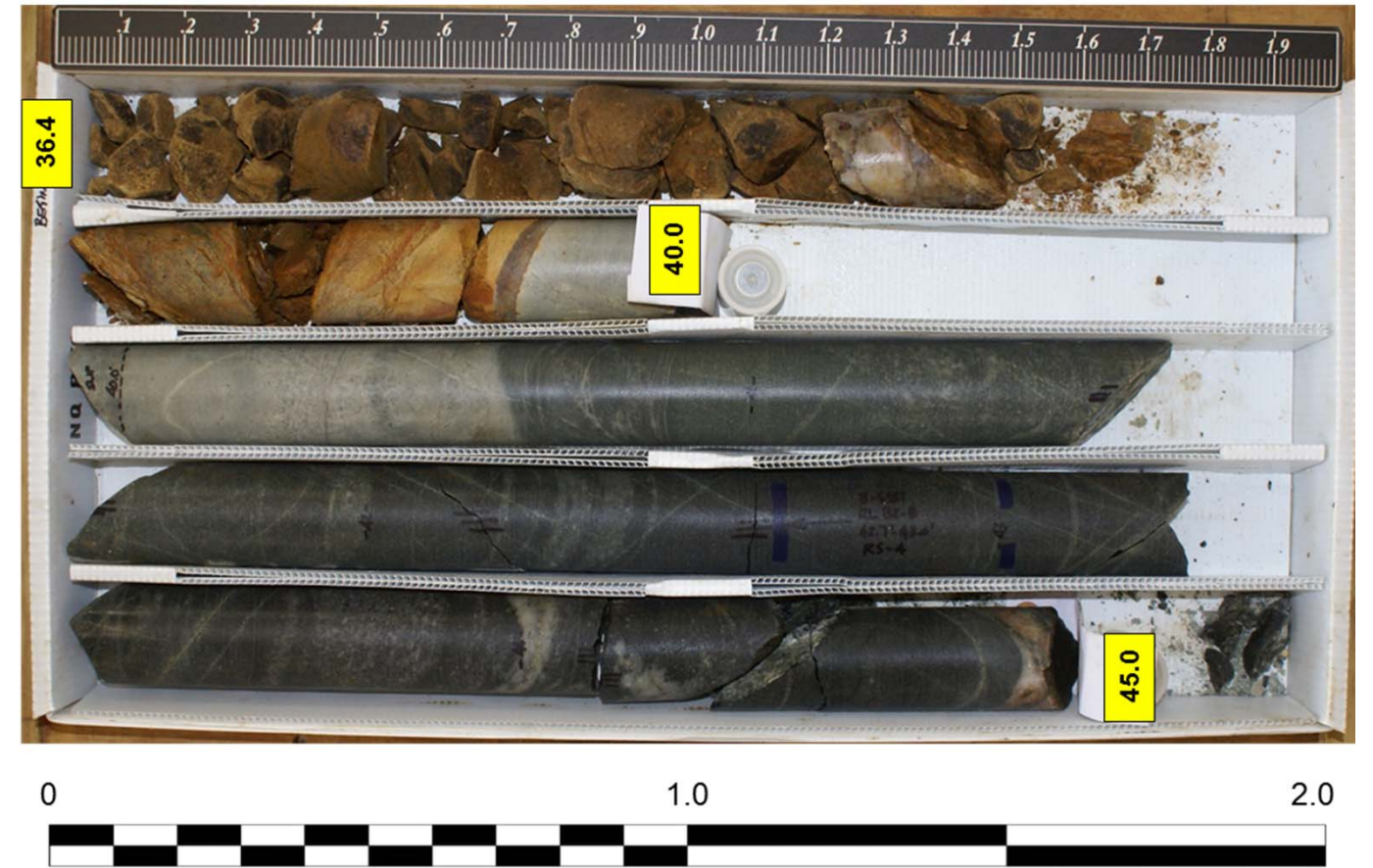
CORE PHOTOGRAPHIC RECORD

Replace Bridge 237/242 on US 29-70 & I-85 Business over Deep River

RL B1-A
STA. 22+75 @ 18' RT.
Box 3 of 3: 35.0' – 40.0'



RL B2-B
STA. 23+75 @ 36' RT.
Box 1 of 3: 36.4' – 45.0'



CORE PHOTOGRAPHIC RECORD

Replace Bridge 237/242 on US 29-70 & I-85 Business over Deep River

RL B2-B
STA. 23+75 @ 36' RT.
Box 2 of 3: 45.0' – 50.0'

RL B2-B
STA. 23+75 @ 36' RT.
Box 3 of 3: 45.0' – 55.0'

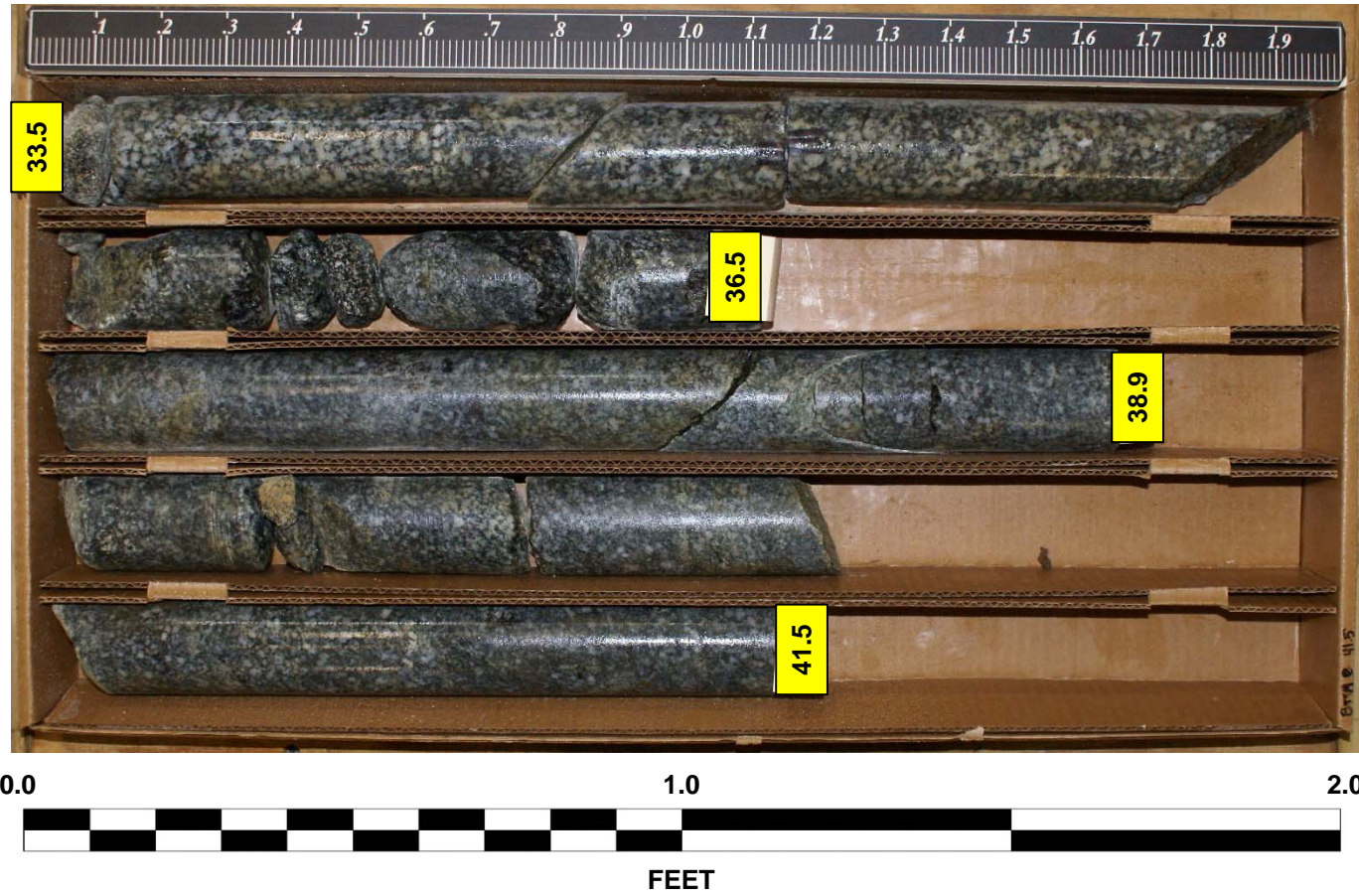


CORE PHOTOGRAPHIC RECORD

Replace Bridge 237/242 on US 29-70 & I-85 Business over Deep River

DET12287
STA. 22+87 @ 23.0' LT.
Box 1 of 2: 8.0 FEET

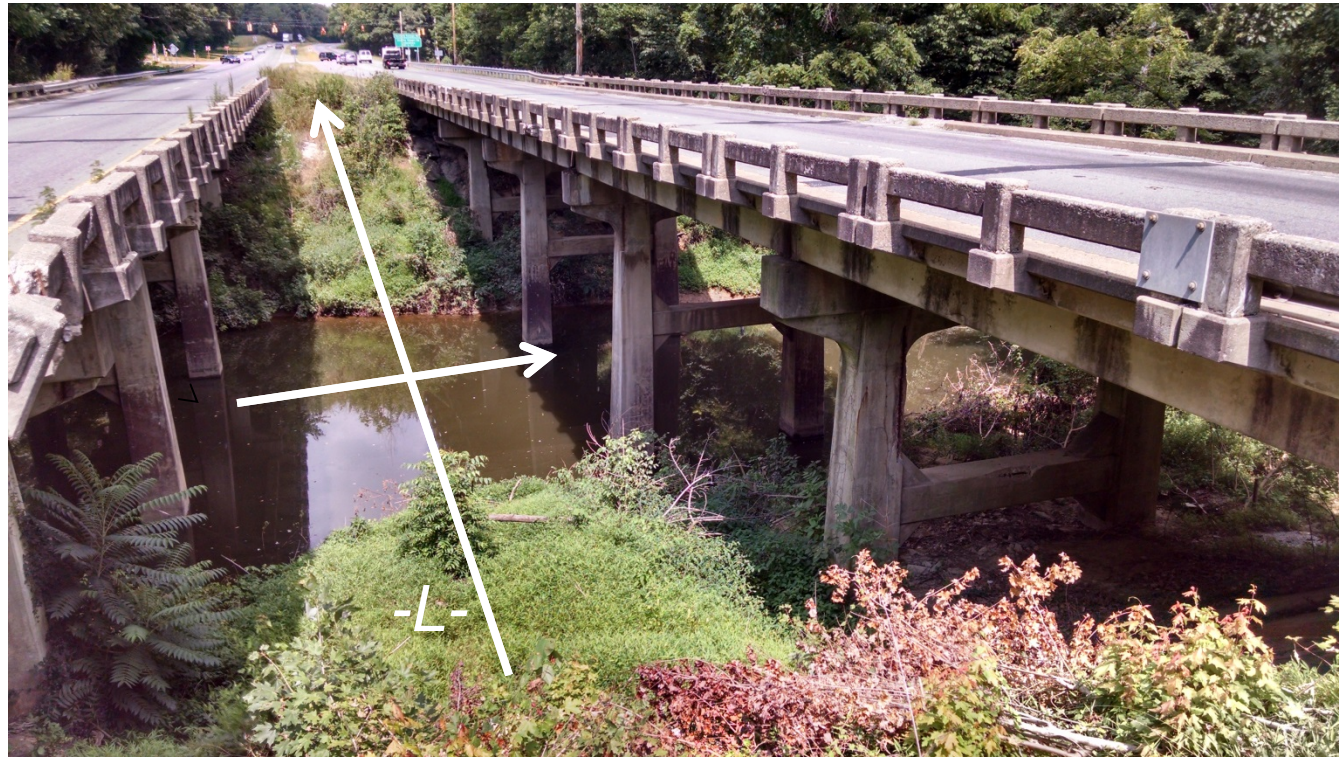
DET12287
STA. 22+87 @ 23.0' LT.
Box 2 of 2: 5.0 FEET



SITE PHOTOGRAPHS

Replace Bridge 237/242 on US 29-70 & I-85 Business over Deep River

BRIDGES NO. 237 & 242 FACING NORTH EAST



BRIDGES NO. 237 & 242 FACING NORTH EAST



BRIDGE NO. 237 FACING NORTH EAST



BRIDGE NO. 242 FACING NORTH EAST

