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REFERENCE: B-5388

PROJECT: 46103

SEE SHEET 3 FOR PLAN SHEET LAYOUT AT TIME OF INVESTIGATION

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2A	LEGEND (GSI)
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STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 GEOTECHNICAL ENGINEERING UNIT

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY ALLEGHANY
 PROJECT DESCRIPTION REPLACE BRIDGE #21
ON NC 18 OVER LITTLE RIVER

INVENTORY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	46103	1	22

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT 1919 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

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

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

- NOTES:
- THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
 - 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.

PERSONNEL

DC Elliott, LG

DO Cheek

CJ Coffey

INVESTIGATED BY DMM

DRAWN BY DMM

CHECKED BY JCK

SUBMITTED BY JCK

DATE 7/23/2018



DocuSigned by:
D Matt Mullen 11/19/2018
 18909BD3CD5440C...
 SIGNATURE DATE

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

SOIL DESCRIPTION	GRADATION	ROCK DESCRIPTION	TERMS AND DEFINITIONS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
<p>SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206; ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</p> <p style="text-align: center;">SOIL LEGEND AND AASHTO CLASSIFICATION</p> <table border="1" style="width: 100%; font-size: 8pt;"> <tr> <th rowspan="2">GENERAL CLASS.</th> <th colspan="6">GRANULAR MATERIALS (≤ 35% PASSING #200)</th> <th colspan="6">SILT-CLAY MATERIALS (> 35% PASSING #200)</th> <th colspan="3">ORGANIC MATERIALS</th> </tr> <tr> <th colspan="2">A-1</th> <th colspan="2">A-3</th> <th colspan="2">A-2</th> <th colspan="2">A-4</th> <th colspan="2">A-5</th> <th colspan="2">A-6</th> <th colspan="2">A-7</th> <th>A-1, A-2</th> <th colspan="2">A-3</th> <th colspan="2">A-4, A-5</th> </tr> <tr> <th>GROUP CLASS.</th> <td>A-1-a</td><td>A-1-b</td><td colspan="2">A-2-4</td><td colspan="2">A-2-5</td><td colspan="2">A-2-6</td><td colspan="2">A-2-7</td><td colspan="2">A-4</td><td colspan="2">A-5</td><td colspan="2">A-6</td><td colspan="2">A-7</td><td colspan="2">A-1, A-2</td><td colspan="2">A-3</td><td colspan="2">A-4, A-5</td> </tr> <tr> <th>SYMBOL</th> <td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td><td>[Symbol]</td> </tr> <tr> <th>% PASSING #10 #40 #200</th> <td>50 Mx 30 Mx 15 Mx</td><td>50 Mx 25 Mx</td><td>51 MN 10 Mx</td><td>35 Mx 10 Mx</td><td>35 Mx 10 Mx</td><td>35 Mx 10 Mx</td><td>35 Mx 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td><td>36 MN 10 Mx</td> </tr> <tr> <th>MATERIAL PASSING #40 LL PI</th> <td>— 6 Mx</td><td>— 6 Mx</td><td>40 Mx 10 Mx</td><td>41 MN 10 Mx</td><td>40 Mx 10 Mx</td><td>41 MN 10 Mx</td><td>40 Mx 10 Mx</td><td>41 MN 10 Mx</td><td>40 Mx 10 Mx</td><td>41 MN 10 Mx</td><td>40 Mx 10 Mx</td><td>41 MN 10 Mx</td><td>40 Mx 10 Mx</td><td>41 MN 10 Mx</td><td>40 Mx 10 Mx</td><td>41 MN 10 Mx</td><td>40 Mx 10 Mx</td><td>41 MN 10 Mx</td><td>40 Mx 10 Mx</td><td>41 MN 10 Mx</td><td>40 Mx 10 Mx</td><td>41 MN 10 Mx</td><td>40 Mx 10 Mx</td> </tr> <tr> <th>GROUP INDEX</th> <td colspan="2">0</td><td colspan="2">0</td><td colspan="2">0</td><td colspan="2">0</td><td colspan="2">0</td><td colspan="2">0</td><td colspan="2">0</td><td colspan="2">0</td><td colspan="2">0</td><td colspan="2">0</td><td colspan="2">0</td><td colspan="2">0</td> </tr> <tr> <th>USUAL TYPES OF MAJOR MATERIALS</th> <td colspan="2">STONE FRAGS. OF MAJOR GRAVEL AND SAND</td><td colspan="2">FINE SAND</td><td colspan="2">SILTY OR CLAYEY GRAVEL AND SAND</td><td colspan="2">SILTY SOILS</td><td colspan="2">CLAYEY SOILS</td><td colspan="2">SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER</td><td colspan="2">HIGHLY ORGANIC SOILS</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td> </tr> <tr> <th>GEN. RATING AS SUBGRADE</th> <td colspan="6">EXCELLENT TO GOOD</td><td colspan="6">FAIR TO POOR</td><td colspan="2">FAIR TO POOR</td><td colspan="2">POOR</td><td colspan="2">UNSATURABLE</td><td colspan="6"></td> </tr> <tr> <td colspan="24">PI OF A-7-5 SUBGROUP IS ≤ LL - 30; PI OF A-7-6 SUBGROUP IS > LL - 30</td> </tr> <tr> <th colspan="4">CONSISTENCY OR DENSENESS</th> </tr> <tr> <th>PRIMARY SOIL TYPE</th> <th>COMPACTNESS OR CONSISTENCY</th> <th>RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)</th> <th>RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)</th> </tr> <tr> <td>GENERALLY GRANULAR MATERIAL (NON-COHESIVE)</td> <td>VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE</td> <td>< 4 4 TO 10 10 TO 30 30 TO 50 > 50</td> <td>N/A</td> </tr> <tr> <td>GENERALLY SILT-CLAY MATERIAL (COHESIVE)</td> <td>VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD</td> <td>< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30</td> <td>< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4</td> </tr> <tr> <th colspan="4">TEXTURE OR GRAIN SIZE</th> </tr> <tr> <td colspan="2">U.S. STD. SIEVE SIZE OPENING (MM)</td> <td>4 4.76</td> <td>10 2.00</td> <td>40 0.42</td> <td>60 0.25</td> <td>200 0.075</td> <td>270 0.053</td> </tr> <tr> <td>BOULDER (BLDR.)</td> <td>COBBLE (COB.)</td> <td>GRAVEL (GR.)</td> <td>COARSE SAND (CS, SD.)</td> <td>FINE SAND (F SD.)</td> <td>SILT (SL.)</td> <td colspan="2">CLAY (CL.)</td> </tr> <tr> <td>GRAIN SIZE</td> <td>MM 305 12</td> <td>75 3</td> <td>2.0</td> <td>0.25</td> <td>0.05</td> <td colspan="2">0.005</td> </tr> <tr> <th colspan="4">SOIL MOISTURE - CORRELATION OF TERMS</th> </tr> <tr> <th>SOIL MOISTURE SCALE (ATTERBERG LIMITS)</th> <th>FIELD MOISTURE DESCRIPTION</th> <th colspan="2">GUIDE FOR FIELD MOISTURE DESCRIPTION</th> </tr> <tr> <td>LL</td> <td>LIQUID LIMIT</td> <td colspan="2">USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE</td> </tr> <tr> <td>PL</td> <td>PLASTIC LIMIT</td> <td colspan="2">SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE</td> </tr> <tr> <td>OM</td> <td>OPTIMUM MOISTURE SHRINKAGE LIMIT</td> <td colspan="2">SOLID; AT OR NEAR OPTIMUM MOISTURE</td> </tr> <tr> <td></td> <td></td> <td colspan="2">REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE</td> </tr> <tr> <th colspan="4">PLASTICITY</th> </tr> <tr> <td colspan="2">NON PLASTIC</td> <td colspan="2">DRY STRENGTH</td> </tr> <tr> <td colspan="2">SLIGHTLY PLASTIC</td> <td colspan="2">VERY LOW</td> </tr> <tr> <td colspan="2">MODERATELY PLASTIC</td> <td colspan="2">SLIGHT</td> </tr> <tr> <td colspan="2">HIGHLY PLASTIC</td> <td colspan="2">MEDIUM</td> </tr> <tr> <td colspan="2"></td> <td colspan="2">HIGH</td> </tr> <tr> <th colspan="4">COLOR</th> </tr> <tr> <td colspan="4">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.</td> </tr> <tr> <th colspan="4">GRADATION</th> </tr> <tr> <td colspan="4">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.</td> </tr> <tr> <th colspan="4">ANGULARITY OF GRAINS</th> </tr> <tr> <td colspan="4">THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</td> </tr> <tr> <th colspan="4">MINERALOGICAL COMPOSITION</th> </tr> <tr> <td colspan="4">MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.</td> </tr> <tr> <th colspan="4">COMPRESSIBILITY</th> </tr> <tr> <td colspan="4">SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50</td> </tr> <tr> <th colspan="4">PERCENTAGE OF MATERIAL</th> </tr> <tr> <td colspan="4">ORGANIC MATERIAL TRACE OF ORGANIC MATTER 2 - 3% LITTLE ORGANIC MATTER 3 - 5% MODERATELY ORGANIC 5 - 10% HIGHLY ORGANIC > 10%</td> </tr> <tr> <td colspan="4">SILT - CLAY SOILS 3 - 5% 5 - 12% 12 - 20% > 20%</td> </tr> <tr> <td colspan="4">OTHER MATERIAL TRACE 1 - 10% LITTLE 10 - 20% SOME 20 - 35% HIGHLY 35% AND ABOVE</td> </tr> <tr> <th colspan="4">GROUND WATER</th> </tr> <tr> <td colspan="4"> ▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING ▽ 24 HOURS STATIC WATER LEVEL AFTER 24 HOURS ▽ PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA SPRING OR SEEP </td> </tr> <tr> <th colspan="4">MISCELLANEOUS SYMBOLS</th> </tr> <tr> <td colspan="4"> </td> </tr> <tr> <th colspan="4">RECOMMENDATION SYMBOLS</th> </tr> <tr> <td colspan="4"> </td> </tr> <tr> <th colspan="4">ABBREVIATIONS</th> </tr> <tr> <td colspan="4"> AR - AUGER REFUSAL MED. - MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA - MICACEOUS WEA. - WEATHERED CL. - CLAY MOD. - MODERATELY UG. - UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC DWG. - DRY UNIT WEIGHT CSE. - COARSE ORG. - ORGANIC SAMP. ABBREVIATIONS DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST S - BULK DPT - DYNAMIC PENETRATION TEST SD. - SAND, SANDY SS - SPLIT SPOON e - VOID RATIO SL. - SILTY, SILTY ST - SHELBY TUBE F - FINE SLI. - SLIGHTLY RS - ROCK FOSS. - FOSSILIFEROUS TCR - TRICONE REFUSAL RT - RECOMPACTED TRIAXIAL FRAC. - FRACTURED, FRACTURES u - MOISTURE CONTENT CBR - CALIFORNIA BEARING RATIO FRAGS. - FRAGMENTS V - VERY </td> </tr> <tr> <th colspan="4">EQUIPMENT USED ON SUBJECT PROJECT</th> </tr> <tr> <td colspan="4"> DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE: <input checked="" type="checkbox"/> CME-45C <input type="checkbox"/> CLAY BITS <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL <input type="checkbox"/> CME-55 <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input checked="" type="checkbox"/> CME-550 <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> PORTABLE HOIST <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> <input checked="" type="checkbox"/> CASING <input checked="" type="checkbox"/> W/ ADVANCER <input type="checkbox"/> <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> <input type="checkbox"/> TRICONE * TUNG-CARB. <input type="checkbox"/> <input type="checkbox"/> CORE BIT <input type="checkbox"/> <input type="checkbox"/> </td> </tr> <tr> <th colspan="4">ROCK HARDNESS</th> </tr> <tr> <td>VERY HARD</td> <td colspan="3">CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.</td> </tr> <tr> <td>HARD</td> <td colspan="3">CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.</td> </tr> <tr> <td>MODERATELY HARD</td> <td colspan="3">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.</td> </tr> <tr> <td>MEDIUM HARD</td> <td colspan="3">CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.</td> </tr> <tr> <td>SOFT</td> <td colspan="3">CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.</td> </tr> <tr> <td>VERY SOFT</td> <td colspan="3">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.</td> </tr> <tr> <th colspan="2">FRACTURE SPACING</th> <th colspan="2">BEDDING</th> </tr> <tr> <td>TERM</td> <td>SPACING</td> <td>TERM</td> <td>THICKNESS</td> </tr> <tr> <td>VERY WIDE</td> <td>MORE THAN 10 FEET</td> <td>VERY THICKLY BEDDED</td> <td>4 FEET</td> </tr> <tr> <td>WIDE</td> <td>3 TO 10 FEET</td> <td>THICKLY BEDDED</td> <td>1.5 - 4 FEET</td> </tr> <tr> <td>MODERATELY CLOSE</td> <td>1 TO 3 FEET</td> <td>THINLY BEDDED</td> <td>0.16 - 1.5 FEET</td> </tr> <tr> <td>CLOSE</td> <td>0.16 TO 1 FOOT</td> <td>VERY THINLY BEDDED</td> <td>0.03 - 0.16 FEET</td> </tr> <tr> <td>VERY CLOSE</td> <td>LESS THAN 0.16 FEET</td> <td>THICKLY LAMINATED</td> <td>0.008 - 0.03 FEET</td> </tr> <tr> <td></td> <td></td> <td>THINLY LAMINATED</td> <td>< 0.008 FEET</td> </tr> <tr> <th colspan="4">INDURATION</th> </tr> <tr> <td colspan="4">FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</td> </tr> <tr> <td>FRIABLE</td> <td colspan="3">RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</td> </tr> <tr> <td>MODERATELY INDURATED</td> <td colspan="3">GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</td> </tr> <tr> <td>INDURATED</td> <td colspan="3">GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</td> </tr> <tr> <td>EXTREMELY INDURATED</td> <td colspan="3">SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</td> </tr> <tr> <td colspan="4">BENCH MARK: NCDOT GPS B5388-1N I022460.4327 E I406019.4914 STA 8+50.37 ELEVATION: 2442.42 FEET</td> </tr> <tr> <td colspan="4">NOTES:</td> </tr> </table>	GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)						SILT-CLAY MATERIALS (> 35% PASSING #200)						ORGANIC MATERIALS			A-1		A-3		A-2		A-4		A-5		A-6		A-7		A-1, A-2	A-3		A-4, A-5		GROUP CLASS.	A-1-a	A-1-b	A-2-4		A-2-5		A-2-6		A-2-7		A-4		A-5		A-6		A-7		A-1, A-2		A-3		A-4, A-5		SYMBOL	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	% PASSING #10 #40 #200	50 Mx 30 Mx 15 Mx	50 Mx 25 Mx	51 MN 10 Mx	35 Mx 10 Mx	35 Mx 10 Mx	35 Mx 10 Mx	35 Mx 10 Mx	36 MN 10 Mx	36 MN 10 Mx	36 MN 10 Mx	36 MN 10 Mx	36 MN 10 Mx	36 MN 10 Mx	36 MN 10 Mx	36 MN 10 Mx	36 MN 10 Mx	36 MN 10 Mx	36 MN 10 Mx	36 MN 10 Mx	36 MN 10 Mx	36 MN 10 Mx	36 MN 10 Mx	36 MN 10 Mx	MATERIAL PASSING #40 LL PI	— 6 Mx	— 6 Mx	40 Mx 10 Mx	41 MN 10 Mx	40 Mx 10 Mx	41 MN 10 Mx	40 Mx 10 Mx	41 MN 10 Mx	40 Mx 10 Mx	41 MN 10 Mx	40 Mx 10 Mx	41 MN 10 Mx	40 Mx 10 Mx	41 MN 10 Mx	40 Mx 10 Mx	41 MN 10 Mx	40 Mx 10 Mx	41 MN 10 Mx	40 Mx 10 Mx	41 MN 10 Mx	40 Mx 10 Mx	41 MN 10 Mx	40 Mx 10 Mx	GROUP INDEX	0		0		0		0		0		0		0		0		0		0		0		0		USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. OF MAJOR GRAVEL AND SAND		FINE SAND		SILTY OR CLAYEY GRAVEL AND SAND		SILTY SOILS		CLAYEY SOILS		SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS												GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD						FAIR TO POOR						FAIR TO POOR		POOR		UNSATURABLE								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 OPENING (MM)		4 4.76	10 2.00	40 0.42	60 0.25	200 0.075	270 0.053	BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CS, SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)		GRAIN SIZE	MM 305 12	75 3	2.0	0.25	0.05	0.005		SOIL MOISTURE - CORRELATION OF TERMS				SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION		LL	LIQUID LIMIT	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE		PL	PLASTIC LIMIT	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE		OM	OPTIMUM MOISTURE SHRINKAGE LIMIT	SOLID; AT OR NEAR OPTIMUM MOISTURE				REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE		PLASTICITY				NON PLASTIC		DRY STRENGTH		SLIGHTLY PLASTIC		VERY LOW		MODERATELY PLASTIC		SLIGHT		HIGHLY PLASTIC		MEDIUM				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 TRACE OF ORGANIC MATTER 2 - 3% LITTLE ORGANIC MATTER 3 - 5% MODERATELY ORGANIC 5 - 10% HIGHLY ORGANIC > 10%				SILT - CLAY SOILS 3 - 5% 5 - 12% 12 - 20% > 20%				OTHER MATERIAL TRACE 1 - 10% LITTLE 10 - 20% SOME 20 - 35% HIGHLY 35% AND ABOVE				GROUND WATER				 ▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING ▽ 24 HOURS STATIC WATER LEVEL AFTER 24 HOURS ▽ PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA SPRING OR SEEP				MISCELLANEOUS SYMBOLS								RECOMMENDATION SYMBOLS								ABBREVIATIONS				AR - AUGER REFUSAL MED. - MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA - MICACEOUS WEA. - WEATHERED CL. - CLAY MOD. - MODERATELY UG. - UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC DWG. - DRY UNIT WEIGHT CSE. - COARSE ORG. - ORGANIC SAMP. ABBREVIATIONS DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST S - BULK DPT - DYNAMIC PENETRATION TEST SD. - SAND, SANDY SS - SPLIT SPOON e - VOID RATIO SL. - SILTY, SILTY ST - SHELBY TUBE F - FINE SLI. - SLIGHTLY RS - ROCK FOSS. - FOSSILIFEROUS TCR - TRICONE REFUSAL RT - RECOMPACTED TRIAXIAL FRAC. - FRACTURED, FRACTURES u - MOISTURE CONTENT CBR - CALIFORNIA BEARING RATIO FRAGS. - FRAGMENTS V - VERY				EQUIPMENT USED ON SUBJECT PROJECT				DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE: <input checked="" type="checkbox"/> CME-45C <input type="checkbox"/> CLAY BITS <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL <input type="checkbox"/> CME-55 <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input checked="" type="checkbox"/> CME-550 <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> PORTABLE HOIST <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> <input checked="" type="checkbox"/> CASING <input checked="" type="checkbox"/> W/ ADVANCER <input type="checkbox"/> <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> <input type="checkbox"/> TRICONE * TUNG-CARB. <input type="checkbox"/> <input type="checkbox"/> CORE BIT <input type="checkbox"/> <input type="checkbox"/>				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 PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.			SOFT	CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.			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		BEDDING		TERM	SPACING	TERM	THICKNESS	VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	4 FEET	WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET	MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET	CLOSE	0.16 TO 1 FOOT	VERY THINLY BEDDED	0.03 - 0.16 FEET	VERY CLOSE	LESS THAN 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.			BENCH MARK: NCDOT GPS B5388-1N I022460.4327 E I406019.4914 STA 8+50.37 ELEVATION: 2442.42 FEET				NOTES:			
GENERAL CLASS.		GRANULAR MATERIALS (≤ 35% PASSING #200)						SILT-CLAY MATERIALS (> 35% PASSING #200)						ORGANIC MATERIALS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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AR - AUGER REFUSAL MED. - MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA - MICACEOUS WEA. - WEATHERED CL. - CLAY MOD. - MODERATELY UG. - UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC DWG. - DRY UNIT WEIGHT CSE. - COARSE ORG. - ORGANIC SAMP. ABBREVIATIONS DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST S - BULK DPT - DYNAMIC PENETRATION TEST SD. - SAND, SANDY SS - SPLIT SPOON e - VOID RATIO SL. - SILTY, SILTY ST - SHELBY TUBE F - FINE SLI. - SLIGHTLY RS - ROCK FOSS. - FOSSILIFEROUS TCR - TRICONE REFUSAL RT - RECOMPACTED TRIAXIAL FRAC. - FRACTURED, FRACTURES u - MOISTURE CONTENT CBR - CALIFORNIA BEARING RATIO FRAGS. - FRAGMENTS V - VERY																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE: <input checked="" type="checkbox"/> CME-45C <input type="checkbox"/> CLAY BITS <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL <input type="checkbox"/> CME-55 <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input checked="" type="checkbox"/> CME-550 <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> PORTABLE HOIST <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> <input checked="" type="checkbox"/> CASING <input checked="" type="checkbox"/> W/ ADVANCER <input type="checkbox"/> <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> <input type="checkbox"/> TRICONE * TUNG-CARB. <input type="checkbox"/> <input type="checkbox"/> CORE BIT <input type="checkbox"/> <input type="checkbox"/>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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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 PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
SOFT	CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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		BEDDING																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
TERM	SPACING	TERM	THICKNESS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	4 FEET																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
CLOSE	0.16 TO 1 FOOT	VERY THINLY BEDDED	0.03 - 0.16 FEET																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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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.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT**

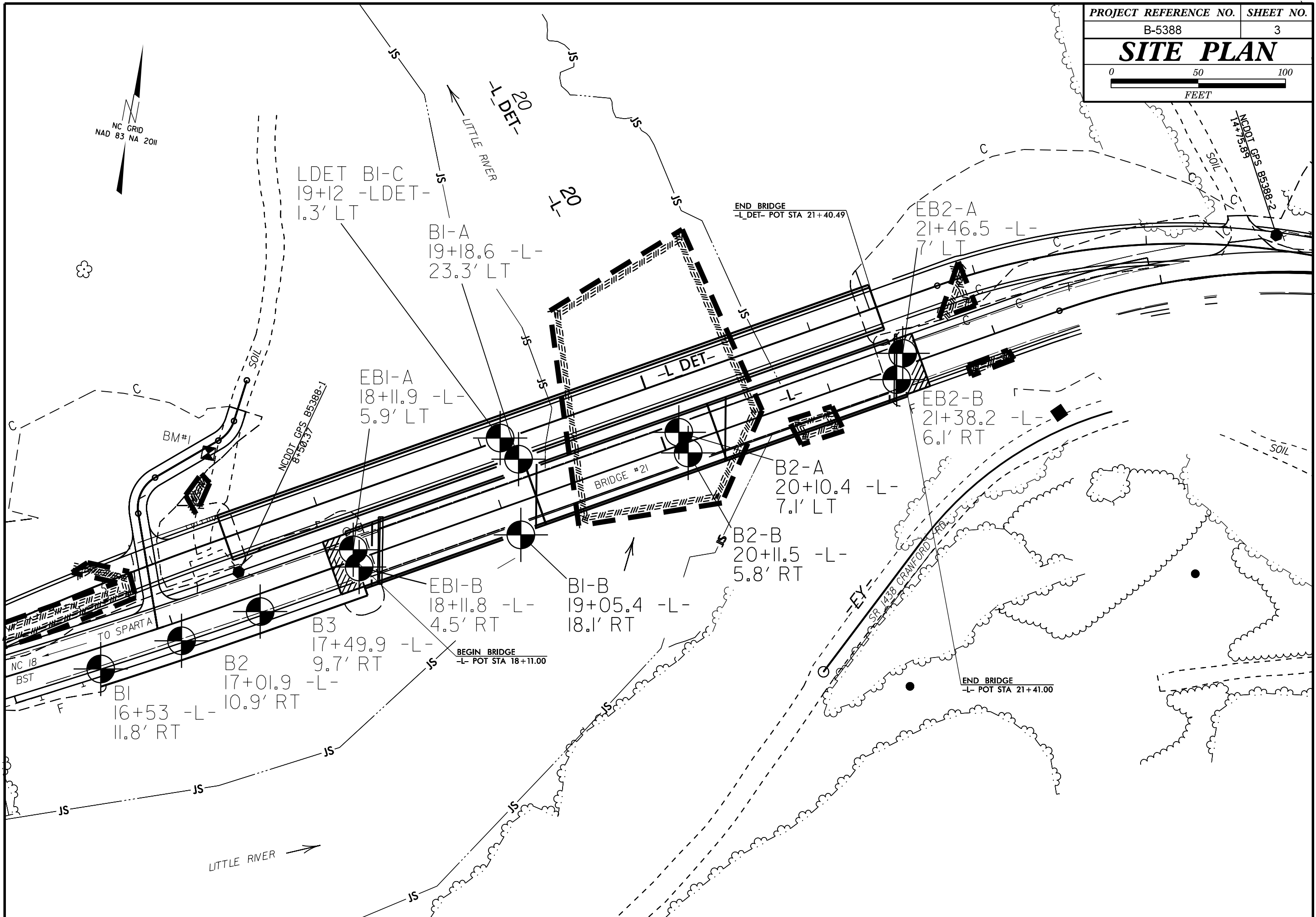
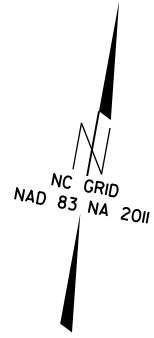
SUBSURFACE INVESTIGATION

**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)

<p>GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)</p> <p>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.</p> <p>STRUCTURE</p>	<p>SURFACE CONDITIONS</p>	<p>VERY GOOD Very rough, fresh unweathered surfaces</p>	<p>GOOD Rough, slightly weathered, iron stained surfaces</p>	<p>FAIR Smooth, moderately weathered and altered surfaces</p>	<p>POOR Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments</p>	<p>VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings</p>
<p>GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)</p> <p>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.</p> <p>COMPOSITION AND STRUCTURE</p>	<p>SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)</p>	<p>VERY GOOD - Very Rough, fresh unweathered surfaces</p>	<p>GOOD - Rough, slightly weathered surfaces</p>	<p>FAIR - Smooth, moderately weathered and altered surfaces</p>	<p>POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments</p>	<p>VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings</p>
<p>INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities</p> <p>BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets</p> <p>VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets</p> <p>BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity</p> <p>DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces</p> <p>LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes</p>	<p>DECREASING INTERLOCKING OF ROCK PIECES</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>
<p>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.</p> <p>B. Sandstone with thin inter-layers of siltstone</p> <p>C. Sandstone and siltstone in similar amounts</p> <p>D. Siltstone or silty shale with sandstone layers</p> <p>E. Weak siltstone or clayey shale with sandstone layers</p> <p>F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</p> <p>G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers</p> <p>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.</p> <p>→ Means deformation after tectonic disturbance</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>



LDET BI-C
19+12 -LDET-
1.3' LT

BI-A
19+18.6 -L-
23.3' LT

EBI-A
18+11.9 -L-
5.9' LT

EB2-A
21+46.5 -L-
7' LT

EB2-B
21+38.2 -L-
6.1' RT

B2-A
20+10.4 -L-
7.1' LT

B2-B
20+11.5 -L-
5.8' RT

EBI-B
18+11.8 -L-
4.5' RT

BI-B
19+05.4 -L-
18.1' RT

B3
17+49.9 -L-
9.7' RT

B2
17+01.9 -L-
10.9' RT

B1
16+53 -L-
11.8' RT

BEGIN BRIDGE
-L- POT STA 18+11.00

END BRIDGE
-L- POT STA 21+41.00

LITTLE RIVER →

TO SPARTA

NC 18
BST

BRIDGE #21

SR 1438
CRANFORD RD

NCCDOT GPS
B5388-1
8+50.37

NCCDOT GPS
B5388-2
14+15.86

C

C

SOIL

JS

JS

JS

JS

JS

JS

JS

JS

JS

JS

JS

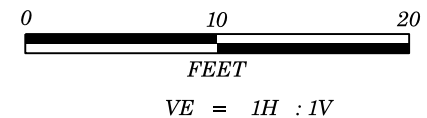
JS

JS

JS

JS

2,480



PROJECT REFERENCE NO. SHEET NO.

B-5388

4

REPLACE ALLEGHANY BRIDGE #21
ON NC 18 OVER LITTLE RIVER

2,470

SECTION ALONG EB1
SKEW = 110 DEGREES

2,470

2,460

2,460

2,450

EB1-A
18+11.9
5.9' LT
11.4' BACK

EB1-B
18+11.8
4.5' RT
7.7' BACK

2,450

EB1-A
AS STAKED

EB1-B
AS STAKED

2,440

2,440

2,430

2,430

A1 ROADWAY EMBANKMENT
WITH GRAVELS AND BOULDERS

A1 ROADWAY EMBANKMENT
WITH GRAVELS AND BOULDERS

2,420

2,420

A2 SAPROLITE

A4 SAPROLITE

2,410

2,410

WEATHERED ROCK

WEATHERED ROCK

B.T. @ 32'
IN C.R.

B.T. @ 33.8'
IN C.R.

2,400

2,400

CRYSTALLINE ROCK

CRYSTALLINE ROCK

2,390

2,390



65' LT 55' LT 45' LT 35' LT 25' LT 15' LT 5' LT 5' RT 15' RT 25' RT 35' RT 45' RT 55' RT 65' RT

2,480

2,470

2,460

2,450

2,440

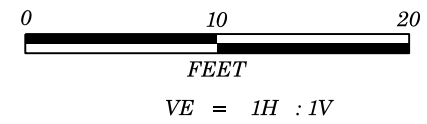
2,430

2,420

2,410

2,400

2,390



PROJECT REFERENCE NO. SHEET NO.

B-5388

5

REPLACE ALLEGHANY BRIDGE #21
ON NC 18 OVER LITTLE RIVER

SECTION ALONG B1
SKEW = 110 DEGREES

2,470

2,460

2,450

2,440

2,430

2,420

2,410

2,400

2,390

B1-A
AS STAKED

B1-B
AS STAKED

B1-C LDET
19+12.7 -L-
38.21' LT
22.4' BACK

B1-A
19+18.6 -L-
23.3' LT
11.1' BACK

B1-B
19+05.4 -L-
18.1' RT
9.2' BACK

A1 ALLUVIUM WITH
GRAVELS AND BOULDERS

A1 ALLUVIUM WITH GRAVELS AND BOULDERS

A4 SAPROLITE

A4 SAPROLITE

WEATHERED ROCK

B.T. @ 8.3'
IN C.R.

B.T. @ 24.3'
IN C.R.

B.T. @ 24.3'
IN C.R.

CRYSTALLINE GNEISS

CRYSTALLINE GNEISS

65' LT

55' LT

45' LT

35' LT

25' LT

15' LT

5' LT

5' RT

15' RT

25' RT

35' RT

45' RT

55' RT

65' RT

2,480

2,470

2,460

2,450

2,440

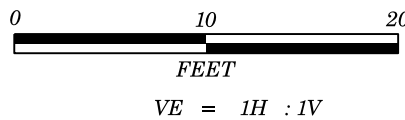
2,430

2,420

2,410

2,400

2,390



PROJECT REFERENCE NO. SHEET NO.

B-5388

6

REPLACE ALLEGHANY BRIDGE #21
ON NC 18 OVER LITTLE RIVER

SECTION ALONG B2
SKEW = 110 DEGREES

2,470

2,460

2,450

2,440

2,430

2,420

2,410

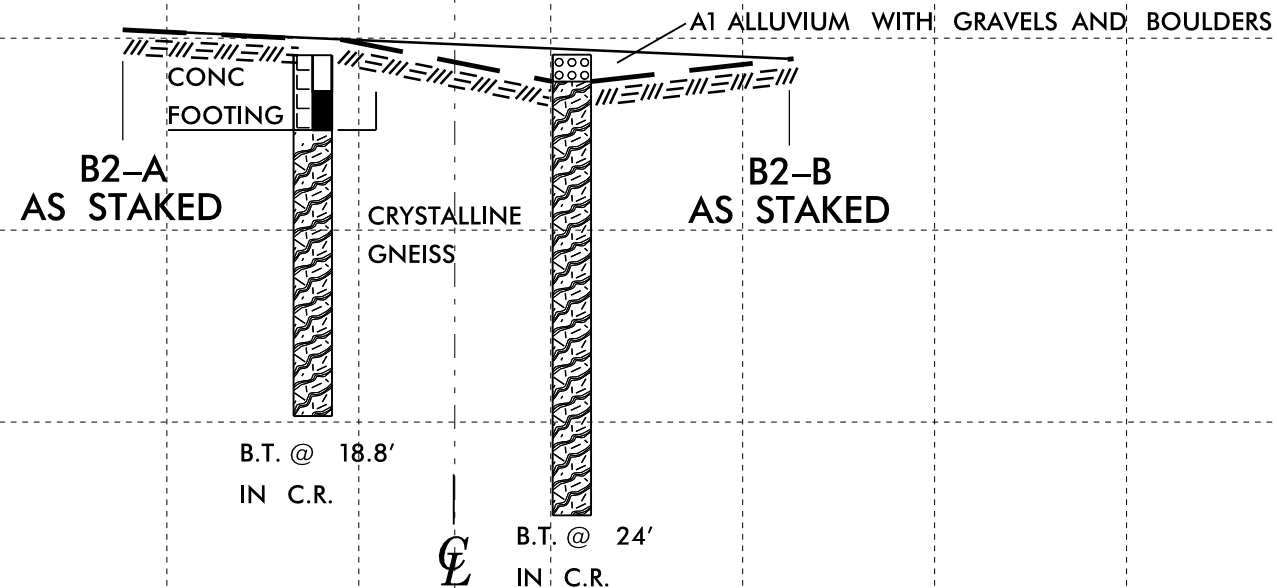
2,400

2,390

B2-A
20+10.4
7.1' RT
28.6' BACK

B2-B
20+11.5
5.8' RT
22.6' BACK

MWS = 2415.5'



65' LT

55' LT

45' LT

35' LT

25' LT

15' LT

5' LT

5' RT

15' RT

25' RT

35' RT

45' RT

55' RT

65' RT

2,480

2,470

2,460

2,450

2,440

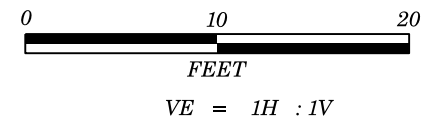
2,430

2,420

2,410

2,400

2,390



PROJECT REFERENCE NO. SHEET NO.

B-5388

7

REPLACE ALLEGHANY BRIDGE #21
ON NC 18 OVER LITTLE RIVER

SECTION ALONG EB2
SKEW = 110 DEGREES

2,470

2,460

2,450

2,440

2,430

2,420

2,410

2,400

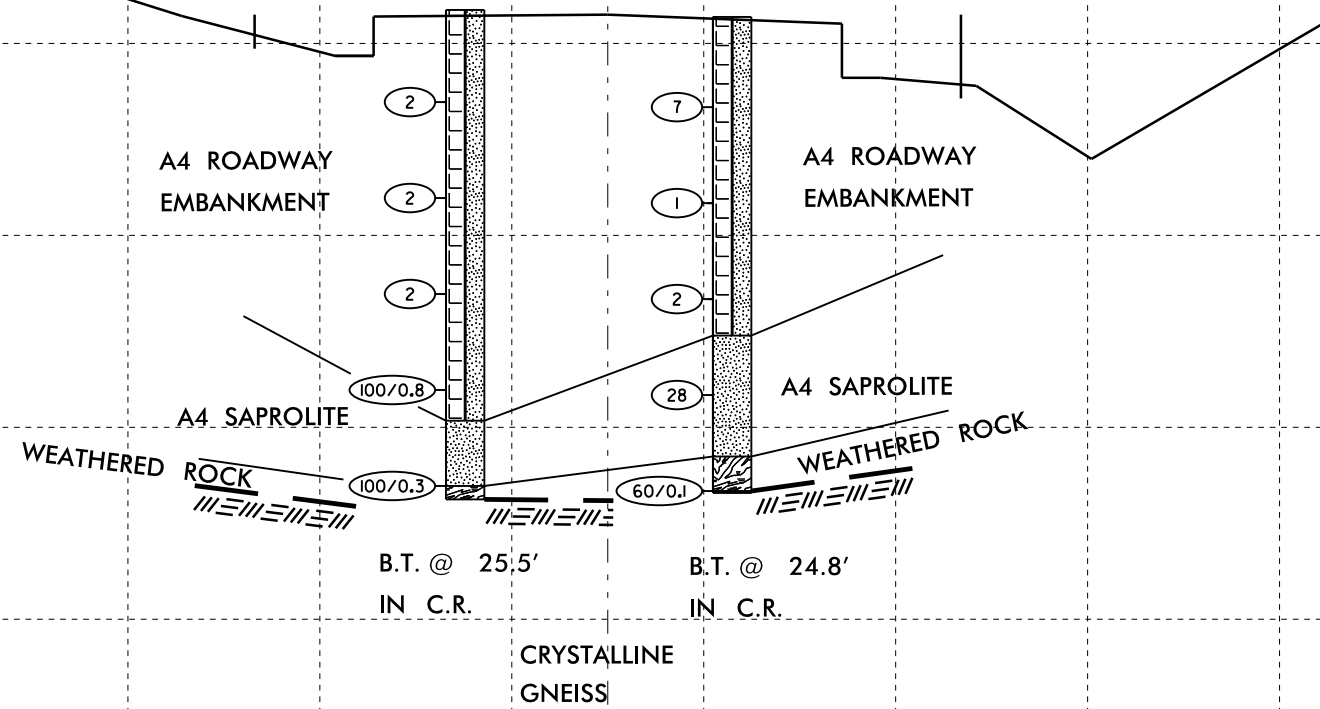
2,390

EB2-A
21+47 -L-
7' LT
7.7' AHEAD

EB2-B
21+38 -L-
6' RT
4.2' AHEAD

EB2-A
AS STAKED

EB2-B
AS STAKED



B.T. @ 25.5'
IN C.R.

B.T. @ 24.8'
IN C.R.

CRYSTALLINE
GNEISS

65' LT

55' LT

45' LT

35' LT

25' LT

15' LT

5' LT

5' RT

15' RT

25' RT

35' RT

45' RT

55' RT

65' RT

2,480

2,470

2,460

2,450

2,440

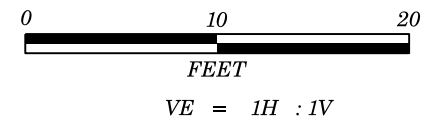
2,430

2,420

2,410

2,400

2,390



PROJECT REFERENCE NO.	SHEET NO.
B-5388	8
REPLACE ALLEGHANY BRIDGE #21 ON NC 18 OVER LITTLE RIVER	

PROFILE ALONG -L-

2,470

2,460

2,450

2,440

2,430

2,420

2,410

2,400

2,390

EB1-A
18+11.9 -L-
5.9' LT

BEGIN BRIDGE
-L- STA 18+11.00

(16)

(31)

(100/0.7)

(17)

(37)

(100/1.3)

(60/0.0)

B.T. @ 32'
SPT REFUSAL
ON C.R.

-L- RT EXISTING GROUND

-L- LT EXISTING GROUND

A1 ROADWAY EMBANKMENT
WITH LARGE BOULDERS

A1 ROADWAY EMBANKMENT
WITH LARGE BOULDERS

A2 SAPROLITE

A2 SAPROLITE

WEATHERED ROCK

WEATHERED ROCK

A1 ALLUVIUM WITH GRAVELS AND BOULDERS

A4 SAPROLITE

CRYSTALLINE GNEISS

MATCH TO SHEET 9

17+80

17+90

18+00

18+10

18+20

18+30

18+40

18+50

18+60

18+70

18+80

18+90

19+00

19+10

2,480

2,470

2,460

2,450

2,440

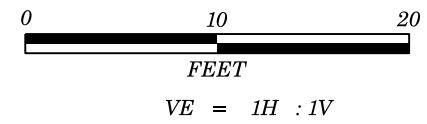
2,430

2,420

2,410

2,400

2,390



PROJECT REFERENCE NO.	SHEET NO.
B-5388	9
REPLACE ALLEGHANY BRIDGE #21 ON NC 18 OVER LITTLE RIVER	

PROFILE ALONG -L-

2,470

2,460

2,450

2,440

2,430

2,420

2,410

2,400

2,390

MATCH TO SHEET 8

MATCH TO SHEET 10

B1-A
-L-
19+18.6
23.3' LT

-L- LT
EXISTING GROUND

-L- RT EXISTING GROUND

B2-A
20+10.4 -L-
7.1' LT

NWS = 2415.5'

80

A1 ALLUVIUM WITH GRAVELS AND BOULDERS

A4 SAPROLITE

CRYSTALLINE GNEISS

CONC
FOOTING

B.T. @ 24.3'
IN C.R.

B.T. @ 18.8'
IN C.R.

19+10 19+20 19+30 19+40 19+50 19+60 19+70 19+80 19+90 20+00 20+10 20+20 20+30 20+40

2,480

2,470

2,460

2,450

2,440

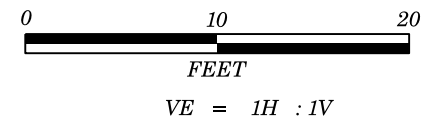
2,430

2,420

2,410

2,400

2,390



PROJECT REFERENCE NO.	SHEET NO.
B-5388	10
REPLACE ALLEGHANY BRIDGE #21 ON NC 18 OVER LITTLE RIVER	

PROFILE ALONG -L-

2,470

2,460

2,450

2,440

2,430

2,420

2,410

2,400

2,390

MATCH TO SHEET 9

20+40 20+50 20+60 20+70 20+80 20+90 21+00 21+10 21+20 21+30 21+40 21+50 21+60 21+70

EB2-B
21+38 -L-
6' RT

END BRIDGE
-L- STA 21+41.00

-L- RT EXISTING GROUND

-L- LT
EXISTING GROUND

A4 ROADWAY EMBANKMENT
WITH GRAVELS

A4 ROADWAY
EMBANKMENT
WITH GRAVELS

A4 SAPROLITE

WEATHERED ROCK

WEATHERED ROCK

B.T. @ 24.8'
SPT REFUSAL
IN C.R.

CRYSTALLINE GNEISS

CRYSTALLINE GNEISS

NWS = 2415.5'

(7)

(1)

(2)

(28)

(60/0.1)

GEOTECHNICAL BORING REPORT BORE LOG

WBS 46103.1.1		TIP B-5388		COUNTY ALLEGHANY		GEOLOGIST Elliott, D. C.								
SITE DESCRIPTION N/A							GROUND WTR (ft)							
BORING NO. EB1-A		STATION 18+12		OFFSET 6 ft LT		ALIGNMENT L								
COLLAR ELEV. 2,443.8 ft		TOTAL DEPTH 32.0 ft		NORTHING 1,022,485		EASTING 1,406,082								
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 77% 07/31/2017		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 03/28/18		COMP. DATE 03/28/18		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				
2445														2,443.8 GROUND SURFACE 0.0
2440	2,438.7	5.1	10	8	8									ROADWAY EMBANKMENT Brown / gray sandy clayey silt with gravels, cobbles, and boulders
2435	2,433.7	10.1	15	21	10									
2430	2,428.7	15.1	22	78/0.2										
2425	2,423.7	20.1	8	11	6									
2420	2,418.7	25.1	10	10	27									2,419.5 SAPROLITE 24.3
2415	2,413.7	30.1	11	18	82/0.3									2,412.6 WEATHERED ROCK 31.2
	2,411.8	32.0	60/0.0											2,411.8 WEATHERED ROCK 32.0
														CRYSTALLINE ROCK Crystalline Gneiss Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,411.8 ft ON CRYSTALLINE ROCK

GEOTECHNICAL BORING REPORT BORE LOG

WBS 46103.1.1		TIP B-5388		COUNTY ALLEGHANY		GEOLOGIST Elliott, D. C.								
SITE DESCRIPTION N/A							GROUND WTR (ft)							
BORING NO. EB1-B		STATION 18+12		OFFSET 5 ft RT		ALIGNMENT L								
COLLAR ELEV. 2,443.7 ft		TOTAL DEPTH 33.8 ft		NORTHING 1,022,476		EASTING 1,406,087								
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 77% 07/31/2017		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 03/27/18		COMP. DATE 03/27/18		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				
2445														2,443.7 GROUND SURFACE 0.0
2440	2,438.7	5.0	21	12	28									ROADWAY EMBANKMENT Gray / brown silty sand with cobbles and boulders
2435	2,433.7	10.0	6	4	6									
2430	2,428.7	15.0	100/0.4											
2425	2,423.7	20.0	6	5	7									
2420	2,418.7	25.0	8	10	8									2,415.3 SAPROLITE 28.4
2415	2,413.7	30.0	3	5	14									2,410.9 WEATHERED ROCK 32.8
2410	2,409.9	33.8	60/0.0											2,409.9 WEATHERED ROCK 33.8
														CRYSTALLINE ROCK Crystalline gneiss Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,409.9 ft ON CRYSTALLINE ROCK

NCDOT BORE DOUBLE B5388_GEO_BRDG_BORELOGS.GPJ NC_DOT.GDT 7/19/18

GEOTECHNICAL BORING REPORT BORE LOG

GEOTECHNICAL BORING REPORT CORE LOG

WBS 46103.1.1		TIP B-5388		COUNTY ALLEGHANY		GEOLOGIST Elliott, D. C.									
SITE DESCRIPTION N/A							GROUND WTR (ft)								
BORING NO. B1-A		STATION 19+19		OFFSET 23 ft LT		ALIGNMENT L									
COLLAR ELEV. 2,414.0 ft		TOTAL DEPTH 24.3 ft		NORTHING 1,022,553		EASTING 1,406,166									
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 77% 07/31/2017		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic											
DRILLER Cheek, D. O.		START DATE 03/25/18		COMP. DATE 03/25/18		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					
2415														2,414.0	0.0
2410	2,409.4	4.6	28	39	41									2,409.4	4.6
2405														2,407.4	6.6
2400															
2395															
2390														2,389.7	24.3

WBS 46103.1.1		TIP B-5388		COUNTY ALLEGHANY		GEOLOGIST Elliott, D. C.						
SITE DESCRIPTION N/A							GROUND WTR (ft)					
BORING NO. B1-A		STATION 19+19		OFFSET 23 ft LT		ALIGNMENT L						
COLLAR ELEV. 2,414.0 ft		TOTAL DEPTH 24.3 ft		NORTHING 1,022,553		EASTING 1,406,166						
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 77% 07/31/2017		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic								
DRILLER Cheek, D. O.		START DATE 03/25/18		COMP. DATE 03/25/18		SURFACE WATER DEPTH N/A						
CORE SIZE NXWL			TOTAL RUN 17.6 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %			
2407.3	2,407.3	6.7	2.6	N=60/0.0	(2.5)	(2.1)						
2405	2,404.7	9.3			96%	81%						
			5.0		(4.5)	(2.3)						
					90%	46%						
2400	2,399.7	14.3			(5.0)	(5.0)						
			5.0		100%	100%						
2395	2,394.7	19.3			(5.1)	(4.7)						
			5.0		102%	94%						
2390	2,389.7	24.3										

GEOTECHNICAL BORING REPORT BORE LOG

WBS 46103.1.1		TIP B-5388		COUNTY ALLEGHANY		GEOLOGIST Elliott, D. C.								
SITE DESCRIPTION N/A							GROUND WTR (ft)							
BORING NO. B1-B		STATION 19+05		OFFSET 18 ft RT		ALIGNMENT L								
COLLAR ELEV. 2,414.4 ft		TOTAL DEPTH 24.3 ft		NORTHING 1,022,510		EASTING 1,406,175								
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 77% 07/31/2017		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 03/25/18		COMP. DATE 03/25/18		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				
2415														2,414.4 GROUND SURFACE 0.0
														ALLUVIAL sand with gravels, cobbles, boulders
2410	2,409.4	5.0	5	8	13									2,410.7 SAPROLITE 3.7
														dark brown to black slightly micaceous sandy silt
2405														2,405.5 WEATHERED ROCK 8.9
														2,404.5 weathered rock 9.9
														CRYSTALLINE ROCK crystalline rock
2400														
2395														
														2,390.1 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,390.1 ft IN CRYSTALLINE ROCK 24.3

GEOTECHNICAL BORING REPORT CORE LOG

WBS 46103.1.1		TIP B-5388		COUNTY ALLEGHANY		GEOLOGIST Elliott, D. C.		
SITE DESCRIPTION N/A							GROUND WTR (ft)	
BORING NO. B1-B		STATION 19+05		OFFSET 18 ft RT		ALIGNMENT L		
COLLAR ELEV. 2,414.4 ft		TOTAL DEPTH 24.3 ft		NORTHING 1,022,510		EASTING 1,406,175		
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 77% 07/31/2017		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic				
DRILLER Cheek, D. O.		START DATE 03/25/18		COMP. DATE 03/25/18		SURFACE WATER DEPTH N/A		
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	TOTAL RUN 13.7 ft		L O G	DESCRIPTION AND REMARKS
					REC. (ft) %	RQD (ft) %		
2403.8	2,403.8	10.6	3.7		(2.9) 78%	(1.6) 43%		Begin Coring @ 10.6 ft CRYSTALLINE ROCK (continued)
2400	2,400.1	14.3	5.0		(4.8) 96%	(4.0) 80%		
2395	2,395.1	19.3	5.0		(4.8) 96%	(4.3) 86%		
	2,390.1	24.3						Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,390.1 ft IN CRYSTALLINE ROCK

GEOTECHNICAL BORING REPORT BORE LOG

WBS 46103.1.1		TIP B-5388		COUNTY ALLEGHANY		GEOLOGIST Elliott, D. C.									
SITE DESCRIPTION N/A							GROUND WTR (ft)								
BORING NO. B1-C LDET		STATION 19+12		OFFSET 1 ft LT		ALIGNMENT LDET									
COLLAR ELEV. 2,416.1 ft		TOTAL DEPTH 8.4 ft		NORTHING 1,022,563		EASTING 1,406,153									
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 77% 07/31/2017		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic											
DRILLER Cheek, D. O.		START DATE 03/25/18		COMP. DATE 03/28/18		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	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
2420															
														2,416.1	0.0
2415															
	2,411.1	5.0	6	8	6										
2410														2,408.8	7.3
														2,407.9	8.2
														2,407.7	8.4
					60/0.1										

NCDOT BORE DOUBLE B5388_GEO_BRDG_BORELOGS.GPJ NC_DOT.GDT 7/19/18

SAPROLITE
crystalline rock

Boring Terminated WITH STANDARD
PENETRATION TEST REFUSAL at
Elevation 2,407.7 ft IN CRYSTALLINE ROCK

GEOTECHNICAL BORING REPORT

BORE LOG

GEOTECHNICAL BORING REPORT

CORE LOG

WBS 46103.1.1		TIP B-5388		COUNTY ALLEGHANY		GEOLOGIST Elliott, D. C.						
SITE DESCRIPTION N/A							GROUND WTR (ft)					
BORING NO. B2-A		STATION 20+10		OFFSET 7 ft LT		ALIGNMENT L						
COLLAR ELEV. 2,409.1 ft		TOTAL DEPTH 18.8 ft		NORTHING 1,022,585		EASTING 1,406,253						
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 77% 07/31/2017			DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic						
DRILLER Cheek, D. O.		START DATE 03/28/18		COMP. DATE 03/28/18		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			
2410												2,409.1 GROUND SURFACE concrete bridge footing
2405												2,405.2 CRYSTALLINE ROCK CRYSTALLINE ROCK
2400												
2395												
												2,390.3 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,390.3 ft IN CRYSTALLINE ROCK

WBS 46103.1.1		TIP B-5388		COUNTY ALLEGHANY		GEOLOGIST Elliott, D. C.			
SITE DESCRIPTION N/A							GROUND WTR (ft)		
BORING NO. B2-A		STATION 20+10		OFFSET 7 ft LT		ALIGNMENT L			
COLLAR ELEV. 2,409.1 ft		TOTAL DEPTH 18.8 ft		NORTHING 1,022,585		EASTING 1,406,253			
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 77% 07/31/2017			DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic			
DRILLER Cheek, D. O.		START DATE 03/28/18		COMP. DATE 03/28/18		SURFACE WATER DEPTH N/A			
CORE SIZE NXWL			TOTAL RUN 18.8 ft					LOG	DESCRIPTION AND REMARKS
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RQD (ft) %	SAMP. NO.		
									Continued from previous page
2405	2,409.1	0.0	3.9						2,405.2 CONCRETE FOOTING
	2,405.2	3.9							2,405.2 CRYSTALLINE ROCK
	2,403.2	5.9	2.0		(2.0) 100%	(2.0) 100%			
			5.0		(5.1) 102%	(5.1) 102%			
	2,398.2	10.9			(5.0) 100%	(4.8) 96%			
			5.0						
	2,393.2	15.9			(2.8) 97%	(2.1) 72%			
	2,390.3	18.8							2,390.3 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,390.3 ft IN CRYSTALLINE ROCK

GEOTECHNICAL BORING REPORT BORE LOG

GEOTECHNICAL BORING REPORT CORE LOG

WBS 46103.1.1		TIP B-5388		COUNTY ALLEGHANY		GEOLOGIST Elliott, D. C.												
SITE DESCRIPTION N/A							GROUND WTR (ft)											
BORING NO. B2-B		STATION 20+12		OFFSET 6 ft RT		ALIGNMENT L												
COLLAR ELEV. 2,409.9 ft		TOTAL DEPTH 24.0 ft		NORTHING 1,022,574		EASTING 1,406,261												
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 77% 07/31/2017		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic														
DRILLER Cheek, D. O.		START DATE 03/27/18		COMP. DATE 03/27/18		SURFACE WATER DEPTH N/A												
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION				
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)			
2410															2,409.9	GROUND SURFACE	0.0	
															2,408.5	ALLUVIAL alluvium	1.4	
2405																CRYSTALLINE ROCK crystalline rock		
2400																		
2395																		
2390																		
															2,385.9	Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,385.9 ft IN CRYSTALLINE ROCK		24.0

NCDOT BORE DOUBLE B5388_GEO_BRDG_BORELOGS.GPJ NC_DOT.GDT 7/19/18

WBS 46103.1.1		TIP B-5388		COUNTY ALLEGHANY		GEOLOGIST Elliott, D. C.						
SITE DESCRIPTION N/A							GROUND WTR (ft)					
BORING NO. B2-B		STATION 20+12		OFFSET 6 ft RT		ALIGNMENT L						
COLLAR ELEV. 2,409.9 ft		TOTAL DEPTH 24.0 ft		NORTHING 1,022,574		EASTING 1,406,261						
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 77% 07/31/2017		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic								
DRILLER Cheek, D. O.		START DATE 03/27/18		COMP. DATE 03/27/18		SURFACE WATER DEPTH N/A						
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	
					REC. (%)	RQD (%)		REC. (%)	RQD (%)		ELEV. (ft)	DEPTH (ft)
2409.92												Continued from previous page
	2,409.9	0.0	4.0		(2.2) 55%	(1.4) 35%					2,408.5	ALLUVIAL
2405	2,405.9	4.0	5.0		(5.0) 100%	(5.0) 100%						CRYSTALLINE ROCK
2400	2,400.9	9.0	5.0		(4.9) 98%	(4.8) 96%						
2395	2,395.9	14.0	5.0		(5.0) 100%	(4.9) 98%						
2390	2,390.9	19.0	5.0		(5.0) 100%	(4.5) 90%						
	2,385.9	24.0									2,385.9	Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,385.9 ft IN CRYSTALLINE ROCK

NCDOT BORE DOUBLE B5388_GEO_BRDG_BORELOGS.GPJ NC_DOT.GDT 7/19/18

GEOTECHNICAL BORING REPORT BORE LOG

WBS 46103.1.1		TIP B-5388		COUNTY ALLEGHANY		GEOLOGIST Elliott, D. C.								
SITE DESCRIPTION N/A						GROUND WTR (ft)								
BORING NO. EB2-A		STATION 21+47		OFFSET 7 ft LT		ALIGNMENT L								
COLLAR ELEV. 2,451.7 ft		TOTAL DEPTH 25.5 ft		NORTHING 1,022,652		EASTING 1,406,371								
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 77% 07/31/2017		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 03/28/18		COMP. DATE 03/28/18		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				
2455														2,451.7 GROUND SURFACE 0.0
2450														ROADWAY EMBANKMENT Brown / red clayey sandy silt with gravels and cobbles
2445	2,446.9	4.8	woh	1	1									
2440	2,441.9	9.8	woh	1	1									
2435	2,436.9	14.8	woh	1	1									
2430	2,431.9	19.8	54	46	0.3									2,430.3 SAPROLITE 21.4 no sample
	2,426.9	24.8	100	0.3										2,426.9 WEATHERED ROCK 24.8 2,426.2 Dark brown / dark orange slightly micaceous weathered rock 25.5 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,426.2 ft ON CRYSTALLINE ROCK

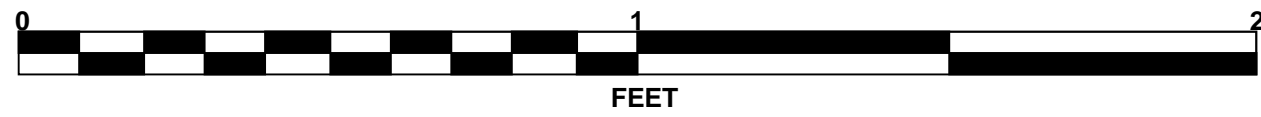
GEOTECHNICAL BORING REPORT BORE LOG

WBS 46103.1.1		TIP B-5388		COUNTY ALLEGHANY		GEOLOGIST Elliott, D. C.								
SITE DESCRIPTION N/A						GROUND WTR (ft)								
BORING NO. EB2-B		STATION 21+38		OFFSET 6 ft RT		ALIGNMENT L								
COLLAR ELEV. 2,451.4 ft		TOTAL DEPTH 24.8 ft		NORTHING 1,022,637		EASTING 1,406,371								
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 77% 07/31/2017		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 03/28/18		COMP. DATE 03/28/18		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				
2455														2,451.4 GROUND SURFACE 0.0
2450														ROADWAY EMBANKMENT Brown / red slightly micaceous clayey sandy silt with gravels
2445	2,446.7	4.7	2	4	3									
2440	2,441.7	9.7	woh	woh	1									
2435	2,436.7	14.7	woh	1	1									
2430	2,431.7	19.7	4	13	15									2,434.8 SAPROLITE 16.6 Orange / tan to dark blue gray slightly micaceous andy silt
	2,428.5	22.9												2,428.5 WEATHERED ROCK 22.9 Weathered gneiss with Crystalline gneiss seams
	2,426.7	24.7	60	0.1										2,426.7 WEATHERED ROCK 24.7 2,426.6 WEATHERED ROCK 24.8 Crystalline gneiss Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,426.6 ft IN CRYSTALLINE ROCK

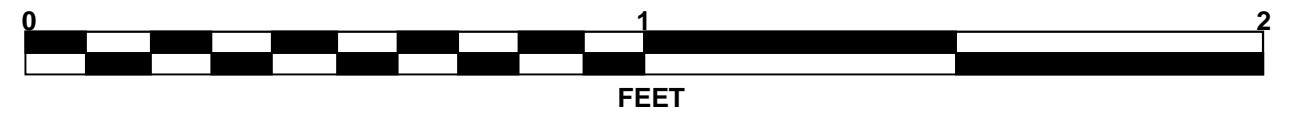
NCDOT BORE DOUBLE B5388_GEO_BRDG_BORELOGS.GPJ NC_DOT_GDT 7/19/18

CORE PHOTOGRAPHS

B1-A
BOX 1 OF 2: 6.7 - 16.3 FEET
GSI 40 - 85



B1-A
BOX 2 OF 2: 16.3 - 24.3 FEET
GSI 40 - 85



CORE PHOTOGRAPHS

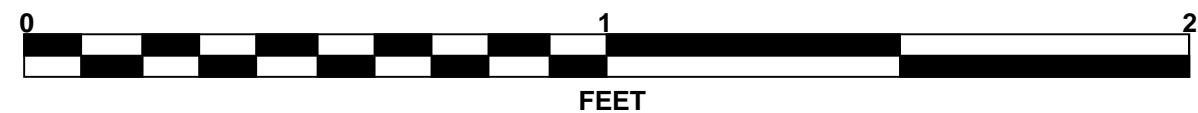
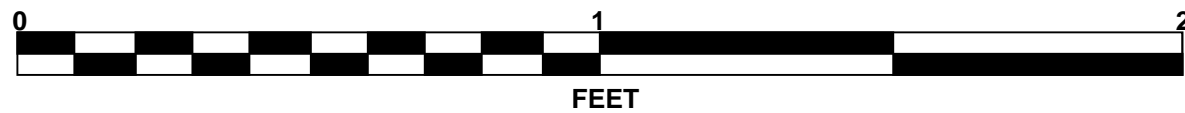
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BOX 1 OF 2: 10.6 - 19.3 FEET
GSI 40 - 85

B1-B

BOX 1 OF 2: 19.3 - 24.3 FEET
GSI 40 - 85

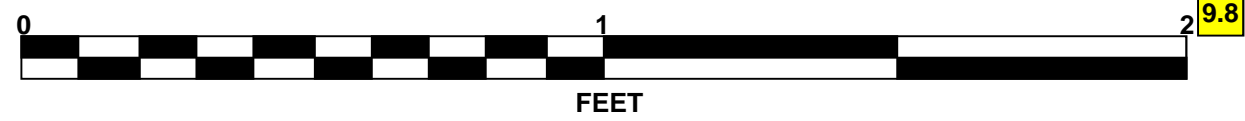
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CORE PHOTOGRAPHS

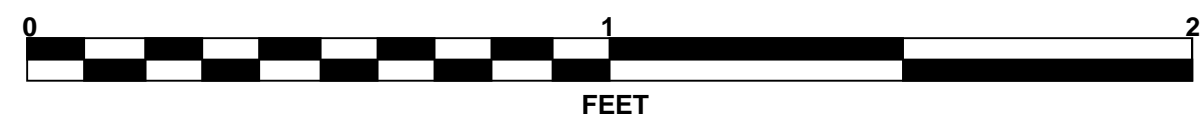
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BOX 1 OF 2: 0.9 - 9.8 FEET
GSI 60 - 85



B2-A

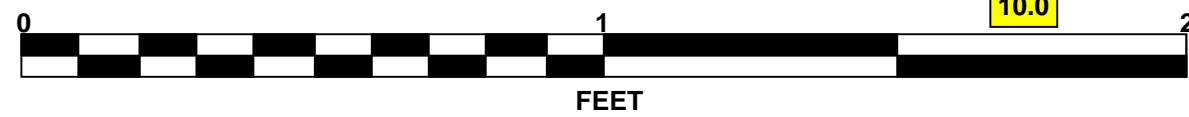
BOX 1 OF 2: 9.8 - 18.8 FEET
GSI 60 - 85



CORE PHOTOGRAPHS

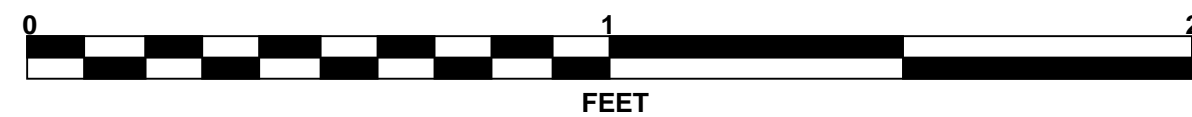
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BOX 1 OF 2: 1.4 - 10.0 FEET
GSI 60 - 85



B2-B

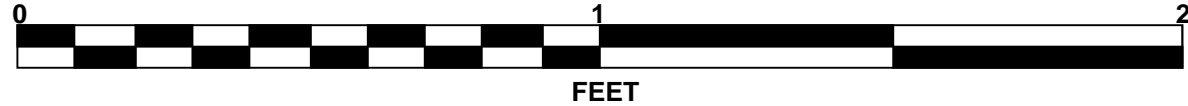
BOX 1 OF 2: 10.0 - 18.7 FEET
GSI 60 - 85



CORE PHOTOGRAPHS

B2-B

BOX 3 OF 3: 18.7 - 24 FEET
GSI 60 - 85



REFERENCE: B-5388

PROJECT: 46103

SEE SHEET 3 FOR PLAN SHEET LAYOUT AT TIME OF INVESTIGATION

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
3	SITE PLAN
4-7	CROSS SECTIONS
8-9	PROFILE

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY ALLEGHANY
 PROJECT DESCRIPTION RETAINING WALL #1 FOR
ON NC 18 OVER LITTLE RIVER

INVENTORY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	46103	1	9

CAUTION NOTICE

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PERSONNEL

DC Elliott, LG

DO Cheek

CJ Coffey

INVESTIGATED BY DMM

DRAWN BY DMM

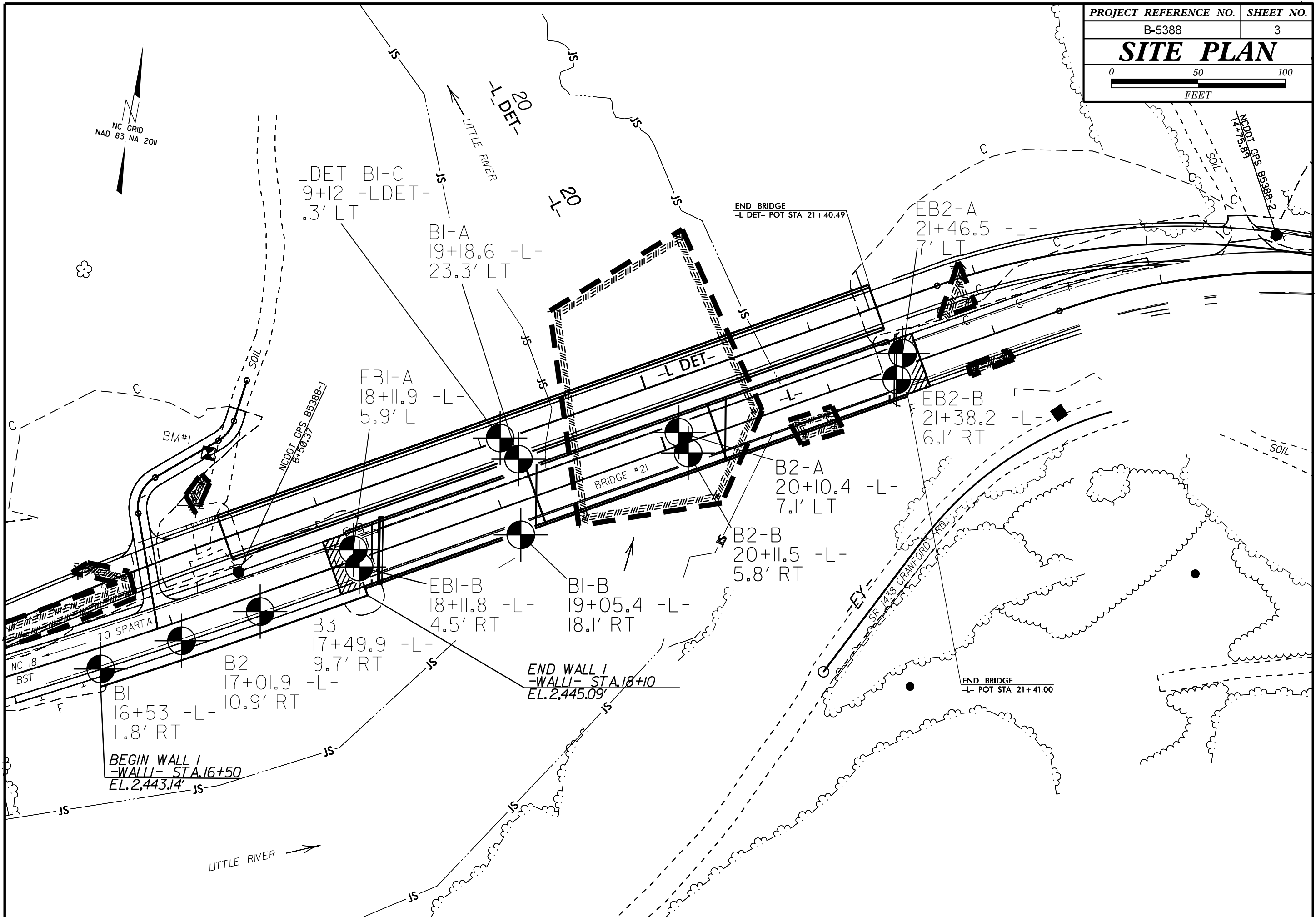
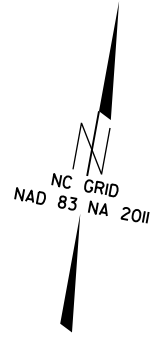
CHECKED BY JCK

SUBMITTED BY JCK

DATE 7/23/2018



DocuSigned by:
D Matt Mullen 11/19/2018



LDET BI-C
19+12 -LDET-
1.3' LT

BI-A
19+18.6 -L-
23.3' LT

EBI-A
18+11.9 -L-
5.9' LT

EB2-A
21+46.5 -L-
7' LT

EB2-B
21+38.2 -L-
6.1' RT

B2-A
20+10.4 -L-
7.1' LT

B2-B
20+11.5 -L-
5.8' RT

EBI-B
18+11.8 -L-
4.5' RT

BI-B
19+05.4 -L-
18.1' RT

B3
17+49.9 -L-
9.7' RT

B2
17+01.9 -L-
10.9' RT

B1
16+53 -L-
11.8' RT

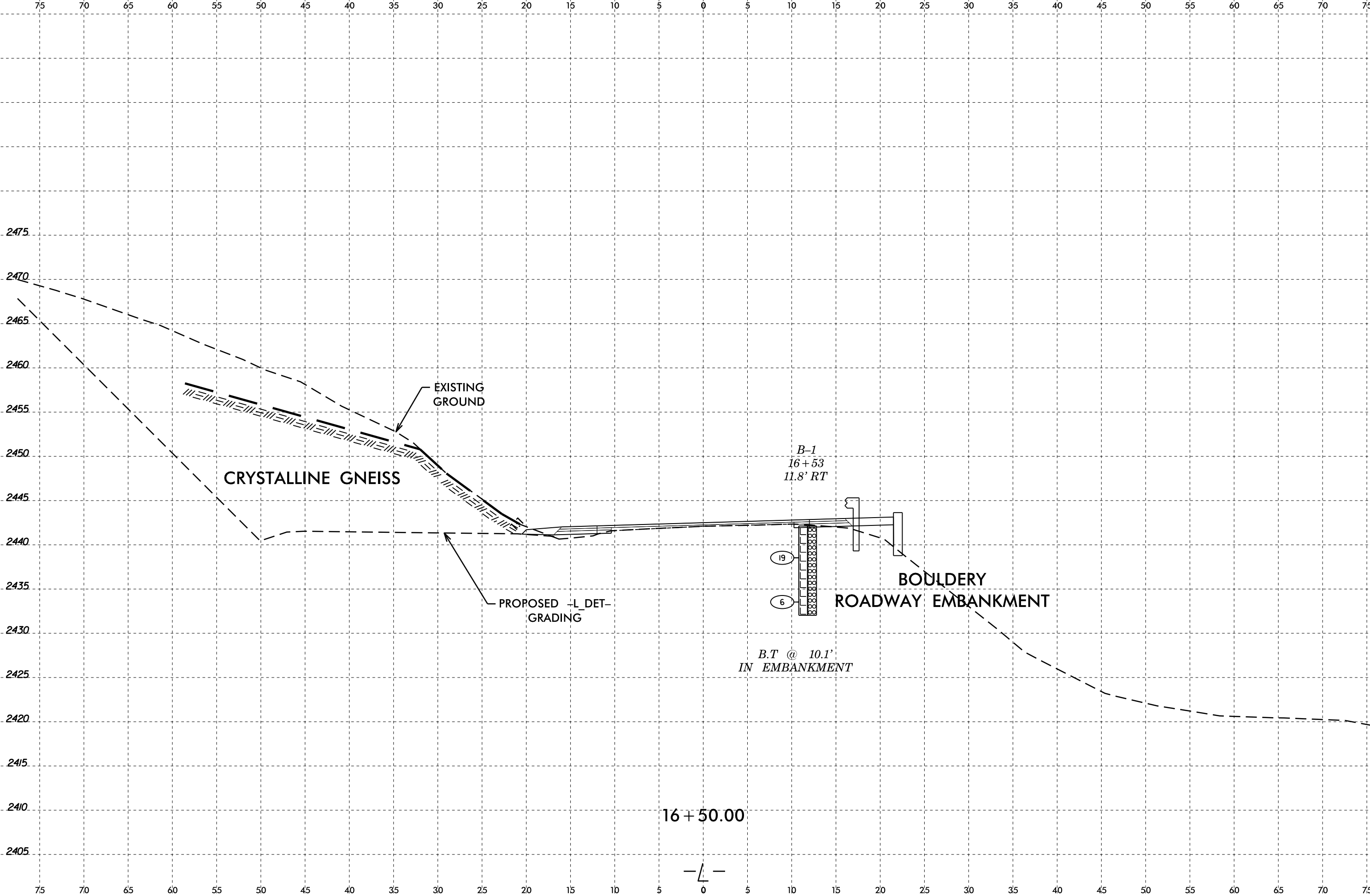
BEGIN WALL 1
-WALL- STA. 16+50
EL. 2,443.14'

END WALL 1
-WALL- STA. 18+10
EL. 2,445.09'

END BRIDGE
-L DET- POT STA 21+40.49

END BRIDGE
-L- POT STA 21+41.00

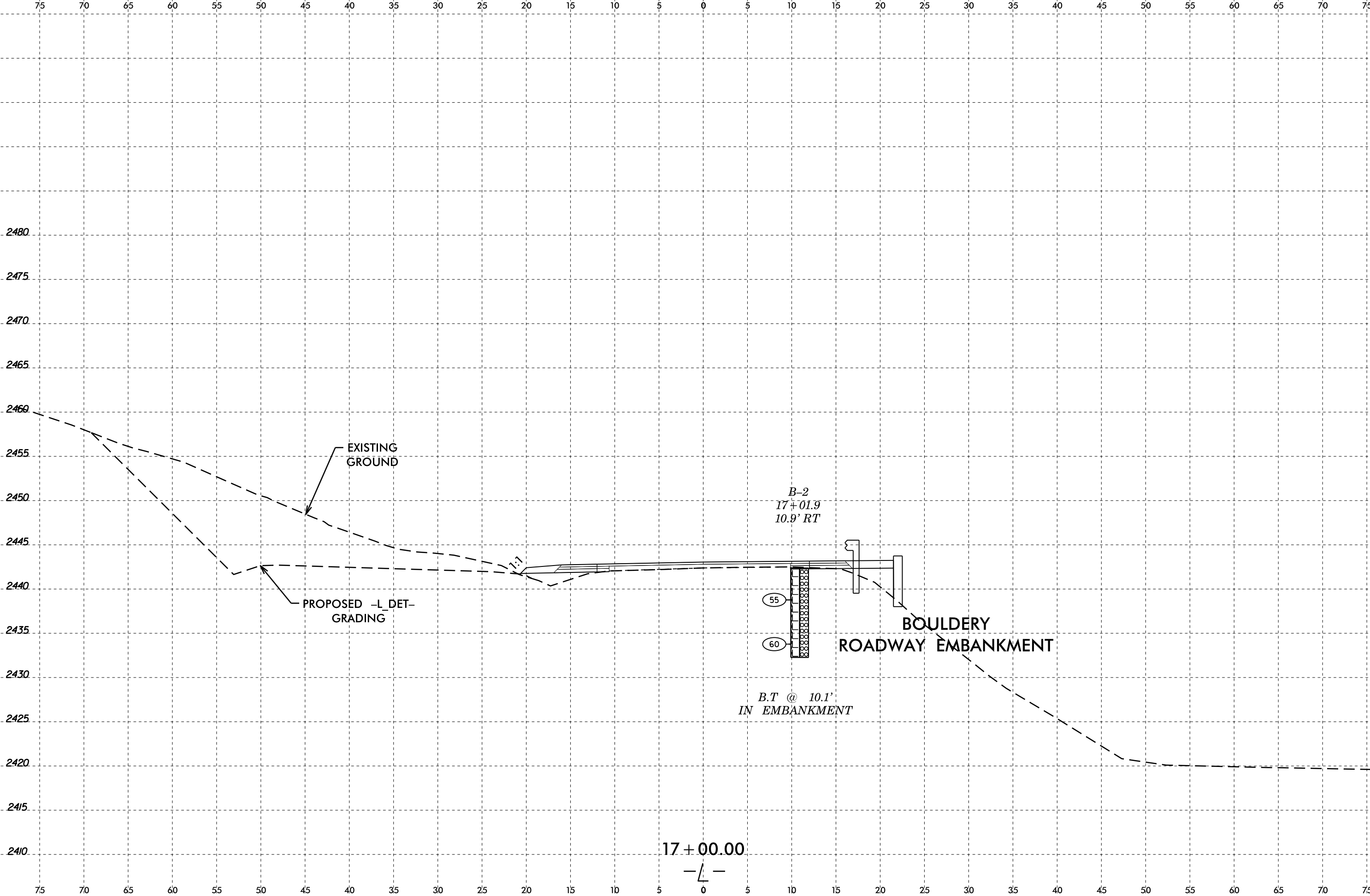
LITTLE RIVER →



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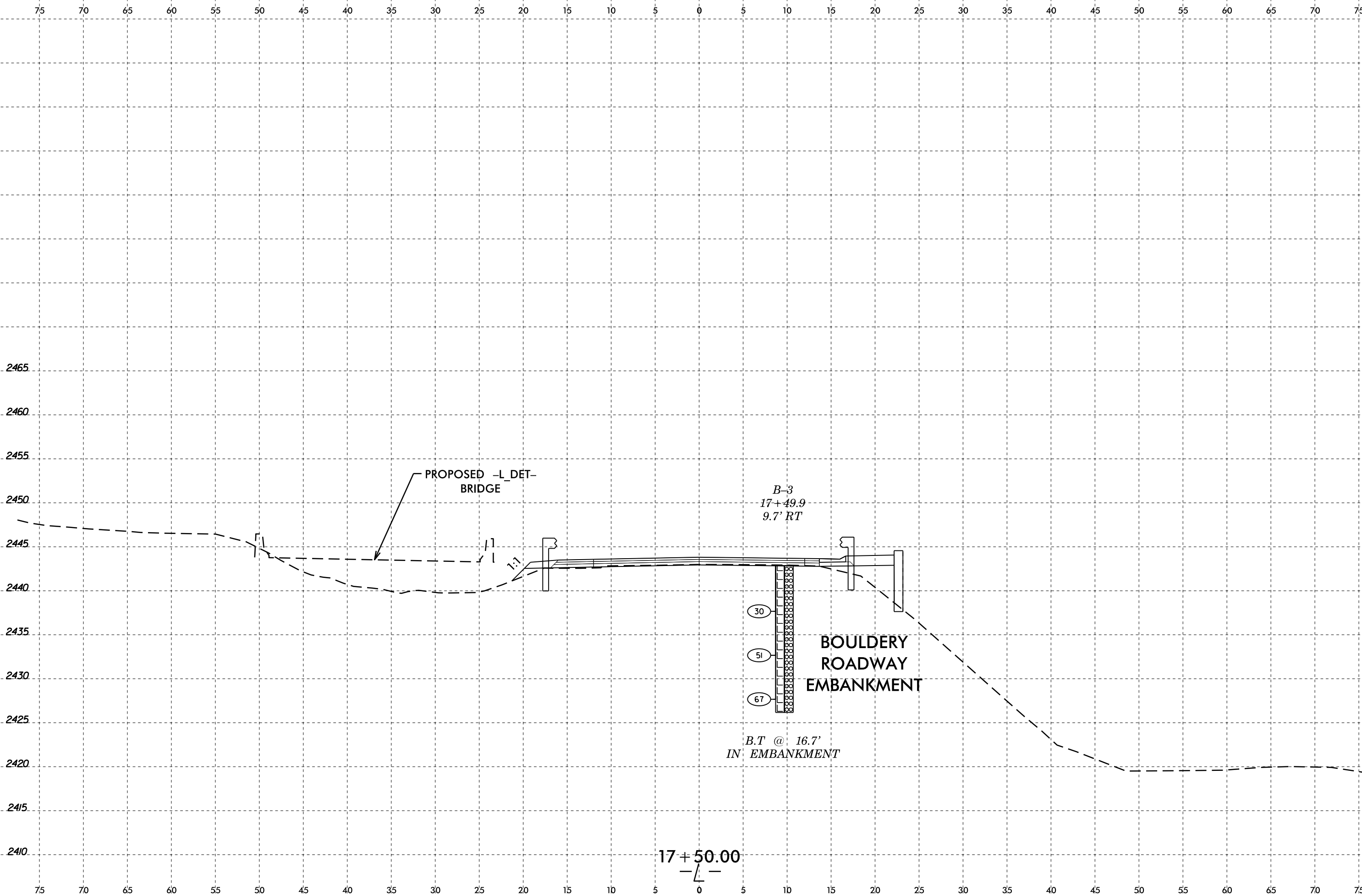
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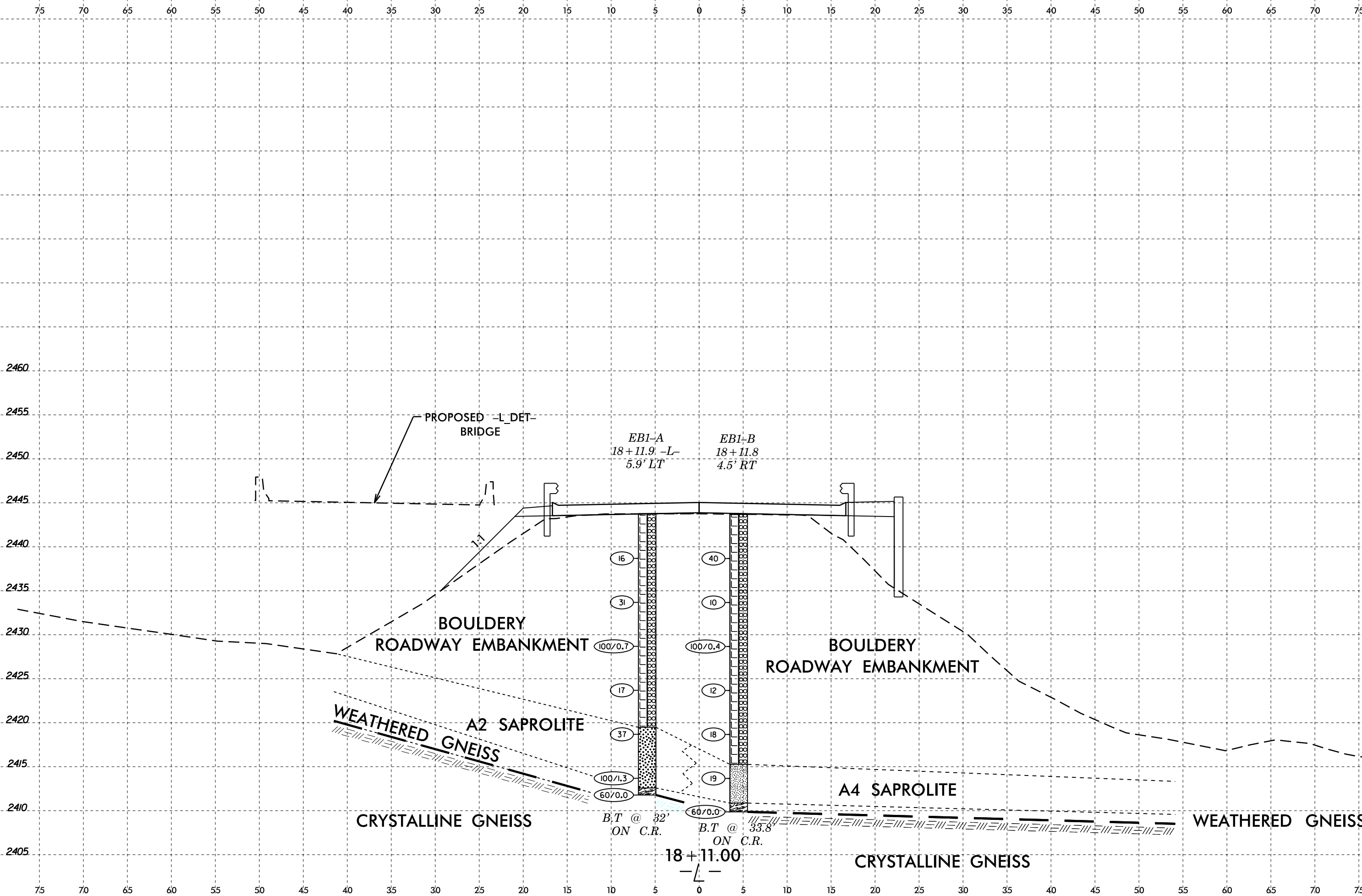


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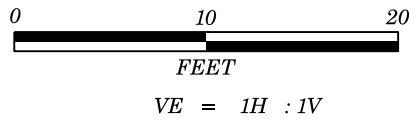
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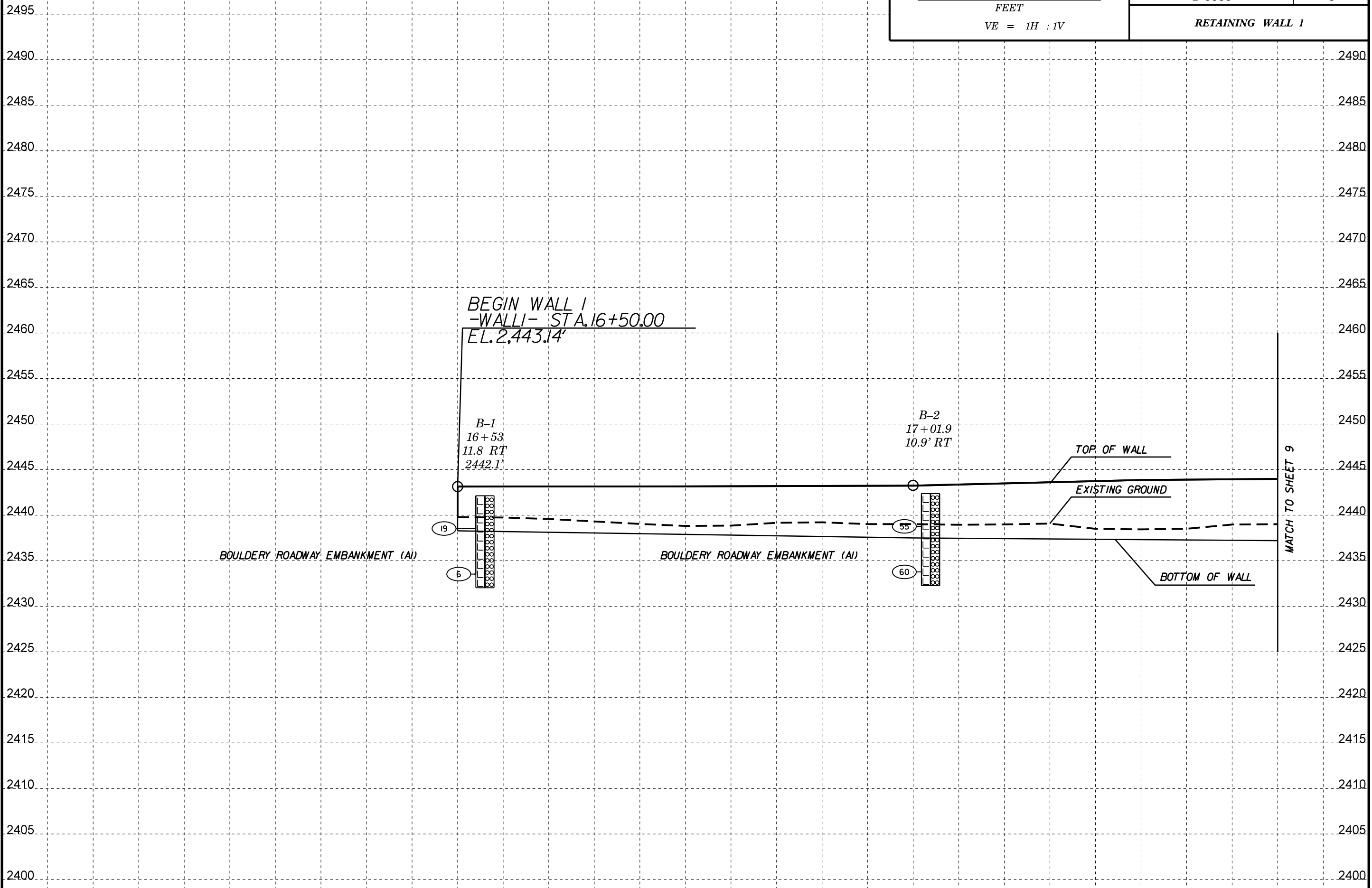
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PROJECT REFERENCE NO.	SHEET NO.
B-5388	8
RETAINING WALL 1	



BEGIN WALL 1
 -WALL 1- STA. 16+50.00
 EL. 2,443.14'

B-1
 16+53
 11.8 RT
 2442.1'

B-2
 17+01.9
 10.9' RT

BOULDERY ROADWAY EMBANKMENT (A)

BOULDERY ROADWAY EMBANKMENT (A)

TOP OF WALL

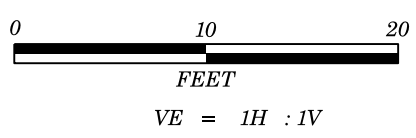
EXISTING GROUND

BOTTOM OF WALL

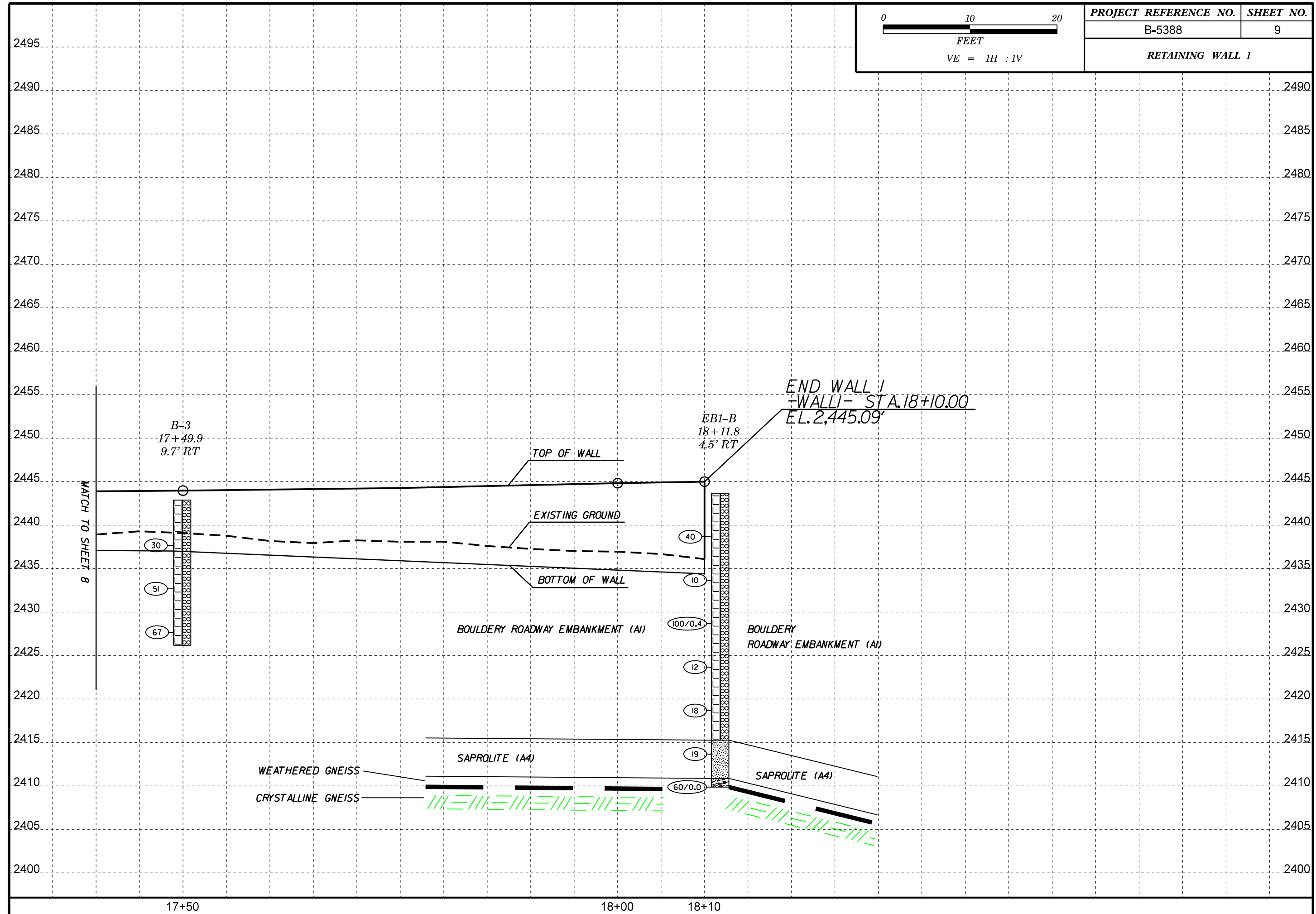
MATCH TO SHEET 9

16+50

17+00



PROJECT REFERENCE NO.	SHEET NO.
B-5388	9
RETAINING WALL 1	



MATCH TO SHEET 8

END WALL 1
- WALL 1 - STA. 18+10.00
EL. 2,445.09'

B-3
17+49.9
9.7' RT

EB1-B
18+11.8
4.5' RT

TOP OF WALL

EXISTING GROUND

BOTTOM OF WALL

BOULDERY ROADWAY EMBANKMENT (A1)

BOULDERY ROADWAY EMBANKMENT (A1)

WEATHERED GNEISS

CRYSTALLINE GNEISS

SAPROLITE (A4)

SAPROLITE (A4)

17+50

18+00

18+10

2495
2490
2485
2480
2475
2470
2465
2460
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2425
2420
2415
2410
2405
2400

SEE SHEET 3 FOR PLAN SHEET LAYOUT
AT TIME OF INVESTIGATION

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

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	46103	1	9

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
3	SITE PLAN
4-7	CROSS SECTIONS
8-9	PROFILE

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY ALLEGHANY
PROJECT DESCRIPTION RETAINING WALL #2 FOR
ON NC 18 OVER LITTLE RIVER

INVENTORY

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PERSONNEL

DC Elliott, LG

DO Cheek

CJ Coffey

INVESTIGATED BY DMM

DRAWN BY DMM

CHECKED BY JCK

SUBMITTED BY JCK

DATE 7/23/2018

REFERENCE: B-5388

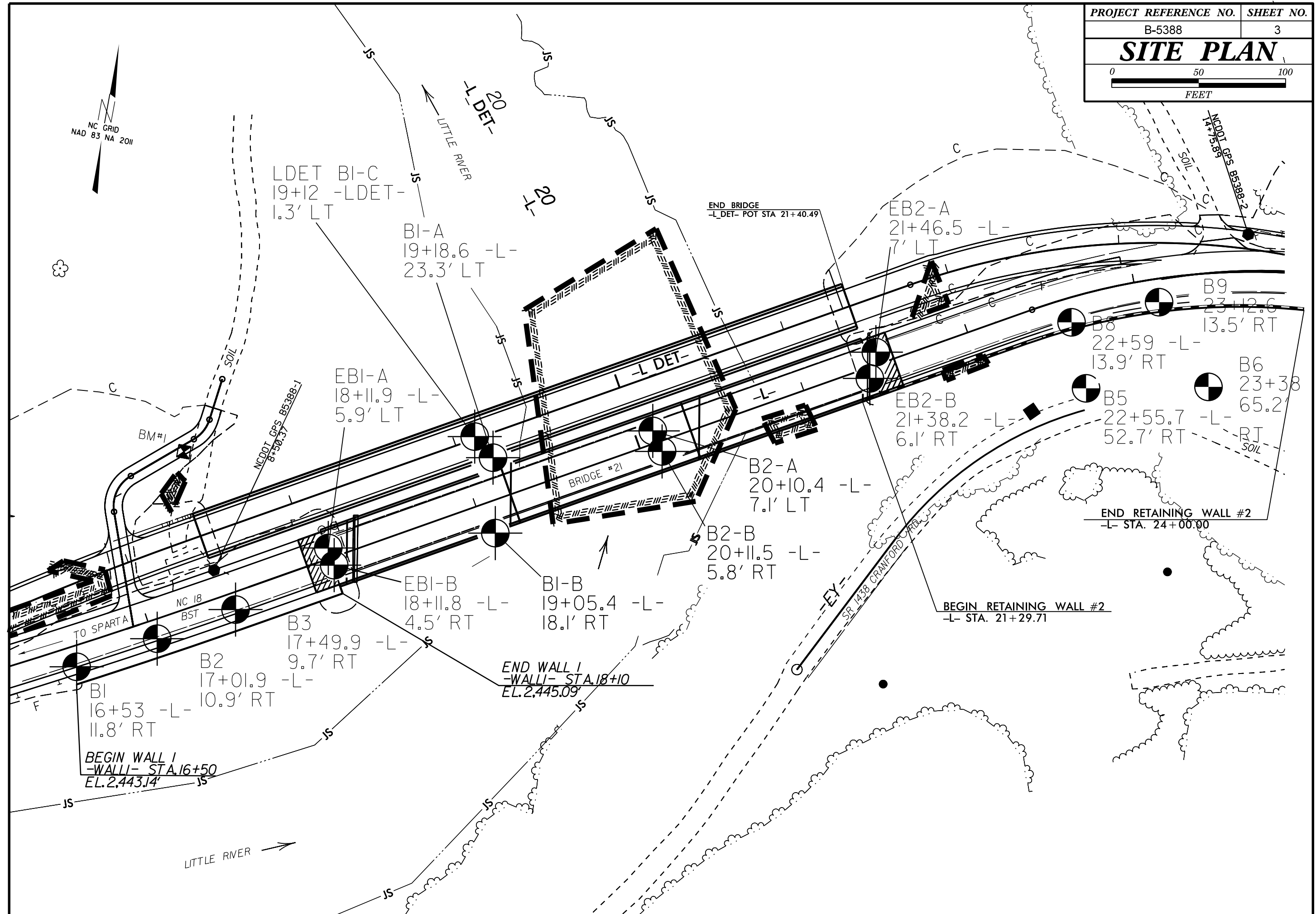
PROJECT: 46103



DocuSigned by:
D Matt Mullen 11/19/2018
18909BD3C2E5440E SIGNATURE DATE

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

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS																																																																																																																																																																					
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										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.										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:										ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOGGED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (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 (IN 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.																																																																																																																																																																					
SOIL LEGEND AND AASHTO CLASSIFICATION										MINERALOGICAL COMPOSITION										WEATHERING																																																																																																																																																																															
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ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.</p> <p align="center">PERCENTAGE OF MATERIAL</p> <table border="1"> <tr> <th>ORGANIC MATERIAL</th> <th>GRANULAR SOILS</th> <th>SILT - CLAY SOILS</th> <th>OTHER MATERIAL</th> </tr> <tr> <td>TRACE OF ORGANIC MATTER</td> <td>2 - 3%</td> <td>3 - 5%</td> <td>TRACE 1 - 10%</td> </tr> <tr> <td>LITTLE ORGANIC MATTER</td> <td>3 - 5%</td> <td>5 - 12%</td> <td>LITTLE 10 - 20%</td> </tr> <tr> <td>MODERATELY ORGANIC</td> <td>5 - 10%</td> <td>12 - 20%</td> <td>SOME 20 - 35%</td> </tr> <tr> <td>HIGHLY ORGANIC</td> <td>> 10%</td> <td>> 20%</td> <td>HIGHLY 35% AND ABOVE</td> </tr> </table> <p align="center">GROUND WATER</p> <p>▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING</p> <p>▽ PW STATIC WATER LEVEL AFTER 24 HOURS</p> <p>○ SPRING OR SEEP</p> <p align="center">MISCELLANEOUS SYMBOLS</p> <p>ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION</p> <p>ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT</p> <p>INFERRED SOIL BOUNDARY</p> <p>INFERRED ROCK LINE</p> <p>ALLUVIAL SOIL BOUNDARY</p> <p>DIP & DIP DIRECTION OF ROCK STRUCTURES</p> <p>SPT DMT VST PMT TEST BORING</p> <p>AUGER BORING</p> <p>CORE BORING</p> <p>MONITORING WELL</p> <p>PIEZOMETER INSTALLATION</p> <p>SLOPE INDICATOR INSTALLATION</p> <p>CONE PENETROMETER TEST</p> <p>SOUNDING ROD</p> <p>TEST BORING WITH CORE</p> <p>SPT N-VALUE</p>										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	<p align="center">ROCK HARDNESS</p> <p>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.</p> <p>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.</p> <p>MODERATELY HARD CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.</p> <p>MEDIUM HARD CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.</p> <p>SOFT CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.</p> <p>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.</p>									
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LDET BI-C
19+12 -LDET-
1.3' LT

BI-A
19+18.6 -L-
23.3' LT

EBI-A
18+11.9 -L-
5.9' LT

END BRIDGE
-L DET- POT STA 21+40.49

EB2-A
21+46.5 -L-
7' LT

B9
23+12.6
13.5' RT

B8
22+59 -L-
13.9' RT

B6
23+38
65.2

B5
22+55.7 -L-
52.7' RT

EBI-B
18+11.8 -L-
4.5' RT

BI-B
19+05.4 -L-
18.1' RT

B2-B
20+11.5 -L-
5.8' RT

B2-A
20+10.4 -L-
7.1' LT

BEGIN RETAINING WALL #2
-L- STA. 21+29.71

END RETAINING WALL #2
-L- STA. 24+00.00

B1
16+53 -L-
11.8' RT

B2
17+01.9 -L-
9.7' RT

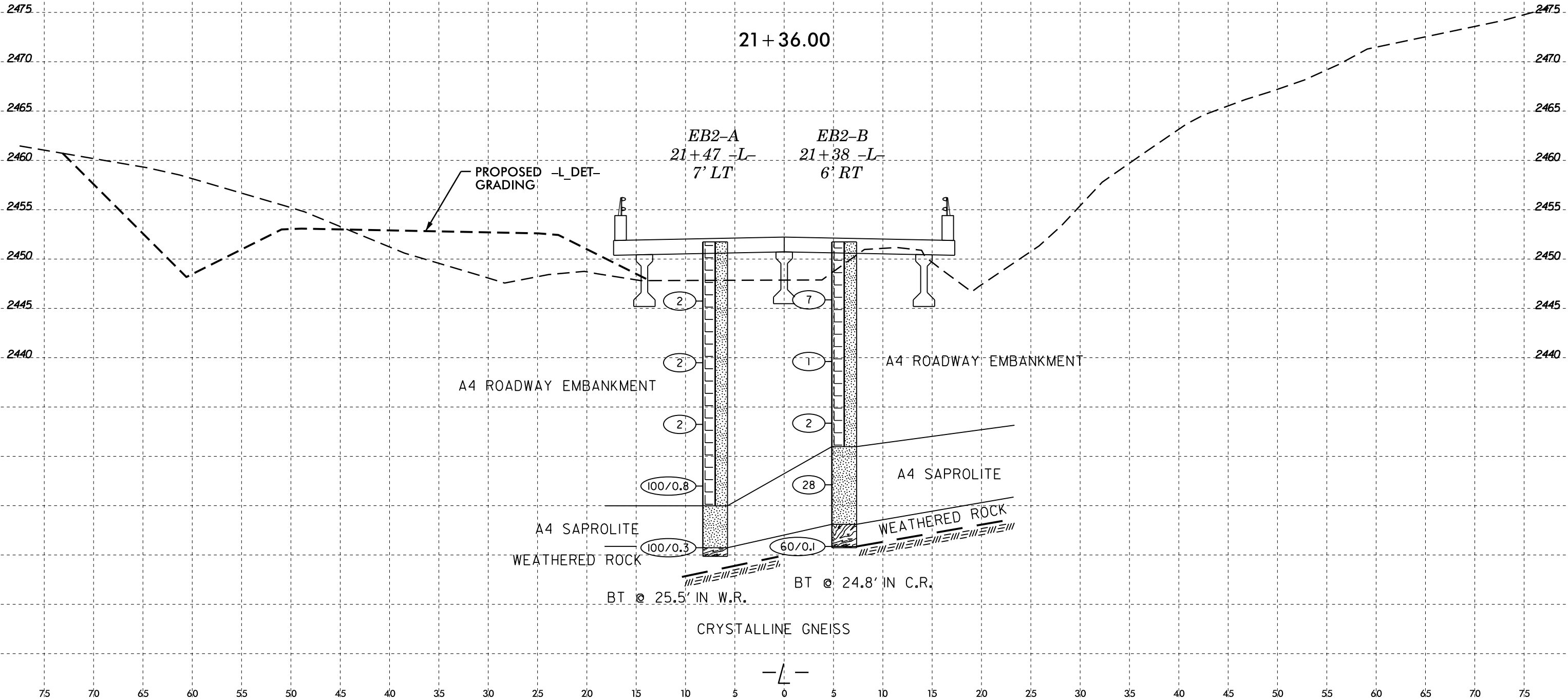
B3
17+49.9 -L-
10.9' RT

END WALL 1
-WALL- STA. 18+10
EL. 2,445.09'

BEGIN WALL 1
-WALL- STA. 16+50
EL. 2,443.14'

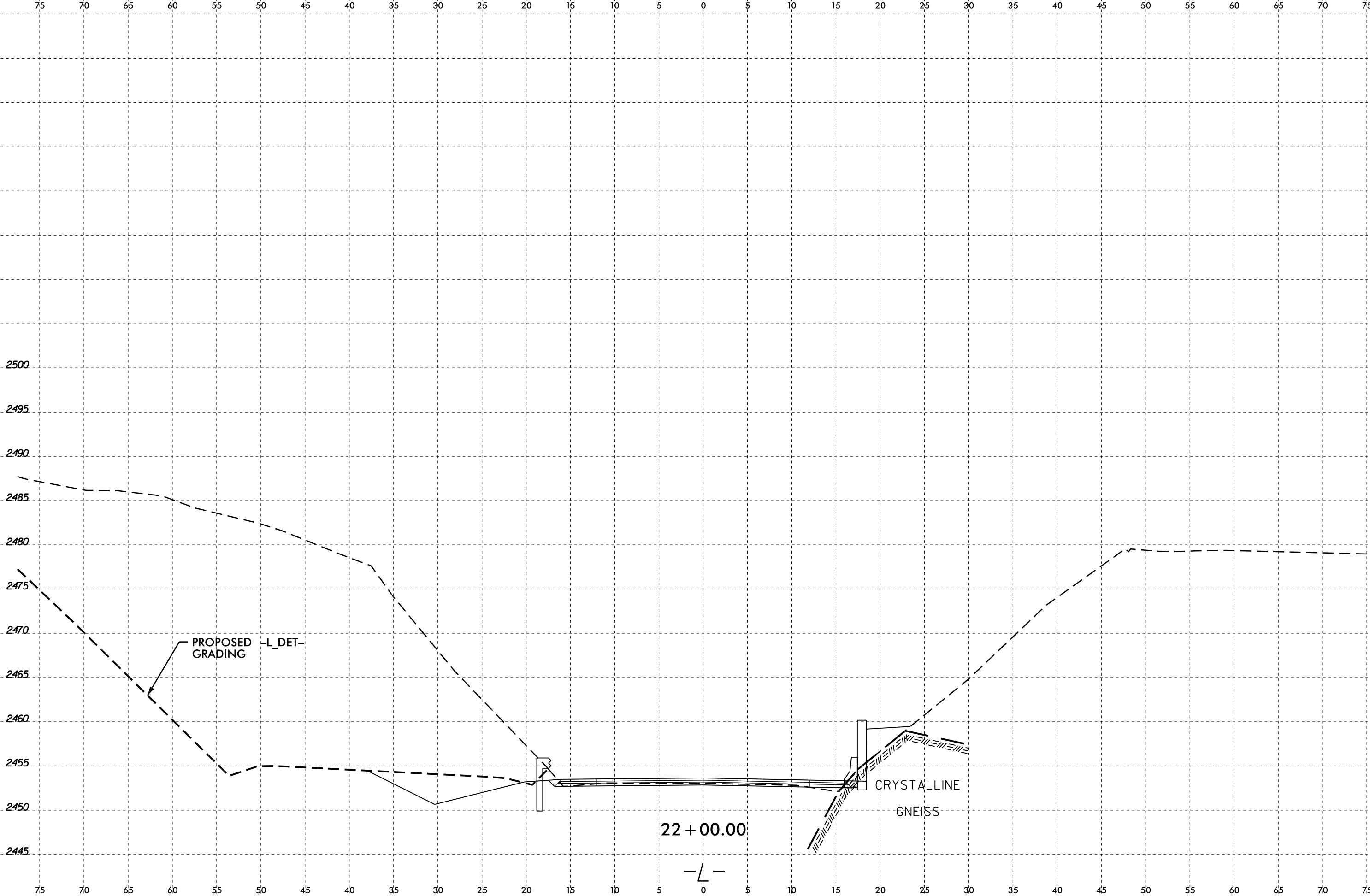
LITTLE RIVER →

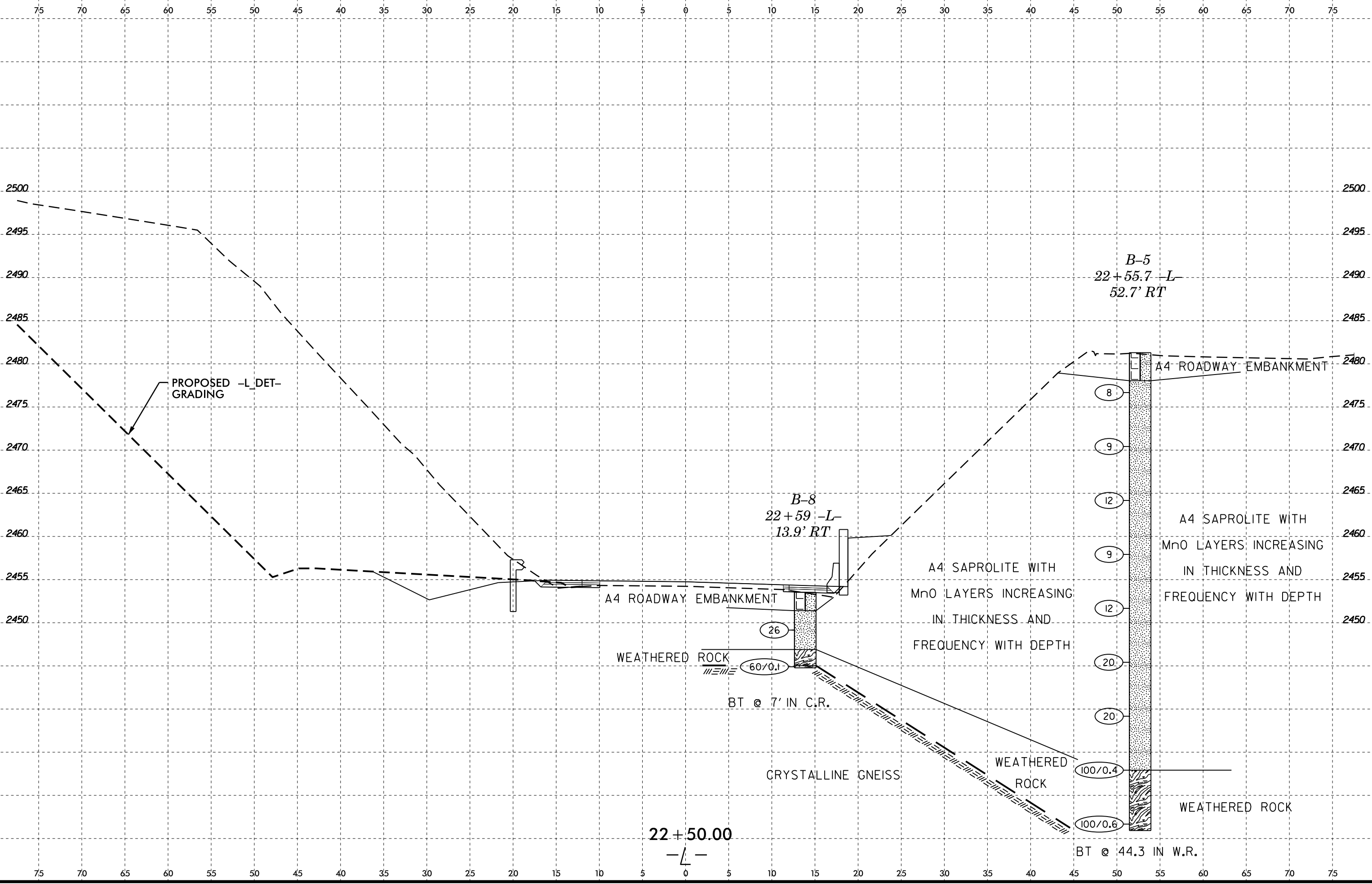
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6/23/16
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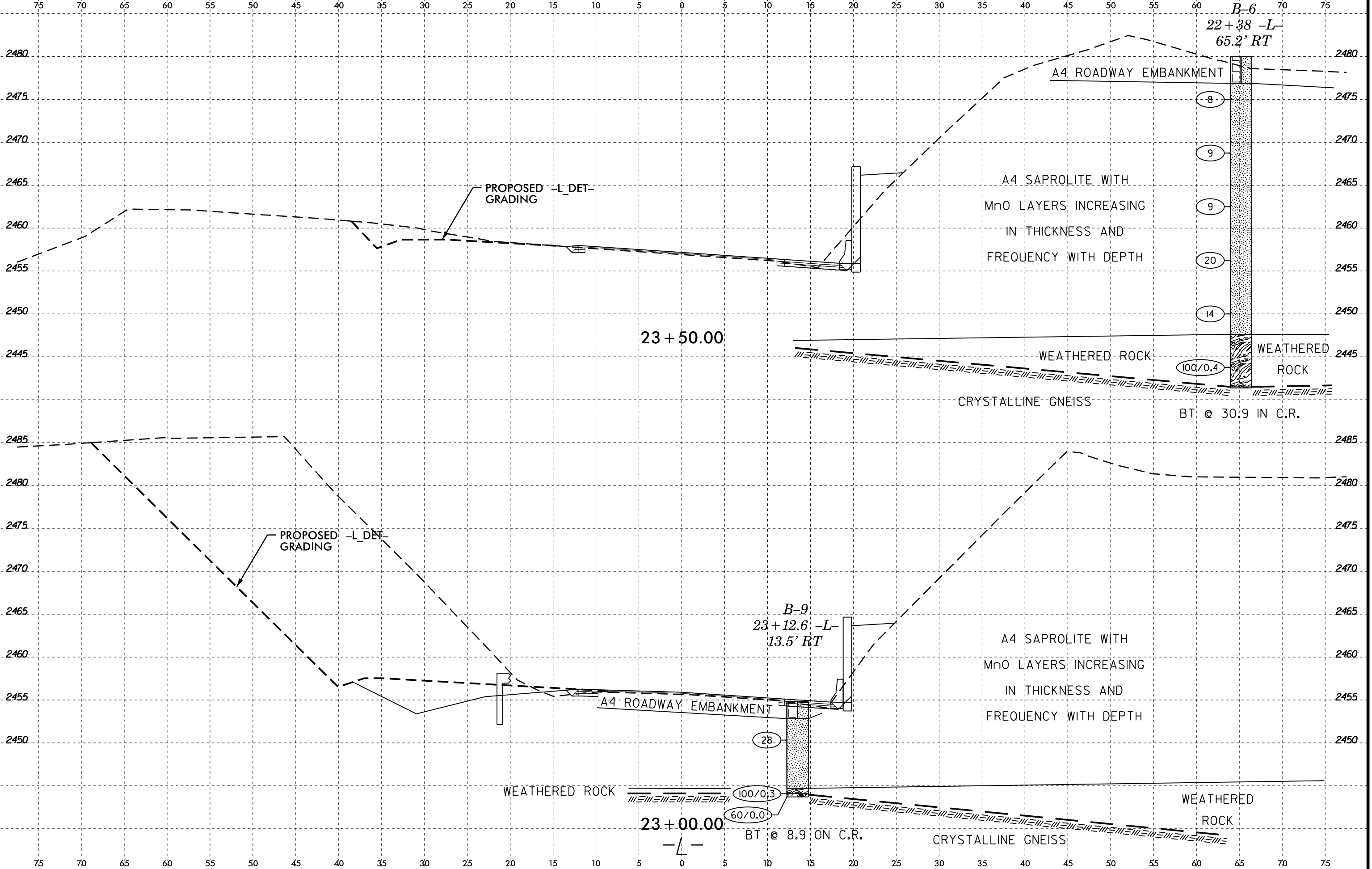
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		B-5388	5

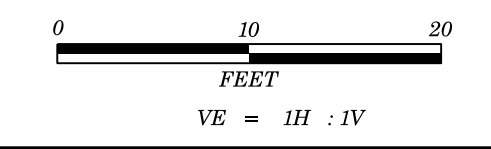




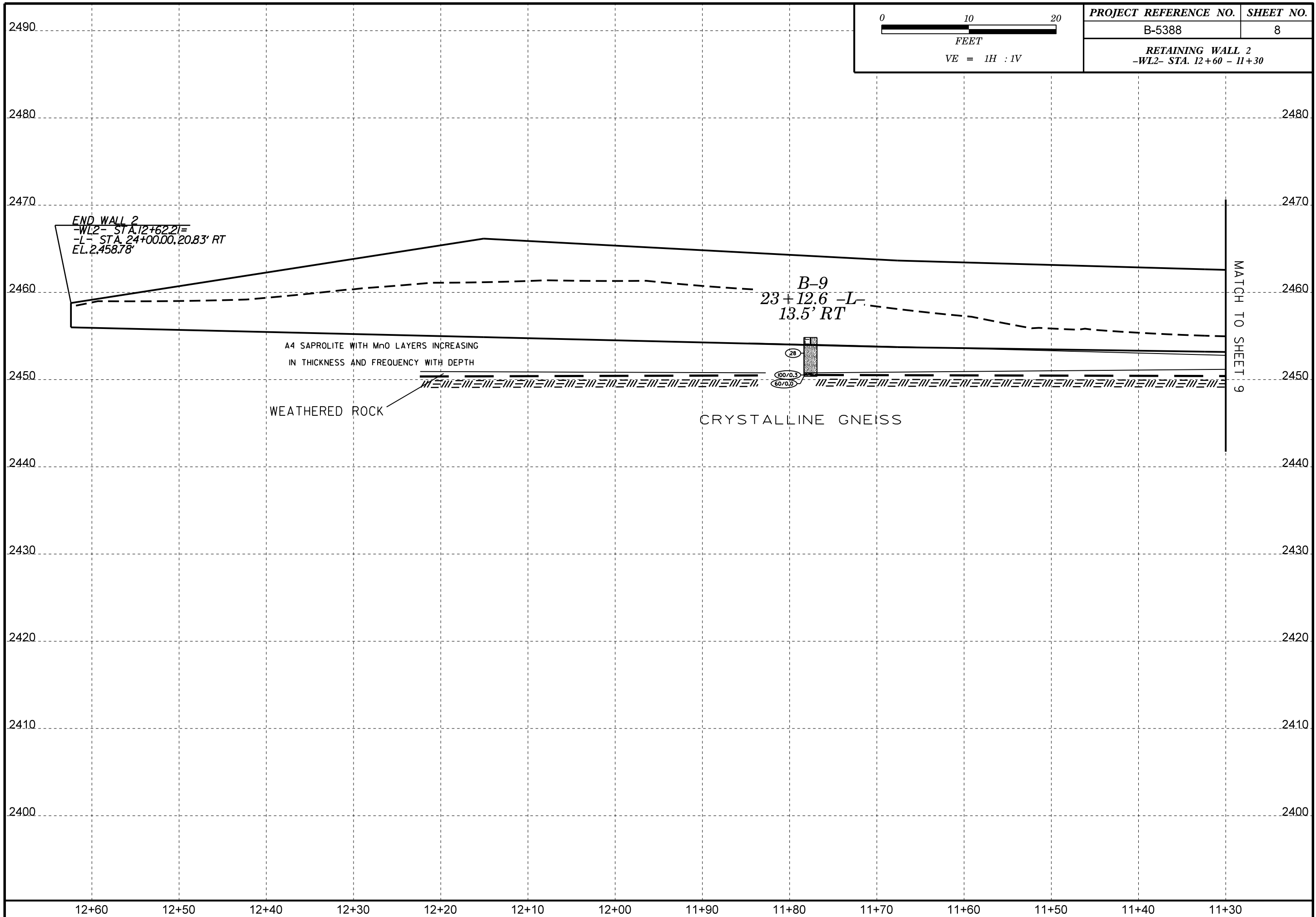
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 \$\$\$USERNAME\$\$\$

22+50.00
-L-





PROJECT REFERENCE NO.	SHEET NO.
B-5388	8
RETAINING WALL 2 -WL2- STA. 12+60 - 11+30	



END WALL 2
 -WL2- STA. 12+62.21=
 -L- STA. 24+00.00, 20.83' RT
 EL. 2,458.78'

A4 SAPROLITE WITH MnO LAYERS INCREASING
 IN THICKNESS AND FREQUENCY WITH DEPTH

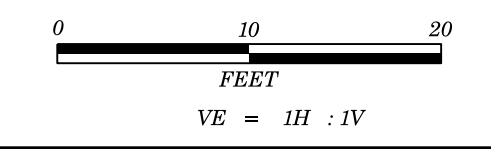
WEATHERED ROCK

CRYSTALLINE GNEISS

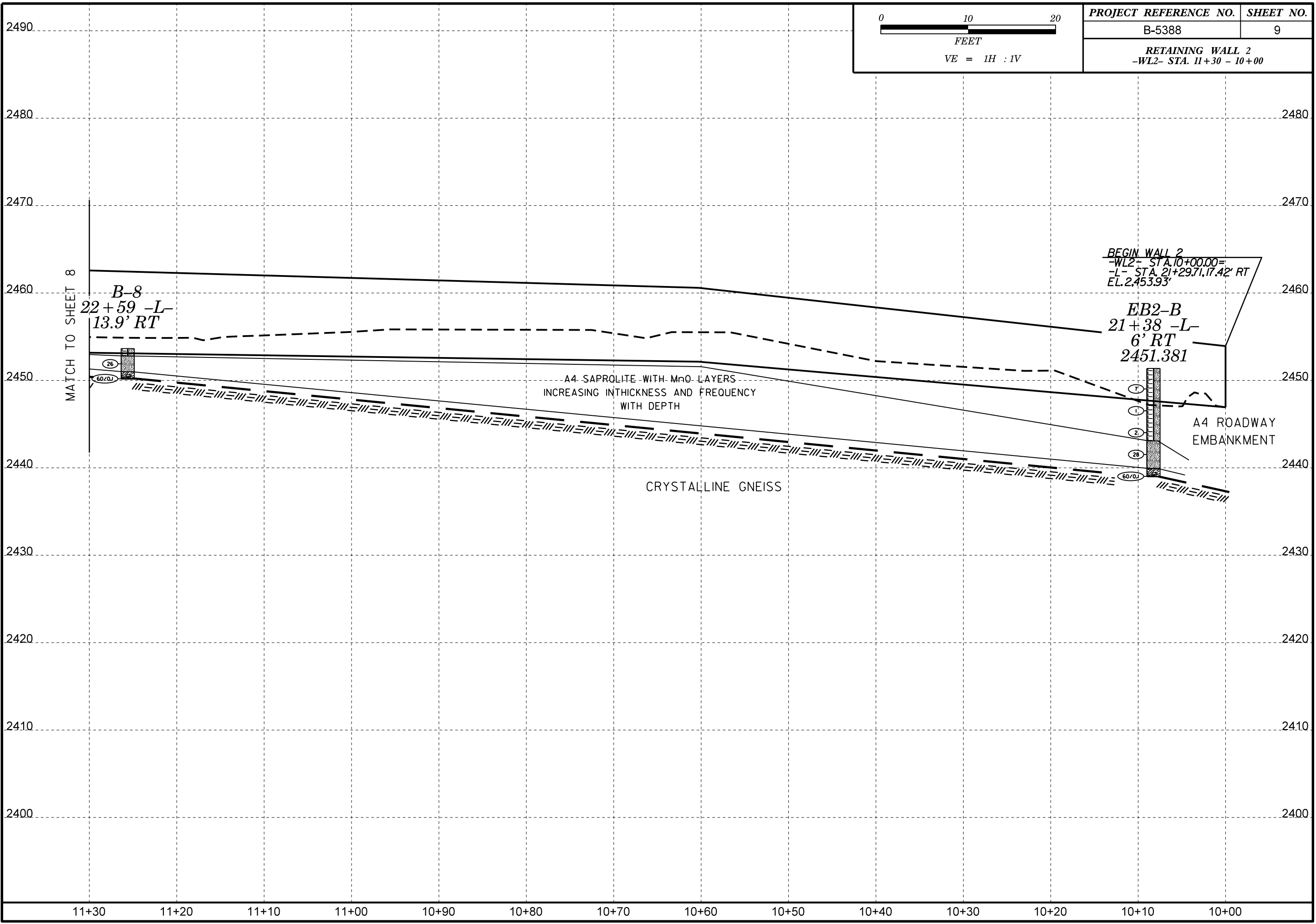
B-9
 23+12.6 -L-
 13.5' RT

MATCH TO SHEET 9

12+60 12+50 12+40 12+30 12+20 12+10 12+00 11+90 11+80 11+70 11+60 11+50 11+40 11+30



PROJECT REFERENCE NO.	SHEET NO.
B-5388	9
RETAINING WALL 2 -WL2- STA. 11+30 - 10+00	



MATCH TO SHEET 8

B-8
22+59 -L-
13.9' RT

BEGIN WALL 2
-WL2- STA. 10+00.00=
-L- STA. 21+2971.17.42' RT
EL. 2453.93'

EB2-B
21+38 -L-
6' RT
2451.381

A4 SAPROLITE WITH MnO₂ LAYERS
INCREASING IN THICKNESS AND FREQUENCY
WITH DEPTH

CRYSTALLINE GNEISS

A4 ROADWAY
EMBANKMENT

11+30 11+20 11+10 11+00 10+90 10+80 10+70 10+60 10+50 10+40 10+30 10+20 10+10 10+00