STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	BL-0008	1	22

REFERENCE: BL-0008

PROJECT: N/A

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

ROADWAY SUBSURFACE INVESTIGATION

COUNTY HENDERSON

PROJECT DESCRIPTION CLEAR CREEK GREENWAY FROM OKLAWAHA GREENWAY TO LAKEWOOD RD

INVENTORY

CONTENTS

APPENDICES

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 PERFORM INDEPENDENT SUBSURFACE INVESTIGATIONS AND MAKE INTERPRETATIONS AS NECESSARY TO CONFIRM CONDITIONS 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:
1. 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.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

GOODNIGHT, D. J.

CG2

INVESTIGATED BY GOODNIGHT, D. J.

DRAWN BY CROCKETT, S. C.

CHECKED BY HAMM, J. R.

SUBMITTED BY FALCON ENG.

DATE OCTOBER, 2024

NORTH CAROLINA PROFESSIONAL SEAL 048207 ENGINEER STEPHEN C. CROCKETT

DocuSigned by:
Stephen Crockett 10/30/2024
C5CA5FED48E0435...
SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
BL-0008	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

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

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

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NON PLASTIC	0-5	VERY LOW
SLIGHTLY PLASTIC	6-15	SLIGHT
MODERATELY PLASTIC	16-25	MEDIUM
HIGHLY PLASTIC	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LL < 31
MODERATELY COMPRESSIBLE	LL = 31 - 50
HIGHLY COMPRESSIBLE	LL > 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY	35% AND ABOVE

GROUND WATER

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

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT, DPT, DMT, VST PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
∇ - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] CME-45C
- [ ] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [X] DIEDRICH D50
- [ ] _____

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

HAMMER TYPE:
- [X] AUTOMATIC
- [ ] MANUAL

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

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

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

AQUIFER - A WATER BEARING FORMATION OR STRATA.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BENCH MARK: ELEVATIONS OBTAINED FROM TIN FILE
BL-0008.TIN, 20240620 DATED JUNE, 2024
ELEVATION: FEET

NOTES:

DATE: 8-15-14

Roadway Subsurface Investigation Report - Inventory

Clear Creek Greenway
From Oklawaha Greenway to Lakewood Road
Hendersonville, North Carolina
Falcon Project No.: G23002.00

Prepared for:
Kimley Horn & Associates, Inc.
421 Fayetteville St, Ste 600
Raleigh, NC 27601

Submitted by:
Falcon Engineering, Inc.
1210 Trinity Road, Suite 110
Cary, North Carolina 27513
(919) 871-0800
www.falconengineers.com

October 28, 2024

TIP No.: BL-0008
COUNTY: Henderson
DESCRIPTION: Clear Creek Greenway from Oklawaha Greenway to Lakewood Road

SUBJECT: Roadway Subsurface Investigation – Inventory

PROJECT DESCRIPTION

This project consists of the construction of 7,500 linear feet (LF) of new paved greenway trail in Hendersonville, North Carolina. The project will also include a bench/exercise area, a play area, a garden area spread along the distance of the trail, and three (3) new bridges over Clear Creek or small adjacent tributaries. We assume the bridges will consist of prefabricated single-span structures. Two (2) small paved trailhead parking lots may be included in the project. No other structural elements (boardwalks, retaining walls, shelters, etc.) are planned at this time.

The investigation was conducted from February 13th through February 16th, 2024 in general accordance with our Proposal for Geotechnical Services. The information provided in this report is based solely on our site reconnaissance, Kessler DCP test data, soil test borings and laboratory test data, engineering evaluation of these data, and generally accepted soil and foundation engineering practices and principles.

A total of five (5) hand auger borings were advanced for the paved greenway trail. At each of the boring locations, Dual Mass Dynamic Cone Penetrometer (DCP) testing was performed at the ground surface. For the structure investigation a total of four (4) Standard Penetration Test (SPT) borings were performed. At Structure 1, an SPT boring was performed at each end bent. For Structures 2 and 3, a single boring was performed at the most accessible end bent. Representative soil samples were collected in moisture-retarding containers and selected for laboratory testing to verify visual field classifications. In addition, two (2) bulk samples were collected for standard Proctor compaction testing and California Bearing Ratio (CBR).

Portions of the following alignments, totaling approximately 1.42 miles were investigated. Other alignments are included on the project but improvements are not anticipated to be significant enough to warrant investigation.

Alignment	Station (ft)
-L1-	80+44.35 – 179+01.14

AREAS OF SPECIAL GEOTECHNICAL INTEREST

I. Highly plastic soil (PI greater than 36) was not encountered within 4 feet of the ground surface.

II. The following locations encountered soft/loose soil within 4 feet of the ground surface:

Alignment	Station (ft)	Offset
-L1-	102+30	LT
-L1-	108+35	RT
-L1-	109+25	LT
-L1-	122+12	RT
-L1-	137+44	LT
-L1-	154+81	CL
-L1-	172+11	LT

III. The following locations encountered shallow groundwater within 6 feet of the ground surface:

Alignment	Station (ft)	Offset
-L1-	109+25	LT
-L1-	154+81	CL
-L1-	172+11	LT

PHYSIOGRAPHY AND GEOLOGY

According to the *Geologic Map of North Carolina (1985),* the site is located near the boundary of the Henderson Gneiss **(Chg)** and a Granite Gneiss interlayered with Biotite Augen Gneiss **(SOgg)**. The weathered bedrock encountered at the site in the borings is consistent with the description of Henderson Gneiss which has a monzonitic to granodioritic composition.

The project corridor generally trends east-west and is located mostly in the floodplain areas along Clear Creek and associated tributaries. On the west end of the project, the alignment extends along the slopes of an upland forested area parallel to Balfour Road. Existing site topography slopes generally downward from both the west and east ends of the project until reaching the floodplain of Clear Creek. The lowest topographic areas of the site occur at the northernmost portions of the project corridor beyond the confluence of Mud Creek and Clear Creek and where Clear Creek continues offsite to the north. The Mud Creek and Clear Creek crossings will be facilitated with new bridges.

SOIL PROPERTIES

A variety of soils were encountered along the project, including existing Artificial Fill, Roadway Embankment fill, Alluvial, and Residual soils.

Artificial Fill was encountered at the ground surface in borings G-5 and S2_EB2 and extended up to 6 feet below the existing ground surface. These soils consist of moist, silty sand (A-2-4) with trace gravel.

Roadway Embankment Fill was encountered at the ground surface in boring G-4 and extended up to 3.5 feet below the existing ground surface. These soils consist of moist, silty sand (A-2-4) with trace gravel.

Alluvial soils were encountered at the ground surface or beneath the fill soils in borings G-2, G-3, G-4, G-5, S1_EB1, S1_EB2, S2_EB2, and S3_EB1, and extended up to 14 feet below the existing ground surface. These soils consist of moist, sandy silt (A-4), silty clayey sand (A-2-5), silty sand (A-2-4), fine sand (A-3), and variably silty fine to coarse sand (A-1-a/A-1-b).

Residual soils were encountered at the ground surface or beneath the alluvial soils in borings G-1, S1_EB1, S1_EB2, and S3_EB1. Residual soils occur as thin zones within weathered rock layers at S2_EB2. These soils consist of moist to wet, silty sand (A-2-4) and sandy silt (A-4).

Weathered Rock (WR) is a hard material with properties intermediate of soil and rock, derived from in-place bedrock. WR is classified as having an SPT N-value of greater than 100 blows per one foot. WR was encountered in borings S1_EB1, S1_EB2, S2_EB2, and S3_EB1 at approximate elevations ranging from 2039.4 to 2063.1 feet. The WR across the project was classified as weathered Gneiss.

Crystalline Rock (CR) is a very hard material indicative of natural, in-place bedrock. CR is indicated usually by powered drill rig auger refusal or by SPT refusal which is defined as 60 blows per 0.1 foot (or less). CR was encountered in borings S1_EB1, S1_EB2, S2_EB2, and S3_EB1 at approximate elevations ranging from 2038.0 to 2051.1 feet. The CR across the project was classified as Gneiss.

Dual Mass Dynamic Cone Penetrometer (DCP) testing was performed on the subgrade at five (5) hand auger locations spread along the greenway alignment to correlate in-situ California Bearing Ratio (CBR) values to depths of up to three feet below subgrade. CBR values were estimated using software provided by Kessler Soils Engineering Products, Inc. which utilizes correlations established by the Army Corps of Engineers Waterways Experiment Station. CBR values on the project ranged from 0.5 to over 10. DCP testing results are attached in Appendix A of this report.

GROUNDWATER PROPERTIES

Groundwater levels were measured at the time of boring completion and after a waiting period of 24 hours. Shallow groundwater was encountered in one of the hand auger borings (G-05) at a depth of 3.3 feet. Groundwater was encountered in each of the end bent borings drilled across the project at depths ranging from 2.5 to 6.8 feet.

ADDITIONAL LABORATORY TESTING

The following bulk samples were obtained:

Sample	Location	Depth (ft)	Test
BS-01	-L1- 108+35, 2 ft RT	0.5-9.0	Standard Proctor, CBR
BS-02	-L1- 146+77, 2 ft LT	0.5-9.0	Standard Proctor, CBR

Classification test results for the bulk samples are included in the Soil Test Results Tables. Standard Proctor and CBR testing data is attached in Appendix B of this report.

CLOSING

Falcon appreciates the opportunity to have provided our geotechnical engineering services for the above referenced project. If you have any questions concerning the contents of this report or need additional information, please do not hesitate to contact our office.

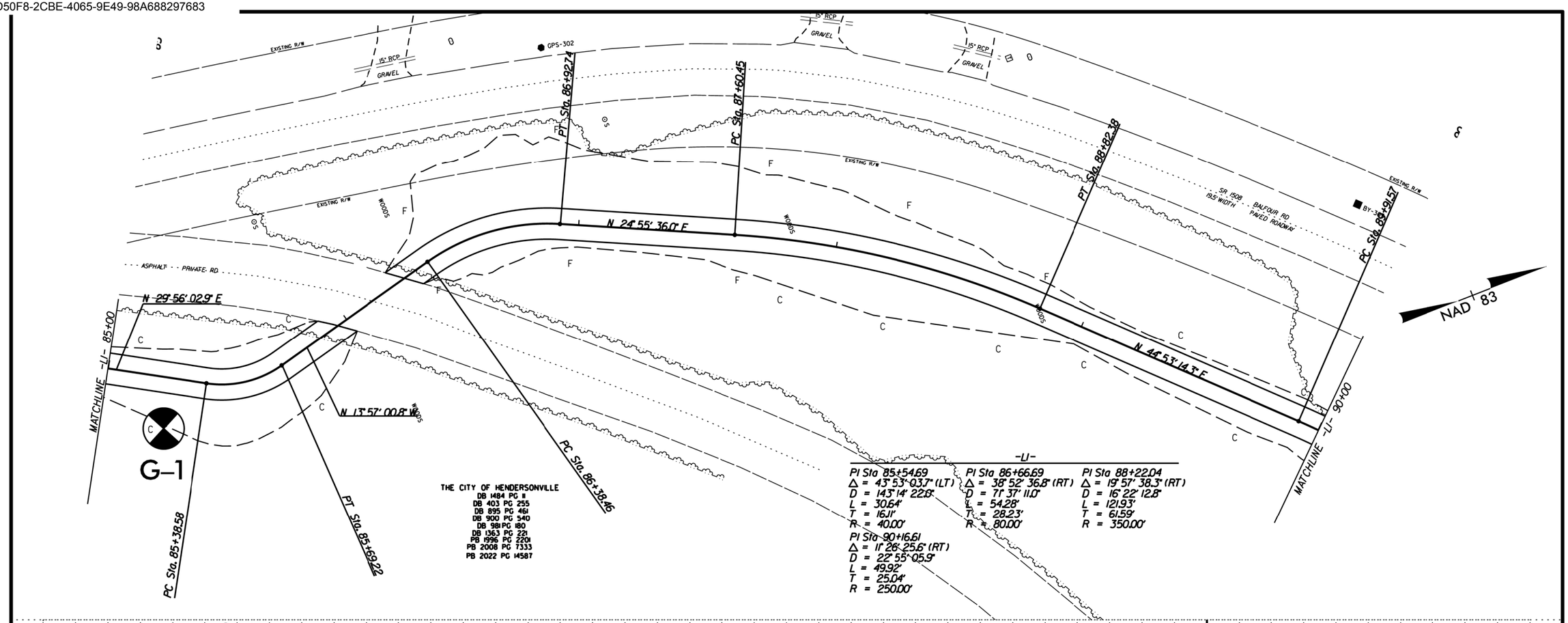
FALCON ENGINEERING, INC.

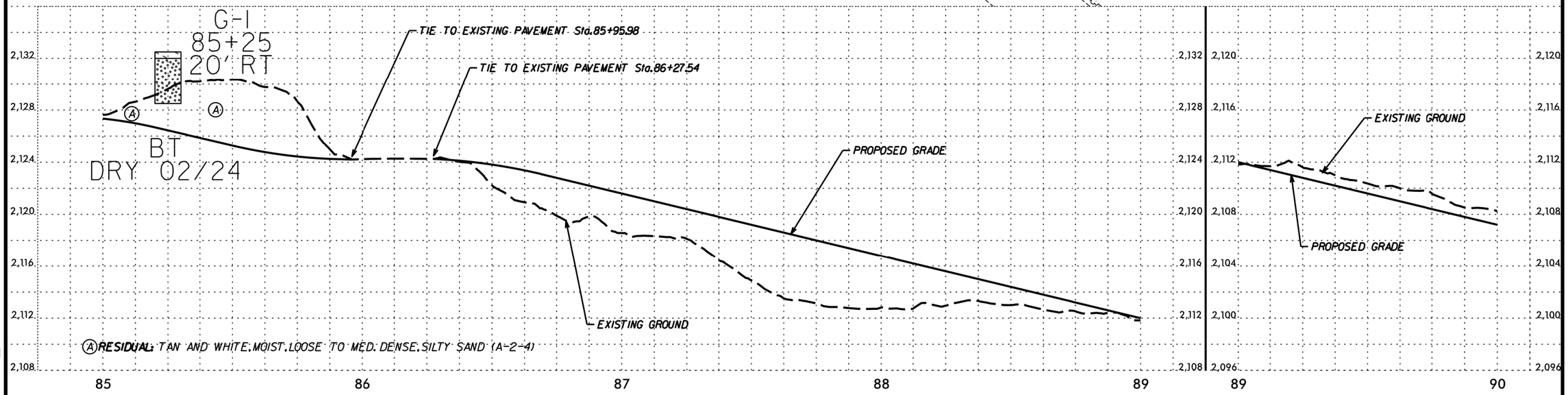
Report Prepared By:

Stephen C. Crockett, PE
Geotechnical Engineer

Report Reviewed By:

Jeremy R. Hamm, PE
Geotechnical Engineering Manager





$FILE$

REV. No.:	REVISION:	DATE:	DRAWN BY:	CHECKED BY:

$DATE$

PREPARED IN THE OFFICE OF:
Kimley»Horn
NC LICENSE #F-0102
200 S TRYON ST, SUITE 200
CHARLOTTE, NORTH CAROLINA 28202
PHONE: (704) 333-5131

-L1- PLAN AND PROFILE

10 0 20

PROJECT:
CLEAR CREEK GREENWAY

JOB NUMBER: 015574013
SHEET NUMBER: 4

-L1-

PI Sta 100+04.92
Δ = 66° 20' 00.2" (RT)
D = 95° 29' 34.7"
L = 69.46'
T = 39.21'
R = 60.00'

PI Sta 100+99.95
Δ = 16° 55' 44.6" (RT)
D = 47° 44' 47.3"
L = 35.46'
T = 17.86'
R = 120.00'

PI Sta 101+88.50
Δ = 13° 55' 24.4" (RT)
D = 38° 11' 49.9"
L = 36.45'
T = 18.32'
R = 150.00'

PI Sta 102+42.31
Δ = 13° 43' 05.9" (LT)
D = 38° 11' 49.9"
L = 35.91'
T = 18.04'
R = 150.00'

PI Sta 103+22.00
Δ = 13° 23' 44.2" (LT)
D = 38° 11' 49.9"
L = 35.07'
T = 17.62'
R = 150.80'

PI Sta 105+28.26
Δ = 72° 41' 21.9" (RT)
D = 47° 44' 47.3"
L = 152.24'
T = 88.29'
R = 120.00'

PT Sta 100+35.17
PC Sta 100+82.09
PT Sta 101+17.55
PC Sta 101+70.18
PT Sta 102+06.64
PT Sta 102+60.18
PC Sta 103+04.38
PC Sta 104+39.97
PT Sta 103+39.45
PC Sta 102+24.27

S 59° 30' 58" E
S 42° 35' 13.5" E
S 28° 39' 49" E
S 47° 22' 55.0" E
S 55° 46' 39.2" E

MATCHLINE -L1- 100+00
MATCHLINE -L1- 105+00

G-2

THE CITY OF HENDERSONVILLE
DB 1484 PG 11
DB 403 PG 255
DB 895 PG 461
DB 900 PG 540
DB 981 PG 180
DB 1363 PG 221
PB 1996 PG 2201
PB 2008 PG 7333
PB 2022 PG 14587

SSMH TOP=2068.13'

128' DUKE POWER EASEMENT

WOODS

NAD 83

PROPOSED GRADE
EXISTING GROUND

G-2
102+30
58' LT
BT
DRY 02/24

Ⓐ ALLUVIAL: TAN, MOIST, V. LOOSE, SILTY FINE SAND (A-2-4)

2,080
2,076
2,072
2,068
2,064
2,060
2,056

100 101 102 103 104 105

$FILE$

REV. No.:	REVISION:	DATE:	DRAWN BY:	CHECKED BY:

$DATE$

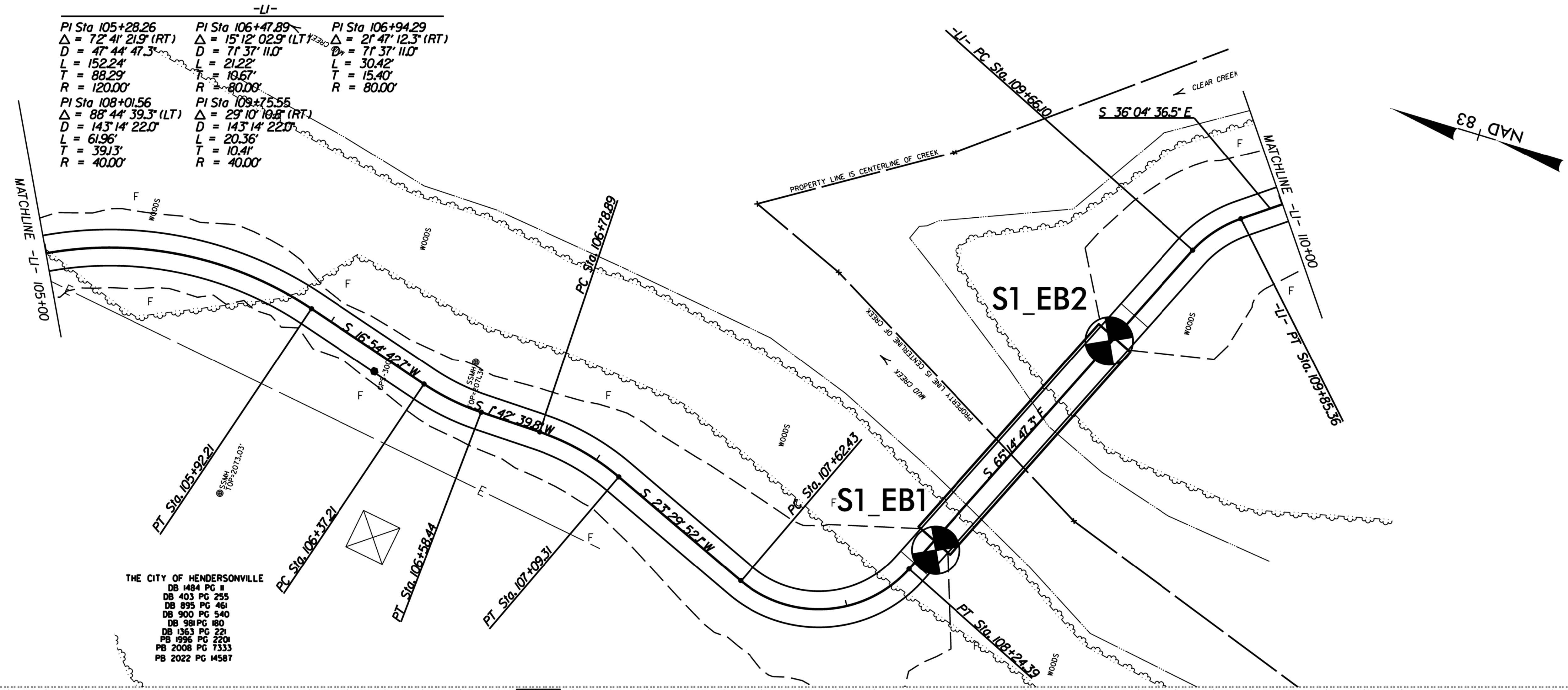
PREPARED IN THE OFFICE OF:
Kimley»Horn
NC LICENSE #F-0102
200 S TRYON ST, SUITE 200
CHARLOTTE, NORTH CAROLINA 28202
PHONE: (704) 333-5131

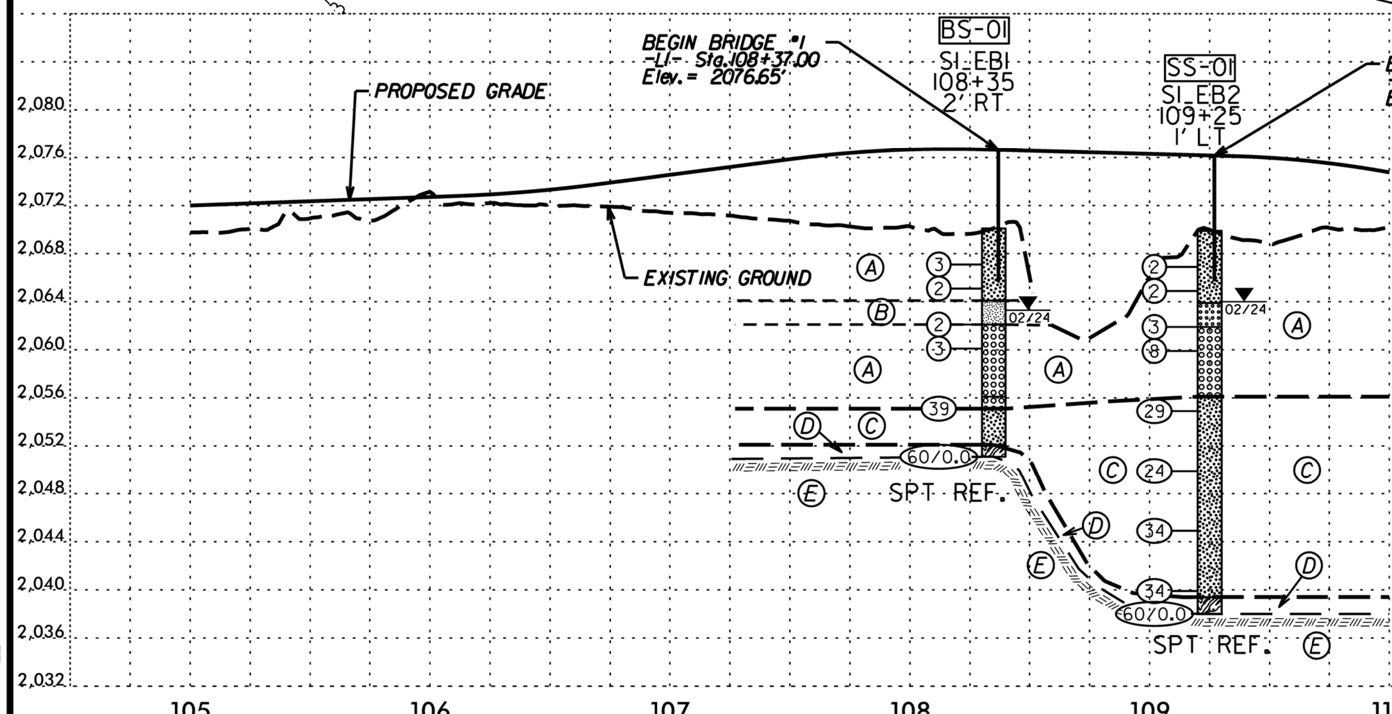
-L1- PLAN AND PROFILE

10 0 20

PROJECT:
CLEAR CREEK GREENWAY

JOB NUMBER: 015574013
SHEET NUMBER: 5





SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							10	40	200		
BS-01	2 FT RT	108+35	0.5'-9.5'	A-2-4	25	1	97	95	34.7	25	-
SS-01	1 FT LT	109+25	4.0'-5.5'	A-2-4	24	NP	100	100	21.6	33	-

Ⓐ **ALLUVIAL:** TAN,BROWN,AND GRAY,MOIST TO SATURATED,V.LOOSE TO LOOSE,FINE TO COARSE SAND AND SILTY SAND (A-1-a,A-3,A-2-4)
Ⓑ **ALLUVIAL:** GRAY,WET,SOFT,FINE SANDY SILT (A-4) WITH TRACE ORGANICS
Ⓒ **RESIDUAL:** TAN AND GRAY,MOIST TO WET,MED.DENSE TO DENSE,SILTY SAND (A-2-4) SAPROLITIC
Ⓓ **WEATHERED ROCK:** TAN AND GRAY,GNEISS
Ⓔ **CRYSTALLINE ROCK:** TAN AND GRAY,GNEISS

$FILE$

REV. No.:	REVISION:	DATE:	DRAWN BY:	CHECKED BY:

$DATE$

PREPARED IN THE OFFICE OF:

Kimley»Horn

NC LICENSE #F-0102
200 S TRYON ST, SUITE 200
CHARLOTTE, NORTH CAROLINA 28202
PHONE: (704) 333-5131
©2024

-L1- PLAN AND PROFILE

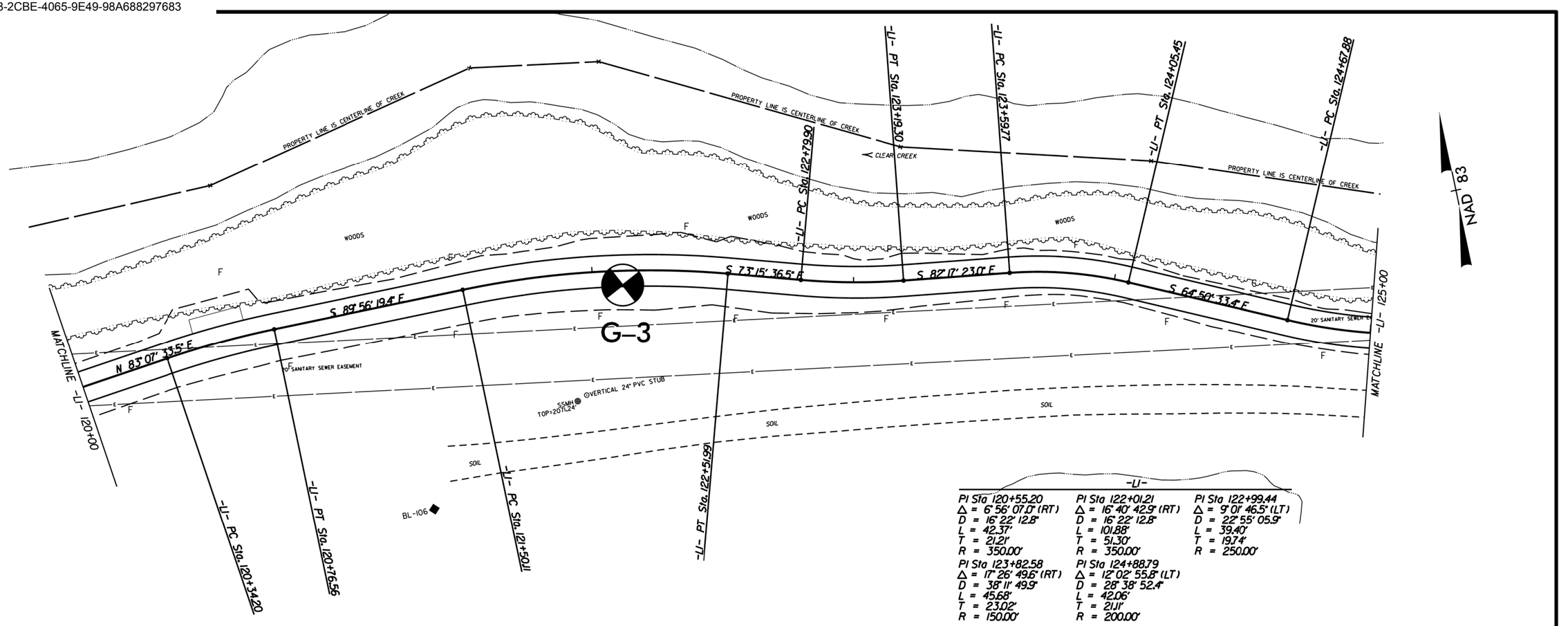
10 0 20

PROJECT:

CLEAR CREEK GREENWAY

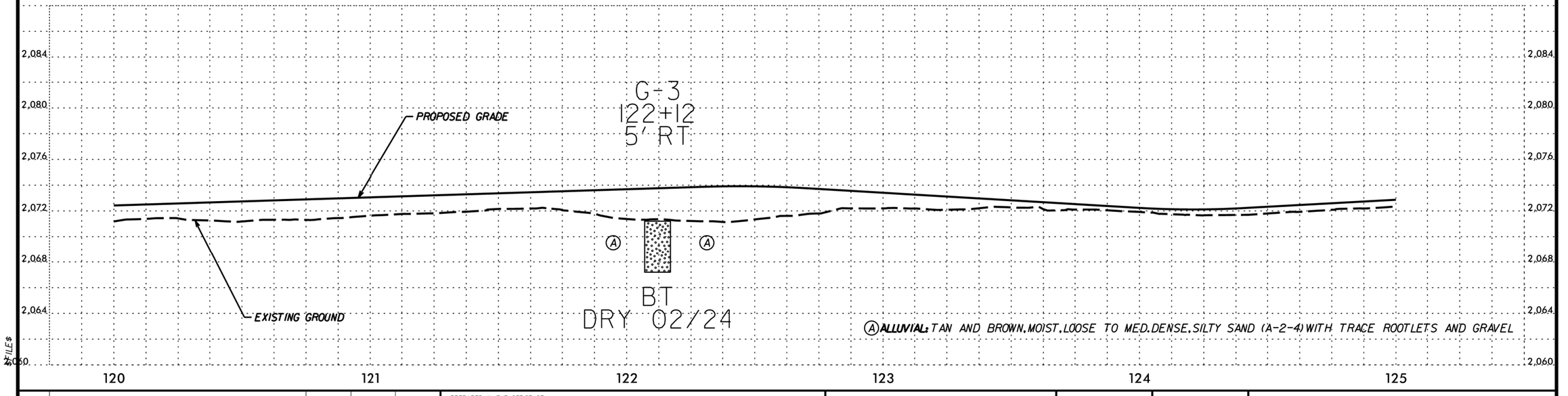
JOB NUMBER: 015574013

SHEET NUMBER: 6



-L1-

PI Sta 120+55.20	PI Sta 122+01.21	PI Sta 122+99.44
Δ = 6° 56' 07.0" (RT)	Δ = 16° 40' 42.9" (RT)	Δ = 9° 01' 46.5" (LT)
D = 16° 22' 12.8"	D = 16° 22' 12.8"	D = 22° 55' 05.9"
L = 42.37'	L = 101.88'	L = 39.40'
T = 21.21'	T = 51.30'	T = 19.74'
R = 350.00'	R = 350.00'	R = 250.00'
PI Sta 123+82.58	PI Sta 124+88.79	
Δ = 17° 26' 49.6" (RT)	Δ = 12° 02' 55.8" (LT)	
D = 38° 11' 49.9"	D = 28° 38' 52.4"	
L = 45.68'	L = 42.06'	
T = 23.02'	T = 21.11'	
R = 150.00'	R = 200.00'	



Ⓐ **ALLUVIAL:** TAN AND BROWN, MOIST, LOOSE TO MED. DENSE, SILTY SAND (A-2-4) WITH TRACE ROOTLETS AND GRAVEL

REV. No.:	REVISION:	DATE:	DRAWN BY:	CHECKED BY:

$DATE$

PREPARED IN THE OFFICE OF:

Kimley»Horn
NC LICENSE #F-0102
200 S TRYON ST, SUITE 200
CHARLOTTE, NORTH CAROLINA 28202
PHONE: (704) 333-5131

-L1- PLAN AND PROFILE

10 0 20

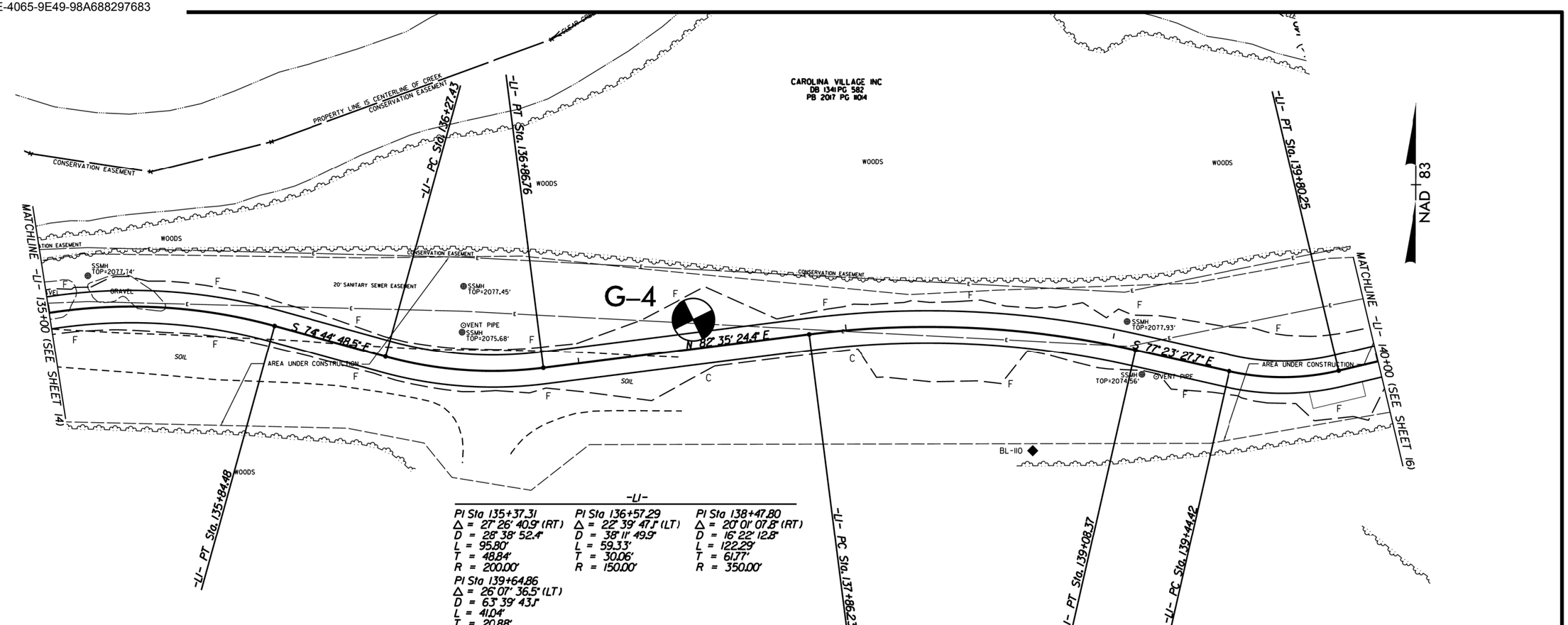
PROJECT:

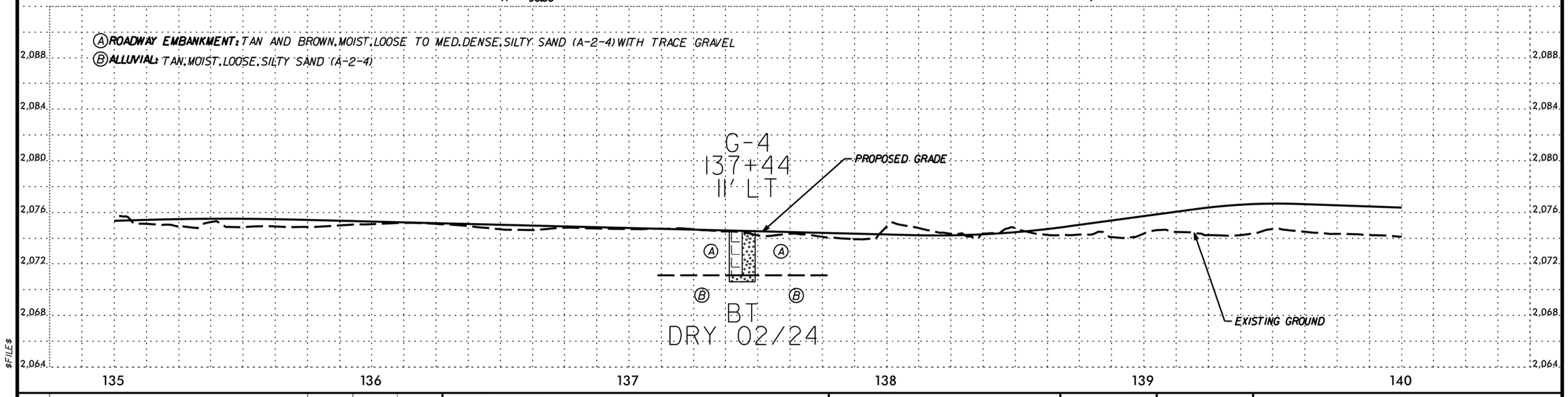
CLEAR CREEK GREENWAY

JOB NUMBER: 015574013

SHEET NUMBER: 7

$FILE$





$FILE$

REV. No.	REVISION:	DATE:	DRAWN BY:	CHECKED BY:

$DATE$

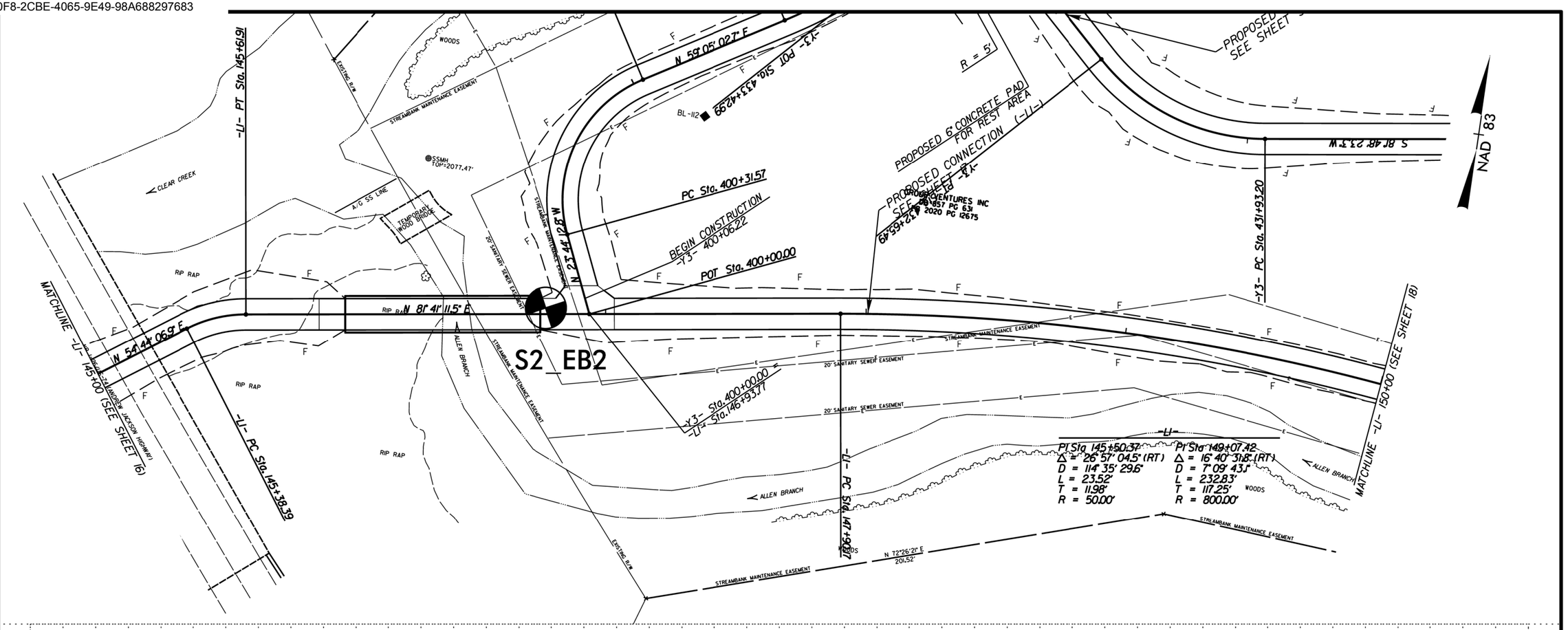
PREPARED IN THE OFFICE OF:
Kimley»Horn
NC LICENSE #F-0102
200 S TRYON ST, SUITE 200
CHARLOTTE, NORTH CAROLINA 28202
PHONE: (704) 333-5131

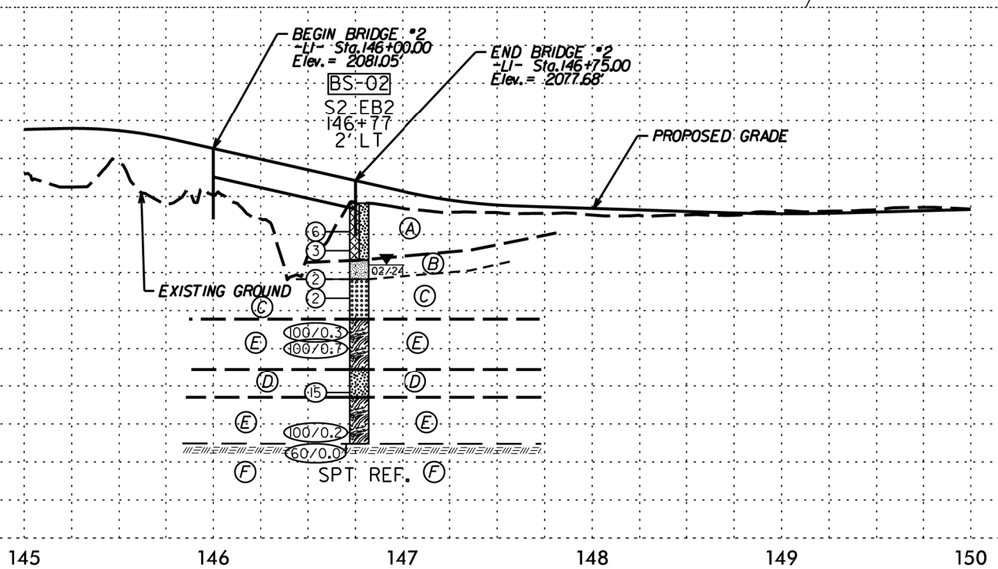
-L1- PLAN AND PROFILE

10 0 20

PROJECT:
CLEAR CREEK GREENWAY

JOB NUMBER: 015574013
SHEET NUMBER: 8





SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
BS-02	2' FT LT	146+77	0.5'-9.5'	A-4	33	8	99	94	59.1	31	-

(A) **ARTIFICIAL FILL:** BROWN, MOIST, V. LOOSE TO LOOSE, SILTY SAND (A-2-4) WITH TRACE GRAVEL AND BOULDERS
(B) **ALLUVIAL:** GRAY, WET, SOFT, FINE SANDY SILT (A-4) WITH TRACE ORGANICS
(C) **ALLUVIAL:** TAN AND GRAY, SATURATED, V. LOOSE, FINE SAND (A-3) WITH TRACE ORGANICS
(D) **RESIDUAL:** BROWN AND GRAY, WET, MED. DENSE, SILTY SAND (A-2-4)
(E) **WEATHERED ROCK:** TAN AND GRAY, GNEISS
(F) **CRYSTALLINE ROCK:** TAN AND GRAY, GNEISS

$FILE$

REV. No.:	REVISION:	DATE:	DRAWN BY:	CHECKED BY:

$DATE$

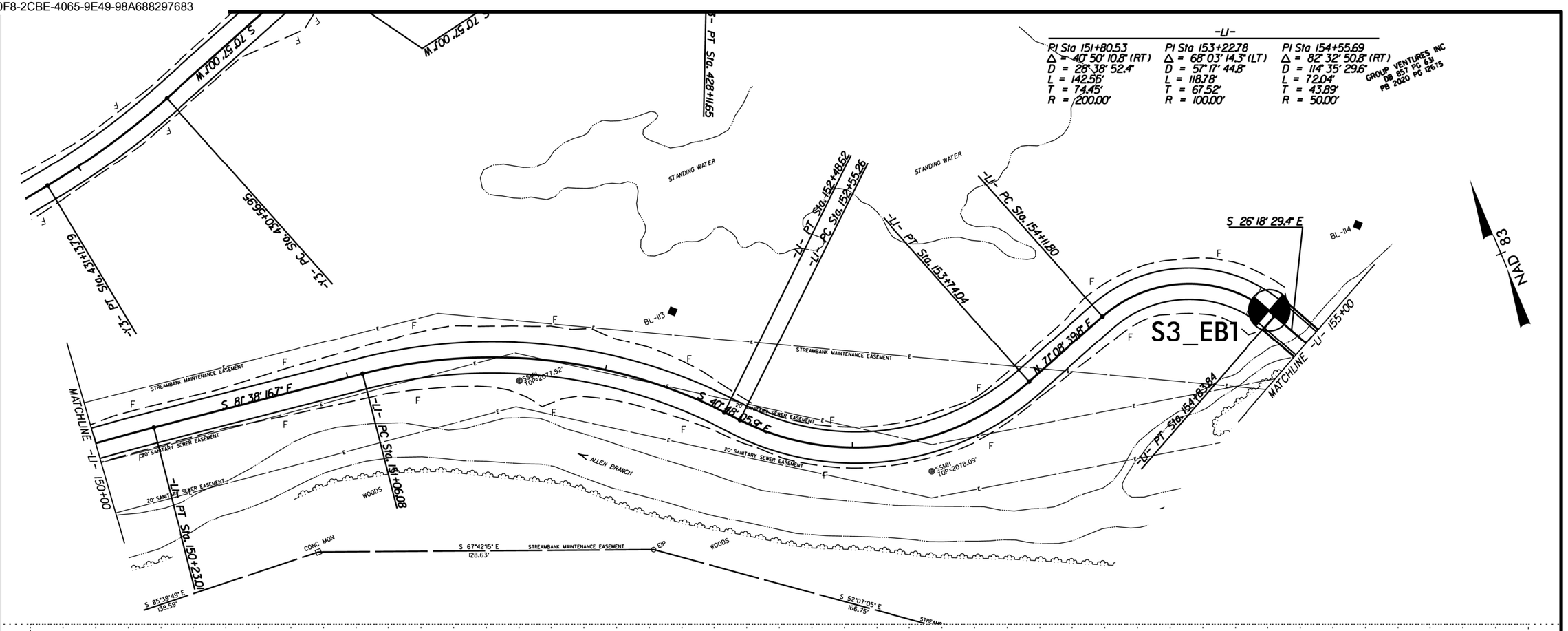
PREPARED IN THE OFFICE OF:
Kimley»Horn
NC LICENSE #F-0102
200 S TRYON ST, SUITE 200
CHARLOTTE, NORTH CAROLINA 28202
PHONE: (704) 333-5131

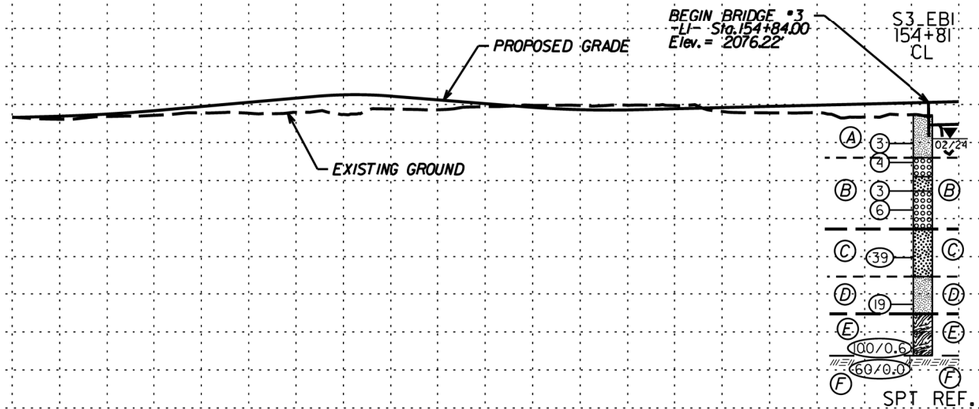
-L1- PLAN AND PROFILE

10 0 20

PROJECT:
CLEAR CREEK GREENWAY

JOB NUMBER: 015574013
SHEET NUMBER: 9





SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
SS-02	CL	154+81	2.0'-3.5'	A-4	39	5	98	95	54.6	39	-

(A) **ALLUVIAL:** BROWN AND GRAY, WET, SOFT, FINE SANDY SILT (A-4) WITH TRACE ORGANICS

(B) **ALLUVIAL:** TAN AND GRAY, WET TO SATURATED, LOOSE, FINE TO COARSE SAND AND CLAYEY SILTY SAND (A-1-a, A-1-b, A-2-5) WITH TRACE ORGANICS

(C) **RESIDUAL:** GRAY AND WHITE, MOIST, DENSE, SILTY SAND (A-2-4) SAPROLITIC

(D) **RESIDUAL:** TAN, MOIST, V. STIFF, FINE SANDY SILT (A-4) WITH TRACE MICA

(E) **WEATHERED ROCK:** TAN WHITE AND GRAY, GNEISS

(F) **CRYSTALLINE ROCK:** TAN WHITE AND GRAY, GNEISS

$FILE$

REV. No.	REVISION:	DATE:	DRAWN BY:	CHECKED BY:

$DATE$

PREPARED IN THE OFFICE OF:
Kimley»Horn
NC LICENSE #F-0102
200 S TRYON ST, SUITE 200
CHARLOTTE, NORTH CAROLINA 28202
PHONE: (704) 333-5131

-L1- PLAN AND PROFILE

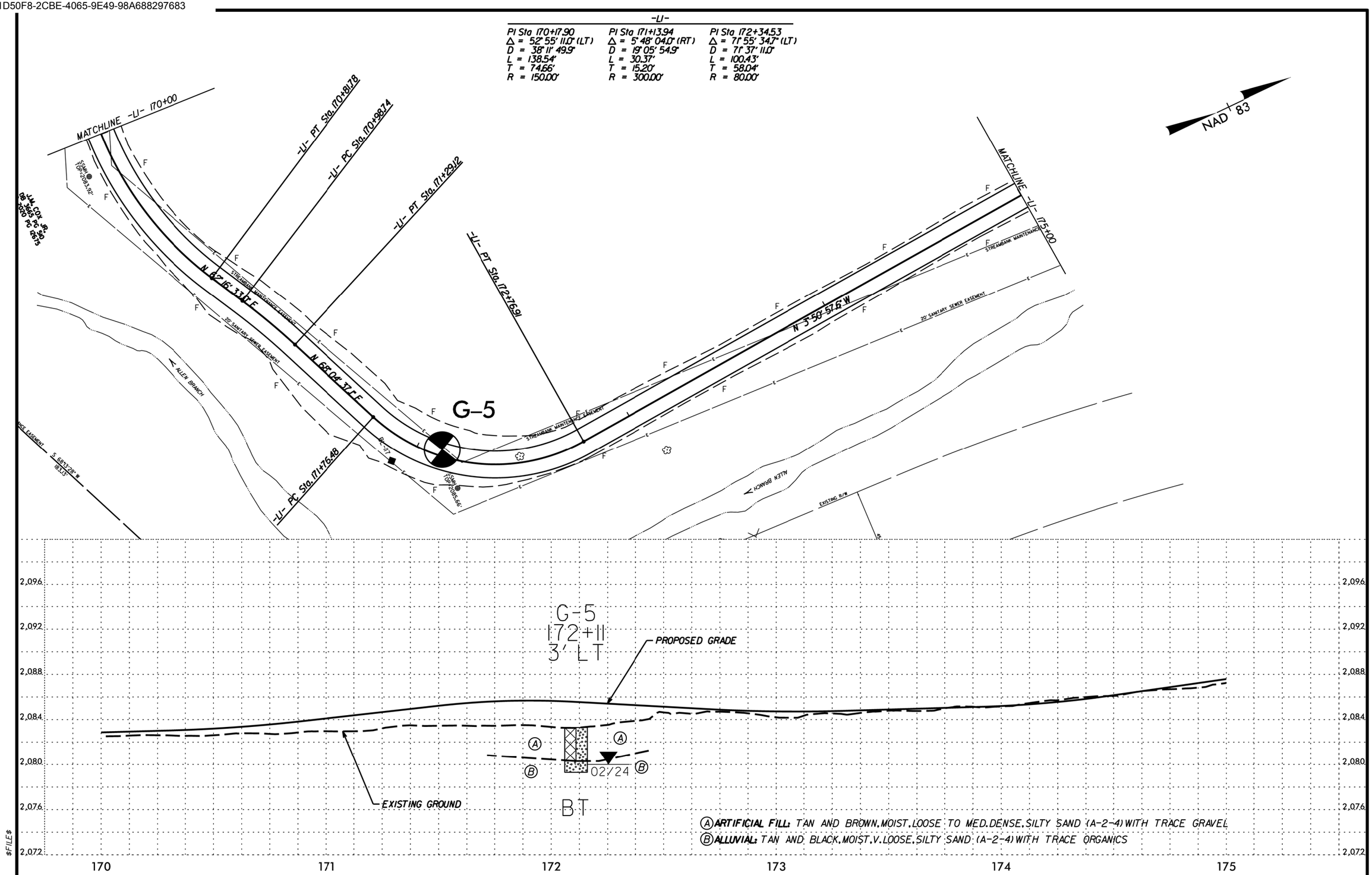
10 0 20

PROJECT:
CLEAR CREEK GREENWAY

JOB NUMBER: 015574013
SHEET NUMBER: 10

-L1-

PI Sta 170+17.90	PI Sta 171+13.94	PI Sta 172+34.53
Δ = 52° 55' 11.0" (LT)	Δ = 5° 48' 04.0" (RT)	Δ = 71° 55' 34.7" (LT)
D = 38° 11' 49.9"	D = 19° 05' 54.9"	D = 71° 37' 11.0"
L = 138.54'	L = 30.37'	L = 100.43'
T = 74.66'	T = 15.20'	T = 58.04'
R = 150.00'	R = 300.00'	R = 80.00'



Ⓐ **ARTIFICIAL FILL:** TAN AND BROWN, MOIST, LOOSE TO MED. DENSE, SILTY SAND (A-2-4) WITH TRACE GRAVEL

Ⓑ **ALLUVIAL:** TAN AND BLACK, MOIST, V. LOOSE, SILTY SAND (A-2-4) WITH TRACE ORGANICS

$FILE$

$DATE$

REV. No.:	REVISION:	DATE:	DRAWN BY:	CHECKED BY:

PREPARED IN THE OFFICE OF:

Kimley»Horn
NC LICENSE #F-0102
200 S TRYON ST, SUITE 200
CHARLOTTE, NORTH CAROLINA 28202
PHONE: (704) 333-5131

-L1- PLAN AND PROFILE

10 0 20

PROJECT:

CLEAR CREEK GREENWAY

JOB NUMBER: 015574013

SHEET NUMBER: 11

PROJECT REFERENCE NO.	SHEET NO.
BL–0008	12

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

APPENDIX A
DCP TEST RESULTS

REFERENCE: BL–0008

PROJECT: _____

DCP TEST DATA

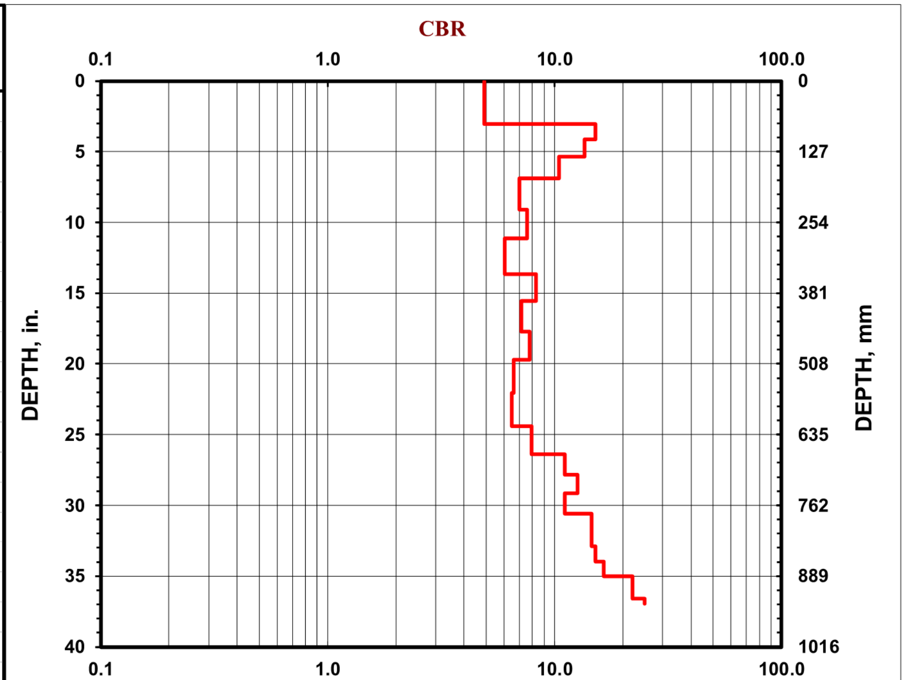
File Name: G-01

Project: *G23002.00 BL-0008* **Date:** 13-Feb-24
Location: Hendersonville, NC **Soil Type(s):** Type in the soil type

Hammer: ○ 10.1 lbs. ● 17.6 lbs. ○ Both hammers used

Soil Type: ○ CH ○ CL ● All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
2	77	1
2	105	1
2	136	1
2	175	1
2	231	1
2	283	1
2	347	1
2	395	1
2	450	1
2	501	1
2	560	1
2	620	1
2	670	1
2	707	1
2	740	1
2	777	1
2	806	1
2	835	1
2	863	1
2	889	1
2	909	1
2	929	1
1	938	1



DCP TEST DATA

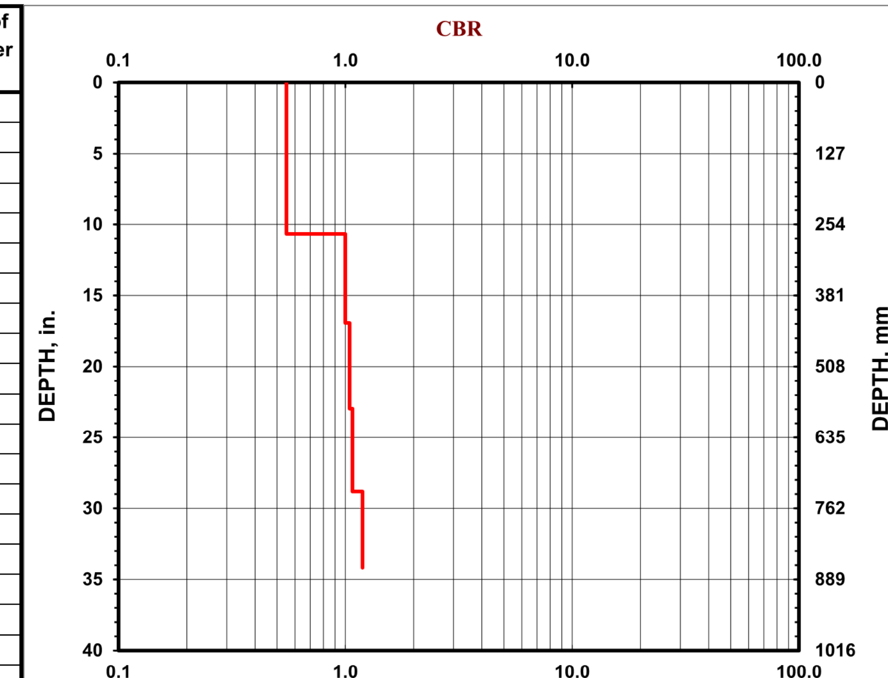
File Name: G-02

Project: *G23002.00 BL-0008* **Date:** 13-Feb-24
Location: Hendersonville, NC **Soil Type(s):** A-2-4

Hammer: ○ 10.1 lbs. ● 17.6 lbs. ○ Both hammers used

Soil Type: ○ CH ○ CL ● All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
1	271	1
1	430	1
1	583	1
1	732	1
1	868	1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1



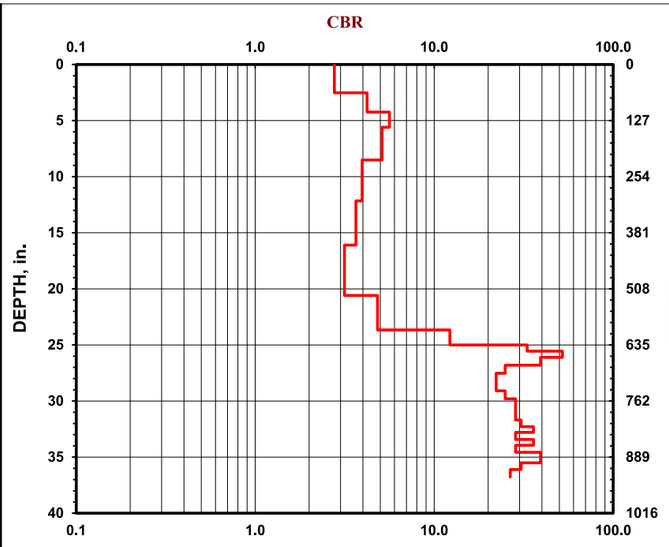
DCP TEST DATA

File Name: G-03

Project: *G23002.00 BL-0008*
Location: Hendersonvillle, NC
Date: 13-Feb-24
Soil Type(s): A-2-4

Hammer: (•) 17.6 lbs. — Soil Type: ( ) CH, ( ) CL, (•) All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
1	64	1
1	108	1
1	142	1
1	179	1
1	216	1
2	309	1
2	409	1
2	523	1
2	601	1
2	635	1
2	649	1
3	663	1
3	681	1
1	690	1
1	699	1
2	719	1
2	739	1
2	757	1
2	773	1
2	789	1
2	805	1
2	820	1
2	833	1
2	849	1
2	862	1
2	878	1
2	890	1
2	902	1
2	917	1
2	934	1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1



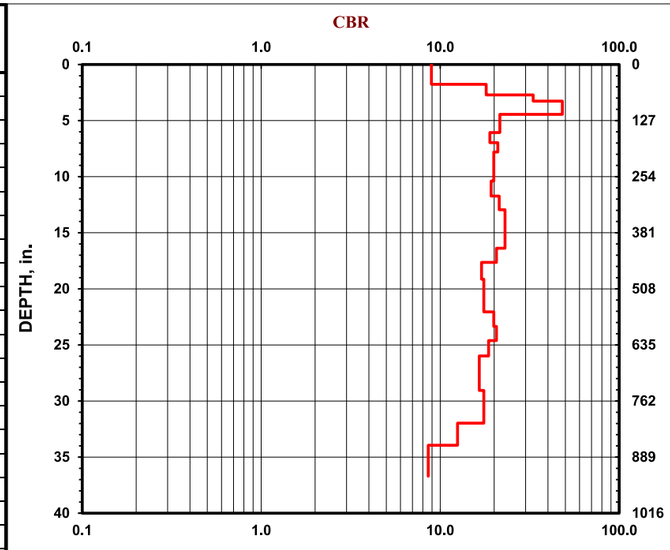
DCP TEST DATA

File Name: G-04

Project: *G23002.00 BL-0008*
Location: Hendersonville, NC
Date: 13-Feb-24
Soil Type(s): A-2-4

Hammer: (•) 17.6 lbs. — Soil Type: ( ) CH, ( ) CL, (•) All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
2	45	1
2	69	1
2	83	1
6	113	1
4	154	1
2	177	1
2	198	1
3	231	1
3	264	1
3	298	1
3	329	1
3	358	1
3	387	1
3	416	1
3	448	1
3	486	1
3	523	1
3	560	1
3	593	1
3	625	1
3	660	1
3	699	1
3	738	1
3	775	1
3	812	1
3	862	1
3	932	1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1



DCP TEST DATA

File Name: G-05

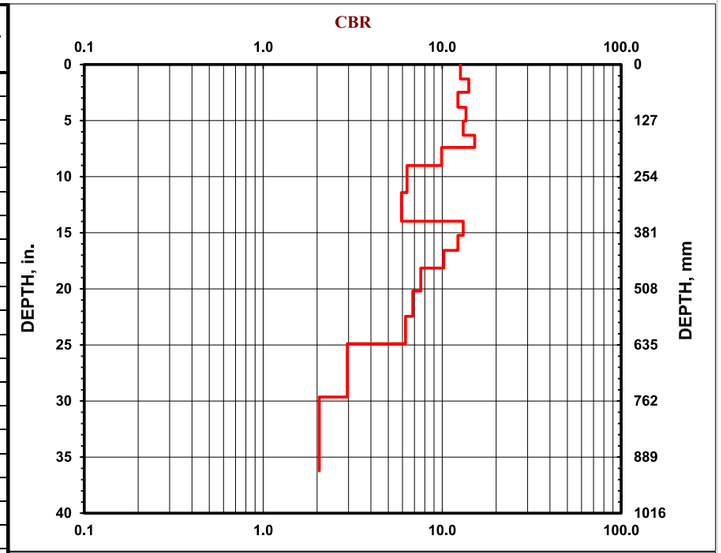
Project: *G23002.00 BL-0008* **Date:** 13-Feb-24

Location: Hendersonville, NC **Soil Type(s):** A-2-4

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
2	33	1
2	63	1
2	97	1
2	128	1
2	160	1
2	188	1
2	229	1
2	290	1
2	355	1
2	387	1
2	421	1
2	461	1
2	513	1
2	570	1
2	632	1
2	753	1
2	920	1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1
		1



PROJECT REFERENCE NO.	SHEET NO.
BL–0008	16

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

APPENDIX A
LABORATORY TEST RESULTS

REFERENCE: BL–0008

PROJECT: _____

FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
CARY, NC 27513

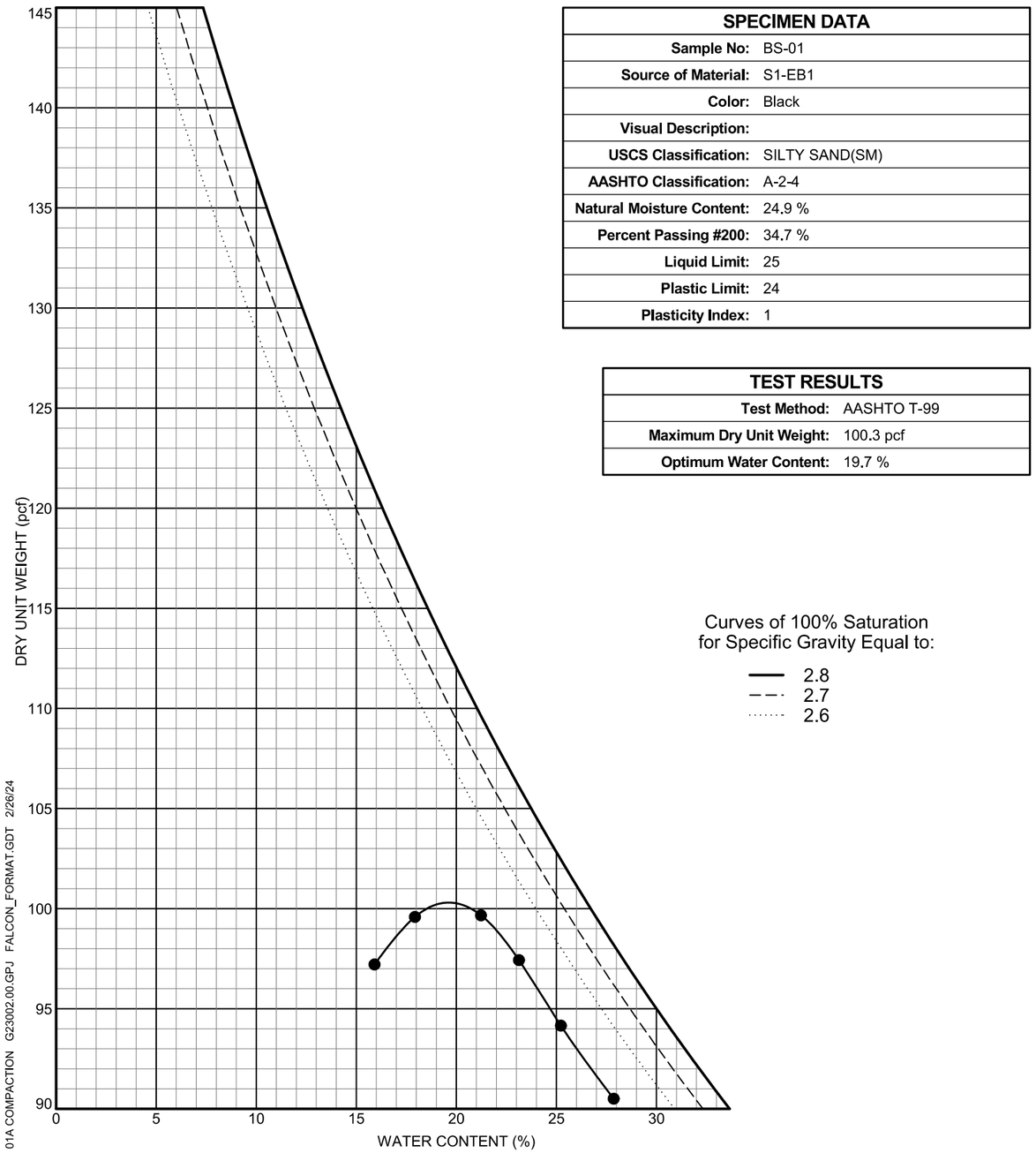
PHONE: 919.871.0800
www.falconengineers.com

LABORATORY COMPACTION TEST RESULTS

Project No.: G23002.00
Project Name: Clear Creek Greenway
Project Location: Hendersonville, NC

SPECIMEN DATA	
Sample No:	BS-01
Source of Material:	S1-EB1
Color:	Black
Visual Description:	
USCS Classification:	SILTY SAND(SM)
AASHTO Classification:	A-2-4
Natural Moisture Content:	24.9 %
Percent Passing #200:	34.7 %
Liquid Limit:	25
Plastic Limit:	24
Plasticity Index:	1

TEST RESULTS	
Test Method:	AASHTO T-99
Maximum Dry Unit Weight:	100.3 pcf
Optimum Water Content:	19.7 %



FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
CARY, NC 27513

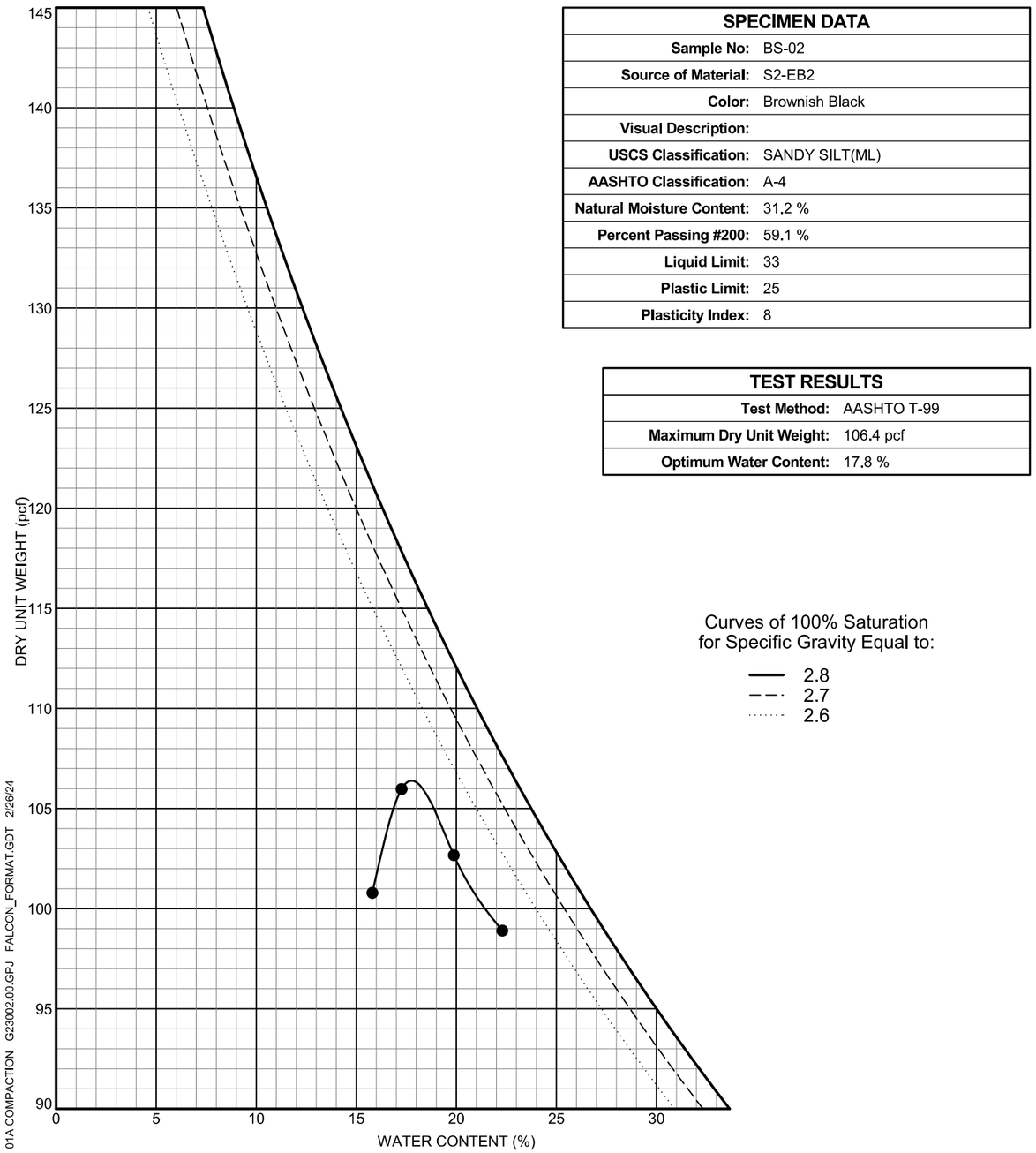
PHONE: 919.871.0800
www.falconengineers.com

LABORATORY COMPACTION TEST RESULTS

Project No.: G23002.00
Project Name: Clear Creek Greenway
Project Location: Hendersonville, NC

SPECIMEN DATA	
Sample No:	BS-02
Source of Material:	S2-EB2
Color:	Brownish Black
Visual Description:	
USCS Classification:	SANDY SILT(ML)
AASHTO Classification:	A-4
Natural Moisture Content:	31.2 %
Percent Passing #200:	59.1 %
Liquid Limit:	33
Plastic Limit:	25
Plasticity Index:	8

TEST RESULTS	
Test Method:	AASHTO T-99
Maximum Dry Unit Weight:	106.4 pcf
Optimum Water Content:	17.8 %



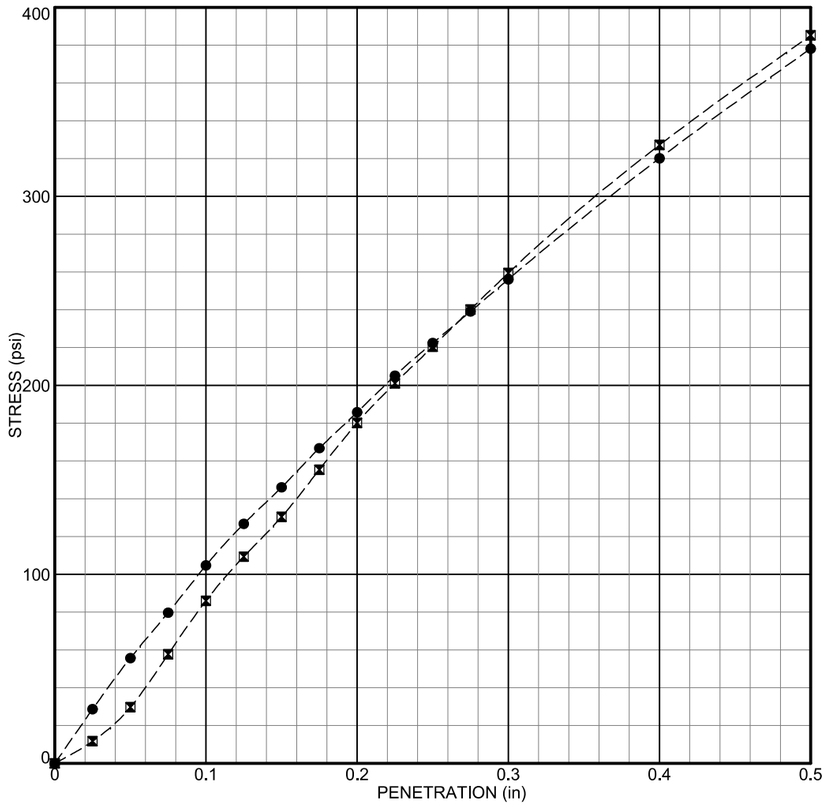
01A COMPACTION G23002.00.GPJ FALCON_FORMAT.GDT 2/26/24

FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
CARY, NC 27513

PHONE: 919.871.0800
www.falconengineers.com

CALIFORNIA BEARING RATIO TEST RESULTS

Project No.: G23002.00
Project Name: Clear Creek Greenway
Project Location: Hendersonville, NC



Sample ID	Boring ID	Depth (ft)	Visual Description | USCS Classification | AASHTO Classification
●	BS-01	S1-EB1	0.5-9.0	Black, SILTY SAND SM| A-2-4
⊠	BS-02	S2-EB2	0.5-9.0	Brownish Black, SANDY SILT ML| A-4

Sample ID	Molded Specimen Data				% Ret.	% Pass.	CBR at Penetration		Percent	Symbol	
	Dry Unit Wt.	MC	% Comp.	Method	#4	#200	0.1 inch	0.2 inch	Swell	USCS	AASHTO
● BS-01	98.4 pcf	19.6%	98.1%	T-99	2.7	34.7	10.5	12.4	0.26%	SM	A-2-4 (0)
⊠ BS-02	104.3 pcf	18.0%	98.0%	T-99	0.3	59.1	10.9	13.4	0.59%	ML	A-4 (5)

FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
CARY, NC 27513

PHONE: 919.871.0800
www.falconengineers.com

CALIFORNIA BEARING RATIO TEST RESULTS

ASTM D1883 / AASHTO T193

Project No.: G23002.00	**Tested By:** C. Sullivan	**Test Date:** 2024-04-03
Project Name: Clear Creek Greenway		
Boring ID: S1-EB1	**Sample ID:** BS-01	**Sample Depth:** 0.5-9.0 ft

MOLDED SPECIMEN TEST DATA

Wt. of Mold + Wet Soil:	20495 g	Moisture Content	Before Molding	After Molding	Max. Dry Unit Weight:	100.3 pcf	
Wt. of Mold:	16482 g	Tare Wt.:	6.40 g	6.80 g	Optimum Moisture Content:	19.7%	
Wt. of Wet Soil:	4013 g	Wt. Tare + Wet Soil:	260.40 g	348.90 g	Percent Compaction:	98.1%	
Mold Volume:	0.0752 cf	Wt. Tare + Dry Soil:	218.70 g	292.80 g	Compaction Method:	T-99	
Wet Unit Weight:	117.7 pcf	Moisture Content:	19.6%	19.6%	Conversion Factors		
Dry Unit Weight:	98.4 pcf	Average Moisture Content:		19.6%	1 lb = 453.6 gram	1 cu. foot = 1728 cu. inch	

LOAD TEST DATA

Penetration (in)	Load (lb)	Stress (psi)
0.000	0	0.0
0.025	86	28.7
0.050	167	55.7
0.075	239	79.7
0.100	314	104.7
0.125	380	126.7
0.150	438	146.1
0.175	500	166.7
0.200	557	185.7
0.225	615	205.1
0.250	667	222.4
0.275	717	239.1
0.300	768	256.1
0.400	960	320.1
0.500	1134	378.2

Piston Calibration

Strain Rate:	0.05 inch/minute
Piston Diameter:	1.954 inch
Piston Area:	2.999 sq. inch

Swell Readings

Soak Time:	96 hours
Surcharge Weight:	10 lb
Surcharge Stress:	51 psf
Molded Sample Height:	4.594 inch
Initial Dial Reading:	0.050 inch
Final Dial Reading:	0.062 inch
Percent Swell:	0.26%

Readings After Soak	
Wt. Mold + Soaked Soil:	20581.00 g
Wt. Tare:	6.30 g
Wt. Wet Soil + Tare:	238.60 g
Wt. Tare + Dry Soil:	192.90 g
Moisture Content:	24.5%
Wet Unit Weight:	120.2 pcf
Dry Unit Weight:	96.5 pcf

BEARING RATIO

CBR at 0.1 inch: **10.5**

CBR at 0.2 inch: **12.4**

Additional Specimen Data

Liquid Limit:	25	Percent Passing #4:	97%
Plastic Limit:	24	Percent Passing #10:	97%
Plasticity Index:	1	Percent Passing #40:	95%
		Percent Passing #200:	34.7%

Color:	Black
Visual Description:	
USCS Classification:	SILTY SAND (SM)
AASHTO Classification:	A-2-4 (0)

FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
CARY, NC 27513

PHONE: 919.871.0800
www.falconengineers.com

CALIFORNIA BEARING RATIO TEST RESULTS

ASTM D1883 / AASHTO T193

Project No.: G23002.00	**Tested By:** C. Sullivan	**Test Date:** 2024-04-03
Project Name: Clear Creek Greenway		
Boring ID: S2-EB2	**Sample ID:** BS-02	**Sample Depth:** 0.5-9.0 ft

MOLDED SPECIMEN TEST DATA

Wt. of Mold + Wet Soil:	20651 g	Moisture Content	Before Molding	After Molding	Max. Dry Unit Weight:	106.4 pcf	
Wt. of Mold:	16456 g	Tare Wt.:	6.30 g	6.40 g	Optimum Moisture Content:	17.8%	
Wt. of Wet Soil:	4195 g	Wt. Tare + Wet Soil:	299.70 g	315.40 g	Percent Compaction:	98.0%	
Mold Volume:	0.0752 cf	Wt. Tare + Dry Soil:	254.90 g	268.50 g	Compaction Method:	T-99	
Wet Unit Weight:	123.0 pcf	Moisture Content:	18.0%	17.9%	Conversion Factors		
Dry Unit Weight:	104.3 pcf	Average Moisture Content:		18.0%	1 lb = 453.6 gram	1 cu. foot = 1728 cu. inch	

LOAD TEST DATA

Penetration (in)	Load (lb)	Stress (psi)
0.000	0	0.0
0.025	35	11.7
0.050	89	29.7
0.075	173	57.7
0.100	258	86.0
0.125	328	109.4
0.150	391	130.4
0.175	466	155.4
0.200	540	180.1
0.225	603	201.1
0.250	661	220.4
0.275	720	240.1
0.300	778	259.4
0.400	981	327.1
0.500	1155	385.2

Piston Calibration

Strain Rate:	0.05 inch/minute
Piston Diameter:	1.954 inch
Piston Area:	2.999 sq. inch

Swell Readings

Soak Time:	96 hours
Surcharge Weight:	10 lb
Surcharge Stress:	51 psf
Molded Sample Height:	4.592 inch
Initial Dial Reading:	0.050 inch
Final Dial Reading:	0.077 inch
Percent Swell:	0.59%

Readings After Soak	
Wt. Mold + Soaked Soil:	20716.00 g
Wt. Tare:	6.50 g
Wt. Wet Soil + Tare:	191.10 g
Wt. Tare + Dry Soil:	158.60 g
Moisture Content:	21.4%
Wet Unit Weight:	124.9 pcf
Dry Unit Weight:	102.9 pcf

BEARING RATIO

CBR at 0.1 inch: **10.9**

CBR at 0.2 inch: **13.4**

Additional Specimen Data

Liquid Limit:	33	Percent Passing #4:	100%
Plastic Limit:	25	Percent Passing #10:	99%
Plasticity Index:	8	Percent Passing #40:	94%
		Percent Passing #200:	59.1%

Color:	Brownish Black
Visual Description:	
USCS Classification:	SANDY SILT (ML)
AASHTO Classification:	A-4 (5)