

REFERENCE: R-2233BB

PROJECT: 34400

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.	R-2233BB	1	161

**CAUTION NOTICE**

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

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

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

- M. Arnold
- C. Wang
- J. Cranston
- D. Aiello
- S. Davis
- T. Sharpe
- C. Boyce
- J. Hoyle

INVESTIGATED BY F&R, Inc.  
DRAWN BY T.T. Walker  
CHECKED BY P. Alton  
SUBMITTED BY P. Alton  
DATE March 2017

SINCE **Prepared in the Office of:**  
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1881

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DocuSigned by:  
W. Patrick Alton 4/6/2017

A270EF78 SIGNATURE DATE

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

# ROADWAY SUBSURFACE INVESTIGATION

COUNTY RUTHERFORD  
PROJECT DESCRIPTION US 221 SOUTH OF US 74  
BUSINESS (CHARLOTTE RD.) TO OF NORTH SR 1366  
(ROPER LOOP RD.)

## INVENTORY

**SECTION A**

**CONTENTS**

LINE	STATION	PLAN	PROFILE
-L3-	738+80.79 to 1004.00	4-22	28-42
-Y2-	23+75 to 32+00	6	
-Y2RPB-	10+00 to 31+16.38	5,6	
-Y2LPB-	10+00 to 22+04.55	6	
-Y2RPC-	10+00 to 27+36.20	6	
-Y2LPC-	10+00 TO 19+94.16	6	
-Y3-	BRIDGE OVER -L3-	11	
-Y3RPA-	10+00 TO 19+85.84	11,12	
-Y3RPD-	10+00 TO 31+20.29	11,12	
-Y3LPD-	10+00 TO 26+86.19	11	
-Y5-	11+75 TO 21+33.23	13	
-Y6-	20+00 TO 33+34.37	24,25	
-Y7A-	13+75 TO 18+45.84	21	
-Y8-	10+00 TO 15+35	26	
-Y10-	12+50 TO 29+82.35	15,26	
-Y11-	10+00 TO 28+00	18,27	
-Y12-	11+25 TO 33+00	15,16	
-Y19-	BRIDGE OVER -L3-	9	
-22A-	34+50 TO 40+35.15	24	
-DR3-	10+00 TO 16+75	11,23	

**SECTION B**

**CONTENTS**

LINE	STATION	PROFILE
-Y2-	23+75 to 32+00	43-44
-Y2RPB-	10+00 to 31+16.38	45-46
-Y2LPB-	10+00 to 22+04.55	47
-Y2RPC-	10+00 to 27+36.20	48-49
-Y2LPC-	10+00 TO 19+94.16	50
-Y3-	BRIDGE OVER -L3-	N/A
-Y3RPA-	10+00 TO 19+85.84	51-52
-Y3RPD-	10+00 TO 31+20.29	53-54
-Y3LPD-	10+00 TO 26+86.19	55-56
-Y5-	11+75 TO 21+33.23	57
-Y6-	20+00 TO 33+34.37	58-59
-Y7A-	13+75 TO 18+45.84	60
-Y8-	10+00 TO 15+35	61
-Y10-	12+50 TO 29+82.35	62-63
-Y11-	10+00 TO 28+00	64-65
-Y12-	11+25 TO 33+00	66-67
-Y19-	BRIDGE OVER -L3-	68
-22A-	34+50 TO 40+35.15	69
-DR3-	10+00 TO 16+75	70

LINE	STATION	CROSS SECTION
-L3-	749+50 to 1003+00	71-118
-Y2-	24+50 to 28+50	119-124
-Y2RPB-	15+44 to 24+50	125-137
-Y2RPC-	16+94.45 to 25+50	138-144
-Y2LPC-	17+54.57	145
-Y3-	25+33.03 to 27+72.89	146-147
-Y11-	18+00 to 22+00	148-151

# ***SECTION A***

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, <i>VERY STIFF GRAY SILTY CLAY WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>	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. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (ROQ) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRODUCED 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 (SCREC) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROQ) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.
<b>SOIL LEGEND AND AASHTO CLASSIFICATION</b>	<b>ANGULARITY OF GRAINS</b> THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.	WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
<b>GENERAL CLASS.</b> GRANULAR MATERIALS (< 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS	<b>MINERALOGICAL COMPOSITION</b> MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.	CRYSTALLINE ROCK (CR) NON-CRYSTALLINE ROCK (NCR) COASTAL PLAIN SEDIMENTARY ROCK (CPI)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC. COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.
<b>GROUP CLASS.</b> A-1, A-1-b, A-3, 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, A-6, A-7	<b>COMPRESSIBILITY</b> SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50	<b>WEATHERING</b> FRESH VERY SLIGHT (V SL) SLIGHT (SL) MODERATE (MOD) MODERATELY SEVERE (MOD, SEV) SEVERE (SEV) VERY SEVERE (V SEV) COMPLETE	ROCK FRESH, CRYSTALS BRIGHT, FINE JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. 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. 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. 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. 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. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i> 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. <i>IF TESTED, WOULD YIELD SPT N VALUES &gt; 100 BPF</i> 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. <i>IF TESTED, WOULD YIELD SPT N VALUES &lt; 100 BPF</i> 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.
<b>PERCENTAGE OF MATERIAL</b> ORGANIC MATERIAL TRACE OF ORGANIC MATTER 2 - 3% LITTLE ORGANIC MATTER 3 - 5% MODERATELY ORGANIC 5 - 10% HIGHLY ORGANIC > 10%	GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL TRACE 1 - 10% LITTLE 10 - 20% SOME 20 - 35% HIGHLY 35% AND ABOVE	<b>GROUND WATER</b> 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	<b>MISCELLANEOUS SYMBOLS</b> ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY DIP & DIP DIRECTION OF ROCK STRUCTURES SPT DMT TEST BORING VST PMT AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION SLOPE INDICATOR INSTALLATION CONE PENETROMETER TEST SOUNDING ROD TEST BORING WITH CORE SPT N-VALUE
<b>CONSISTENCY OR DENSENESS</b> PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> )	<b>RECOMMENDATION SYMBOLS</b> 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	<b>ROCK HARDNESS</b> VERY HARD HARD MODERATELY HARD MEDIUM HARD SOFT VERY SOFT	<b>ABBREVIATIONS</b> 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 HL - HIGHLY MED. - MEDIUM MICA - MICACEOUS MOD. - MODERATELY NP - NON PLASTIC ORG. - ORGANIC PMT - PRESSUREMETER TEST SAP. - SAPROLITIC SD. - SAND, SANDY SL. - SILT, SILTY SLI. - SLIGHTLY TCR - TRICONE REFUSAL w - MOISTURE CONTENT V - VERY VST - VANE SHEAR TEST WE. - WEATHERED % - UNIT WEIGHT % - DRY UNIT WEIGHT <b>SAMPLE ABBREVIATIONS</b> S - BULK SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO
<b>TEXTURE OR GRAIN SIZE</b> U.S. STD. SIEVE SIZE OPENING (MM) BOULDER (BLDR.) COBBLE (COB.) GRAVEL (GR.) COARSE SAND (CSE. SD.) FINE SAND (F SD.) SILT (SL.) CLAY (CL.)	<b>SOIL MOISTURE - CORRELATION OF TERMS</b> SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION LIQUID LIMIT (LL) PLASTIC RANGE (PI) PLASTIC LIMIT (PL) OPTIMUM MOISTURE (OM) SHRINKAGE LIMIT (SL)	<b>EQUIPMENT USED ON SUBJECT PROJECT</b> DRILL UNITS: CME-45C CME-55 CME-550 VANE SHEAR TEST PORTABLE HOIST CME-550X 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 HAND TOOLS: POST HOLE DIGGER HAND AUGER SOUNDING ROD VANE SHEAR TEST	<b>FRACTURE SPACING</b> TERM SPACING BEDDING TERM THICKNESS
<b>PLASTICITY</b> NON PLASTIC SLIGHTLY PLASTIC MODERATELY PLASTIC HIGHLY PLASTIC	<b>COLOR</b> 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.	<b>INDURATION</b> FRIABLE MODERATELY INDURATED INDURATED EXTREMELY INDURATED	<b>NOTES:</b> FIAD = FILLED IMMEDIATELY AFTER DRILLING TBM 1: BL-170, -L- STA. 774+07, 16' RT. N: 600615, E: 1121619, ELEV.=985.65' (BRG. -L3- OVER -Y2- AND RETAINING WALLS ALONG -Y2-) TBM 2: BL-189, -L- STA. 812.56, 38' LT. N: 604373, E: 1120786, ELEV.=979.78' (BRG. -Y19- OVER -L3-) TBM 3: BL-200, -L- STA. 842.07, 83' RT. N: 607299, E: 1120969, ELEV.=1044.46' (BRG. -Y3- OVER -L3-) GPS WITH CENTIMETER ACCURACY USED TO OBTAIN ELEVATION OF BORING Y6.3200L

09/08/99

See Sheet 1A For Index of Sheets

# STATE OF NORTH CAROLINA DIVISION OF HIGHWAYS

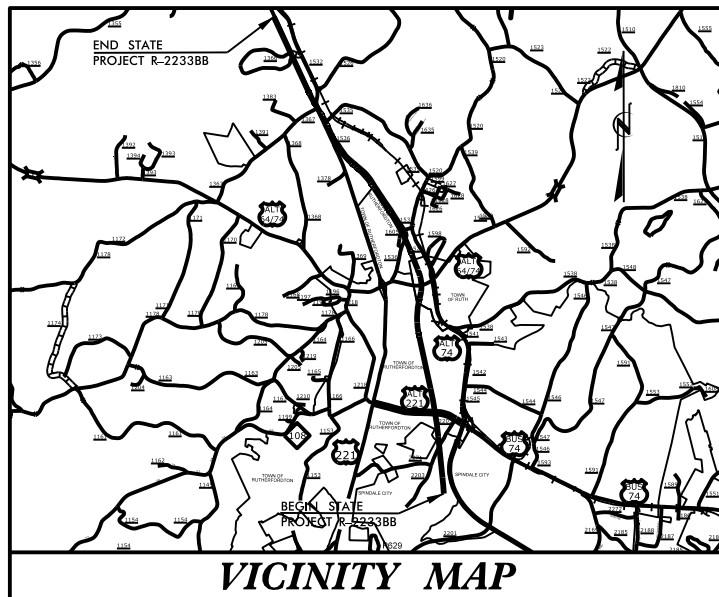
## RUTHERFORD COUNTY

LOCATION: US 221 SOUTH OF US 74 BUSINESS (CHARLOTTE ROAD)  
TO NORTH OF SR 1366 (ROPER LOOP ROAD)

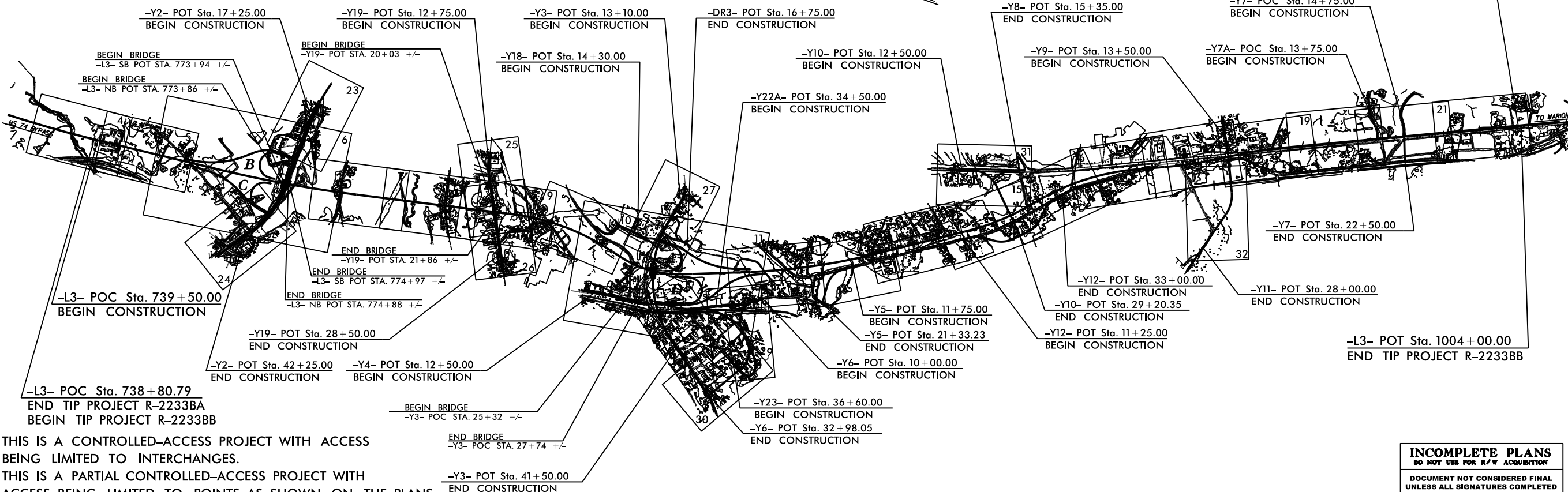
TYPE OF WORK: GRADING, DRAINAGE, PAVING  
AND STRUCTURES

**25% APPROVED PLANS**

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2233BB	3	159
STATE PROJ. NO.	P.A. PROJ. NO.	DESCRIPTION	
34400.1.S5		PE	



**TIP PROJECT: R-2233BB**



THIS IS A CONTROLLED-ACCESS PROJECT WITH ACCESS BEING LIMITED TO INTERCHANGES.

THIS IS A PARTIAL CONTROLLED-ACCESS PROJECT WITH ACCESS BEING LIMITED TO POINTS AS SHOWN ON THE PLANS.

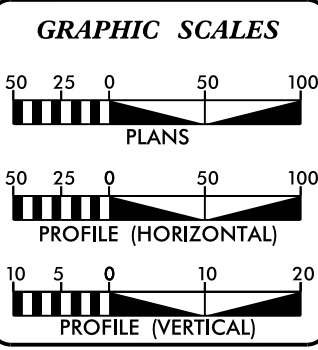
CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD \_\_\_\_.

A PORTION OF THIS PROJECT IS WITHIN THE MUNICIPAL BOUNDARIES OF THE TOWNS OF RUTHERFORDTON, RUTH, AND SPINDALE CITY

NCDOT CONTACT: THAD DUNCAN, P.E.

**INCOMPLETE PLANS**  
DO NOT USE FOR R/W ACQUISITION  
DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED

**CONTRACT:**



**DESIGN DATA**

ADT 2020 =	13300
ADT 2040 =	14500
K =	9 %
D =	60 %
T =	9 % *
V =	70 MPH
* TTST	5% DUAL 4%
FUNC CLASS =	ARTERIAL
REGIONAL	TIER

**PROJECT LENGTH**

LENGTH ROADWAY TIP PROJECT R-2233BB =	4.991 MILES
LENGTH STRUCTURE TIP PROJECT R-2233BB =	0.019 MILES
TOTAL LENGTH TIP PROJECT R-2233BB =	5.010 MILES
STRUCTURE LENGTH BASED ON -L3- NB STATIONING.	

**PLANS PREPARED FOR NCDOT BY:**

**Dewberry**  
2610 WYCLIFF ROAD  
SUITE 410  
RALEIGH, NC 27607  
PHONE: 919.881.9939  
NC COA No. F-0929

2012 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE: JULY 21, 2017

LETTING DATE: JANUARY 21, 2020

DENNIS J. MORY, P.E.  
PROJECT ENGINEER

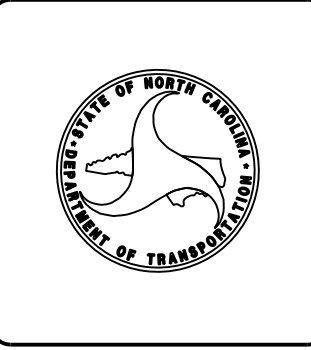
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March 16, 2017

State Project No.: 34400.1.S5  
 TIP No.: R-2233BB  
 F.A. Number: N/A  
 County: Rutherford  
 Description: US 221 south of US 74 Business (Charlotte Rd) to north of SR 1366 (Roper Loop Rd)

**SUBJECT: Geotechnical Report – Inventory**

**Project Description**

This project primarily involves the creation of 5.0 miles of roadway on new alignment (-L3-) in Rutherfordton, Rutherford County, North Carolina. The new roadway begins at -L3- station 738+80.79, which is located off the west side of US-74 Alternate about ¼ mile north of its intersection with Ellington Heights. The roadway ends at -L3- station 1004+00, which is located on existing US 221 about ½ mile north of its northernmost intersection with Roper Loop Road. The new roadway will typically consist of two northbound and two southbound lanes separated by a median. More-specifically, the typical section will incorporate 12-foot lanes, a 10-foot outside shoulder, and a 46-foot median. Two main partial cloverleaf intersections are proposed at Charlotte Road (-Y2-) and East Mountain Street (-Y3-). The intersection at Charlotte Road will consist of a ramp and loop within the B and C quadrants while the East Mountain Street intersection will consist of a ramp and loop within the A and D quadrants. The mainline of the proposed road also crosses the following existing roads: Laurel Hill Road, East 2<sup>nd</sup> Street, Collett Street, Green Street, Oak Street, Reece Street, Southern Street, Old US 221, Hildebrand Drive, Cedar Lane, Broyhill Road, and Gilboa Church Road.

A majority of the new alignment generally extends through undeveloped/wooded areas and residential properties. In addition, several bridges, culverts, and retaining walls are proposed as follows, although at this preliminary stage of the project, the specifics of such structures are unknown. The locations of the culverts are assumed based on the presence of the more-predominant streams that run through the areas, and additional culverts may be necessary that are not listed below. The locations shown below represent areas where additional subsurface investigation was performed in anticipation of the listed structures.

Dual Bridges on -L3- over -Y2-  
 Bridge on -Y19- over -L3-  
 Bridge on -Y3- over -L3-

Abutment retaining walls for Dual Bridges on -L3- over -Y2-:  
 End Bent 1 from approximate -Y2- station 27+75 to 31+50, right  
 End Bent 2 from approximate -Y2- station 28+50 to 31+00, left

Culvert at approximate -L3- station 797+75  
 Culvert at approximate -L3- station 831+25  
 Culvert at approximate -L3- station 874+50

The geotechnical field investigation was performed between November 2016 and January 2017. During this time period, a total of 214 Standard Penetration Test (SPT) borings were advanced with ATV- and track-mounted CME-55 drill rigs with automatic hammers. In addition, two (2) auger probe borings were completed due to highly variable rock elevations. Representative soil samples were collected from the split spoon for visual classification in the field and for analysis by F&R's testing laboratory.

The following alignments were investigated:

<u>Alignment</u>	<u>Station (±)</u>
-L3-	738+80.79 to 1004+00.00
-Y2-	23+75 to 32+00
-Y2RPB-	10+00 to 31+16.38
-Y2LPB-	10+00 to 22+04.55
-Y2RPC-	10+00 to 27+36.20
-Y2LPC-	10+00 to 19+94.16
-Y3-	Bridge over -L3-
-Y3RPA-	10+00 to 27+55.95
-Y3RPD-	10+00 to 31+20.29
-Y3LPD-	10+00 to 26+86.19
-Y5-	11+75 to 21+33.23
-Y6-	20+00 to 33+34.37
-Y7A-	13+75 to 18+45.84
-Y8-	10+00 to 15+35
-Y10-	12+50 to 29+82.35
-Y11-	10+00 to 28+00
-Y12-	11+25 to 33+00
-Y19-	Bridge over -L3-
-Y22A-	34+50 to 40+35.15
-DR3-	10+00 to 16+75

**Areas of Special Geotechnical Interest**

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

<u>Alignment</u>	<u>Station (±)</u>
-L3-	842+25 to 845+25
-L3-	977+75 to 978+25, right
-Y2-	25+25 to 28+75
-LPC-	17+25 to 17+99
-RPC-	22+65 to 25+90
-RPB-	15+25 to 16+25
-RPB-	18+25 to 19+60
-RPB-	20+30 to 24+75

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

<u>Alignment</u>	<u>Station (±)</u>
-L3-	761+00 to 763+00
-L3-	769+00 to 771+00
-L3-	774+25 to 774+75
-L3-	776+50 to 778+00
-L3-	842+00 to 845+50
-L3-	973+50 to 974+50
-Y2-	28+51 to 30+75, left
-RPB-	13+25 to 16+50
-RPB-	20+50 to 20+75
-RPB-	23+80 to 25+40
-LPB-	16+00 to 16+40
-RPC-	14+75 to 15+75
-RPC-	18+30 to 26+50
-LPC-	11+25 to 11+90
-LPC-	14+00 to 19+20

- 3) **Soft, Loose and/or Wet Soils**: The following areas contain relatively soft or loose and/or wet, near-surface soils that have the potential to cause subgrade problems during construction:

<u>Alignment</u>	<u>Station (±)</u>
-L3-	766+50 to 767+50
-L3-	780+50 to 781+50, left
-L3-	794+50 to 803+00
-L3-	807+50 to 808+50

-L3-	814+50 to 818+00
-L3-	822+50 to 840+00
-L3-	871+50 to 877+00
-L3-	920+00 to 944+00
-L3-	961+50 to 964+50, left
-L3-	968+50 to 969+50, left
-L3-	981+00 to 982+00, left
-L3-	989+50 to 997+50, left
-Y2-	27+50 to 32+00
-RPA-	23+50 to 26+50
-LPD-	18+50 to 19+50
-RPD-	14+00 to 24+00
-DR3-	11+50 to 12+50
-Y5-	19+50 to 20+50
-Y6-	26+12 to 33+22
-Y8-	10+12 to 12+00
-Y10-	18+50 to 19+50
-Y10-	24+50 to 27+50
-Y11-	10+47 to 28+00
-Y12-	16+00 to 20+00
-Y12-	26+00 to 28+00
-Y19-	19+00 to 23+00

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

<u>Alignment</u>	<u>Station (±)</u>
-L3-	739+50 to 740+50
-L3-	745+00 to 753+50
-L3-	757+00 to 760+00
-L3-	766+50 to 767+50
-L3-	775+50 to 776+50
-L3-	778+00 to 803+00
-L3-	807+00 to 841+50
-L3-	859+00 to 884+00
-L3-	903+50 to 948+50
-L3-	956+00 to 957+00, right
-L3-	961+50 to 971+50, left
-L3-	981+00 to 986+00
-L3-	989+50 to 990+50, left
-L3-	995+00 to 997+50, left
-RPA-	10+50 to 11+50

-RPA-	24+50 to 25+50
-RPC-	12+00 to 14+00
-LPD-	14+50 to 19+50
-RPD-	10+00 to 24+00
-Y5-	11+75 to 21+01
-Y6-	20+00 to 23+00
-Y6-	29+00 to 31+00
-Y8-	10+12 to 11+75
-Y10-	12+50 to 29+70
-Y11-	10+47 to 28+00
-Y12-	11+25 to 33+00
-Y19-	19+00 to 22+00
-Y22A-	39+50 to 40+35
-DR3-	10+25 to 16+75

5) Cohesive Soils: The following areas contain deeper deposits of relatively soft cohesive soils (AASHTO A-5, A-6 & A-7 soils) that have the potential to cause embankment instability or long-term settlement problems:

<u>Alignment</u>	<u>Station (±)</u>
-L3-	778+25 to 781+25
-L3-	794+00 to 799+00
-L3-	814+50 to 815+50
-L3-	830+00 to 838+00
-L3-	865+00 to 867+50
-L3-	871+50 to 875+00
-L3-	968+00 to 970+00, left
-L3-	989+00 to 991+00, left
-RPD-	16+50 to 18+00
-RPD-	20+00 to 21+00
-Y8-	10+50 to 12+00
-Y10-	16+50 to 19+50
-Y11-	19+00 to 22+50
-Y12-	16+50 to 17+50

6) Highly Plastic Soils: The following areas of unclassified excavation contain soils with plasticity indices of 26 through 35:

<u>Alignment</u>	<u>Station (±)</u>
-L3-	749+45 to 756+90
-L3-	903+30 to 905+70

7) Groundwater: The following areas exhibited groundwater within six feet of the proposed grade:

<u>Alignment</u>	<u>Station (±)</u>
-L3-	782+50 to 783+50
-L3-	843+00 to 844+00

The following areas exhibited groundwater within three feet of existing grade, which have the potential to cause subgrade problems during construction:

<u>Alignment</u>	<u>Station (±)</u>
-L3-	766+50 to 767+50
-L3-	780+50 to 781+50
-L3-	797+00 to 798+50
-L3-	873+50 to 874+50
-L3-	968+50 to 969+50
-RPD-	18+00 to 22+00
-Y11-	19+00 to 23+00

8) Artificial Fill: The following location contains artificial fill. These soils have the potential to be highly variable, which could cause subgrade problems during construction if undetected pockets of organics, debris, or soft/loose/wet soils are present. In addition, a majority of these soils are cohesive, which may cause embankment instability or long-term settlement problems. It was noted during the field investigation that fill placement/site alteration appeared recent or ongoing in the area of Loop-D/Ramp-D. The similar was true near boring Y6\_3200L, where a survey-grade GPS was utilized in order to obtain an accurate ground surface elevation. Therefore, the ground surface elevations depicted on the plans (with the exception of Y6\_3200L), may not accurately represent the current ground surface elevations.

<u>Alignment</u>	<u>Station (±)</u>
-L3-	739+50 to 746+50
-L3-	759+50 to 765+25
-L3-	772+70 to 774+50
-L3-	775+75 to 776+25
-L3-	778+00 to 780+00, left
-L3-	807+70 to 814+00
-L3-	816+60 to 821+60
-L3-	872+70 to 874+25
-L3-	894+00 to 906+50
-L3-	934+50 to 936+50, right
-L3-	938+00 to 954+80
-L3-	992+50 to 993+50, left
-Y2-	24+00 to 33+00
-LPB-	17+00 to 22+05

-RPB-	15+50 to 19+50, left
-RPB-	25+50 to 30+40
-RPC-	13+00 to 17+50
-RPC-	22+75 to 23+25, right
-LPD-	15+60 to 25+00
-RPD-	27+00 to 29+00
-Y6-	30+50 to 33+00
-Y11-	11+00 to 12+75, left
-Y12-	14+00 to 15+25
-Y19-	19+00 to 22+50
-Y22A-	39+75 to 40+25
-DR3-	13+80 to 14+25

-L3-	995+65, 212' left
-RPD-	22+28, 49' right

**Physiography and Geology**

The proposed road will generally run in a north-to-south direction, and primarily through undeveloped, wooded, and residential properties. However, from the beginning of the project through its crossing of Charlotte Road, the proposed road generally traverses through commercial properties. The existing ground surface along the centerline of the proposed road generally slopes upward from an elevation (EL) of ±995 feet at the beginning of the project to EL ±1,076 feet near station 754+00, and then downward to EL ±1,001 feet near station 767+00. The ground surface then generally slopes upward to EL ±1,038 feet near station 771+50 and then downward to EL ±984 feet at the proposed dual bridges over Charlotte Road (-Y2-, near station 774+50). The ground surface then generally slopes upward to EL ±1,072 feet near station 784+00, downward to EL ±929 feet near station 797+75 (location of the first culvert investigated), and then upward to EL ±1,035 feet near station 804+50. The existing ground surface at the proposed bridge on -Y19- over -L3- near station 812+50 is at EL ±982 feet. The ground surface then generally slopes downward to EL ±940 feet near station 815+00, upward to EL ±989 feet near station 822+00, and then downward to EL ±944 feet near station 831+25 (location of the second culvert investigated). The existing ground surface at the proposed bridge on -Y3- over -L3- near station 843+45 is at EL ±1,058 feet. The ground surface then generally slopes upward to EL ±1,075 feet near station 847+50, downward to EL ±925 feet near station 874+50 (location of the third culvert investigated), and then upward to EL ±1,073 feet near station 919+00. The ground surface is then relatively level, sloping gradually upward to EL ±1088 feet near station 954+00 and then gradually downward to EL ±1022 feet near station 998+00. Finally, the ground surface then slopes upward to EL ±1,044 feet near the end of the project.

The surface water across the southern portion of the project is generally drained by Cleghorn Creek, which is present about ¼ to ½ mile west of the proposed road and generally flows in a north-south direction. The surface water across the northern portion of the project is generally drained by Hollands Creek, which generally flows in a northwest-to-southeast direction. Hollands Creek is generally about 700 to 1,500 feet east of the proposed road; however, at about -L3- station 874+50, Hollands Creek crosses the alignment where a culvert will likely be necessary. Numerous other drainage features cross the site with the most notable features located at approximate -L3- stations 797+75 and 831+25, where additional culverts will likely be necessary. In addition, from about -L3- 831+25 to 836+50, several spring-fed streams run about parallel with the alignment and intersect the larger drainage feature at 831+25. Severe erosion was also observed in this area at about 830+50, 180 feet left, which appears to have originated from a drain pipe next to the road. Another noted drainage feature is located on -Y11- at approximate station 21+00, and this is also indicated to be stream-fed. Numerous other springs are also indicated on the roadway plans and are located within the project limits.

The project is located in the Piedmont Physiographic Province of North Carolina within the Inner Piedmont Belt. More-specifically, it is located in an area mapped as migmatitic granitic gneiss (OCgm), amphibolite and biotite gneiss (CZab), and mica schist (CZms). Typical weathered rock samples recovered from our borings primarily exhibit the characteristics of biotite gneiss or mica schist. Soils weathered from the

9) **Organic Soils:** The following locations were found to contain organic-laden soils (greater than 4% organic and 4 inches in thickness), which have the potential to cause subgrade problems during construction, embankment instability, or long-term settlement problems. Organic content tests were performed on 8 topsoil samples, and the results ranged from 7.7 to 17.0% organic content:

<u>Alignment</u>	<u>Station (±)</u>	<u>Association</u>
-L3-	790+50 to 791+50	Topsoil/root mat
-L3-	794+50 to 795+50	Topsoil/root mat
-L3-	809+50 to 810+50	Topsoil/root mat
-L3-	986+50 to 987+50	Topsoil/root mat
-RPA-	20+50 to 21+50	Topsoil/root mat
-Y11-	12+50 to 13+50	Topsoil/root mat
-Y11-	21+50 to 22+50	Topsoil/root mat
-Y12-	21+50 to 22+50	Topsoil/root mat

10) **Springs:** Springs were located within the proposed construction limits at the following locations:

<u>Line</u>	<u>Station (±)</u>
-L3-	739+88, 20' left
-L3-	815+06, 4' left
-L3-	815+48, 103' left
-L3-	834+29, 15' right
-L3-	834+95, 27' left
-L3-	835+24, 29' right
-L3-	835+99, 55' right
-L3-	836+46, 88' right
-L3-	968+63, 161' left
-L3-	969+07, 192' left



parent rock generally consist of sandy silts and silty sands. The in-situ soils are the residual product of in-place chemical weathering of rock that was similar to the rock presently underlying the site.

During the investigation, we observed one general area that contained exposed rock at the existing ground surface. This area is generally located at the proposed dual bridges on -L3- over -Y2- (Charlotte Road). More-specifically, rock was observed within the slope on the north side of the road approximately between -Y2- station 28+00 to 31+00, left. Rock was also observed within the slope face on the south side of -Y2- behind the commercial buildings approximately from -Y2- station 27+00 to 33+00, right.

### Soils Properties

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

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

**Artificial Fill:** Artificial fill (AF) was encountered at the surface of 49 borings. The AF extended to depths ranging from 2 to 37 feet, with most extending to less than about 7 feet. The artificial fill was typically described as moist, medium stiff to very stiff sandy and silty CLAY (A-7) and loose to medium dense silty SAND (A-2-4). A majority of the samples contained trace organic matter, mica and gravel. Trash and debris was encountered at borings L3\_77403L(1) and LPD\_2260R from a depth of about 16.6 to 20.4 feet and from 2 to 7 feet, respectively. Boulder fill was encountered at boring L3\_77377R(1) to a depth of about 4.3 feet, at which depth the boring was terminated. Offset boring L3\_77377R(2) was performed to a depth of about 29.8 feet, which did not encounter boulder fill.

**Roadway Embankment:** Roadway embankment (RE) soils were encountered at the surface of 9 borings. The RE was typically associated with existing Charlotte Road and Collett Street. The RE extended to depths ranging from 2 to 6 feet, with most less than about 2 feet. The fill was variable and described as moist, medium stiff to stiff, sandy and silty CLAY (A-6 & A-7), medium stiff to very stiff sandy SILT (A-4) and loose to medium dense silty SAND (A-2-4). A majority of the samples contained trace organic matter, mica and gravel.

**Alluvial Soil:** Alluvial soils were encountered in 25 borings. The alluvial soils were typically encountered below artificial fill and at the ground surface where they were associated with varying-sized drainage systems crossing the alignment. The alluvial extended to depths ranging from 2 to 42 feet with an average of about 17 feet. The alluvium was typically described as moist to saturated, very loose to loose, silty and clayey SAND (A-2-4 & A-2-6), very soft to medium stiff sandy and clayey SILT (A-4 & A-5), and very soft to

medium stiff, sandy and silty CLAY (A-6 & A-7). A majority of the soil samples contained trace organic matter, mica, and gravel.

**Residual Soil:** A majority of the soils encountered on this project were residual soils. Residual soils were encountered at the surface of 146 borings, below artificial fill at 33 borings, below alluvial soils at 25 borings, and below roadway embankment at 7 borings. No residual soils were encountered in 5 borings, and these borings were terminated in artificial fill or weathered rock/crystalline rock. The residual soils were typically described as moist, medium stiff to stiff sandy and silty CLAY (A-6 & A-7) in the upper 2 to 7 feet of the borings. The surficial clays were then typically underlain by moist, medium stiff to very stiff, sandy and clayey SILT (A-4 & A-5), and medium dense to dense silty SAND (A-2-4). A majority of the samples contained varying amounts of mica and manganese oxides.

### Rock Properties

Weathered Rock (WR) was encountered in 58 borings. Of these 58 borings, 7 of the borings terminated in residual soils, 22 terminated in WR, and 29 terminated in/on Crystalline Rock (CR). Twenty-five of the borings encountered intermediate layers of WR before re-encountering soils below this layer. Of these 25 borings, 7 borings terminated in residual soils and 18 borings re-encountered WR and/or CR at boring termination. These intermediate zones of WR ranged in thickness from about 1 to 15 feet. Excluding the intermediate zones of WR, the WR was encountered at depths ranging from about 4 to 72 feet and elevations ranging from about 893 to 1,072 feet.

CR was encountered in 51 borings as indicated by auger and SPT refusal. Of these 51 borings, 50 of the borings terminated in/on CR and 1 terminated in WR. Four of the borings encountered intermediate layers of CR before re-encountering soils or WR below this layer. Of these 4 borings, 1 boring terminated in WR and 4 borings re-encountered CR at boring termination. These intermediate zones of CR ranged in thickness from about 1 to 5 feet. The CR was encountered at depths ranging from about 7 to 77 feet, or elevations ranging from about 888 to 1,062 feet. The rock typically consisted of biotite gneiss and mica schist. Refusal is a designation applied to any material that cannot be penetrated by the soil auger, and is typically caused by encountering boulders, hard rock lenses/ledges or bedrock. The nature of the materials causing refusal was not explored in these borings, but is anticipated to represent the CR level.

### Groundwater Properties

Generally, groundwater measurements were attempted in a majority of the borings along the project immediately upon their completion and after a stabilization period of approximately 24 hours. Twenty-one borings were backfilled immediately upon their completion. Immediately upon completion, groundwater was encountered in 62 borings at depths ranging from 1.2 to 62.1 feet, and elevations ranging from about 907.7 to 1,034.7 feet. Stabilized groundwater was encountered in 62 borings at depths ranging from 0.5 to 53 feet, and elevations ranging from 914.1 to 1,032.3 feet. Groundwater was not encountered in the remaining borings. The recovered soil samples were generally described as moist above the groundwater level and wet or saturated below the groundwater level. It should be noted that the groundwater levels

fluctuate depending upon seasonal factors such as precipitation and temperature. As such, soil moisture and groundwater conditions at other times may vary or be different from those described in this report.

### Geotechnical Descriptive Analysis of the Project

For descriptive purposes, the project has been divided into three segments. The division of the segments is primarily based on the centerline topography of the proposed roadway.

#### **Segment 1: -L3- Station 739+50 to 878+00 (±):**

Segment 1 of the project generally traverses existing commercial properties and wooded areas, with fewer impacts on residential areas. The project begins at an existing elevation (EL) of ±995 feet with dramatic upward and downward elevation changes and ends at existing EL ±945. Maximum elevations exist in the following areas: from -L3- station 754+00 to 764+50 (EL ±1,077); at station 784+00 (EL ±1,072); and at station 847+50 (EL ±1,076). The lowest elevations exist in the following areas: station 774+50 (EL ±983, intersection with -Y2-); at station 797+75 (EL ±930, at a stream); at station 815+00 (EL ±940, at a possible spring); at station 831+25 (EL ±944, at a stream); at station 866+00 (EL ±946, at a stream); and at station 874+50 (EL ±925, at a stream). The size and locations of proposed pipes and/or culverts is unknown at this time.

This segment requires maximum fills up to about 90 feet as measured at the centerline of the road, which occurs at about -L3- station 797+75. Other locations where maximum fill depths are required exist at: about station 746+00 (38' fill); station 831+25 (60' fill); and at station 865+75 (36' fill). The subgrade within the areas of proposed fills is anticipated to consist mainly of soft to stiff residual clays (A-7) and soft to medium stiff residual silts (A-4 & A-5).

This segment requires maximum cuts up to about 46 feet as measured at the centerline of the road, which occurs at about -L3- station 784+00. Other locations where maximum cut depths are required exist at: about station 764+50 (40' cut); station 804+50 (40' cut); and at station 847+50 (42' cut). The unclassified excavation to be encountered in the cuts is anticipated to consist mainly of residual clays (A-7) near the surface underlain by silts (A-4 & A-5) and silty sands (A-2-4). The subgrade within the areas of proposed cuts is anticipated to consist mainly of medium stiff to hard residual silts (A-4 & A-5) and medium dense to very dense silty sands (A-2-4).

#### **Segment 2: -L3- Station 878+00 to 951+00 (±):**

Segment 2 of the project generally traverses existing residential properties with more-significant impacts to existing homes. The project begins at an existing elevation (EL) of ±945 feet and ends at existing EL ±1,085, with more-gentle and less-significant grade changes. The maximum elevation exists in the area between station 918+00 and 951+00 where the ground surface is relatively level and ranges from about EL ±1,060 to 1,085. The lowest elevation exists at the beginning of this segment at station 878+00 (EL ±945) since the elevation generally increases to the end of this segment.

This segment requires maximum fills up to about 15 feet as measured at the centerline of the road, which occurs at about -L3- station 947+00, although fills less than about 7 feet are typically required. The subgrade within the areas of proposed fills is anticipated to consist mainly of soft to medium stiff residual clays (A-6 & A-7).

This segment requires maximum cuts up to about 11 feet as measured at the centerline of the road, which occurs at about -L3- station 898+50. The unclassified excavation to be encountered in the cuts is anticipated to consist mainly of clayey artificial fill and residual soils (A-7) and residual silts (A-4). The subgrade within the areas of proposed cuts is anticipated to consist mainly of stiff residual clays and silts (A-7 & A-4).

#### **Segment 3: -L3- Station 951+00 to 1004+00 (±):**

Segment 3 of the project generally consists of widening existing US-221 from its intersection with Thompson Road to the end of the project, which is just past the northernmost intersection of Roper Loop Road. The widened areas generally extend west of the existing road into residential and commercial properties, although the impacts are generally restricted to the wooded and/or undeveloped portions of the properties. The project begins at an existing EL of ±1,085 and ends at existing EL ±1,045. The maximum elevation exists at about -L3- station 954+00 at EL ±1,088. The lowest elevation exists at station 998+00 (EL ±1,022).

Through station 960+50, the proposed road contains existing cut slopes on the right side of the proposed alignment and is relatively level on the left. Through station 972+50, existing fill slopes are present on both sides, and then through station 988+50, existing cut slopes are present on both sides of the proposed alignment. Through station 998+50, existing fill slopes are present on both sides, and then through the end of the project, existing cut slopes are present on both sides of the proposed alignment.

Generally, cut and fill on the order of 10 feet and less will be required at the centerline of the road. However, the widening will require cuts on the left up to about 50 feet (station 976+00) and cuts on the right up to about 32 feet (station 976+00). The unclassified excavation to be encountered in the cuts is anticipated to consist mainly of residual clays (A-7) near the surface underlain by silts (A-4 & A-5) and silty sands (A-2-4). The subgrade within the areas of proposed cuts is anticipated to consist mainly of medium stiff to very stiff residual silts (A-4 & A-5) and medium dense silty sand (A-2-4).

The widening will require fills up to 54 feet (station 996+00) on the left and fills up to 20 feet (station 970+00) on the right. Generally, only sliver fills are required on the right. The subgrade within the areas of proposed fills is anticipated to consist mainly of soft to medium stiff residual and alluvial clays (A-6 & A-7).

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

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

DocuSigned by:  
*W. Patrick Alton*  
 W. Patrick Alton, P.E.  
 Geotechnical Services Manager

DocuSigned by:  
*Derick Racey*  
 Derick Racey  
 Geotechnical Project Manager

**Appendix A**

**Shelby Tubes**

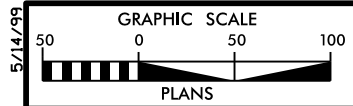
The following Shelby tubes were obtained and transported to our laboratory for potential testing to determine the engineering properties of the soil. A total of 23 Shelby tubes were attempted and only 17 samples were able to be obtained.

Sample No.	Boring No.	Line	Station	Offset	Depth (ft)	Test(s) Performed	
ST-1	L3_77369R	-L3-	773+69	145' Rt.	13.0 – 15.0	No recovery	
					15.0 – 17.0	Not tested	
ST-2	L3_77441L	-L3-	774+41	220' Lt.	18.0 – 20.0	No recovery	
					215' Lt.	17.5 – 19.5	No recovery
					210' Lt.	17.5 – 18.0	Only asphalt recovered
ST-3	L3_77900L	-L3-	779+00	70' Lt.	13.0 – 15.0	Hit a rock	
					70' Lt.	15.0 – 17.0	No recovery
					60' Lt.	13.0 – 15.0	Consolidation
ST-4	L3_80800	-L3-	808+00	CL	14.5 – 16.5	Consolidation	
ST-5	RPB_1732	-RPB-	17+32	CL	15.0 – 17.0	Not tested	
ST-6	RPB_1732	-RPB-	17+32	CL	17.0 – 19.0	CU Triaxial	
ST-7	Samples misnumbered, ST-7 does not exist						
ST-8	RPD_2100L	-RPD-	21+00	25' Lt.	5.5 – 7.5	Consolidation	
ST-9	L3_97600L	-L3-	976+00	70' Lt.	10.0 – 12.0	Not tested	
ST-10	L3_97600L	-L3-	976+00	70' Lt.	12.0 – 14.0	Not tested	
ST-11	L3_97800L	-L3-	978+00	70' Lt.	14.0 – 16.0	CU Triaxial	
ST-12	L3_97800L	-L3-	978+00	70' Lt.	18.5 – 20.5		
ST-13	L3_95625R	-L3-	956+49	98' Rt.	13.0 – 15.0	CU Triaxial	
ST-14	L3_95625R	-L3-	956+49	98' Rt.	15.0 – 17.0	Not tested	
ST-15	Y10_1700R	-Y10-	17+00	10' Rt.	14.0 – 16.0	CU Triaxial	
ST-16	Y10_1700R	-Y10-	17+00	10' Rt.	16.0 – 18.0	Consolidation	
ST-17	RPA_2100L	-RPA-	21+00	30' Lt.	17.0 – 19.0	Not tested	
ST-18	RPA_2100L	-RPA-	21+00	30' Lt.	19.0 – 21.0	Not tested	

**Bulk Samples**

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

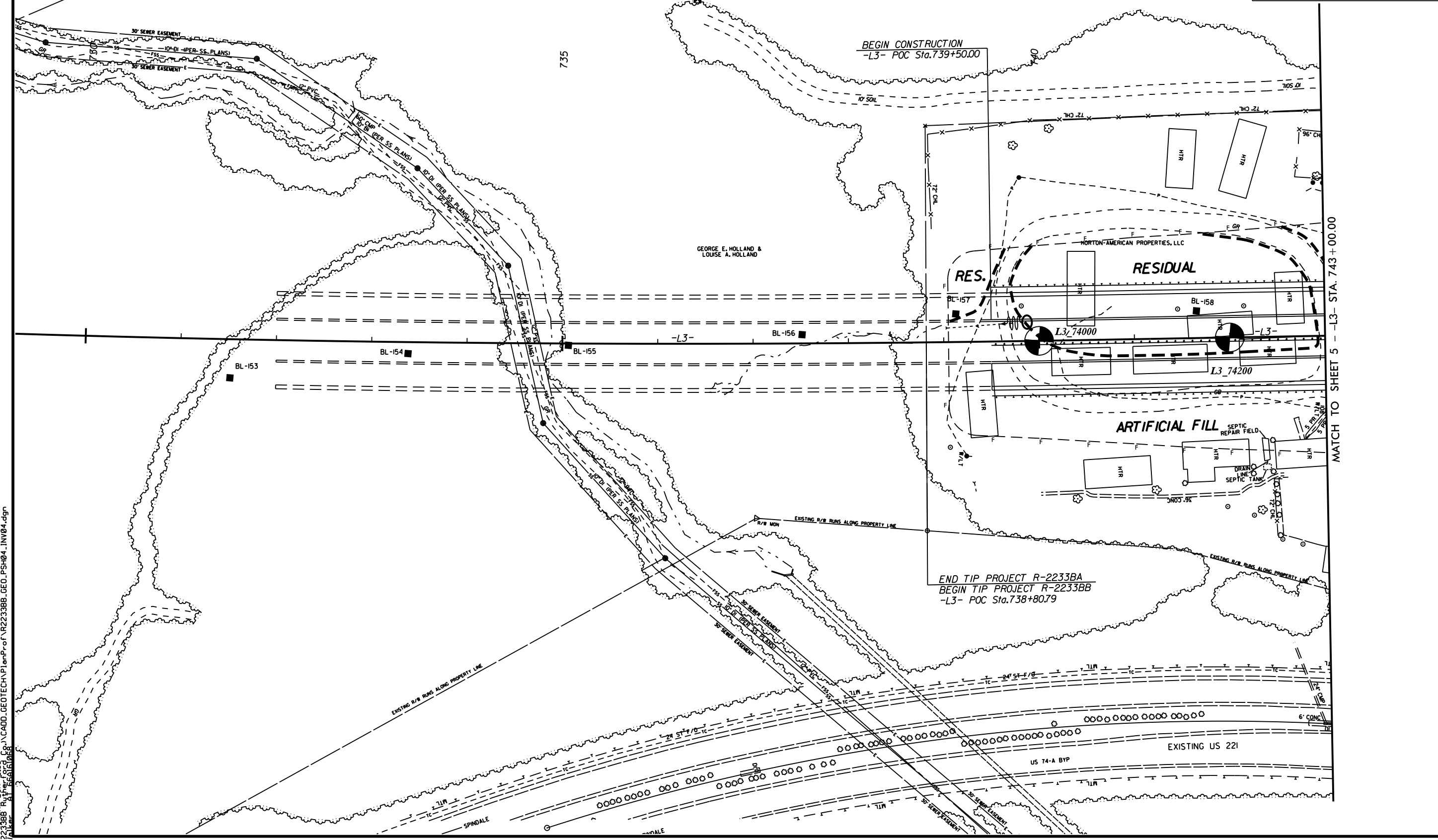
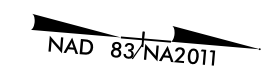
Sample No.	Boring No.	Line	Station	Offset	Depth (ft)	Test(s) Performed
S-1	L3_76200	-L3-	762+00	CL	5.0 – 13.0	Standard Proctor, CBR
S-2	RPA_2100L	-RPA-	21+00	30' Lt.	17.0 – 35.0	Standard Proctor, CBR
S-3	L3_95625R	-L3-	956+25	95' Rt.	11.0 – 17.0	Standard Proctor, CBR



5/14/99

PROJECT REFERENCE NO. R-2233BB	SHEET NO. 4
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	

DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED



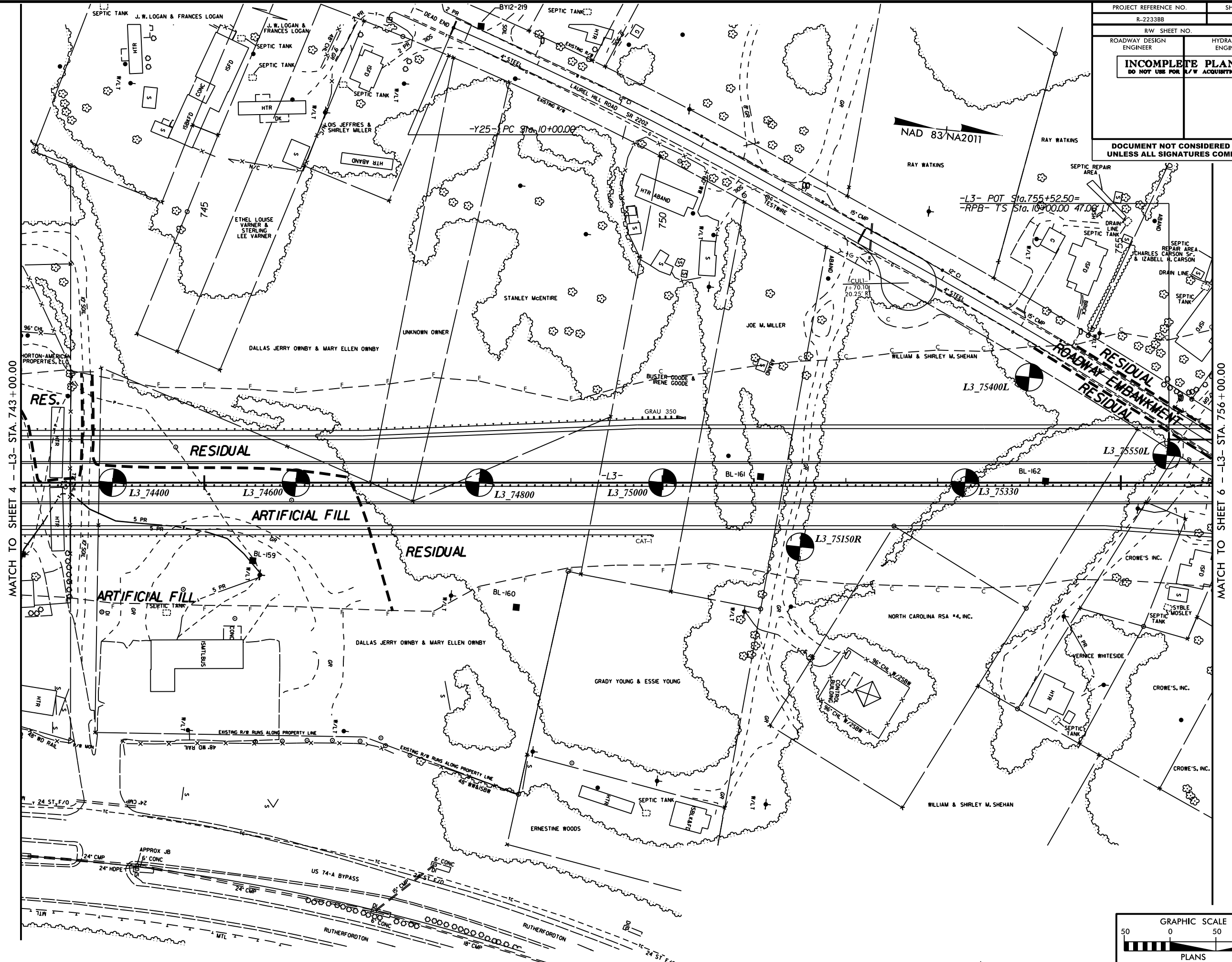
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MATCH TO SHEET 5 - L3- STA. 743+00.00

5/14/09

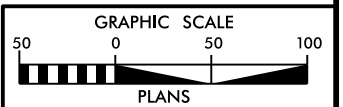
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<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



MATCH TO SHEET 4 - L3- STA. 743+00.00

MATCH TO SHEET 6 - L3- STA. 756+00.00



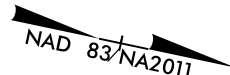
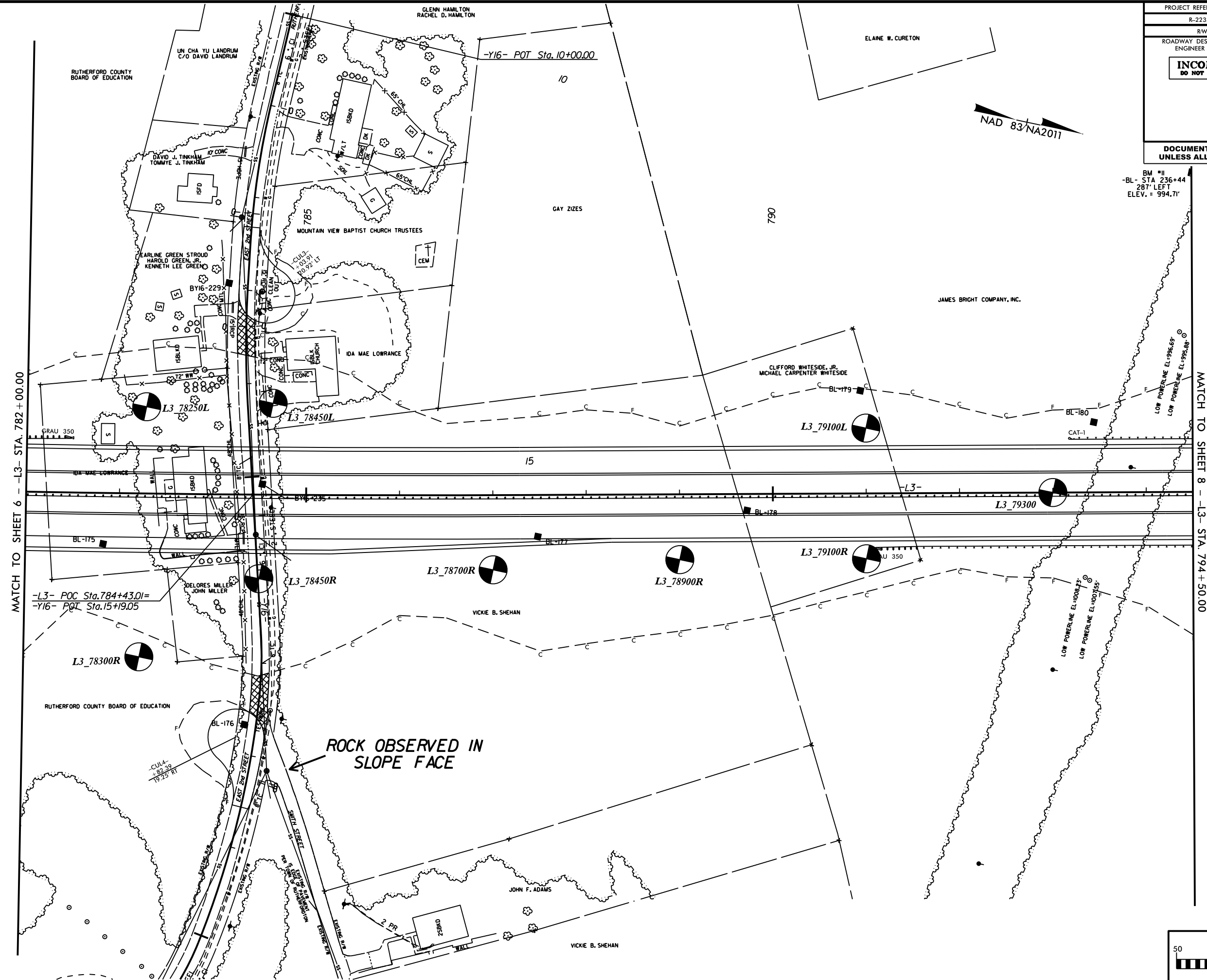
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 5/14/09



5/14/99

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ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	

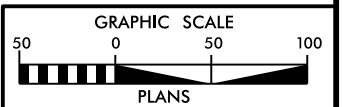
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



BM #11  
-BL- STA 236+44  
287' LEFT  
ELEV. = 994.71'

MATCH TO SHEET 8 - L3- STA. 794 + 50.00

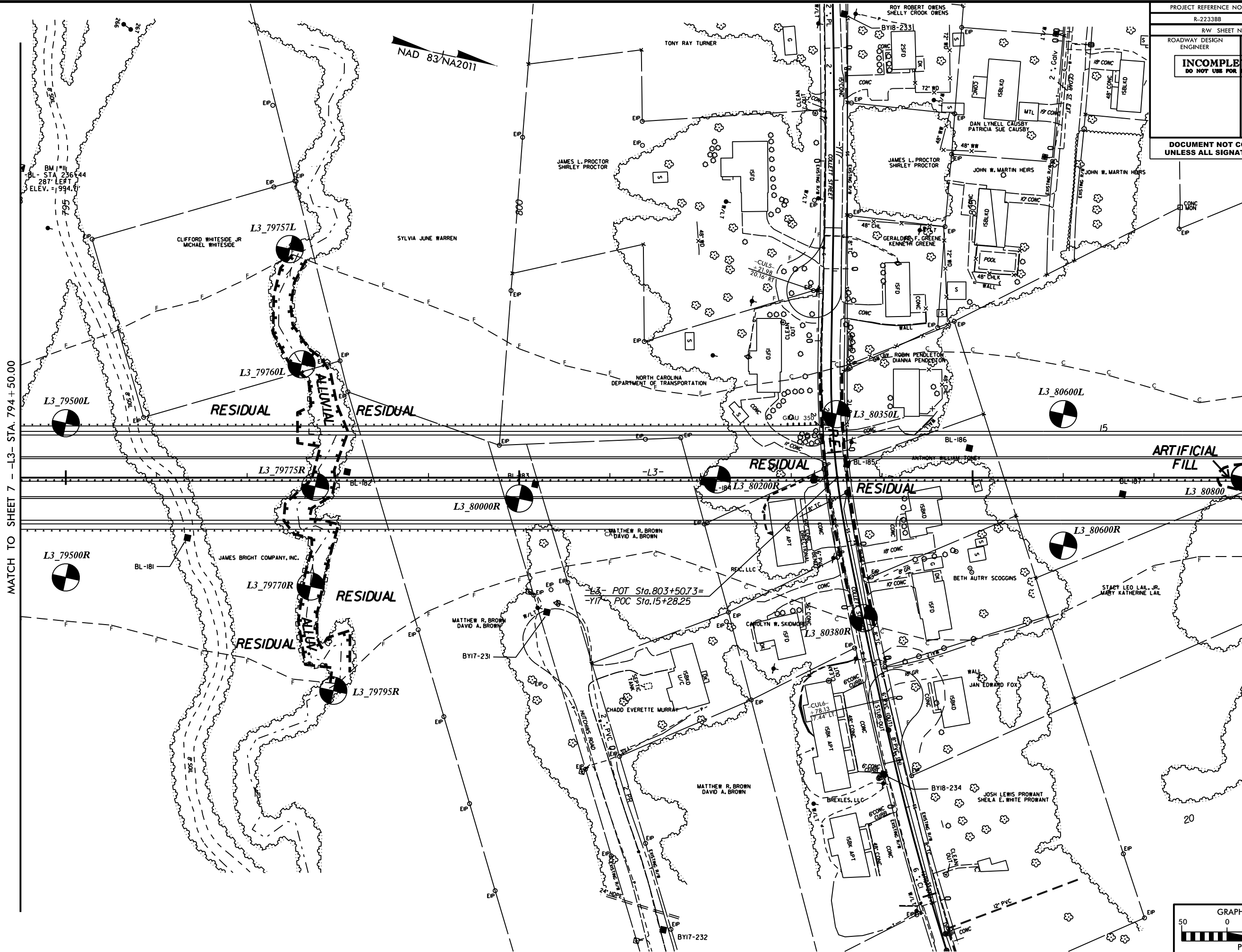
MATCH TO SHEET 6 - L3- STA. 782 + 00.00



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223388 Rutherford County Board of Education  
C:\CADD\GEO\TECH\PlanPrj\AR223388\_GEO\_PSH07\_INV07.DGN  
5/14/99

**INCOMPLETE PLANS**  
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED

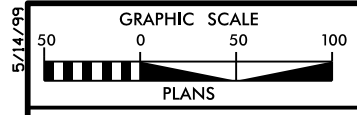


MATCH TO SHEET 7 --L3-- STA. 794+50.00

MATCH TO SHEET 9 --L3-- STA. 808+00.00

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Author: J. White  
Plotter: AT 556161088

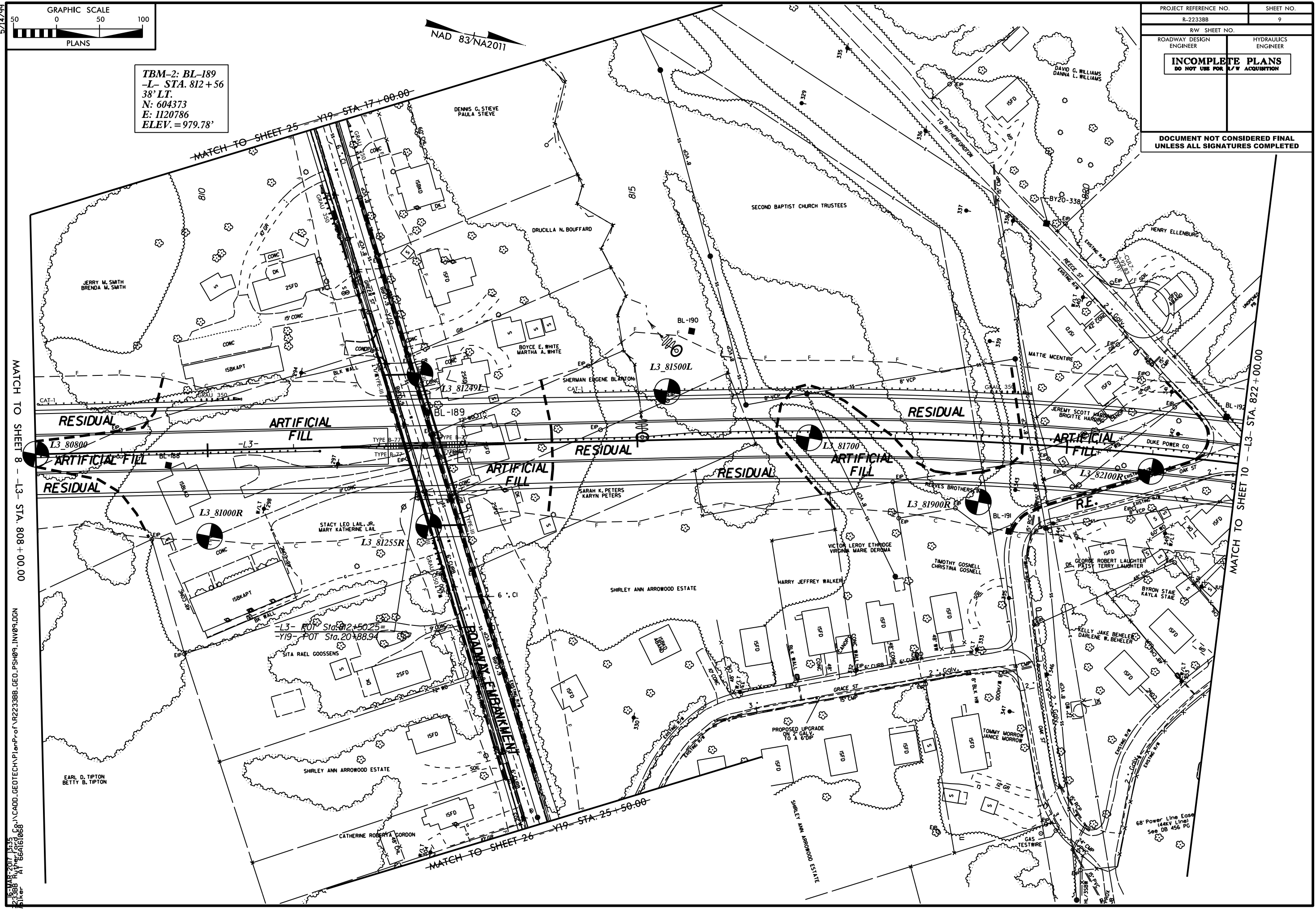




TBM-2: BL-189  
 -L- STA. 812+56  
 38' LT.  
 N: 604373  
 E: 1120786  
 ELEV. = 979.78'

NAD 83/NA2011

PROJECT REFERENCE NO. R-2233BB	SHEET NO. 9
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



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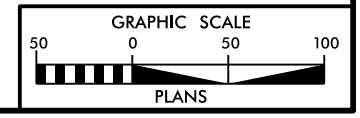
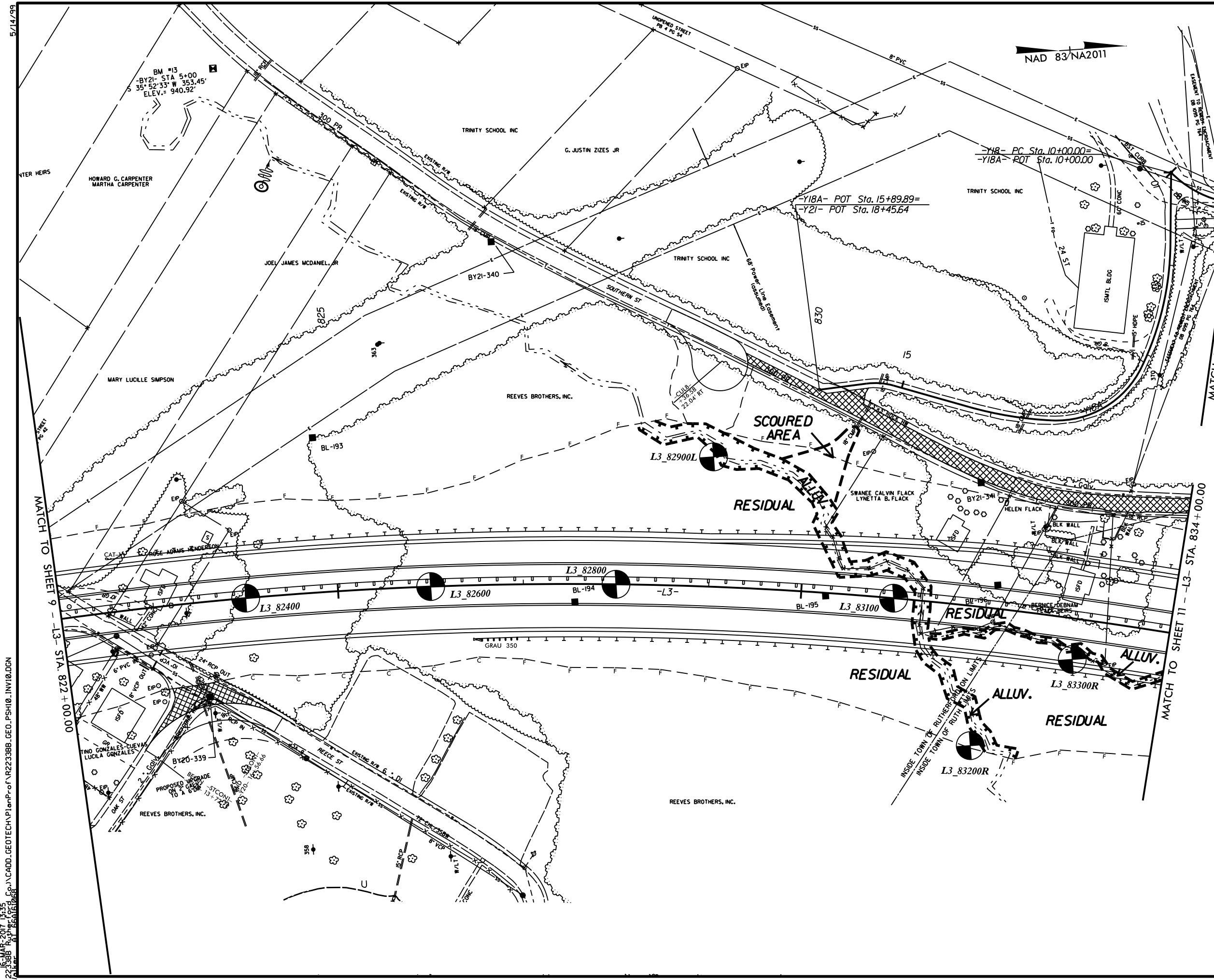
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 At 664161068

60' Power Line Eases  
 (44KV Line)  
 See DB 456 PG

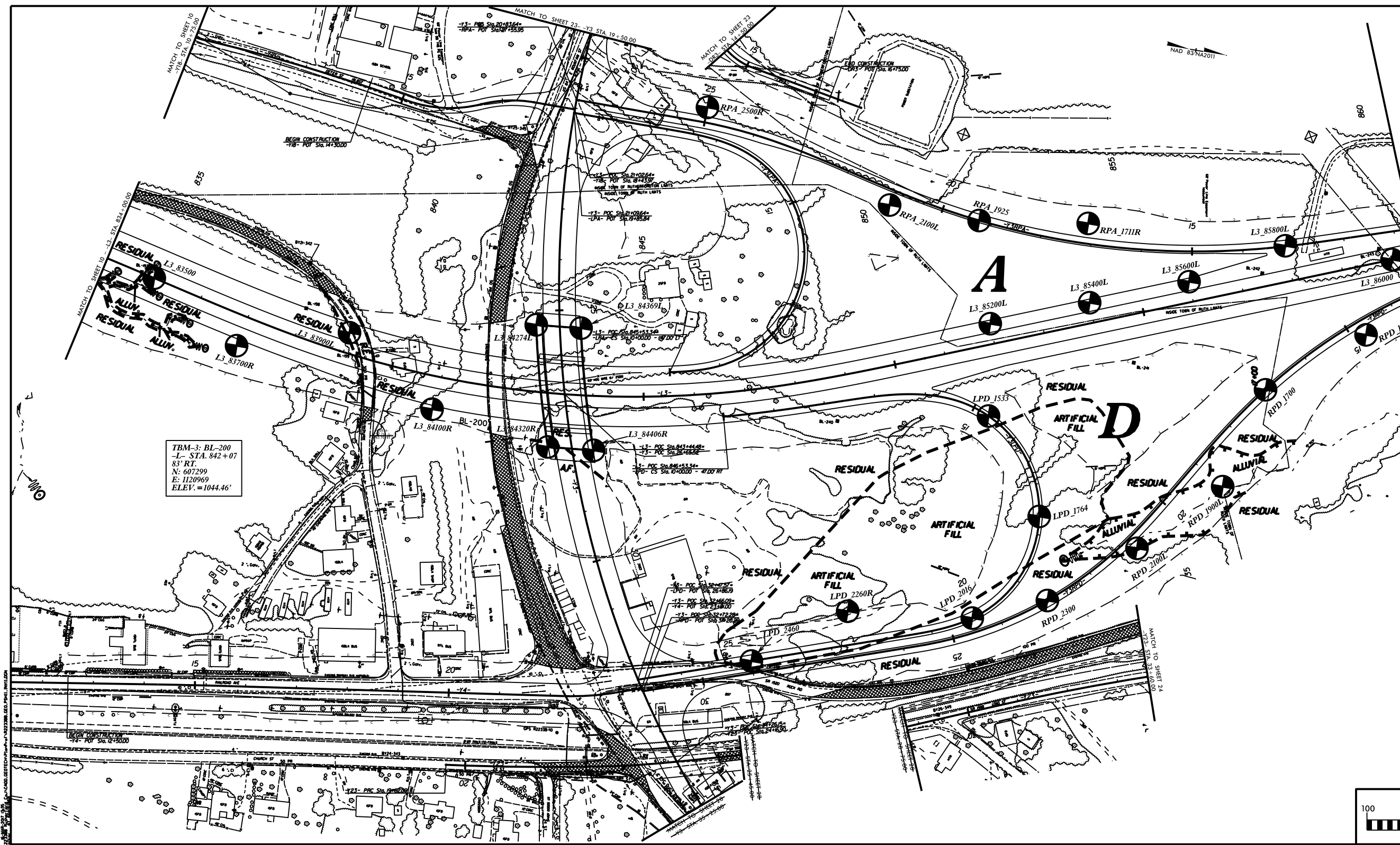
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<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	

DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED



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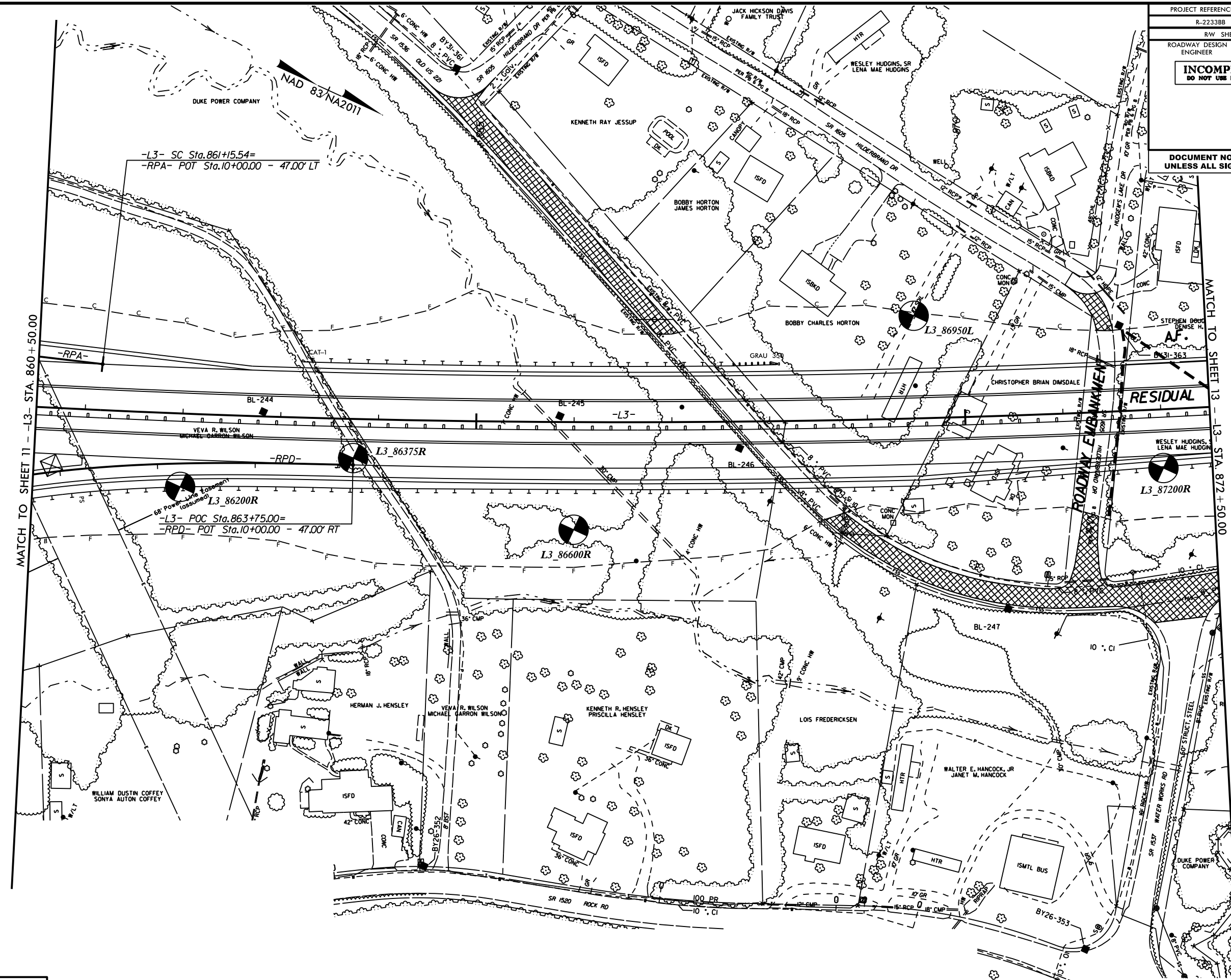
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R-22338B	11
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
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DO NOT USE FOR B/L/V ACQUISITION	
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



5/14/99

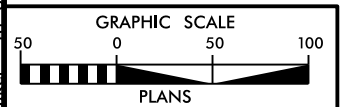
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R/W SHEET NO.	HYDRAULICS ENGINEER
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	

DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED



MATCH TO SHEET 11 - L3- STA. 860 + 50.00

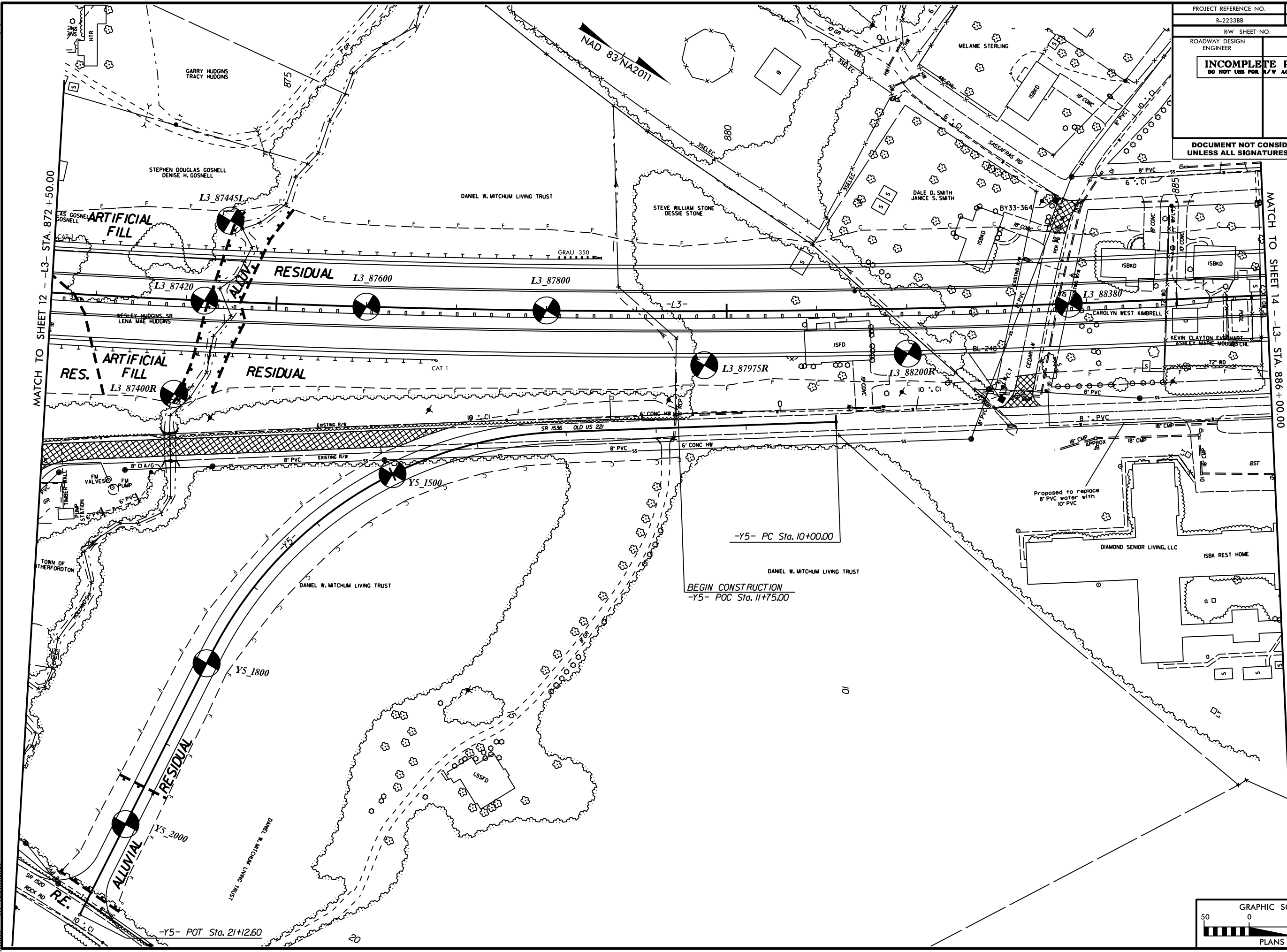
MATCH TO SHEET 13 - L3- STA. 872 + 50.00



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PROJECT REFERENCE NO. R-2233BB	SHEET NO. 13
R/W SHEET NO.	HYDRAULICS ENGINEER
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
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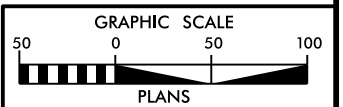
DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED



MATCH TO SHEET 12 - L3- STA. 872+50.00

MATCH TO SHEET 14 - L3- STA. 886+00.00

BEGIN CONSTRUCTION  
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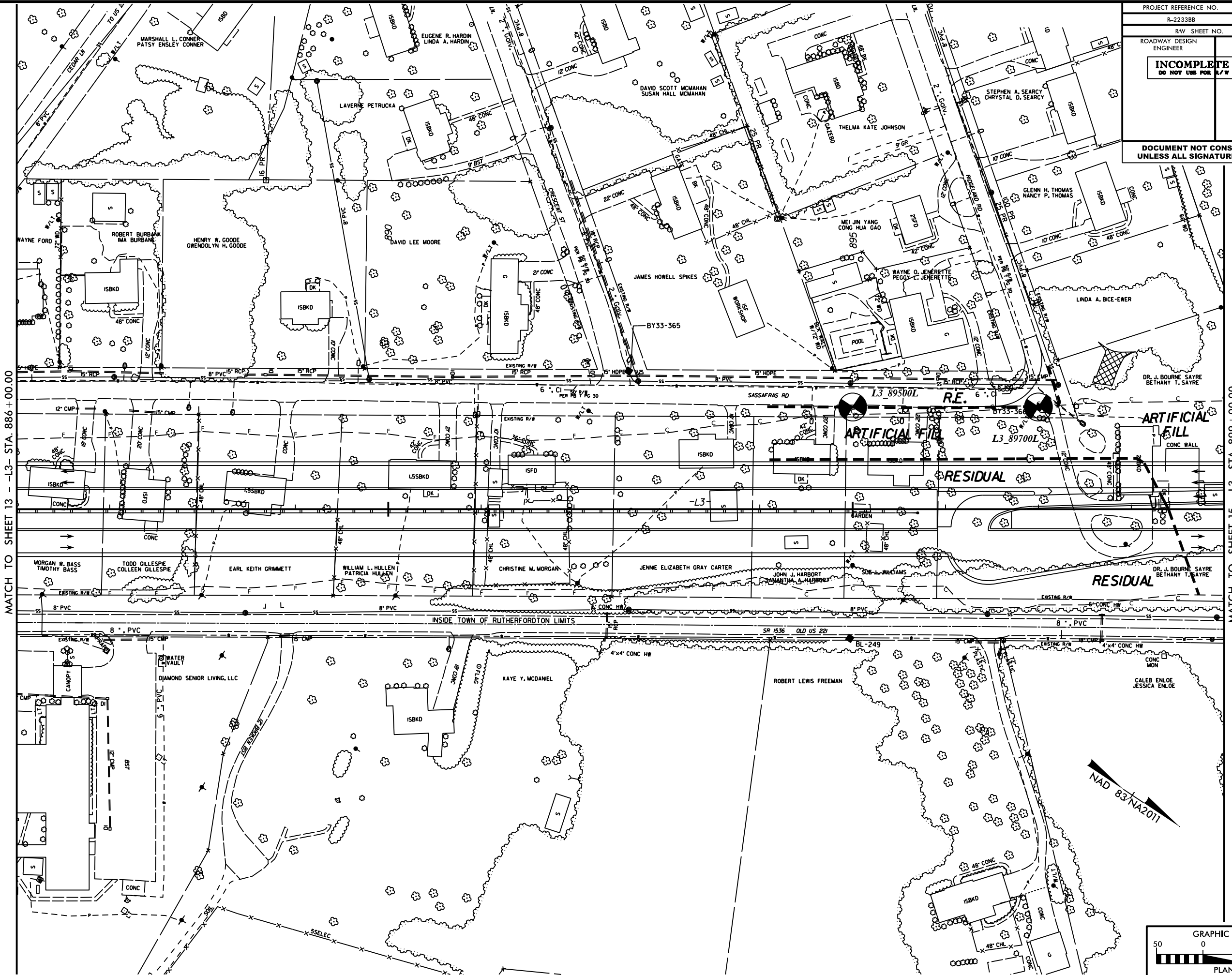


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5/14/09

PROJECT REFERENCE NO. R-2233BB	SHEET NO. 14
R/W SHEET NO. ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
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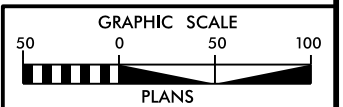
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UNLESS ALL SIGNATURES COMPLETED



MATCH TO SHEET 13 -L3- STA. 886+00.00

MATCH TO SHEET 15 -L3- STA. 899+00.00

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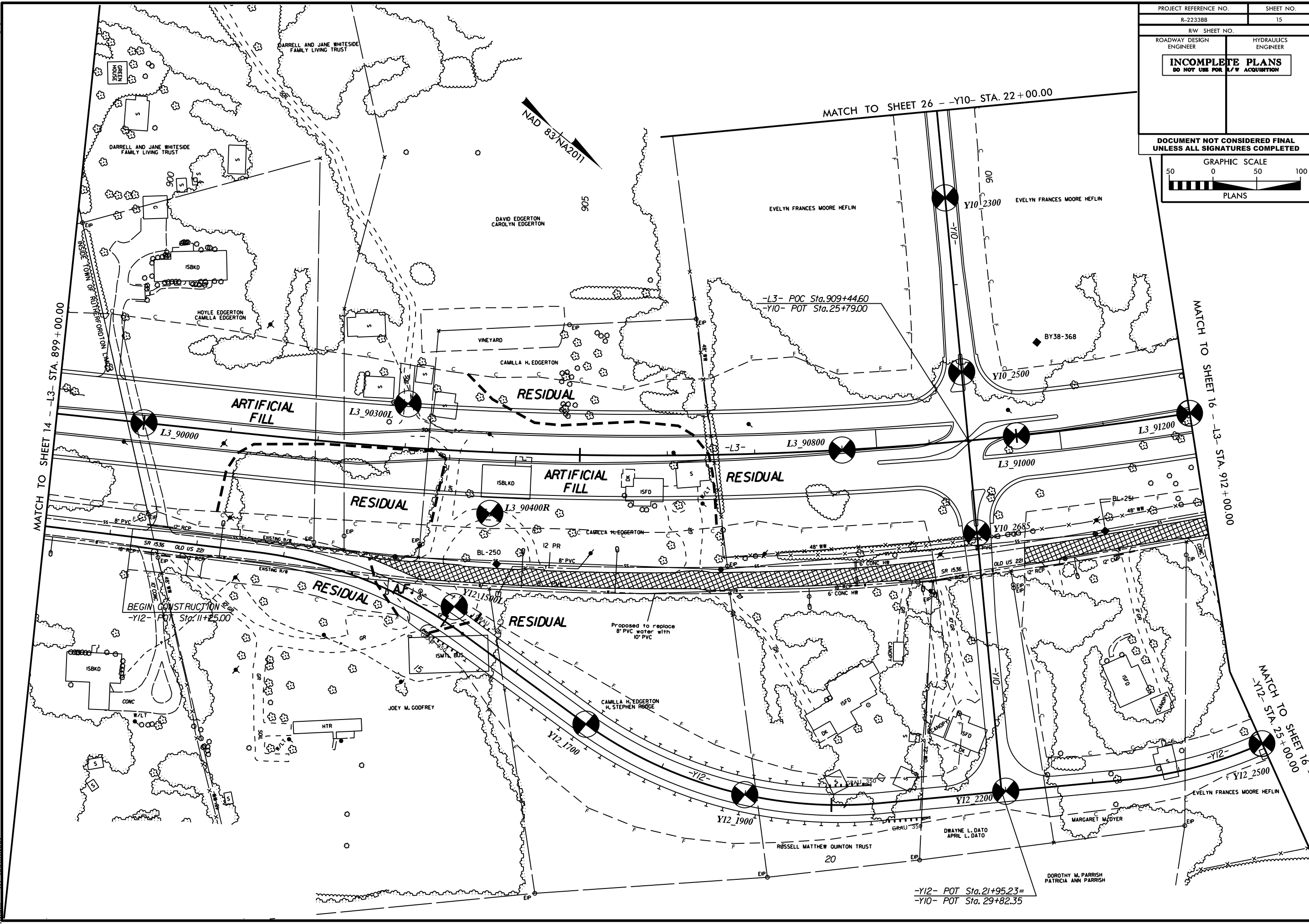


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UNLESS ALL SIGNATURES COMPLETED

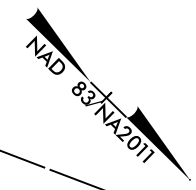
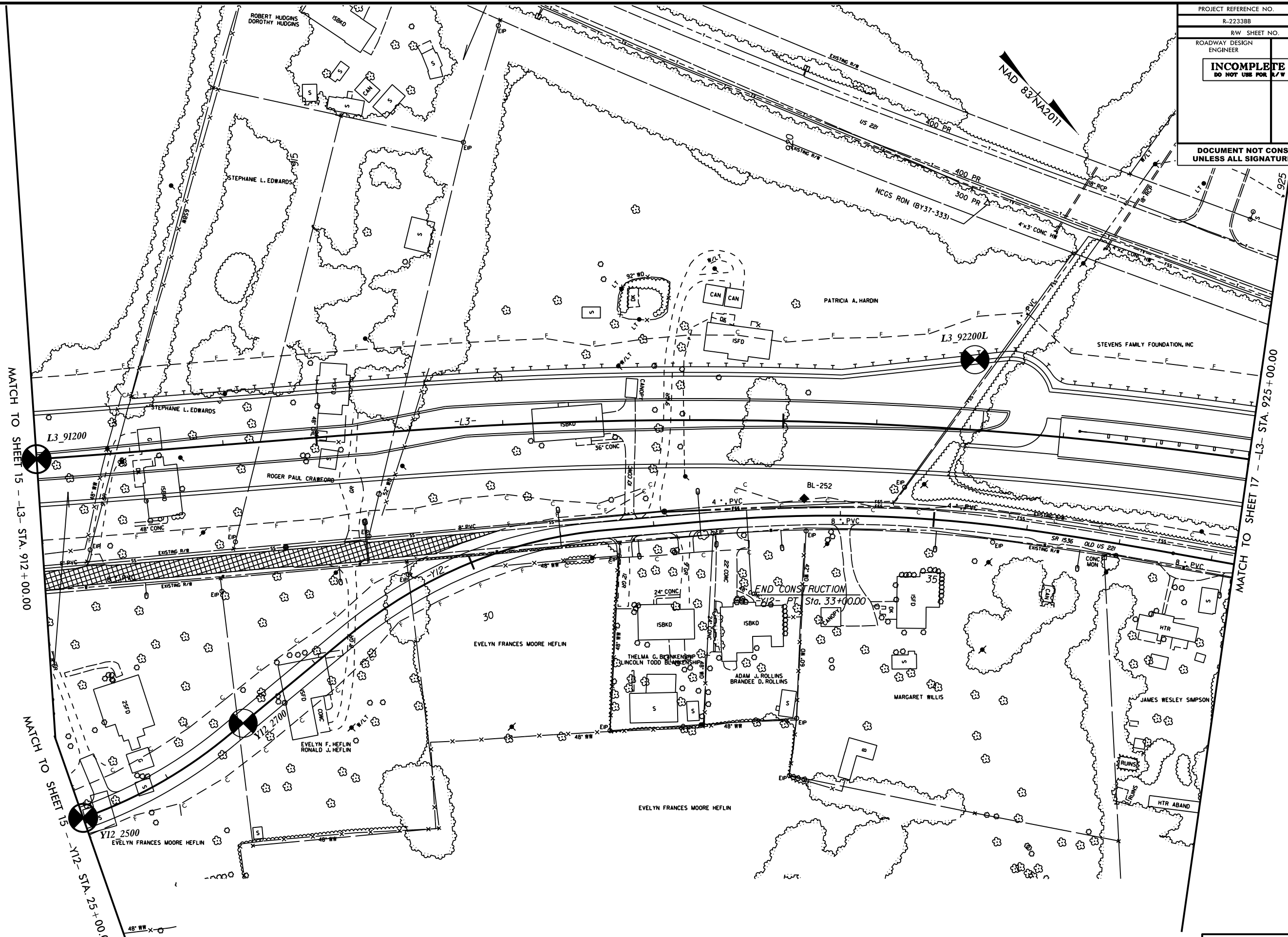
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PLANS



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 5/14/99

-Y12- POT Sta. 21+95.23=  
 -Y10- POT Sta. 29+82.35

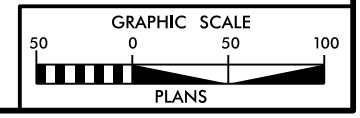
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R/W SHEET NO.	HYDRAULICS ENGINEER
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	
<b>DOCUMENT NOT CONSIDERED FINAL</b> UNLESS ALL SIGNATURES COMPLETED	



MATCH TO SHEET 15 --L3-- STA. 912+00.00

MATCH TO SHEET 15 --Y12-- STA. 25+00.00

MATCH TO SHEET 17 --L3-- STA. 925+00.00



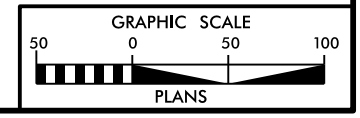
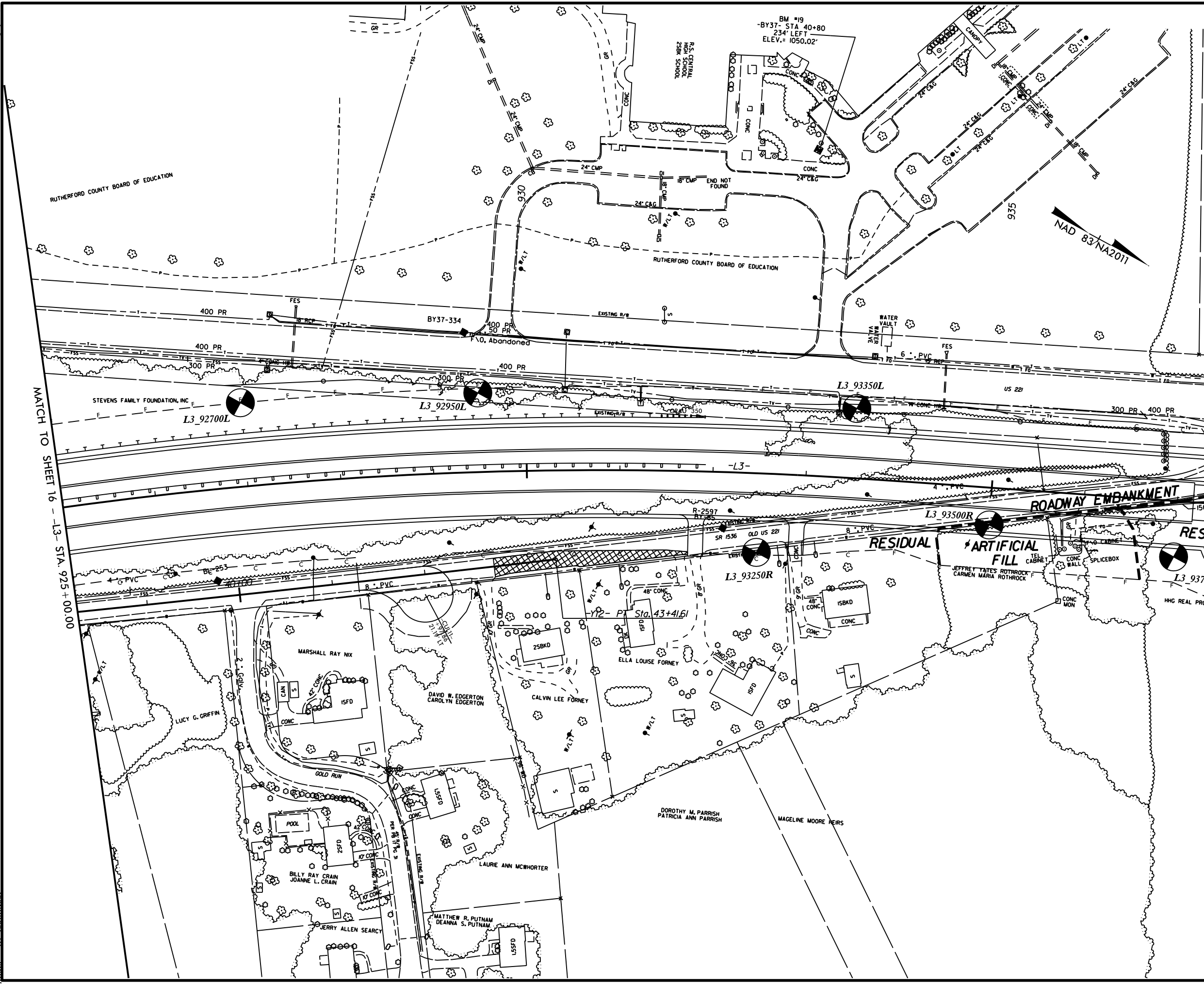
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PROJECT REFERENCE NO. R-2233BB	SHEET NO. 17
R/W SHEET NO.	HYDRAULICS ENGINEER
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
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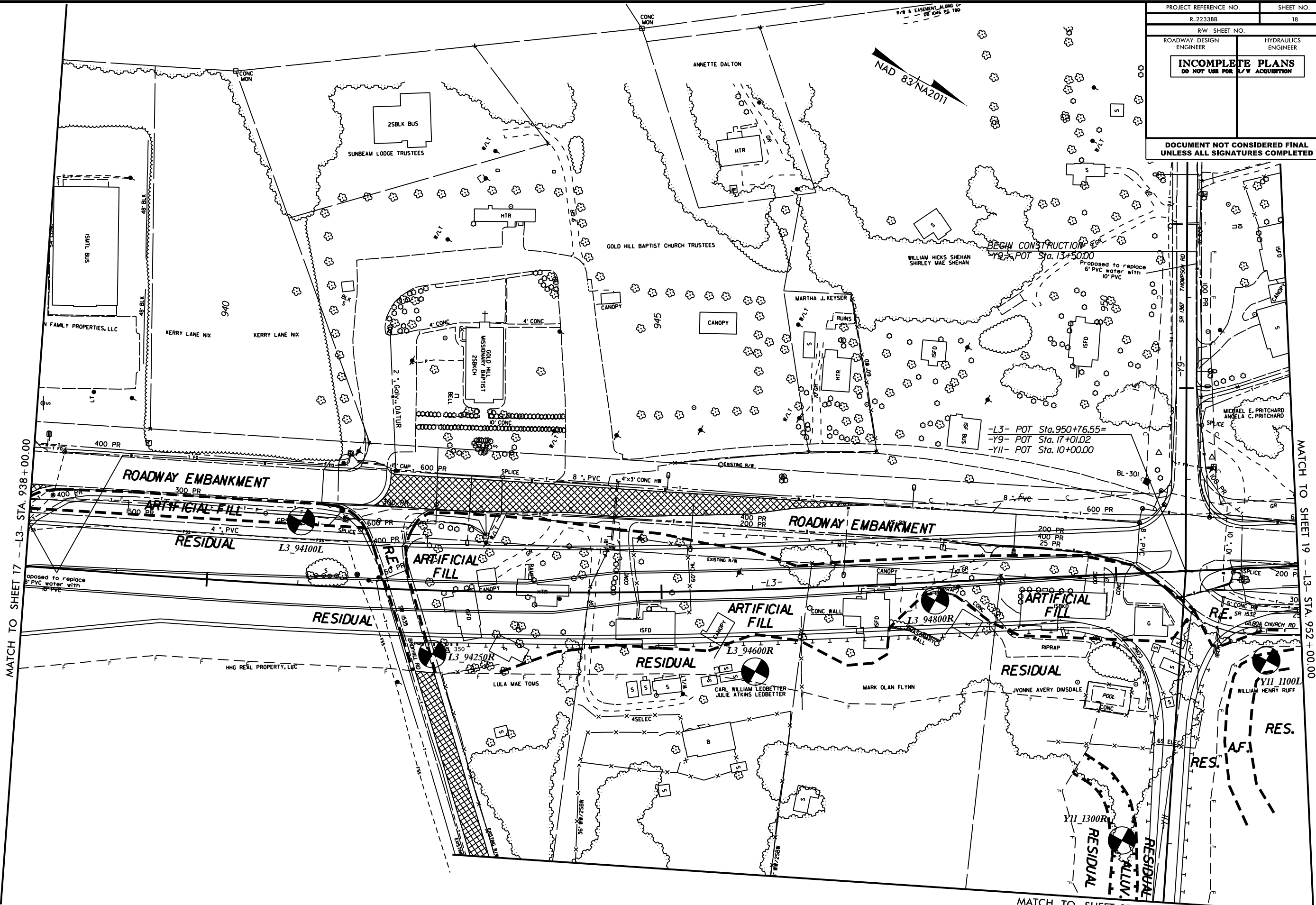
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UNLESS ALL SIGNATURES COMPLETED

5/14/99  
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Author: J. B. B. 5/14/99



5/14/99

PROJECT REFERENCE NO.	SHEET NO.
R-2233BB	18
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
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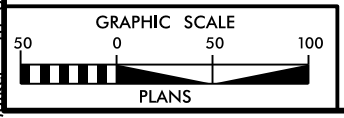


MATCH TO SHEET 17 --L3-- STA. 938+00.00

MATCH TO SHEET 19 --L3-- STA. 952+00.00

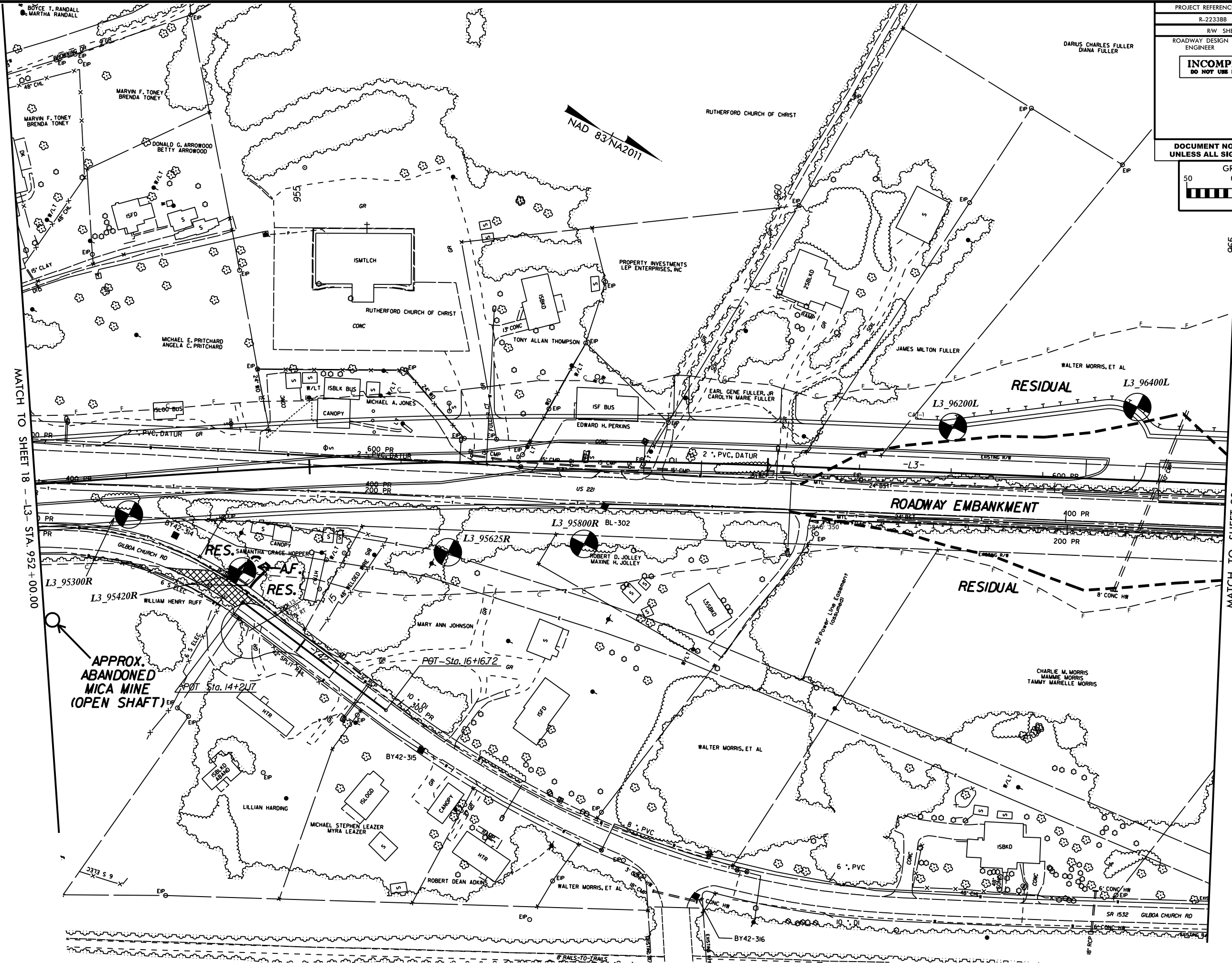
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5/14/99

PROJECT REFERENCE NO. R-2233BB	SHEET NO. 19
R/W SHEET NO.	HYDRAULICS ENGINEER
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	
<b>DOCUMENT NOT CONSIDERED FINAL</b> UNLESS ALL SIGNATURES COMPLETED	
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MATCH TO SHEET 18 - L3- STA. 952+00.00

MATCH TO SHEET 20 - L3- STA. 965+00.00

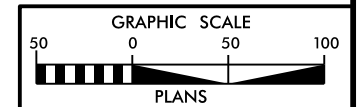
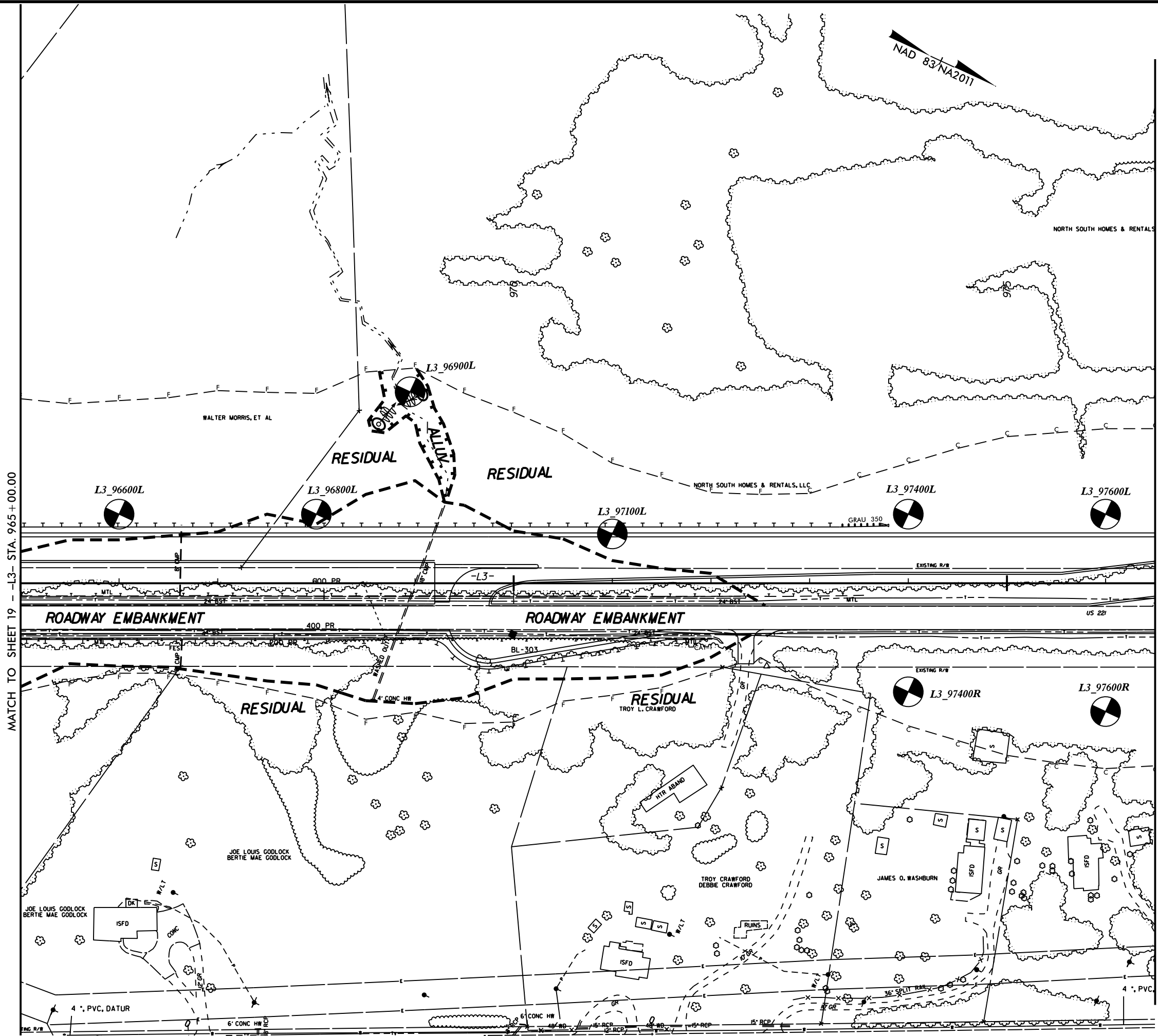
APPROX. ABANDONED MICA MINE (OPEN SHAFT)

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5/14/99

PROJECT REFERENCE NO. R-2233BB	SHEET NO. 20
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	

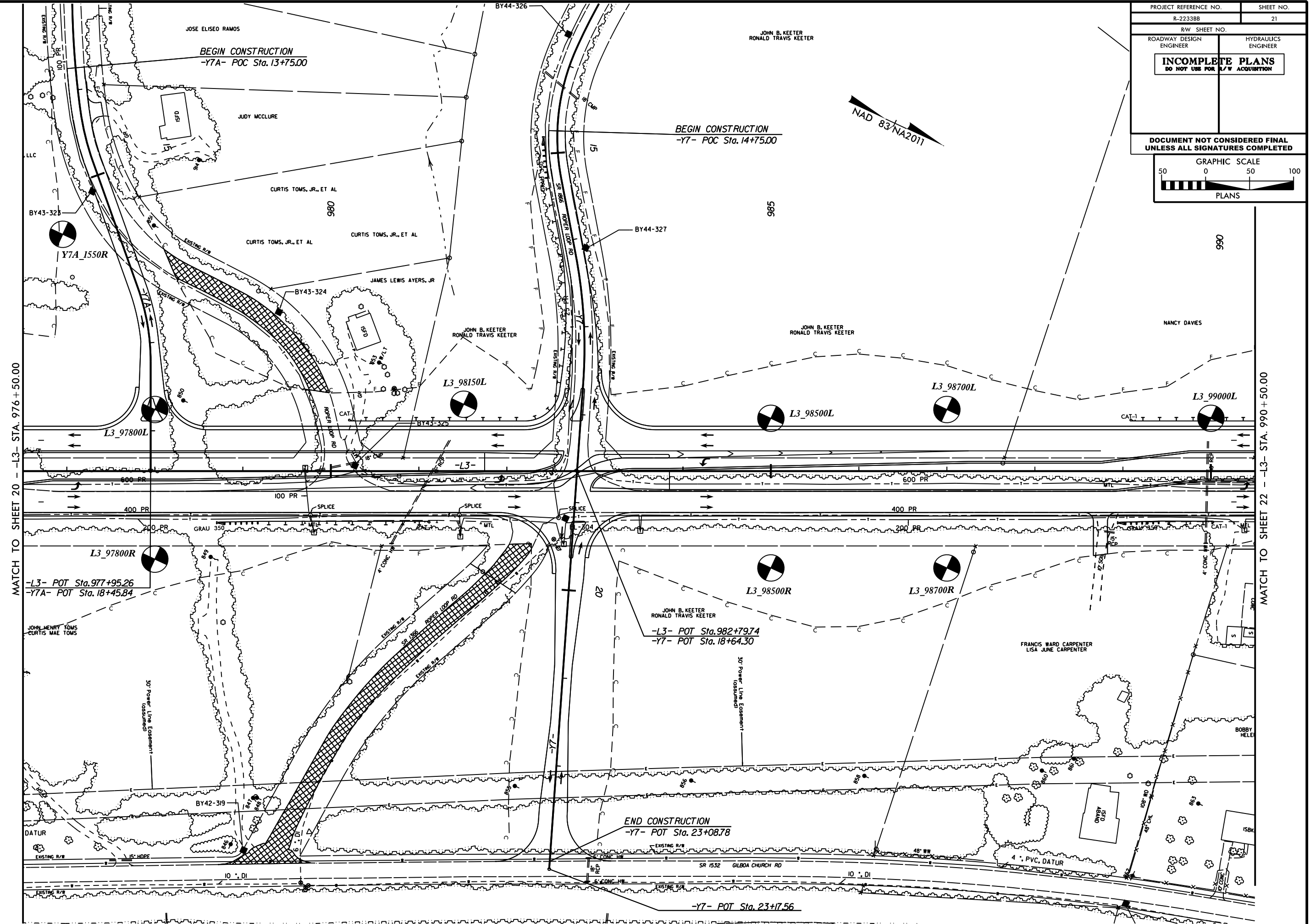
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UNLESS ALL SIGNATURES COMPLETED



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 5/14/99  
 156151088

5/14/99

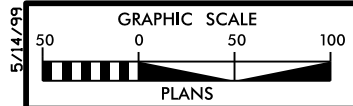
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R/W SHEET NO.	HYDRAULICS ENGINEER
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	
<b>DOCUMENT NOT CONSIDERED FINAL</b> UNLESS ALL SIGNATURES COMPLETED	
GRAPHIC SCALE 50 0 50 100 PLANS	



MATCH TO SHEET 20 - L3- STA. 976+50.00

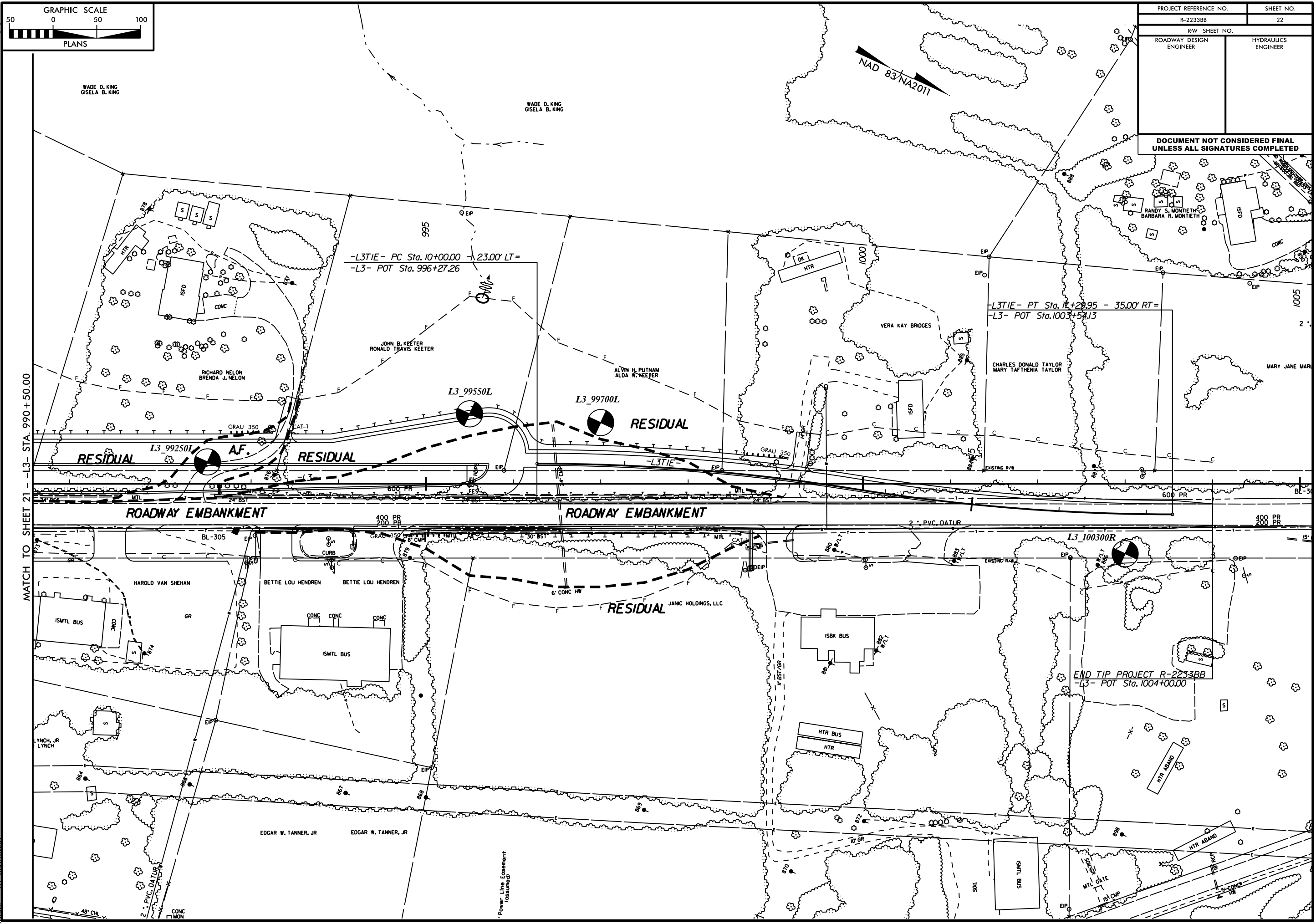
MATCH TO SHEET 22 - L3- STA. 990+50.00

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PROJECT REFERENCE NO. R-2233BB	SHEET NO. 22
ROADWAY DESIGN ENGINEER RANDY S. MONTETH BARBARA R. MONTETH	HYDRAULICS ENGINEER

DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED



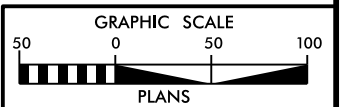
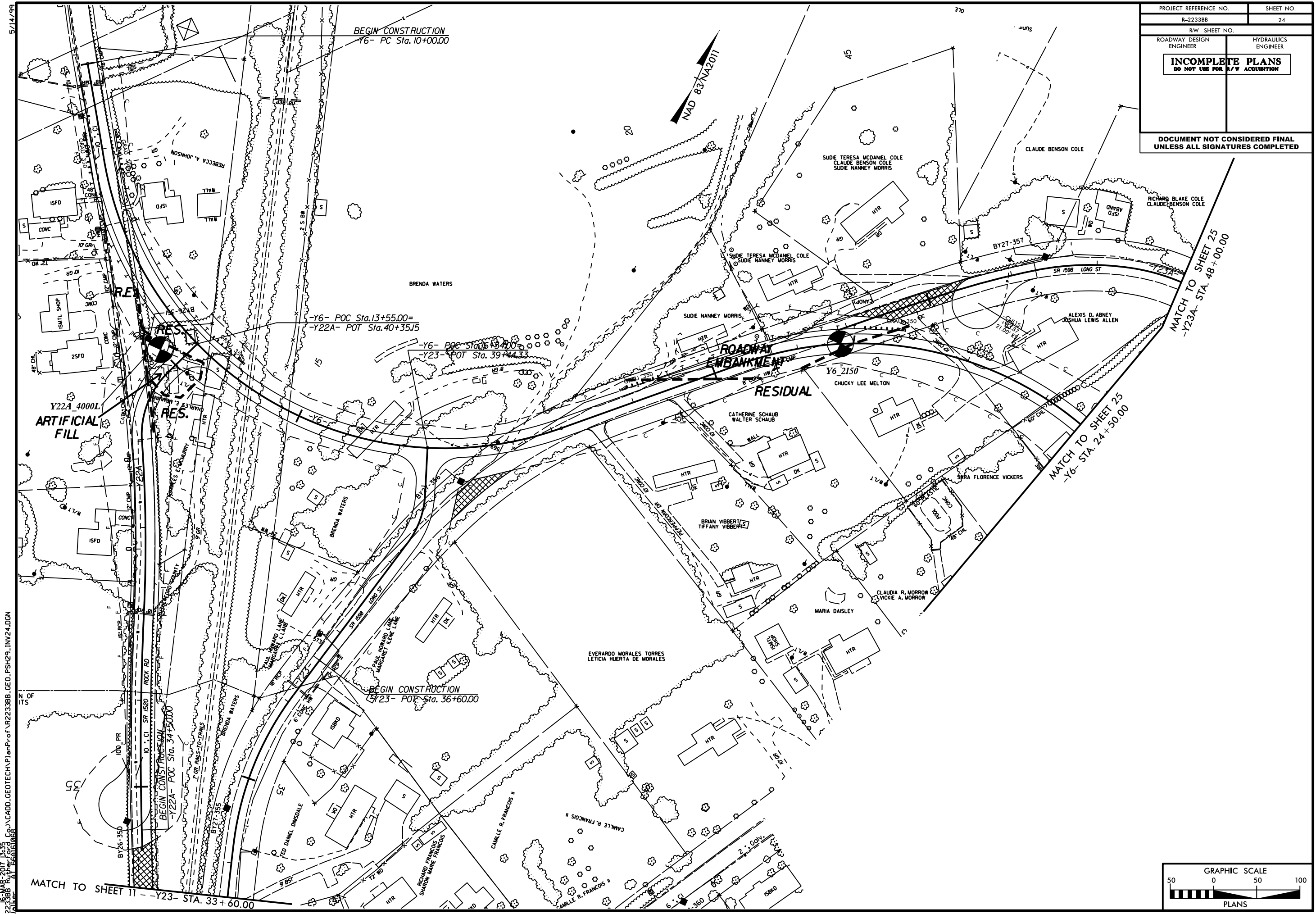
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PROJECT REFERENCE NO. R-2233BB	SHEET NO. 24
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	

DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED



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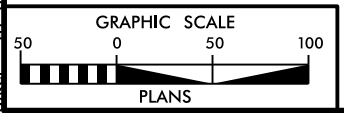
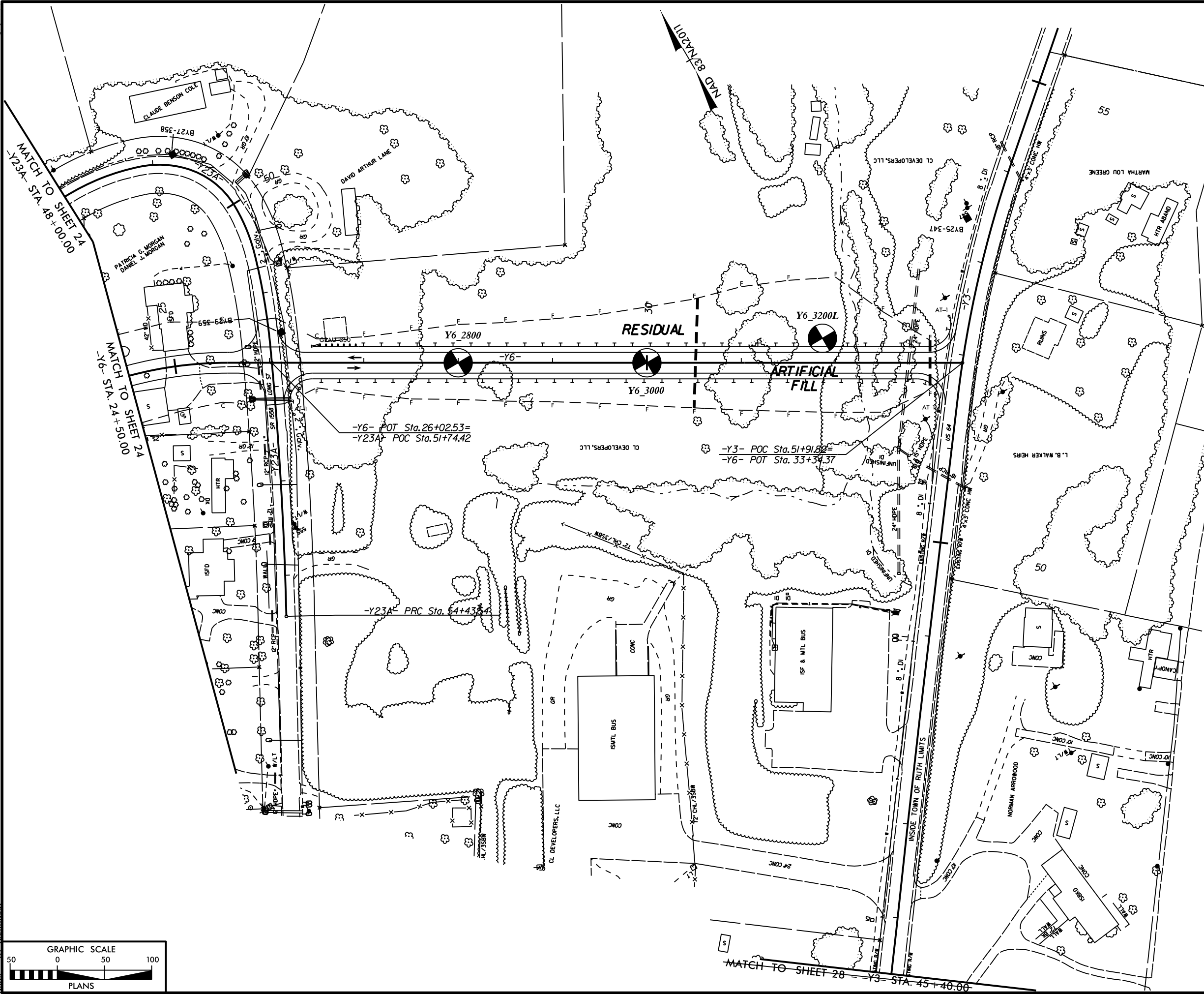
PROJECT REFERENCE NO. R-2233BB	SHEET NO. 25
R/W SHEET NO. ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	

DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED

WILLIAM B. STEFFE  
HANNAH TILLOTSON  
Pg 5 Pg 9  
Pg 6 Pg 74

SEE SHEET 76 FOR -Y6- PROFILE  
SEE SHEETS 2- THRU 2- FOR DRAINAGE DETAILS

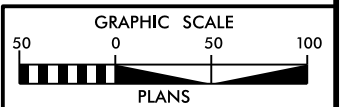
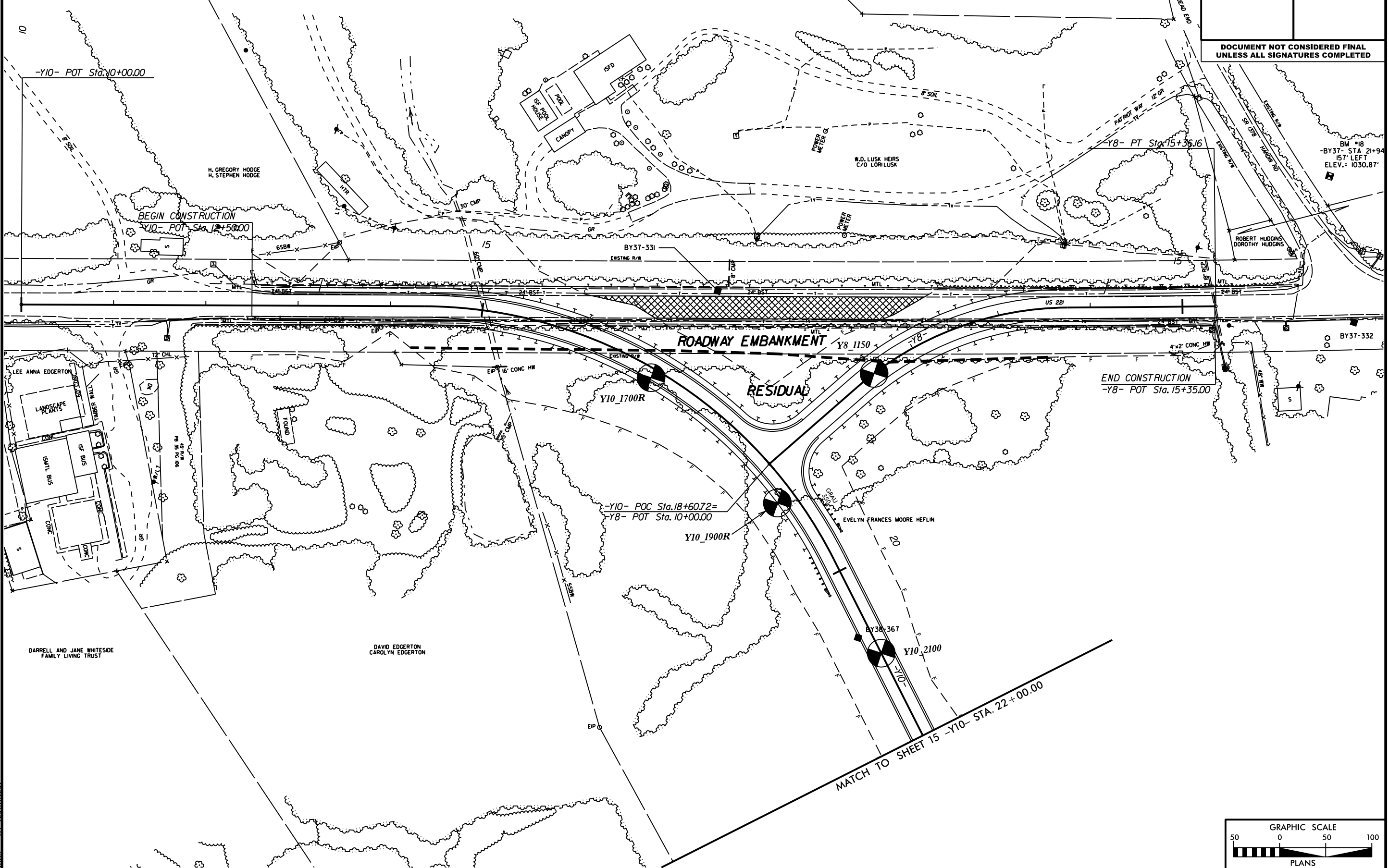
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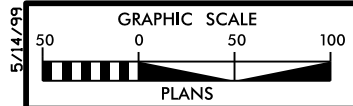
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PROJECT REFERENCE NO. R-2233BB	SHEET NO. 26
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	

DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED

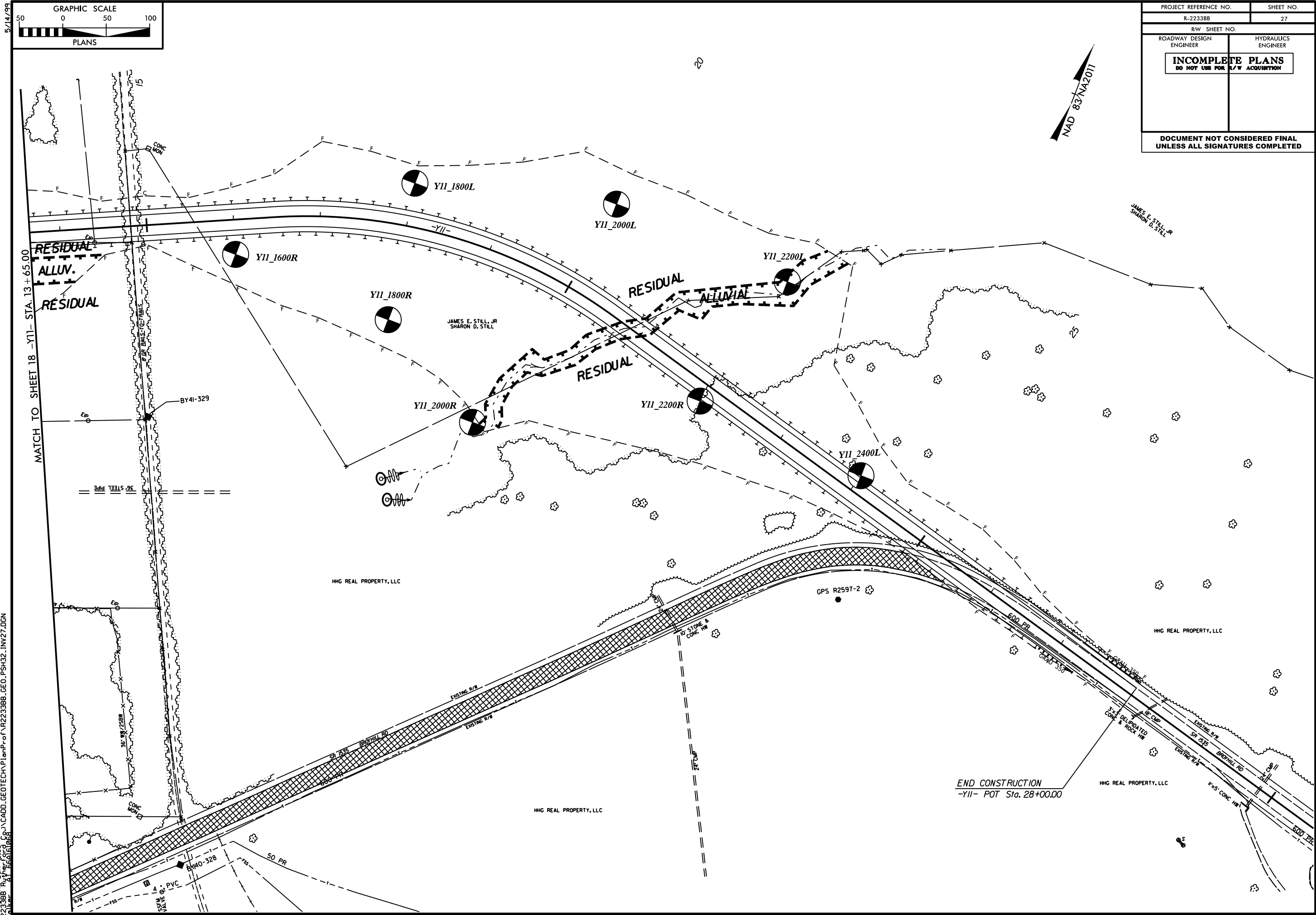


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PROJECT REFERENCE NO. R-2233BB	SHEET NO. 27
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	
<b>DOCUMENT NOT CONSIDERED FINAL</b> UNLESS ALL SIGNATURES COMPLETED	

NAD 83 NA2011



MATCH TO SHEET 18 -YII- STA. 13 + 65.00

END CONSTRUCTION  
-YII- POT Sta. 28+00.00

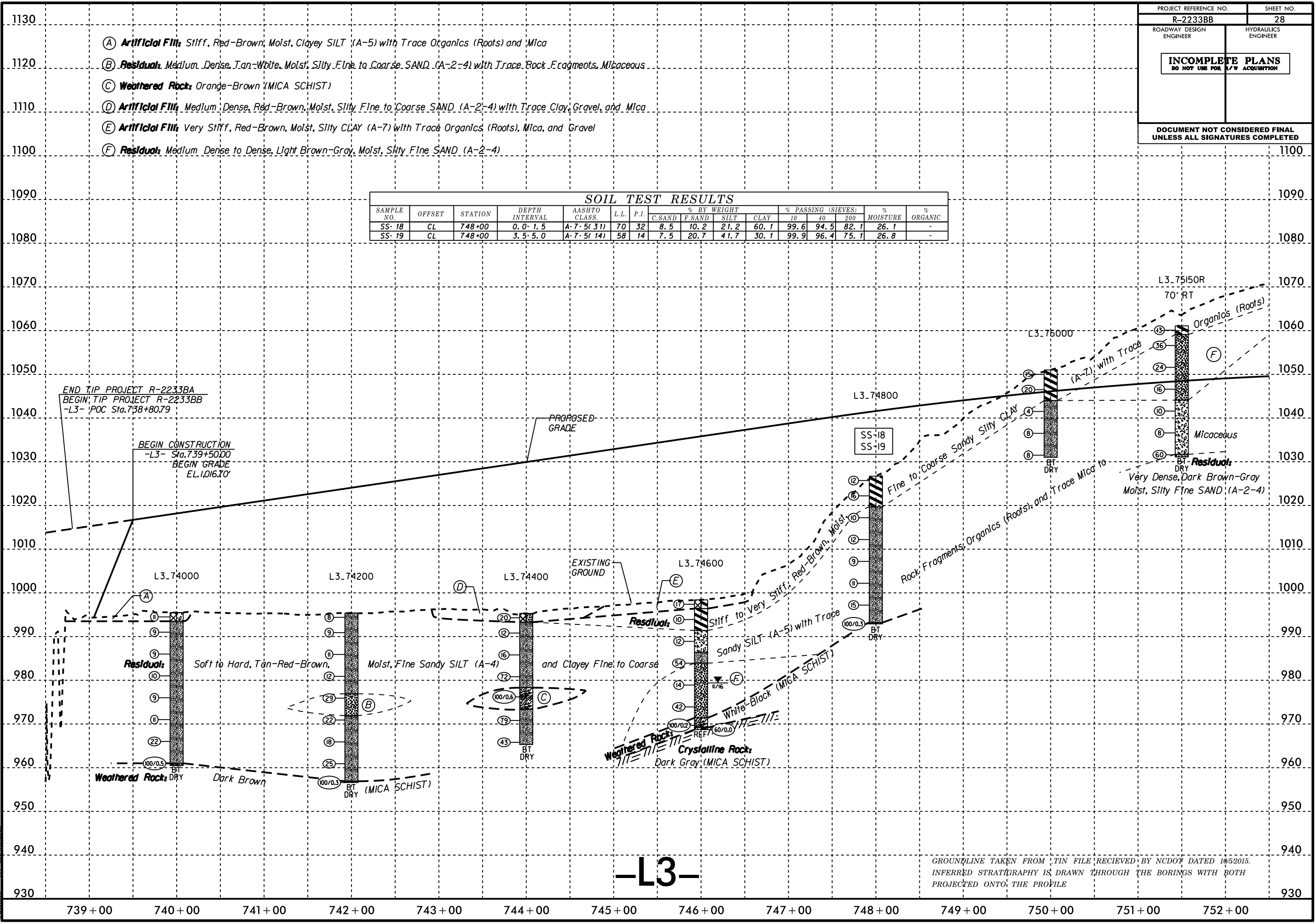
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Author: A156161088

5/14/99  
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 Walker - 61 65181058

PROJECT REFERENCE NO. <b>R-2233BB</b>	SHEET NO. <b>28</b>
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	
<b>DOCUMENT NOT CONSIDERED FINAL</b> UNLESS ALL SIGNATURES COMPLETED	

- (A) **Artificial Fill:** Stiff, Red-Brown, Moist, Clayey SILT (A-5) with Trace Organics (Roots) and Mica
- (B) **Residual:** Medium Dense, Tan-White, Moist, Silty Fine to Coarse SAND (A-2-4) with Trace Rock Fragments, Micaceous
- (C) **Weathered Rock:** Orange-Brown (MICA SCHIST)
- (D) **Artificial Fill:** Medium Dense, Red-Brown, Moist, Silty Fine to Coarse SAND (A-2-4) with Trace Clay, Gravel, and Mica
- (E) **Artificial Fill:** Very Stiff, Red-Brown, Moist, Silty CLAY (A-7) with Trace Organics (Roots), Mica, and Gravel
- (F) **Residual:** Medium Dense to Dense, Light Brown-Gray, Moist, Silty Fine SAND (A-2-4)

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-18	CL	748+00	0.0-1.5	A-7-5(31)	70	32	8.5	10.2	21.2	60.1	99.6	94.5	82.1	26.1	-
SS-19	CL	748+00	3.5-5.0	A-7-5(14)	58	14	7.5	20.7	41.7	30.1	99.9	96.4	75.1	26.8	-



-L3-

GROUNDLINE TAKEN FROM TIN FILE RECEIVED BY NCDOT DATED 10/5/2015.  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
 PROJECTED ONTO THE PROFILE

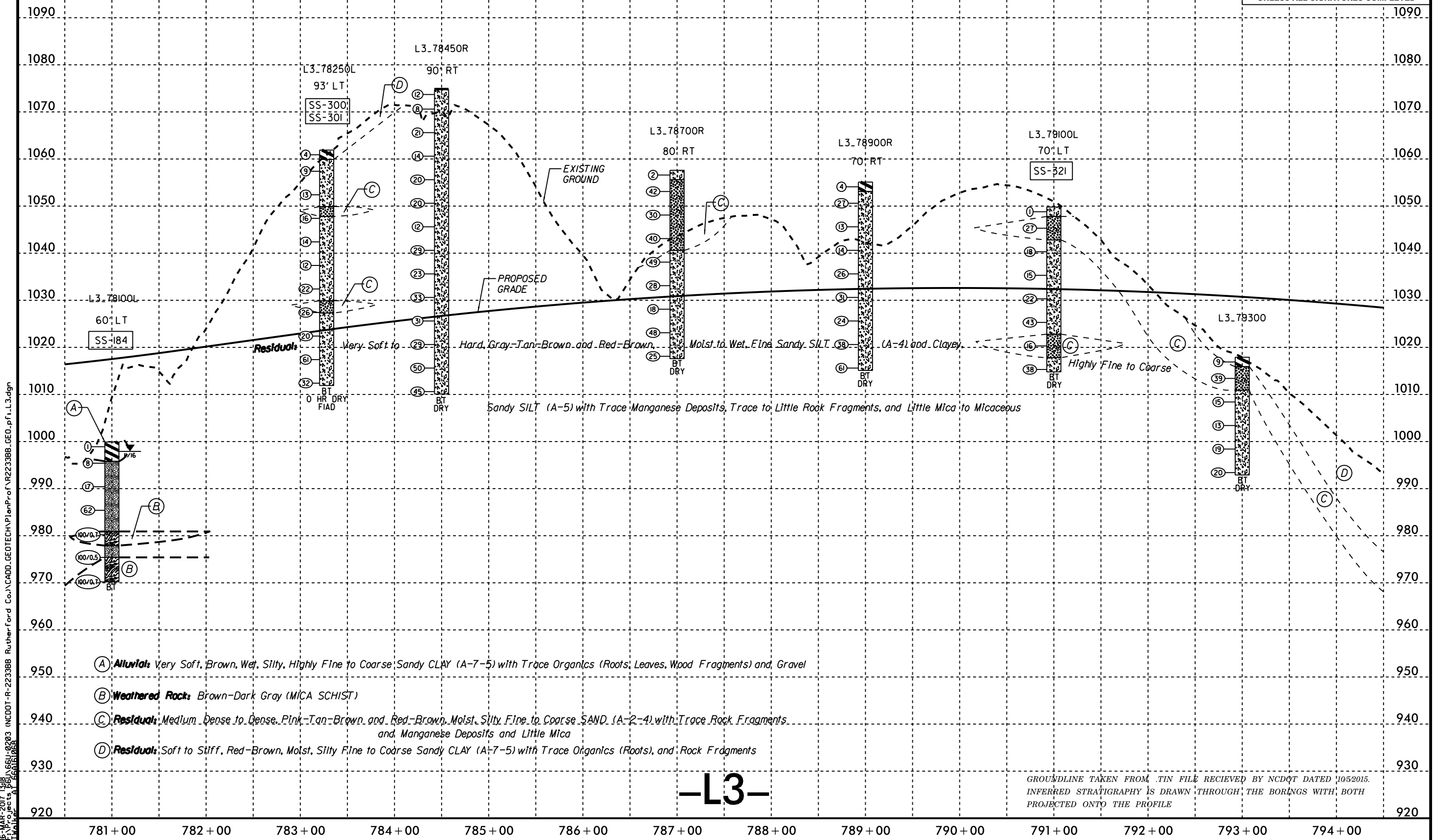




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PROJECT REFERENCE NO. R-2233BB	SHEET NO. 31
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-184	60' LT	781+00	0.0-1.5	A-7-5(1)	62	11	33.0	30.2	22.1	14.7	96.2	77.3	38.3	53.8	-
SS-300	93' LT	783+28	0.1-1.5	A-7-5(14)	54	22	12.6	26.0	12.9	48.5	99.7	92.8	65.5	28.8	-
SS-301	93' LT	783+28	3.5-5.0	A-5(0)	49	NP	28.2	33.9	22.7	15.2	87.6	71.6	37.1	22.7	-
SS-321	70' LT	791+00	0.0-0.4	-	-	-	-	-	-	-	-	-	47.6	16.5	



-L3-

GROUNDLINE TAKEN FROM TIN FILE RECEIVED BY NCDOT DATED 10/5/2015.  
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
PROJECTED ONTO THE PROFILE

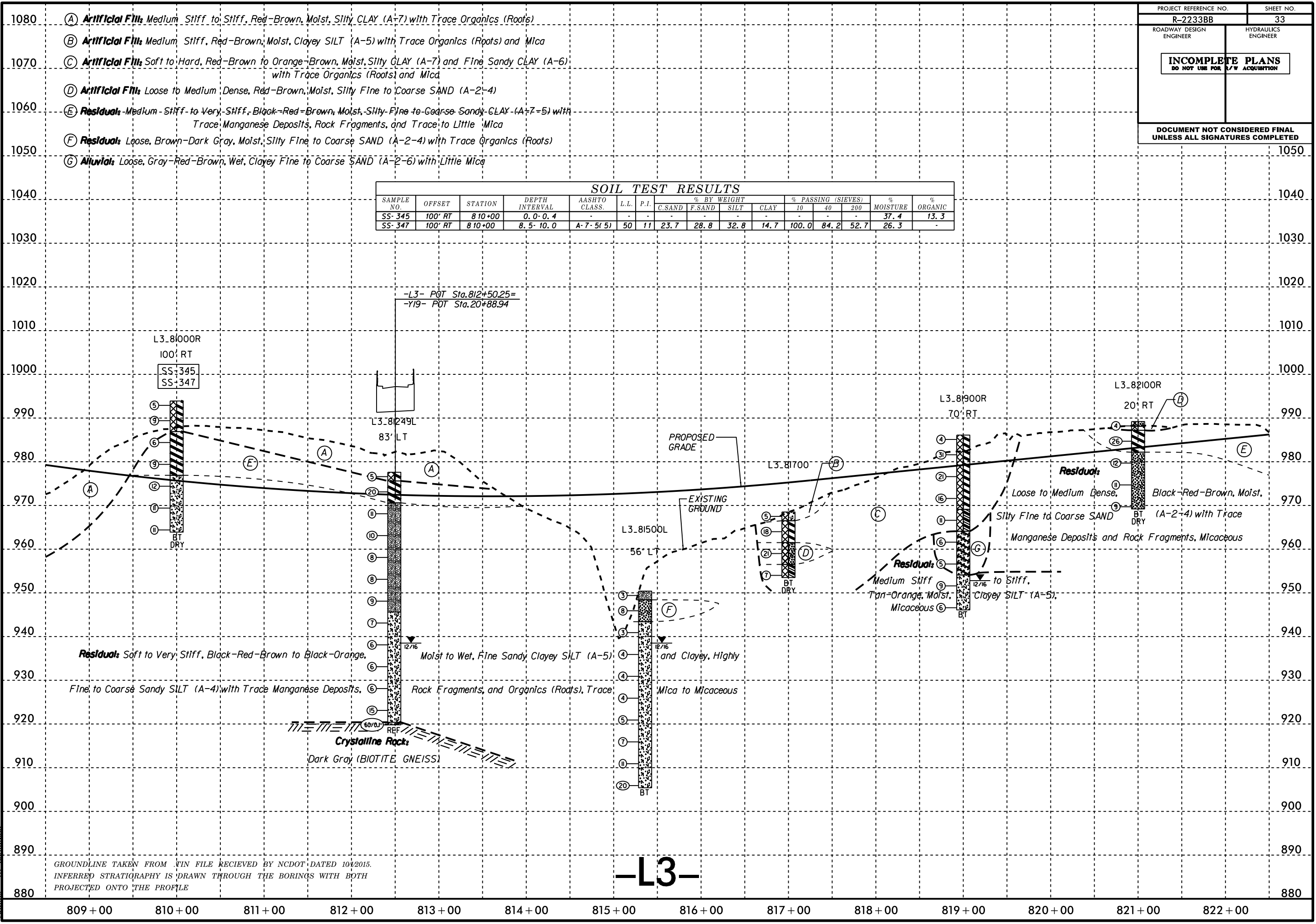
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 User: jg  
 Plotter: AT





5/14/99  
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 Walker - AT 661666

PROJECT REFERENCE NO. <b>R-2233BB</b>	SHEET NO. <b>33</b>
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	
<b>DOCUMENT NOT CONSIDERED FINAL</b> UNLESS ALL SIGNATURES COMPLETED	



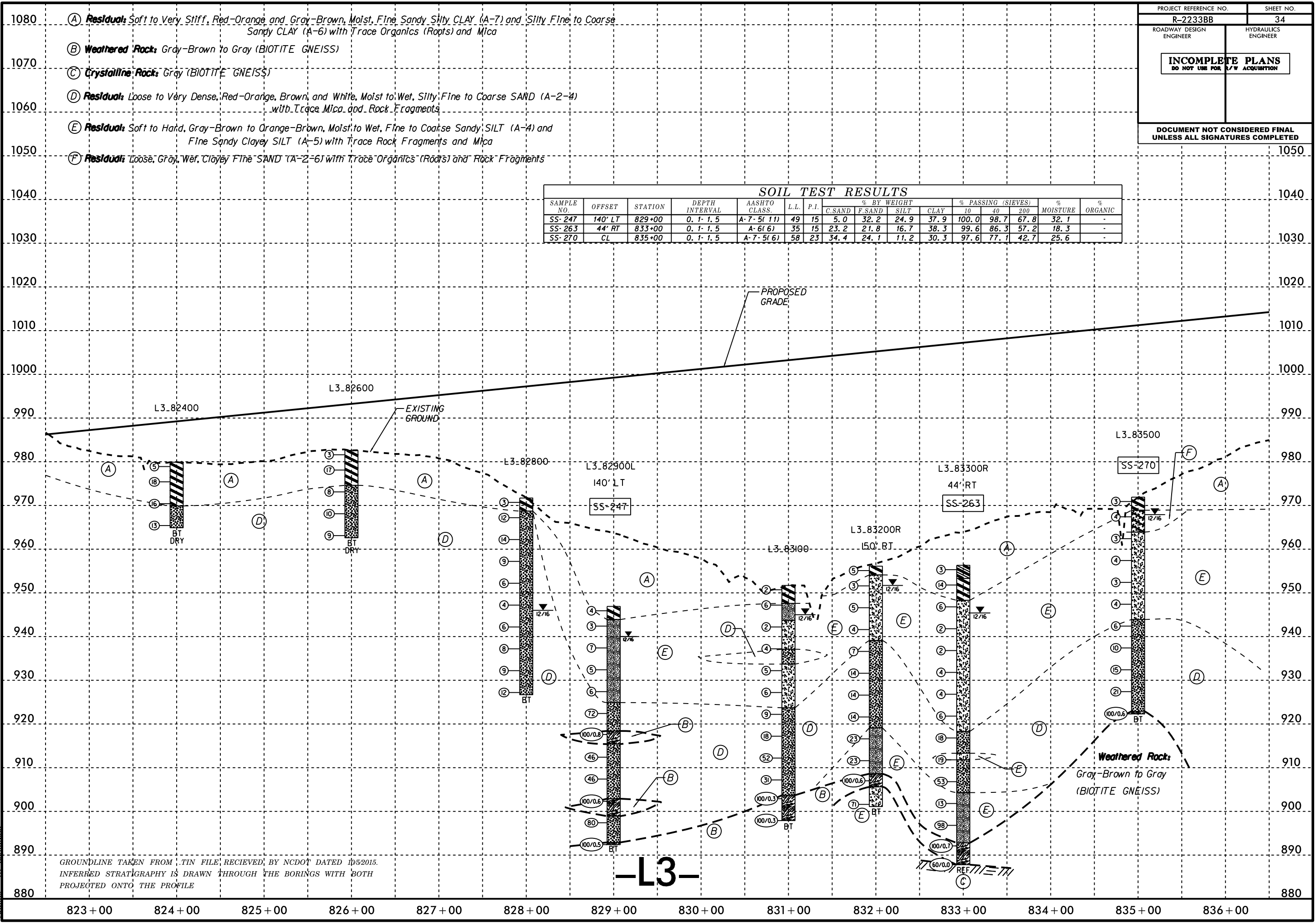
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 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
 PROJECTED ONTO THE PROFILE

**-L3-**

- (A) **Residual:** Soft to Very Stiff, Red-Orange and Gray-Brown, Moist, Fine Sandy Silty CLAY (A-7) and Silty Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots) and Mica
- (B) **Weathered Rock:** Gray-Brown to Gray (BIOTITE GNEISS)
- (C) **Crystalline Rock:** Gray (BIOTITE GNEISS)
- (D) **Residual:** Loose to Very Dense, Red-Orange, Brown, and White, Moist to Wet, Silty, Fine to Coarse SAND (A-2-4) with Trace Mica and Rock Fragments
- (E) **Residual:** Soft to Hard, Gray-Brown to Orange-Brown, Moist to Wet, Fine to Coarse Sandy SILT (A-4) and Fine Sandy Clayey SILT (A-5) with Trace Rock Fragments and Mica
- (F) **Residual:** Loose, Gray, Wet, Clayey Fine SAND (A-2-6) with Trace Organics (Roots) and Rock Fragments

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-247	140' LT	829+00	0.1-1.5	A-7-5(11)	49	15	5.0	32.2	24.9	37.9	100.0	98.7	67.8	32.1	-
SS-263	44' RT	833+00	0.1-1.5	A-6(6)	35	15	23.2	21.8	16.7	38.3	99.6	86.3	57.2	18.3	-
SS-270	CL	835+00	0.1-1.5	A-7-5(6)	58	23	34.4	24.1	11.2	30.3	97.6	77.1	42.7	25.6	-

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 Walker - BT 6/6/16



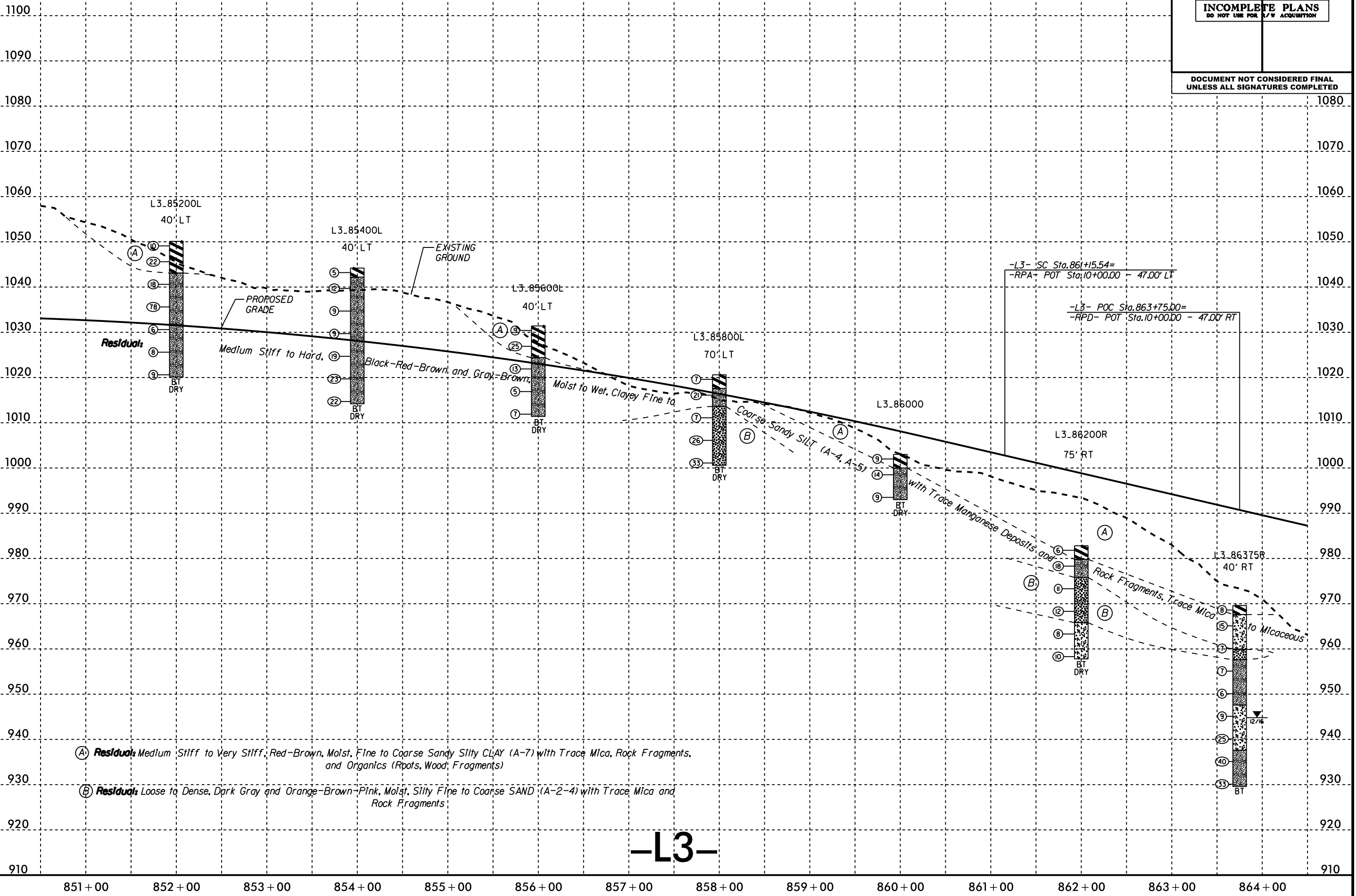
-L3-



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GROUNDLINE TAKEN FROM TIN FILE RECEIVED BY NCDOT, DATED 10/2/2015.  
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
PROJECTED ONTO THE PROFILE

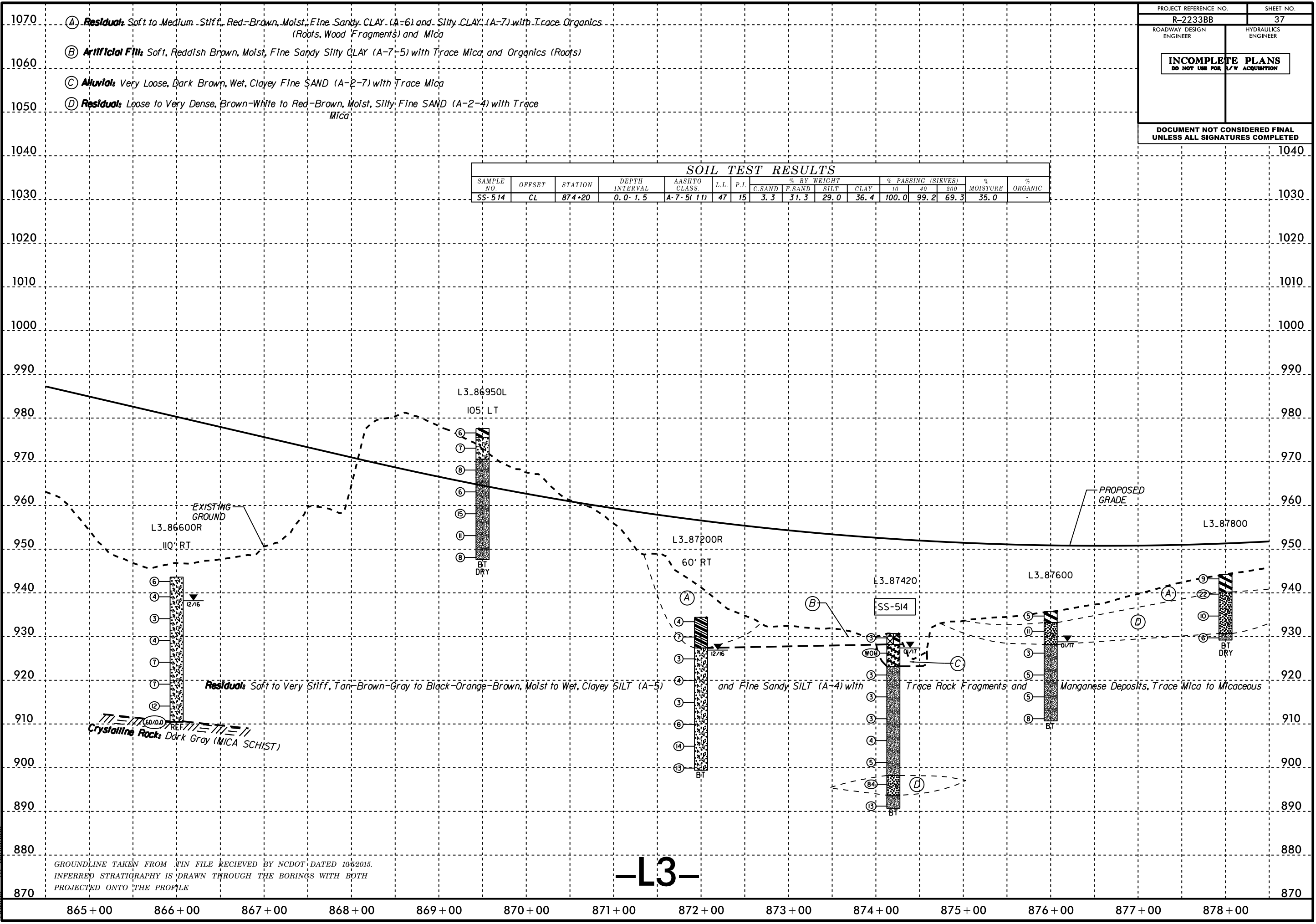
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ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



-L3-

16-MAR-2017 13:18 I:\Projects\66166U-0203 INCDOT-R-2233BB Rutherford Co.\CADD\GEO\TECH\Plan\Prof\R2233BB\_GEO\_pf\_1.L3.dgn

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 Walker - BT 6/18/08

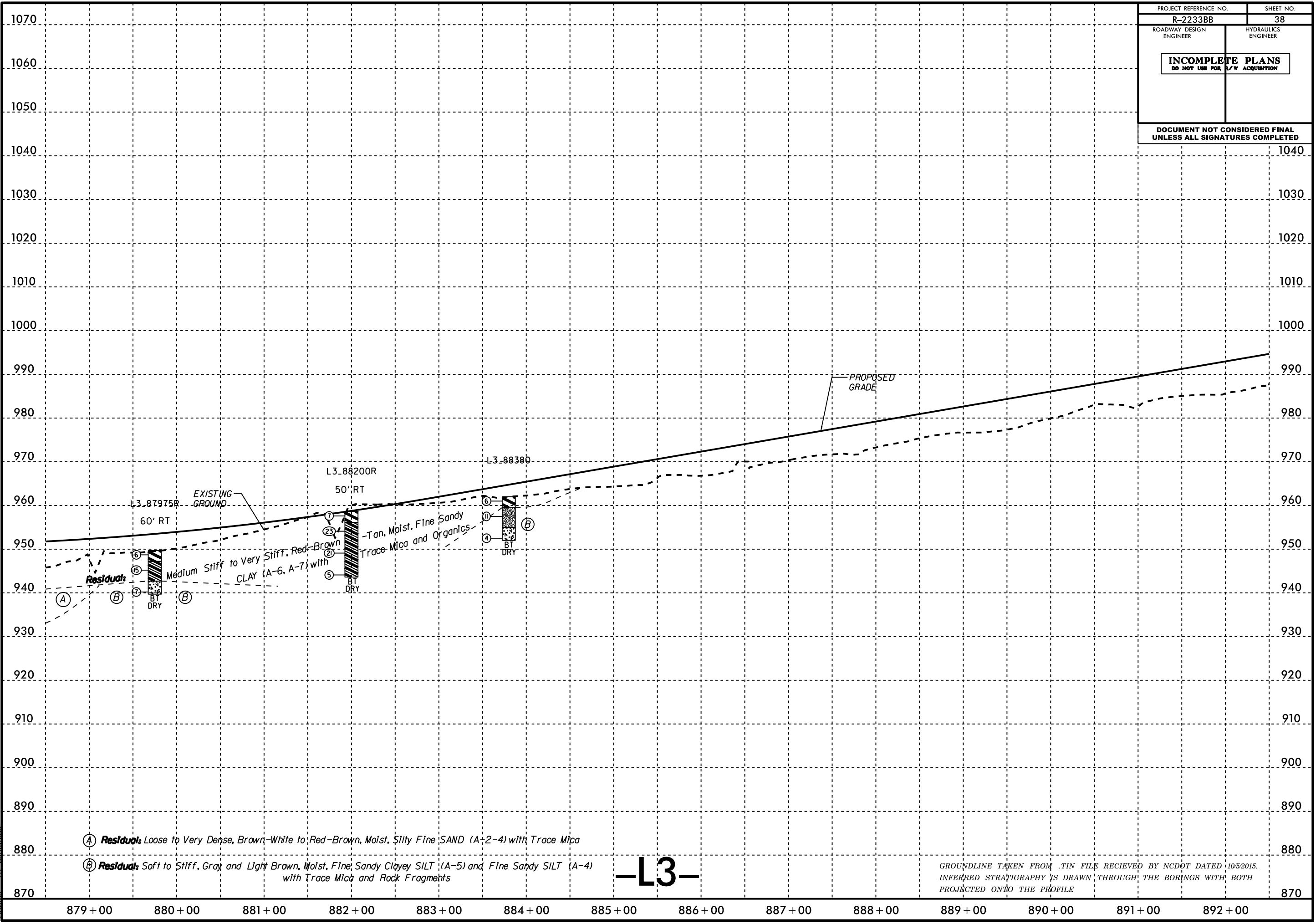


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 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
 PROJECTED ONTO THE PROFILE

-L3-

PROJECT REFERENCE NO. R-2233BB	SHEET NO. 38
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	
<b>DOCUMENT NOT CONSIDERED FINAL</b> UNLESS ALL SIGNATURES COMPLETED	

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 Walker - 66166U68



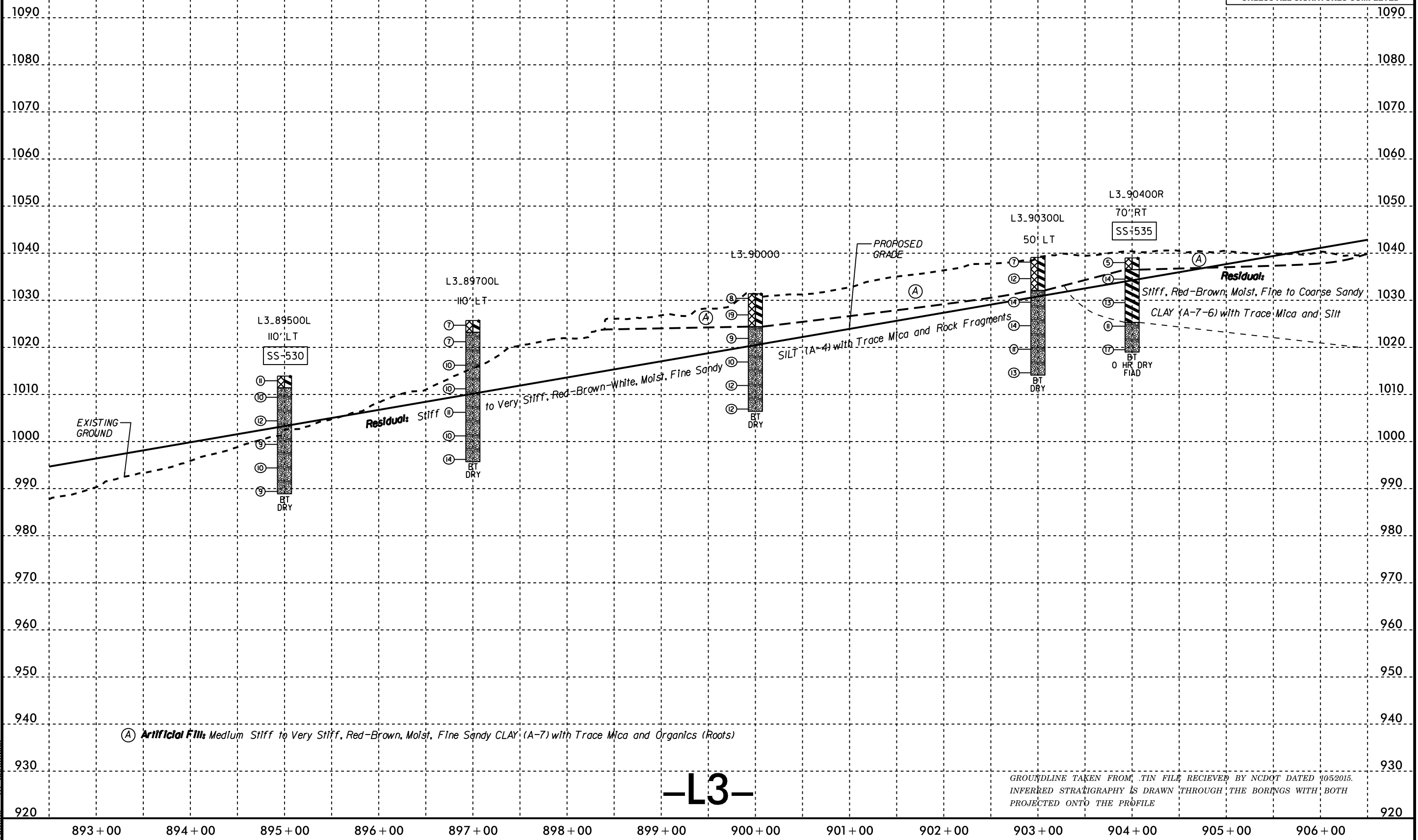
-L3-

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 Walker - AT 65181058

PROJECT REFERENCE NO. <b>R-2233BB</b>	SHEET NO. <b>39</b>
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	
<b>DOCUMENT NOT CONSIDERED FINAL</b> UNLESS ALL SIGNATURES COMPLETED	

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-530	110' LT	895+00	3.5-5.0	A-7-5(13)	58	13	5.5	22.7	43.5	28.3	99.9	98.0	75.8	30.3	-
SS-535	70' RT	904+00	3.5-5.0	A-7-6(21)	59	30	15.9	15.4	9.4	59.3	99.9	97.3	69.9	23.9	-

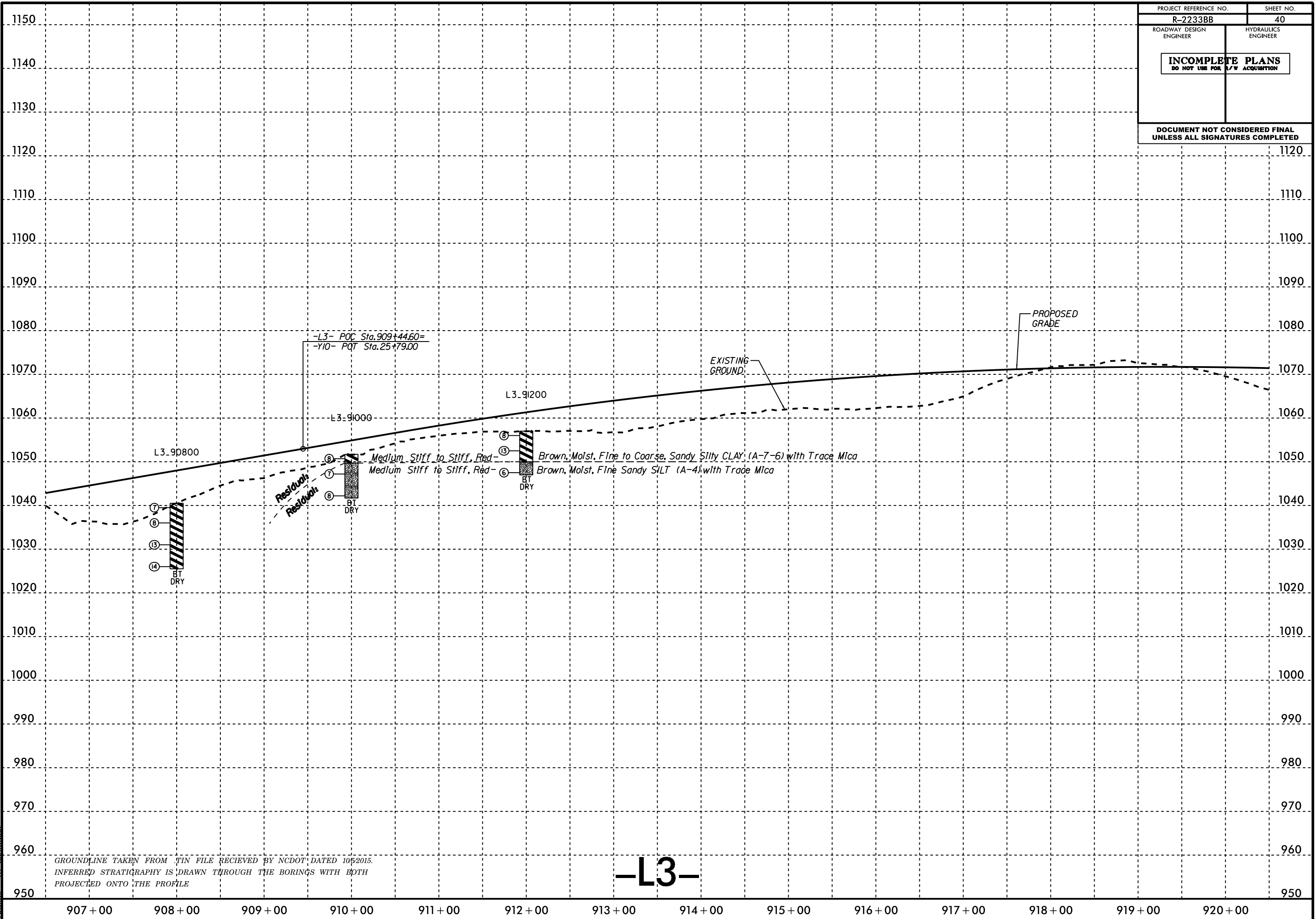


-L3-

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 PROJECTED ONTO THE PROFILE

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 Walker - BT

PROJECT REFERENCE NO. R-2233BB	SHEET NO. 40
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



GROUNDLINE TAKEN FROM TIN FILE RECEIVED BY NCDOT DATED 10/5/2015.  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
 PROJECTED ONTO THE PROFILE

**-L3-**

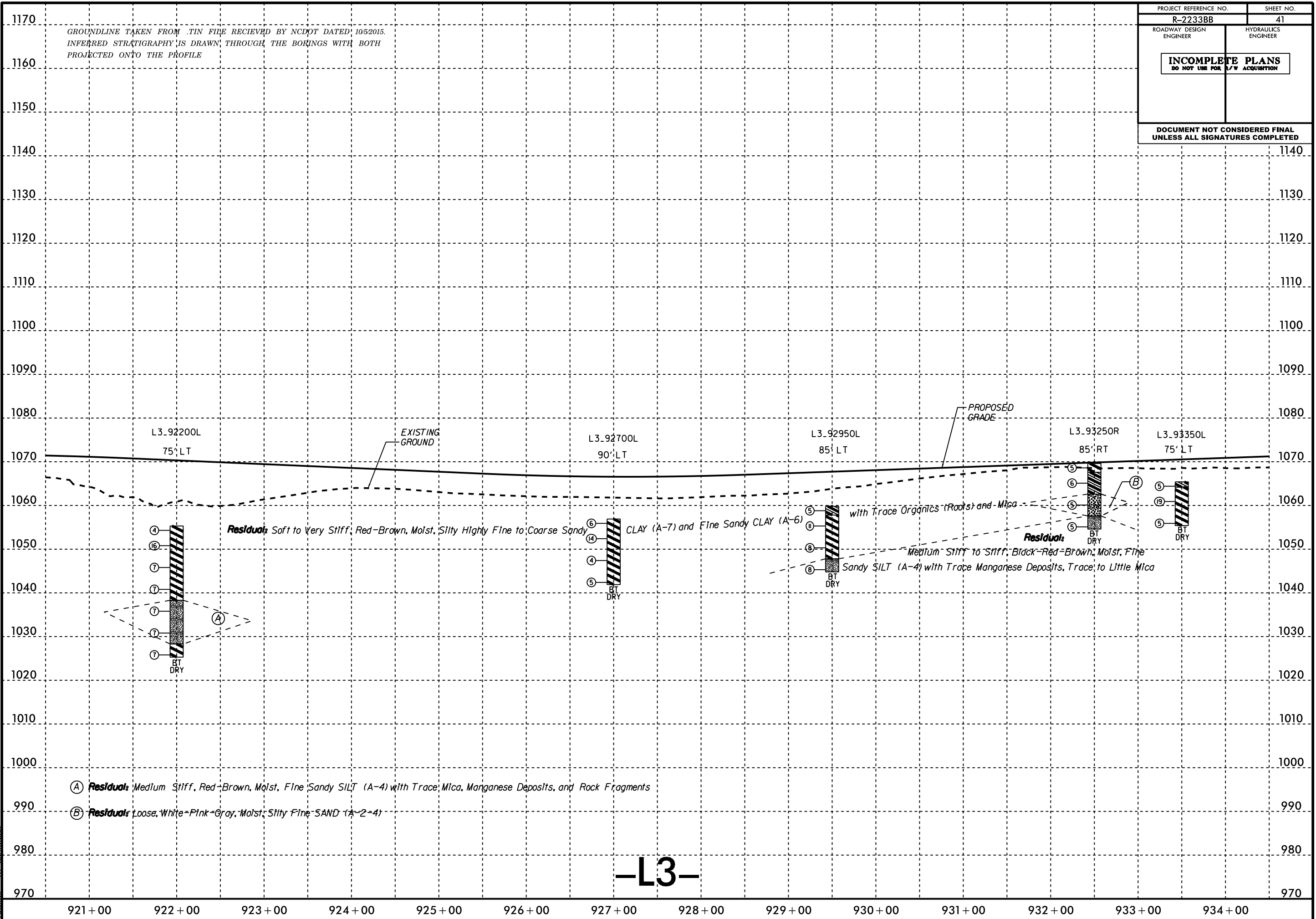


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PROJECT REFERENCE NO.	SHEET NO.
R-2233BB	41
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION	
<b>DOCUMENT NOT CONSIDERED FINAL</b> UNLESS ALL SIGNATURES COMPLETED	

GROUNDLINE TAKEN FROM TIN FILE RECEIVED BY NCDOT DATED 10/5/2015.  
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 Walker - AT 65161058



- (A) **Residual:** Medium Stiff, Red-Brown, Moist, Fine Sandy SILT (A-4) with Trace Mica, Manganese Deposits, and Rock Fragments
- (B) **Residual:** Loose, White-Pink-Gray, Moist, Silty Fine SAND (A-2-4)

-L3-

