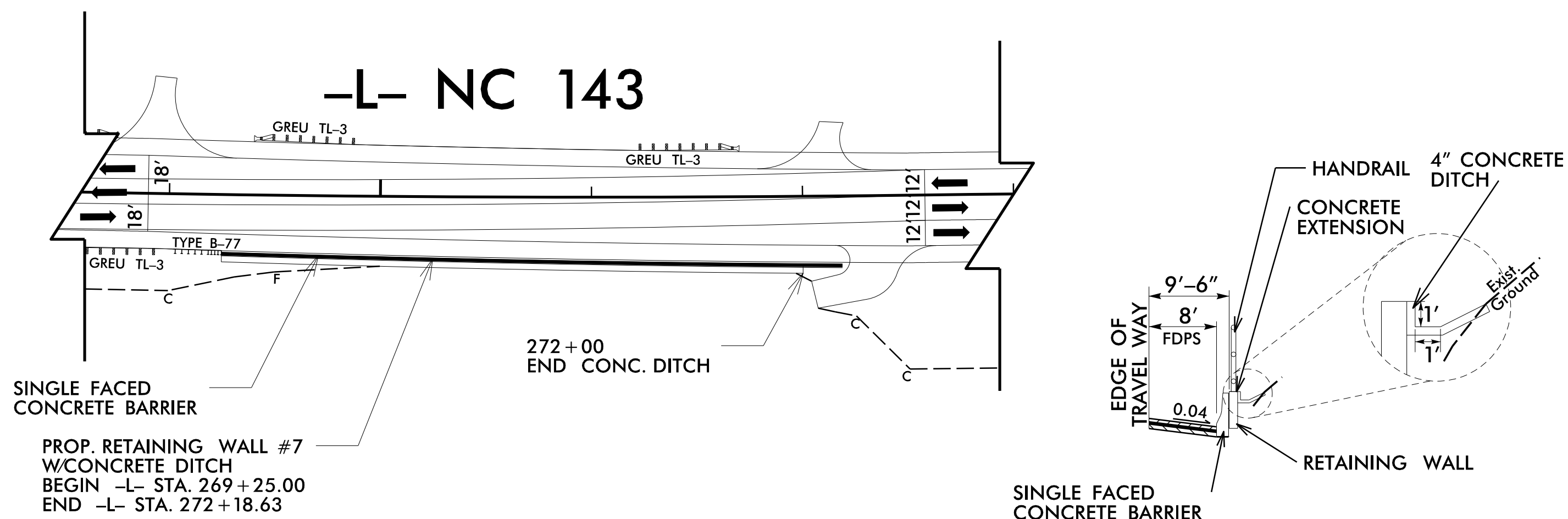
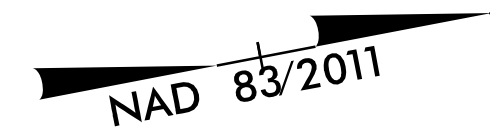


RETAINING WALL #7:

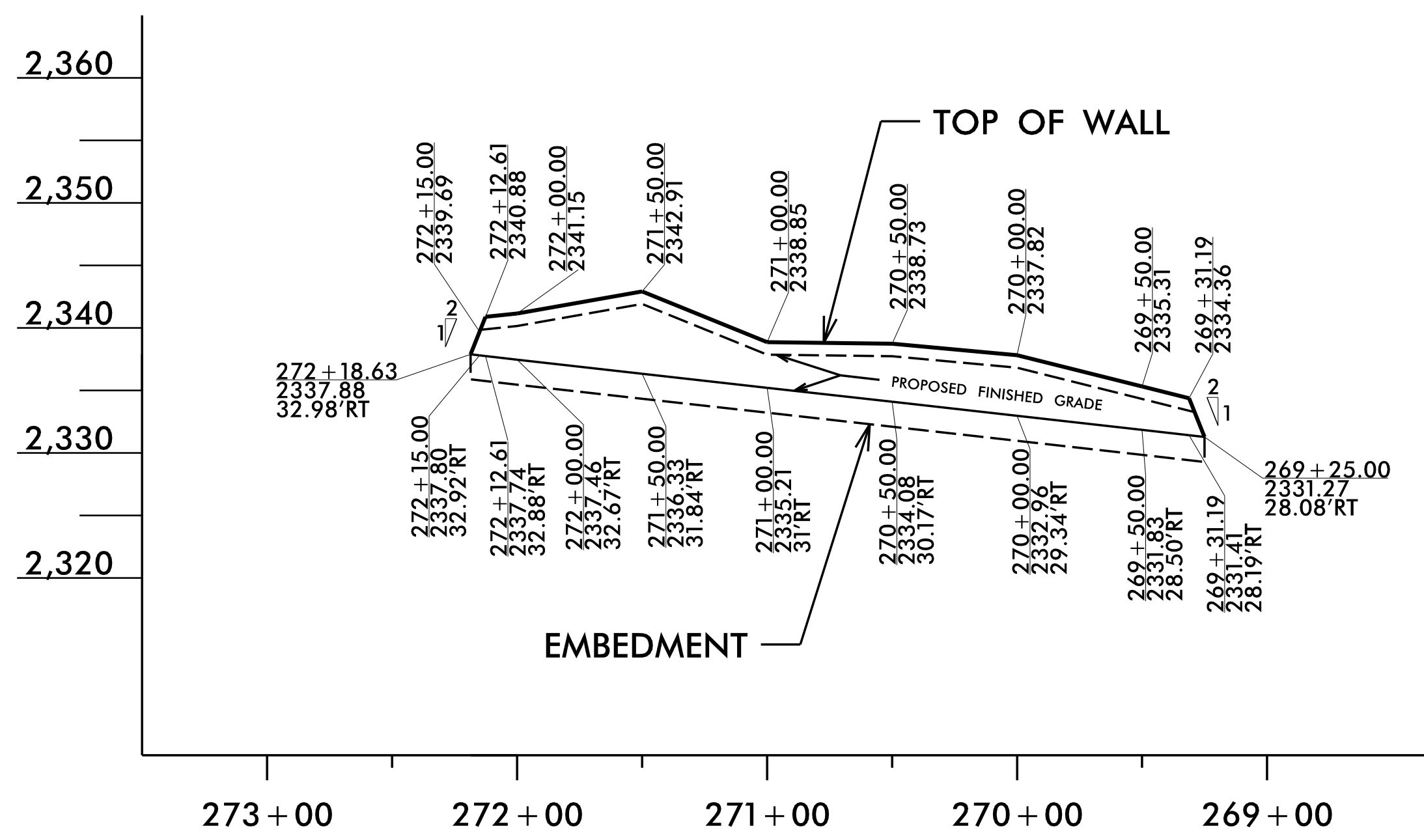
270



PROP. RETAINING WALL #7
W/CONCRETE DITCH
BEGIN -L- STA. 269+25.00
END -L- STA. 272+18.63

DETAIL FOR WALL #7
NOT TO SCALE
-L- STA. 269+25.00 TO -L- STA. 272+18.63, RT

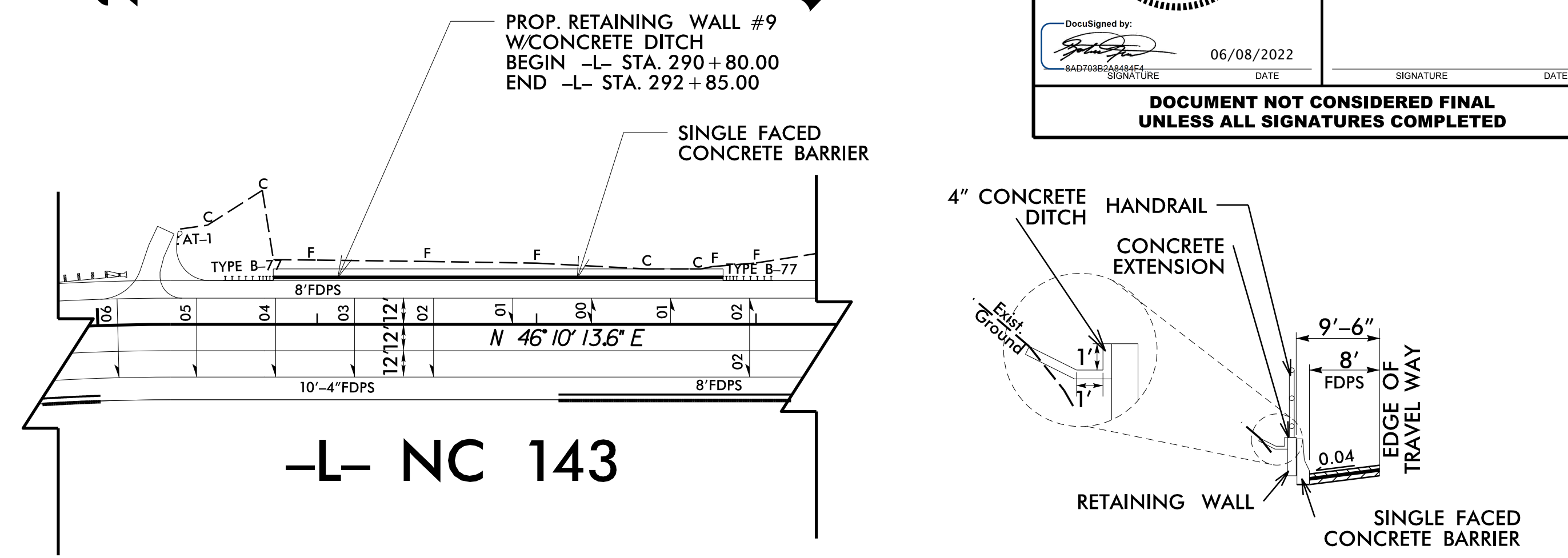
ESTIMATED RETAINING WALL QUANTITY (SQUARE FEET)	
NON-STANDARD CIP GRAVITY RETAINING WALL #7	1,595 SF



RETAINING WALL #7:
NOT TO SCALE
(LOOKING AT FACE OF WALL)

RETAINING WALL #9:

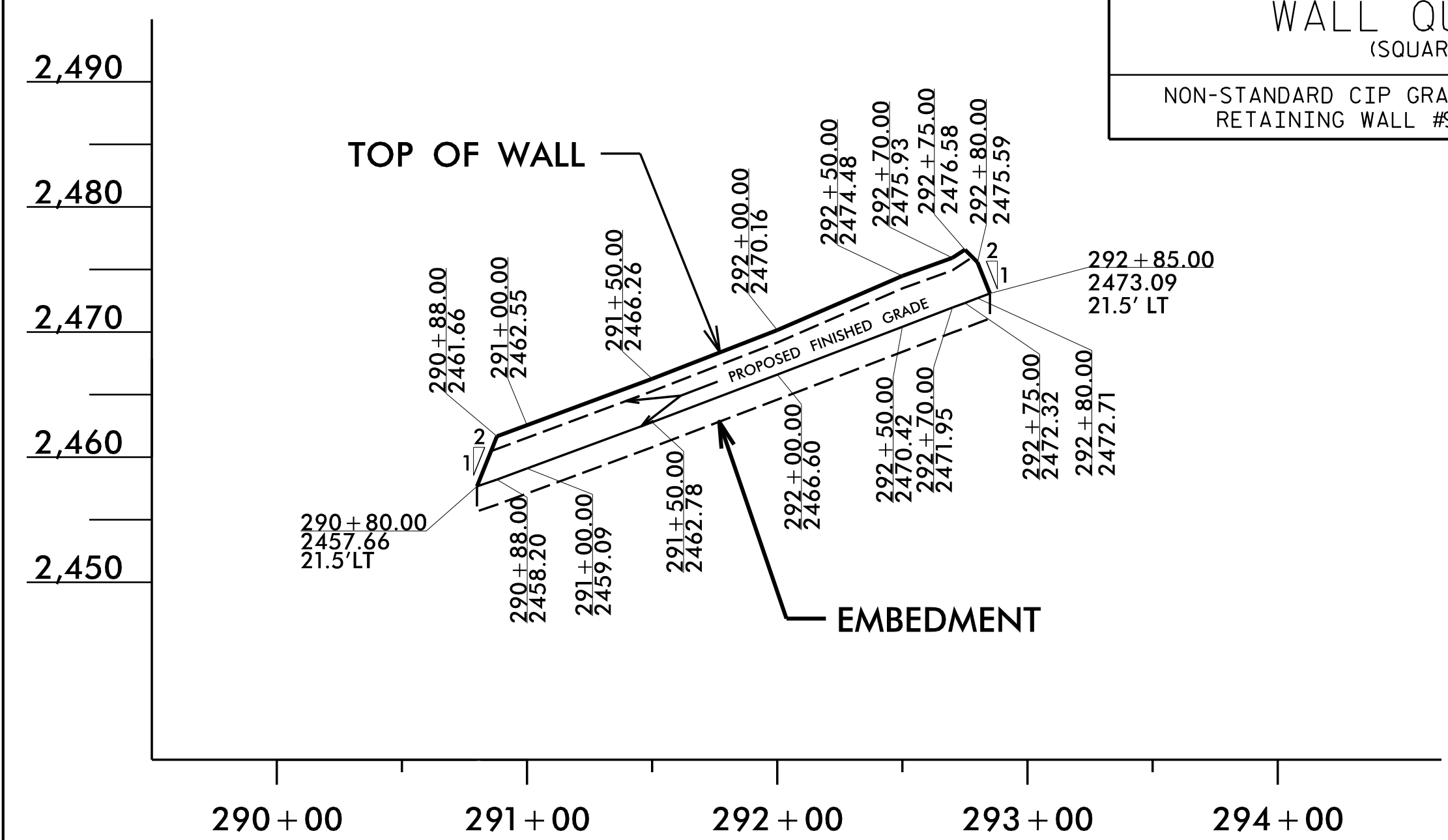
290



PROP. RETAINING WALL #9
W/CONCRETE DITCH
BEGIN -L- STA. 290+80.00
END -L- STA. 292+85.00

DETAIL FOR WALL #9
NOT TO SCALE
-L- STA. 290+80.00 TO -L- STA. 292+85.00, LT

ESTIMATED RETAINING WALL QUANTITY (SQUARE FEET)	
NON-STANDARD CIP GRAVITY RETAINING WALL #9	945 SF



RETAINING WALL #9:
NOT TO SCALE
(LOOKING AT FACE OF WALL)

PROJECT NO.: A-0009CB
GRAHAM COUNTY
RETAINING WALL #7: -L- 269+25, 28' RT TO 272+19, 33' RT
RETAINING WALL #9: -L- 290+80, 22' LT TO 292+85, 22' LT
RETAINING WALL #11: -L- 330+82, 22' LT TO 333+24, 22' LT
RETAINING WALL #38: -L- 319+29, 34' LT TO 321+08, 34' LT

PREPARED BY: R. KRAL
REVIEWED BY: M. BREWER
DATE: 5/17/2022

RETAINING WALL #7 AND #9 ENVELOPES AND WALL LAYOUTS PROVIDED BY TGS ENGINEERS, INC.
DATE: 5/17/2022

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
2400 CROWPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #7, #9, #11, #38
NON-STANDARD CIP GRAVITY RETAINING WALL

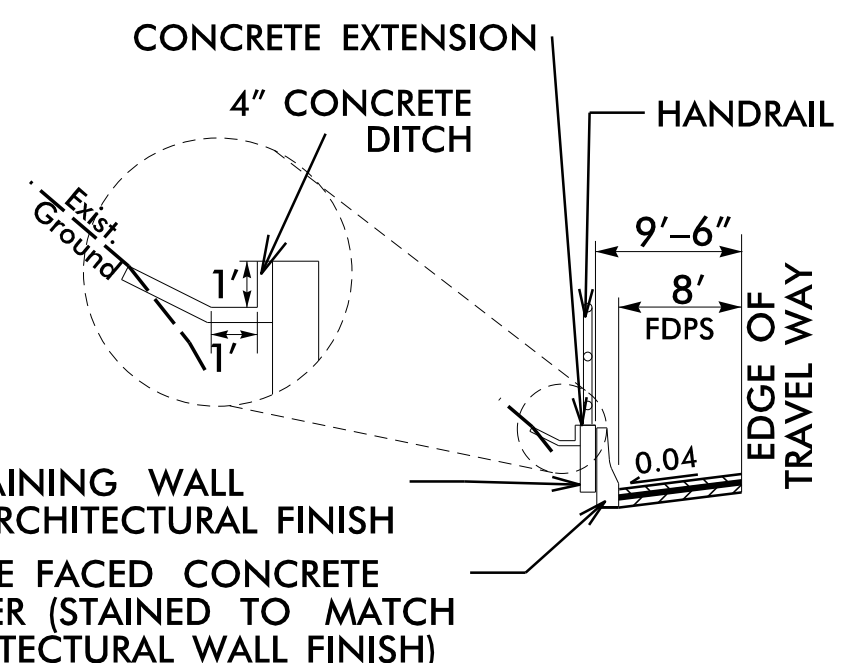
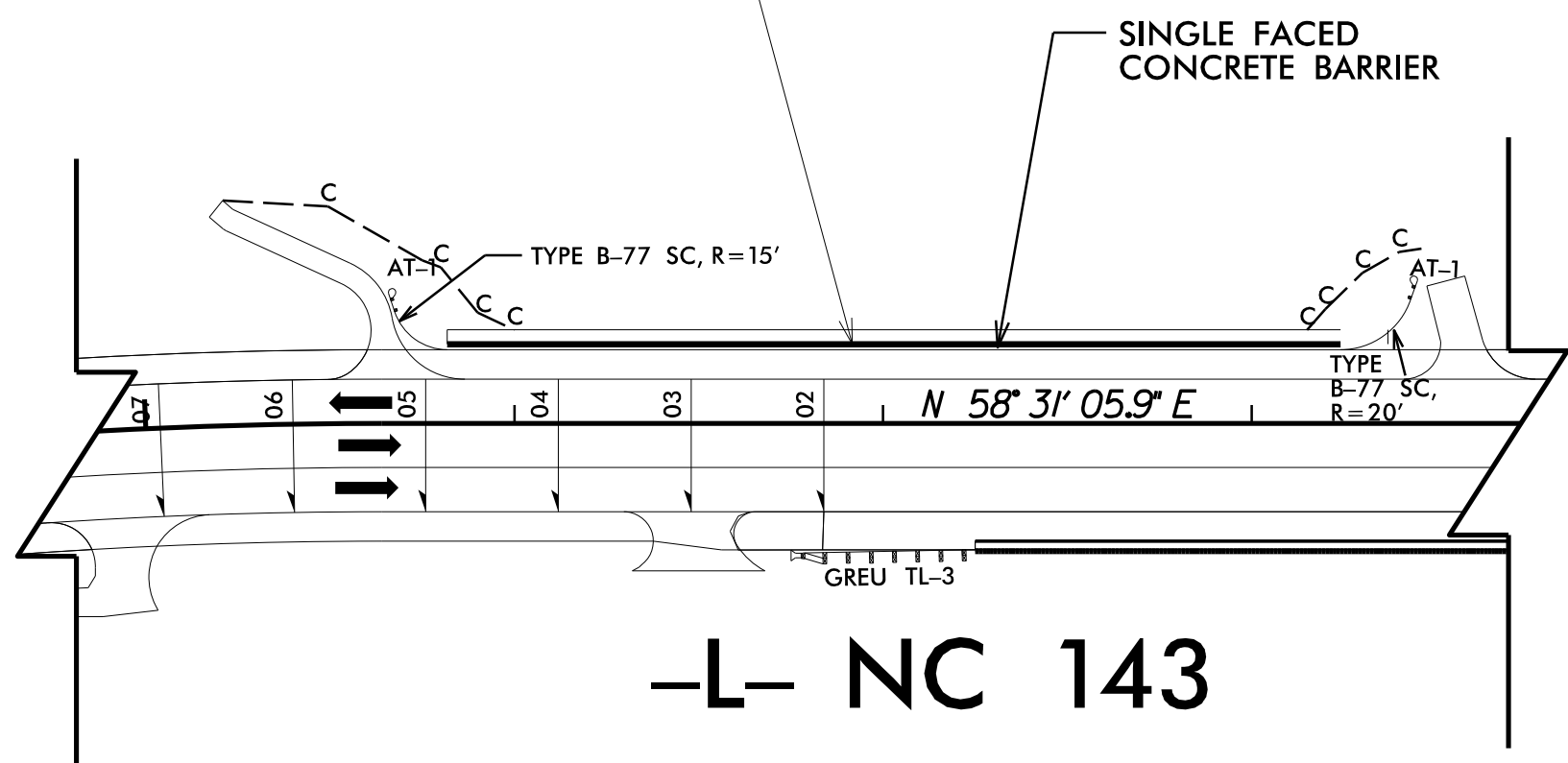
REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W7-1

RETAINING WALL #11:

330

PROP. RETAINING WALL #11
W/CONCRETE DITCH
BEGIN -L- STA. 330+81.78
END -L- STA. 333+24.11

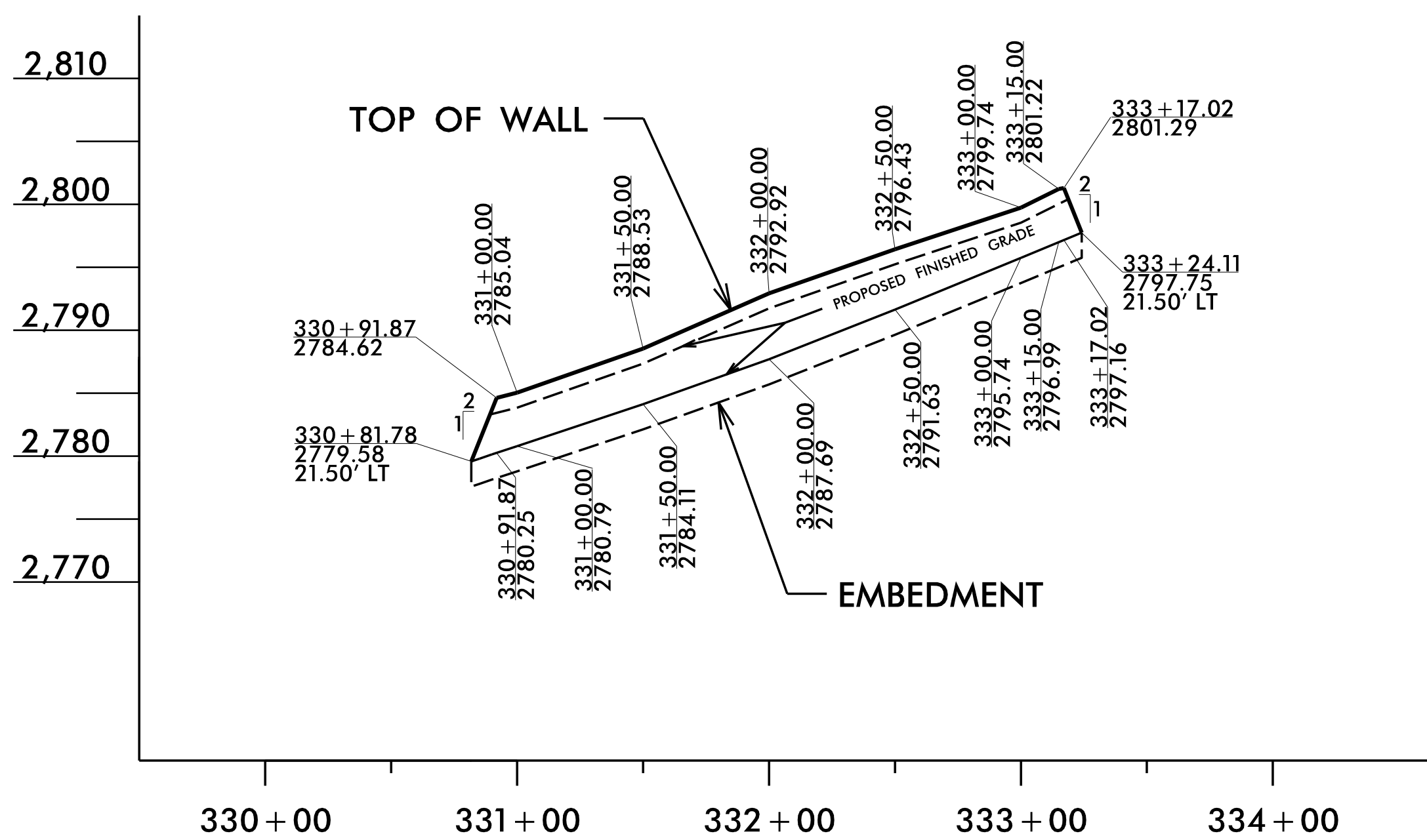


DETAIL FOR WALL #11

NOT TO SCALE
-L- STA. 330+81.78 TO -L- STA. 333+24.11, LT

ESTIMATED RETAINING WALL QUANTITY (SQUARE FEET)	
NON-STANDARD CIP GRAVITY RETAINING WALL #1	1,285 SF
FORM LINER ARCHITECTURAL FINISH*	430 SF

* AREA OF EXPOSED WALL FACE BETWEEN TOP OF SINGLE FACED CONCRETE BARRIER AND TOP OF WALL



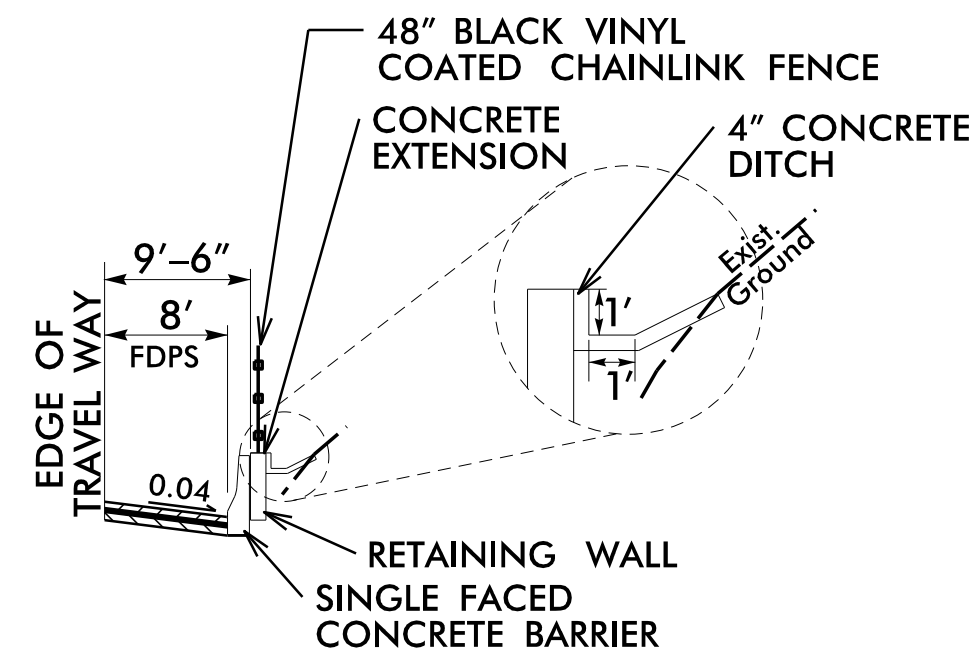
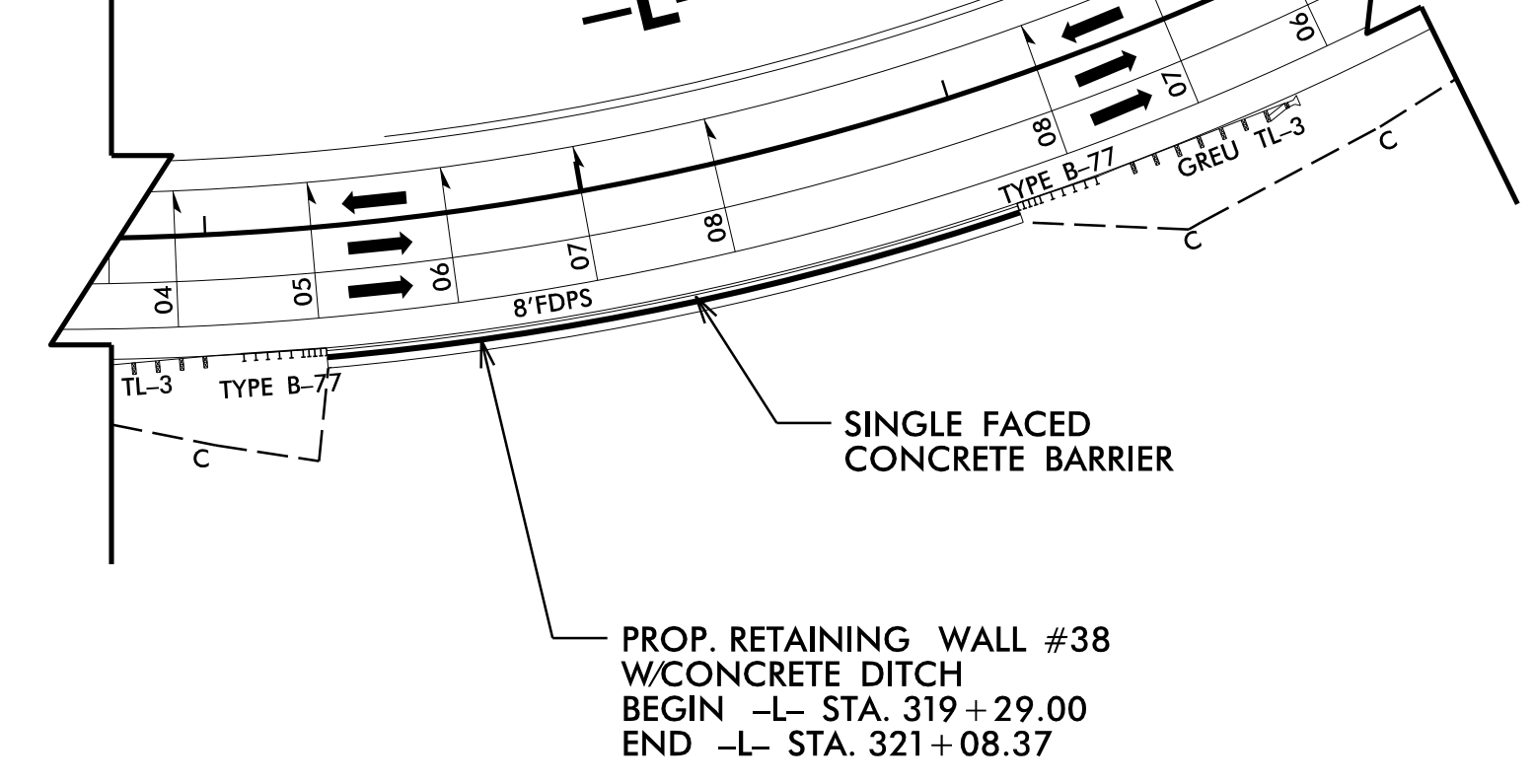
RETAINING WALL #11:

NOT TO SCALE
(LOOKING AT FACE OF WALL)

RETAINING WALL #38:

320

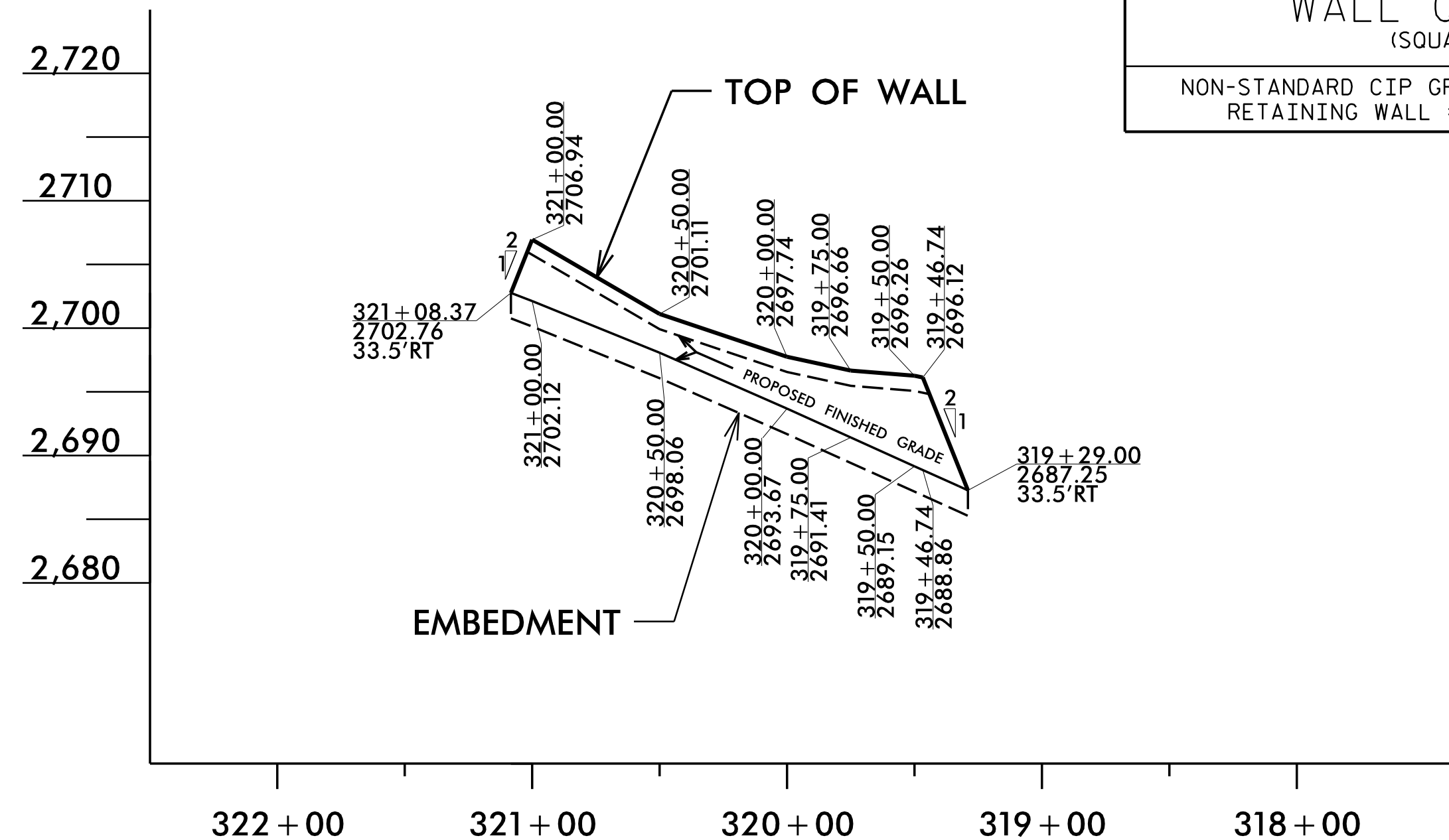
-L- NC 143



DETAIL FOR WALL #38

NOT TO SCALE
-L- STA. 319+29.00 TO -L- STA. 321+08.37, RT

ESTIMATED RETAINING WALL QUANTITY (SQUARE FEET)	
NON-STANDARD CIP GRAVITY RETAINING WALL #38	930 SF



RETAINING WALL #38:

NOT TO SCALE
(LOOKING AT FACE OF WALL)

PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #7: -L- 269+25, 28' RT TO 272+19, 33' RT

RETAINING WALL #9: -L- 290+80, 22' LT TO 292+85, 22' LT

RETAINING WALL #11: -L- 330+82, 22' LT TO 333+24, 22' LT

RETAINING WALL #38: -L- 319+29, 34' LT TO 321+08, 34' LT

SHEET 2 OF 3

PREPARED BY: R. KRAL
REVIEWED BY: M. BREWER
DATE: 5/17/2022

RETAINING WALL #11 AND #38 ENVELOPES AND WALL LAYOUTS PROVIDED BY TGS ENGINEERS, INC.
DATE: 5/17/2022

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
2400 CROWNPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #7, #9, #11, #38
NON-STANDARD CIP GRAVITY RETAINING WALL

REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W7-2

NOTES:

FOR NON-STANDARD CIP GRAVITY RETAINING WALLS, SEE NON-STANDARD CIP GRAVITY RETAINING WALLS SPECIAL PROVISION.

FOR STEEL BEAM GUARDRAIL, SEE ROADWAY PLANS AND SECTION 862 OF THE STANDARD SPECIFICATIONS.

FOR SINGLE FACED PRECAST CONCRETE BARRIER, SEE ROADWAY PLANS AND SECTION 857 OF THE STANDARD SPECIFICATIONS.

FOR SINGLE FACED PRECAST CONCRETE BARRIER (STAINED), SEE ROADWAY PLANS, SECTION 857 OF THE STANDARD SPECIFICATION, AND SIMULATED STONE FORM LINER FINISH SPECIAL PROVISION.

FOR FENCES OR HANDRAILS ON TOP OF WALLS, SEE ROADWAY PLANS FOR FENCE OR HANDRAIL ATTACHMENT DETAILS.

FOR ANY EXPOSED FACE, A FORM LINER ARCHITECTURAL FINISH IS REQUIRED FOR THE CIP GRAVITY RETAINING WALL #1. THE CONTRACTOR SHALL PROVIDE THE REQUESTED FINISH BEFORE BEGINNING CIP GRAVITY RETAINING WALL CONSTRUCTION. THE APPEARANCE (STONE SIZE AND SHAPE, STONE COLOR, AND STONE TEXTURE, PATTERN, AND RELIEF) SHOULD MATCH NATURAL STONE AND ROCK. FOR FORM LINER ARCHITECTURAL FINISH, SEE THE SIMULATED STONE FORM LINER FINISH SPECIAL PROVISION.

FOR SUBSURFACE DRAINAGE AT WEEP HOLES, SEE ARTICLE 414-8 OF THE STANDARD SPECIFICATIONS.

NON-STANDARD CIP GRAVITY WALLS ARE BASED ON THE FOLLOWING:

RETAINING WALLS #7, #1, AND #38:
 IN-SITU ASSUMED RETAINED SOIL PARAMETERS:
 UNIT WEIGHT, $\gamma = 120$ PCF
 FRICTION ANGLE, $\phi = 34$ DEGREES
 COHESION, $c = 0$ PSF

IN-SITU ASSUMED FOUNDATION SOIL PARAMETERS:
 UNIT WEIGHT, $\gamma = 120$ PCF
 FRICTION ANGLE, $\phi = 34$ DEGREES
 COHESION, $c = 0$ PSF

RETAINING WALL #9:
 IN-SITU ASSUMED RETAINED SOIL PARAMETERS:
 UNIT WEIGHT, $\gamma = 120$ PCF
 FRICTION ANGLE, $\phi = 38$ DEGREES
 COHESION, $c = 0$ PSF

IN-SITU ASSUMED FOUNDATION SOIL PARAMETERS:
 UNIT WEIGHT, $\gamma = 120$ PCF
 FRICTION ANGLE, $\phi = 34$ DEGREES
 COHESION, $c = 0$ PSF

A MINIMUM BEARING RESISTANCE OF 1.0 TSF IS REQUIRED FOR RETAINING WALL #7, #9, AND #1.

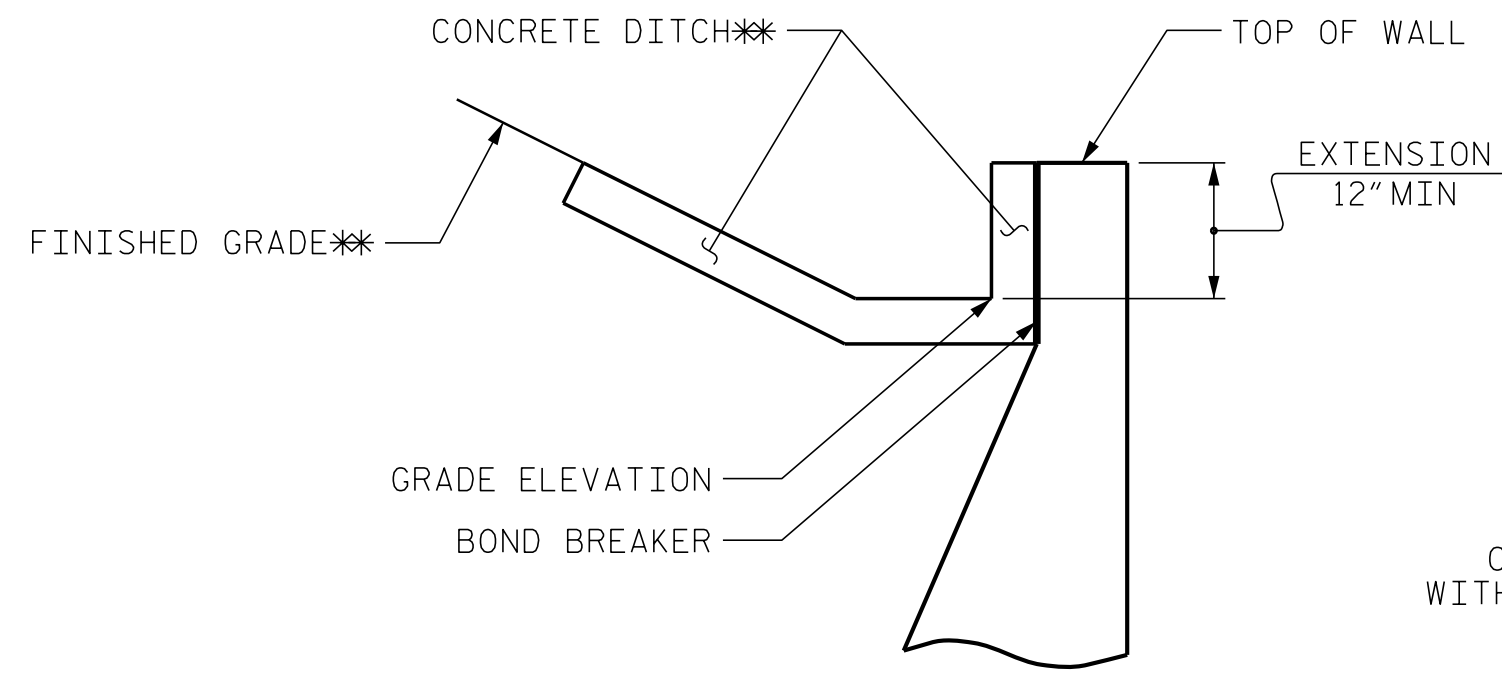
A MINIMUM BEARING RESISTANCE OF 1.5 TSF IS REQUIRED FOR RETAINING WALL #38.

UNDERCUTTING SOFT AND/OR WET SOILS IN THE VICINITY OF THE WALL FOUNDATION MAY BE REQUIRED TO IMPROVE BEARING RESISTANCE. THE ENGINEER WILL DETERMINE THE SOILS BEARING RESISTANCE AFTER THE WALL FOOTING IS EXCAVATED TO BEARING GRADE. IF REQUIRED BY THE ENGINEER, USE UNDERCUT EXCAVATION TO REMOVE SOFT AND/OR WET SOILS. UNDERCUT TO SUITABLE FOUNDATION SOILS OR TO A DEPTH NO GREATER THAN 3 FEET BELOW THE BOTTOM OF FOOTING ELEVATION, WHICHEVER OCCURS FIRST. PLACE GEOTEXTILE FOR SOIL STABILIZATION IN THE BOTTOM OF THE EXCAVATION AND BACKFILL WITH SELECT GRANULAR MATERIAL. FOR UNDERCUT EXCAVATION AND SELECT GRANULAR MATERIAL SEE STANDARD SPECIFICATIONS. UNDERCUT EXCAVATION, SELECT GRANULAR MATERIAL, AND GEOTEXTILE FOR SOIL STABILIZATION WILL BE PAID AS SEPARATE ADDITIONAL QUANTITIES.

BEFORE BEGINNING NON-STANDARD CIP GRAVITY WALL CONSTRUCTION, SURVEY WALL LOCATIONS AND SUBMIT WALL PROFILE VIEWS (WALL ENVELOPES) FOR REVIEW. FOR WALL ENVELOPES, INCLUDE BOTTOM OF WALL, EXISTING GROUND AND GRADE ELEVATIONS, AND SLOPE ELEVATIONS BEHIND THE WALL AT INTERVALS OF 25' OR LESS ALONG WALLS. DO NOT START WALL CONSTRUCTION UNTIL WALL ENVELOPES ARE ACCEPTED.

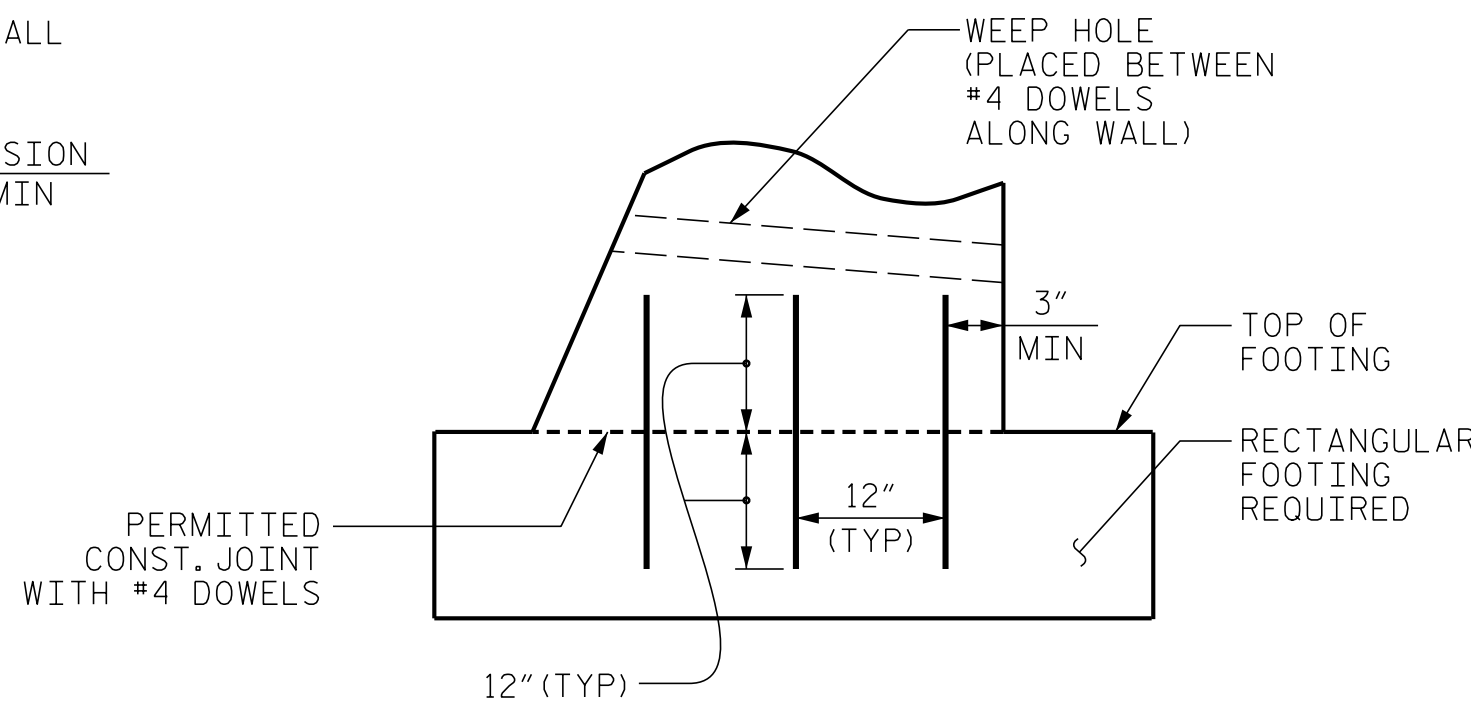
DO NOT PLACE CONCRETE FOR FOOTINGS UNTIL EXCAVATION DIMENSIONS AND FOUNDATION MATERIAL ARE APPROVED.

WHEN CONSTRUCTING NON-STANDARD CIP GRAVITY WALLS WITH A CONSTRUCTION JOINT AS SHOWN IN DETAIL "A", PROVIDE A MINIMUM OF 3 EQUALLY SPACED #4 DOWELS AT INTERVALS OF 1'-6" ALONG WALLS.

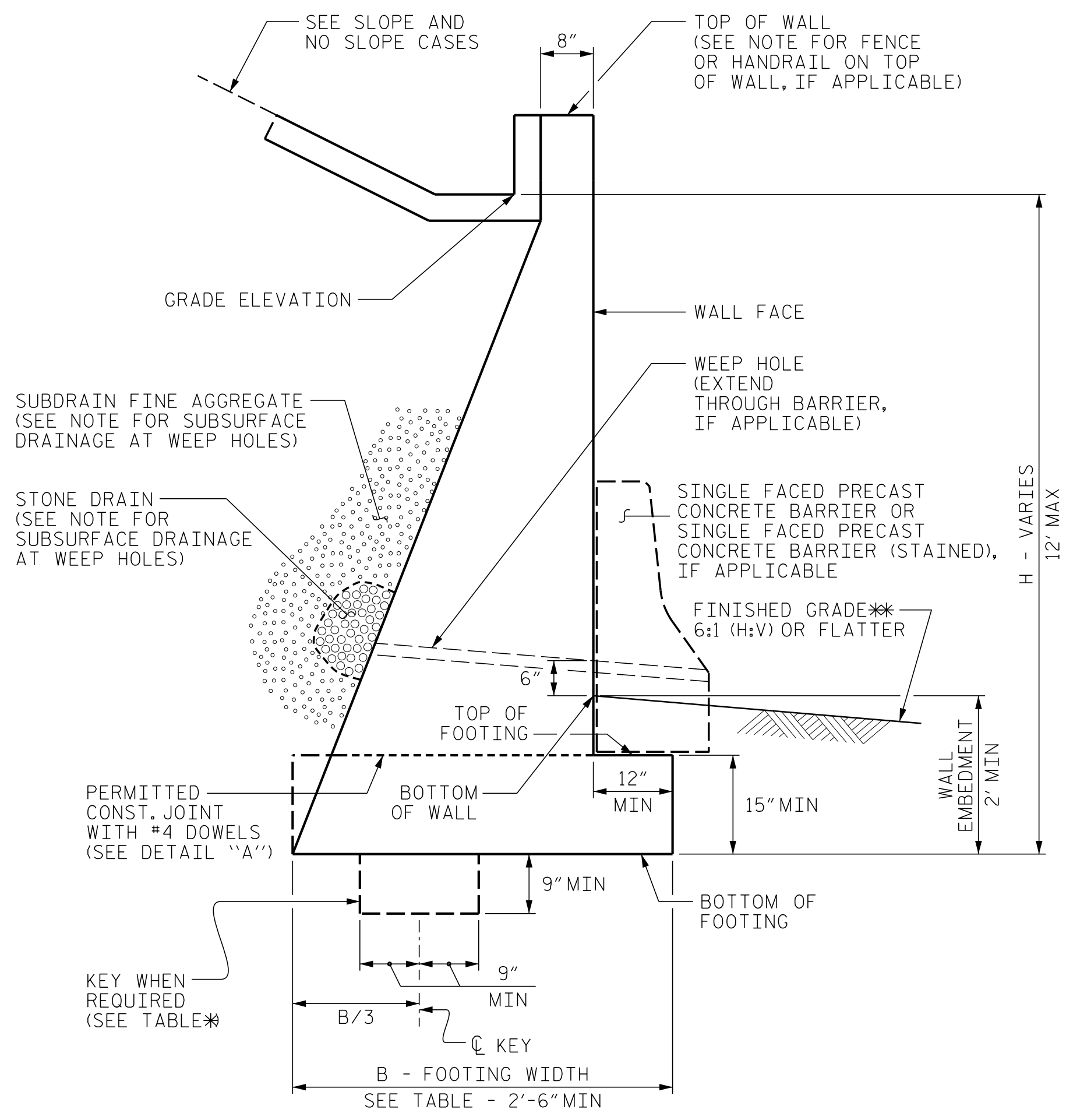


SLOPE CASE

**SEE ROADWAY PLANS FOR CONCRETE DITCH AND FINISHED GRADE DETAILS.



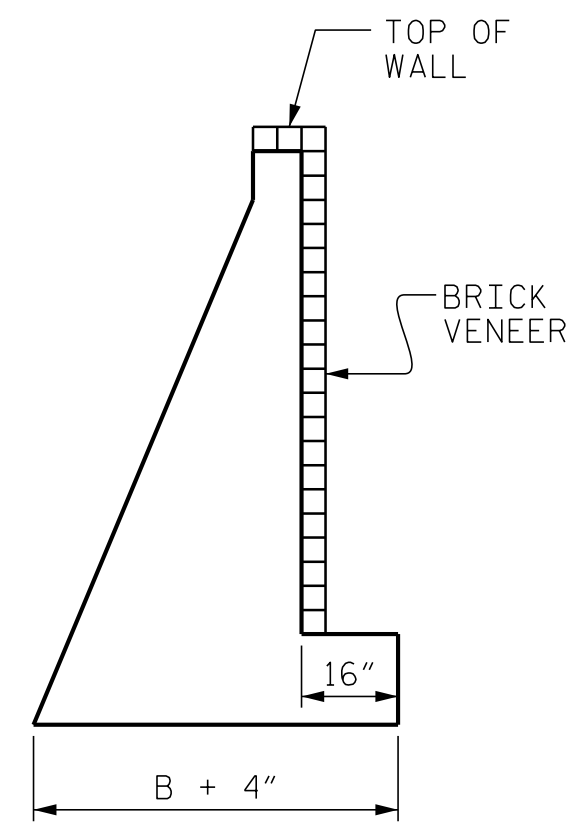
DETAIL "A"



NON-STANDARD CIP GRAVITY WALL

**SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.

GEOTECHNICAL ENGINEER Robert E. Kral	ENGINEER _____ SIGNATURE
DateSigned by: _____ DATE: 06/08/2022	_____ DATE
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



BRICK VENEER DETAIL

(WHEN APPLICABLE)

H (FT)	3 - < 6	6 - 9	> 9 - 12
SLOPE CASE	.66	.70*	.75*
NO SLOPE CASE WITH TRAFFIC SURCHARGE	.80	.75*	.70*
NO SLOPE CASE WITHOUT TRAFFIC SURCHARGE	.60	.60	.60

B/H RATIO (B = 2'-6" MIN)

*KEY IS REQUIRED FOR "SLOPE CASE" OR "NO SLOPE CASE WITH TRAFFIC SURCHARGE" WHEN H IS 6' OR GREATER.

PROJECT NO.: A-0009CB

GRAHAM COUNTY

- RETAINING WALL #7: -L- 269+25, 28' RT TO 272+19, 33' RT
- RETAINING WALL #9: -L- 290+80, 22' LT TO 292+85, 22' LT
- RETAINING WALL #11: -L- 330+82, 22' LT TO 333+24, 22' LT
- RETAINING WALL #38: -L- 319+29, 34' LT TO 321+08, 34' LT

SHEET 3 OF 3

PREPARED BY: R. KRAL	DATE: 5/17/2022
REVIEWED BY: M. BREWER	DATE: 5/17/2022

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
 2400 CROWNPOINT EXECUTIVE DRIVE
 SUITE 800
 CHARLOTTE, NC 28227
 (980) 339-8684

NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

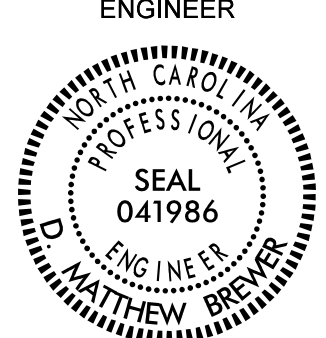
REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

**RETAINING WALL #7, #9, #11, #38
 NON-STANDARD CIP GRAVITY RETAINING WALL**

SHEET NO. W7-3

RETAINING WALL #10:

GEOTECHNICAL ENGINEER

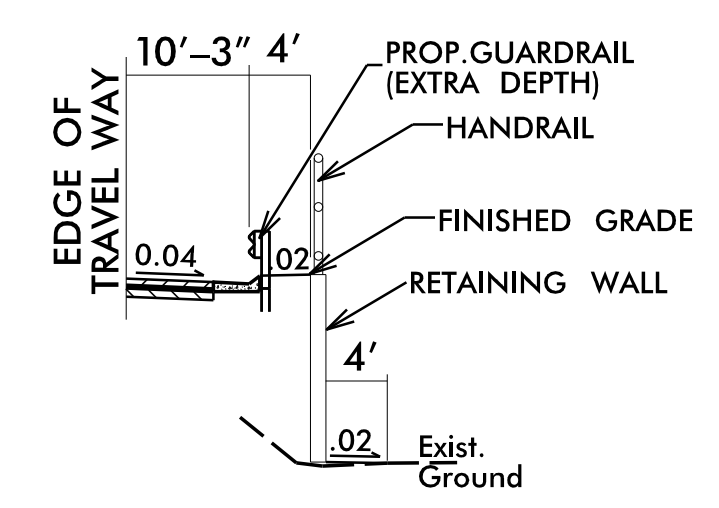
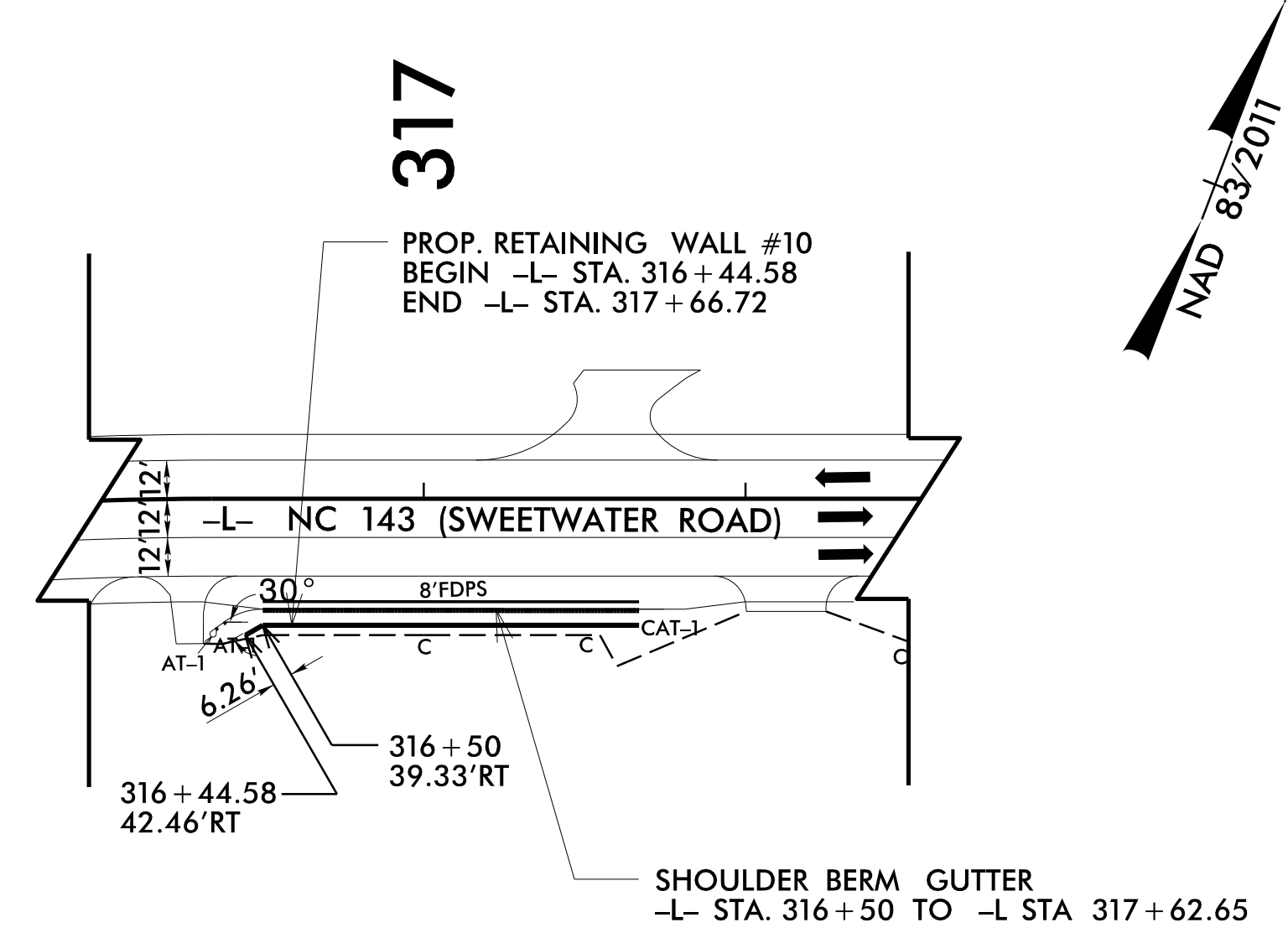


DocuSigned by:
D. Matthew Browne
388128C0A0C1462

SIGNATURE DATE

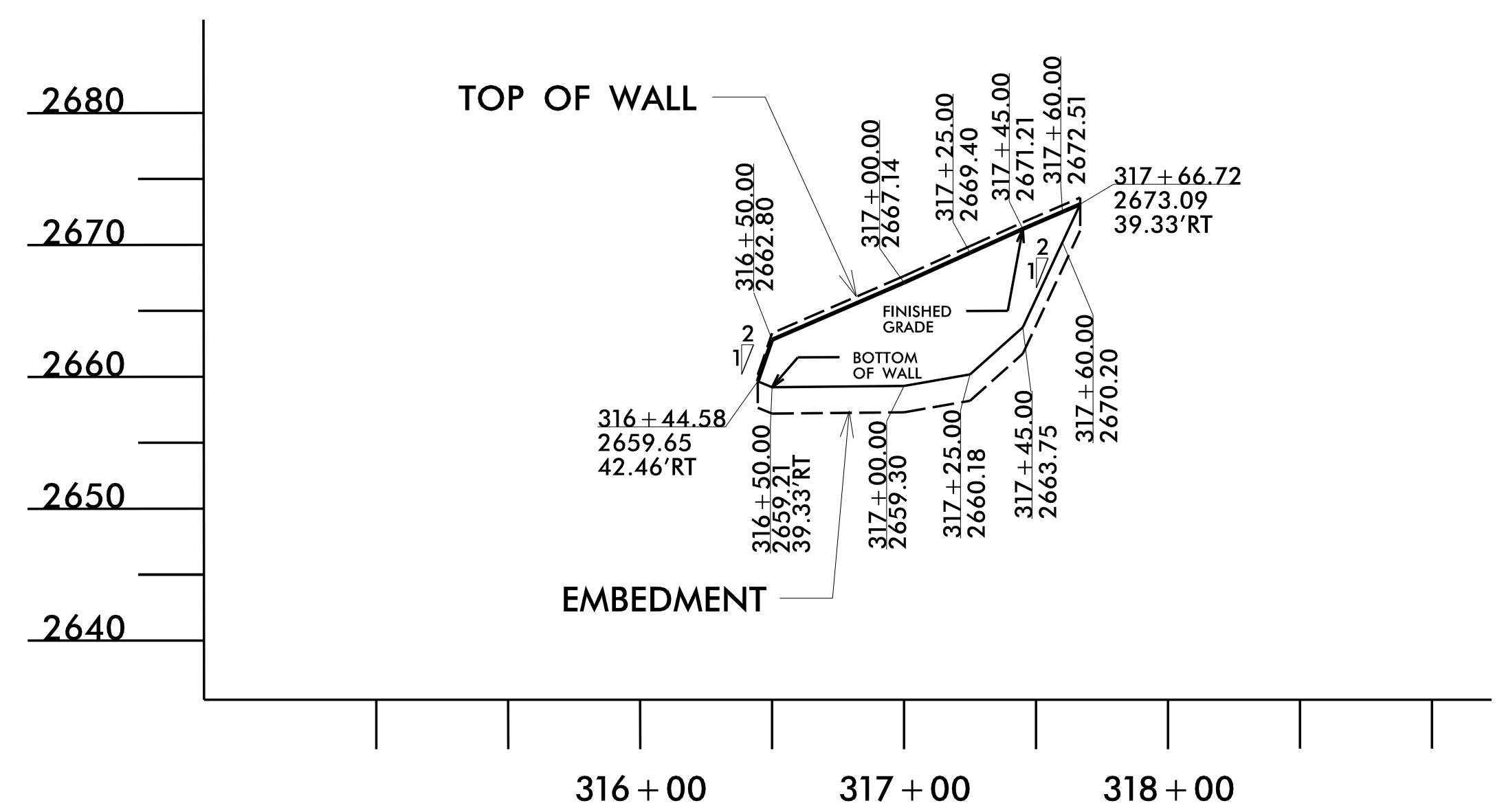
ENGINEER

SIGNATURE DATE



DETAIL FOR RETAINING WALL #10
-L- STA. 316+44.58 TO -L- STA. 317+66.72, RT

ESTIMATED RETAINING WALL QUANTITY (SQUARE FEET)	
MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALL #10	1,070 SF*
*INCLUDES WALL EMBEDMENT	



RETAINING WALL #10:
NOT TO SCALE
(LOOKING AT FACE OF WALL)

MSE RETAINING WALL #10						
STA. -L-	OFFSET FROM -L- (FT)	FINISHED GRADE* (FT)	BOTTOM OF WALL (FT)	TOP OF LEVELING PAD (FT)	ESTIMATED MSE WALL EMBEDMENT (FT)	DESIGN MSE WALL HEIGHT "H" (FT)
316+44.58	42.46 RT	2659.65	2659.65	2657.65	2.00	2.00
316+50.00	39.33 RT	2662.80	2659.21	2657.21	2.00	5.59
317+00.00	39.33 RT	2667.14	2659.30	2657.30	2.00	9.84
317+25.00	39.33 RT	2669.40	2660.18	2658.18	2.00	11.22
317+45.00	39.33 RT	2671.21	2663.75	2661.75	2.00	9.46
317+60.00	39.33 RT	2672.51	2670.20	2668.20	2.00	4.31
317+66.72	39.33 RT	2673.09	2673.09	2671.09	2.00	2.00

*FINISHED GRADE ELEVATION ADJACENT TO COPING EXTENSION, SEE TYPICAL DETAIL

PROJECT NO.: A-0009CB
GRAHAM COUNTY
RETAINING WALL #10 STATION: -L- 316+45, 42' RT TO 317+67, 39' RT
SHEET 1 OF 3


PREPARED BY: DMB
REVIEWED BY: REK
DATE: 5/6/2022

RETAINING WALL #10 ENVELOPE AND WALL LAYOUT PROVIDED BY TGS ENGINEERS, INC.

Prepared in the Office of:



CAROLINAS GEOTECHNICAL GROUP
2400 CROWNPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684



TGS ENGINEERS
804-C N. LAFAYETTE ST
SHELBY, NC 28150
PH (704) 476-0003
CORP. LICENSE NO.: C-0275

RETAINING WALL #10 MECHANICALLY STABILIZED EARTH (MSE)					
REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W10-1

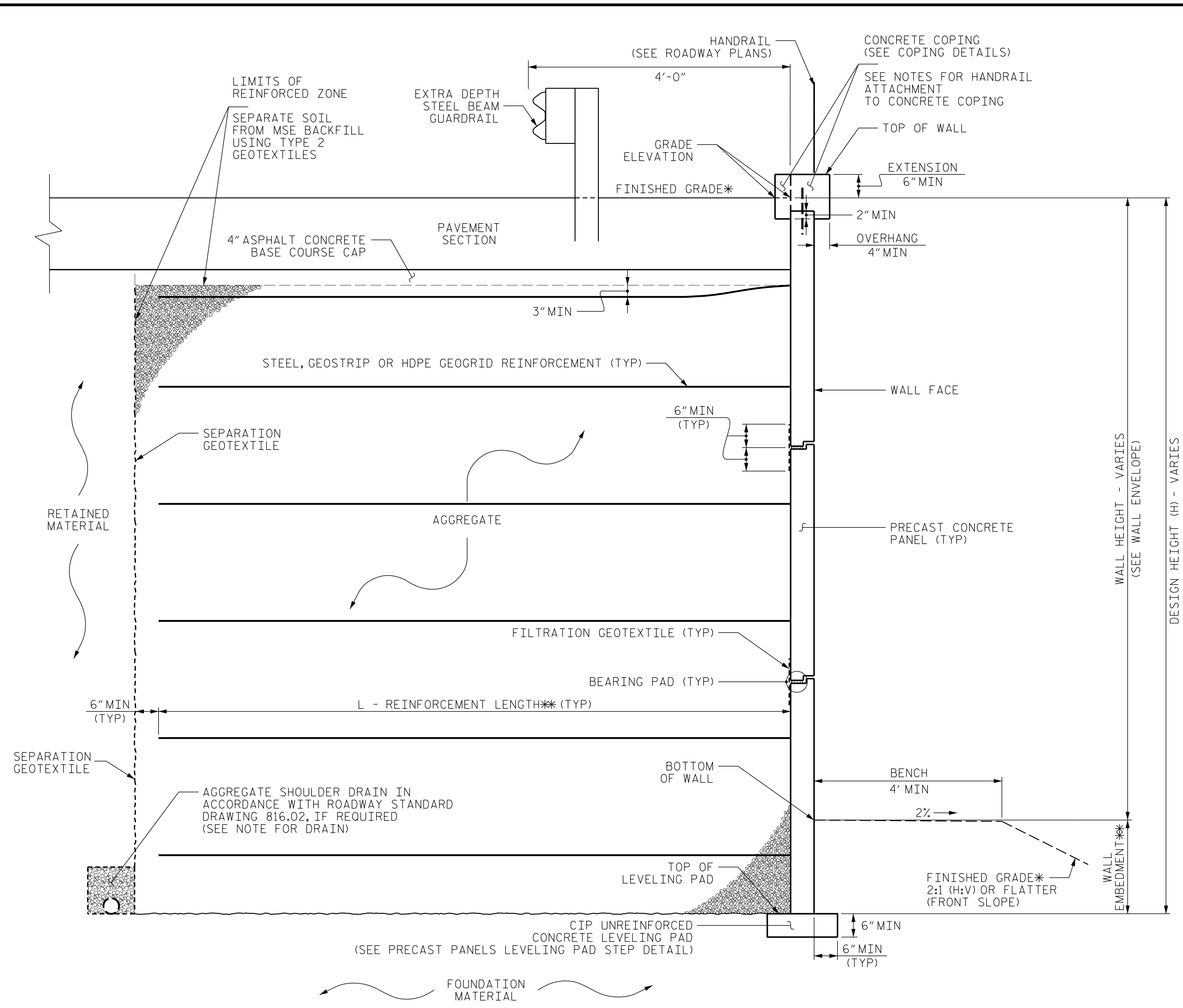
GEOTECHNICAL ENGINEER

ENGINEER

DocuSigned by:
D. Matthew Brewer
38812BC0A0C1462
 SIGNATURE

6/7/2022
38812BC0A0C1462
 DATE

SIGNATURE DATE

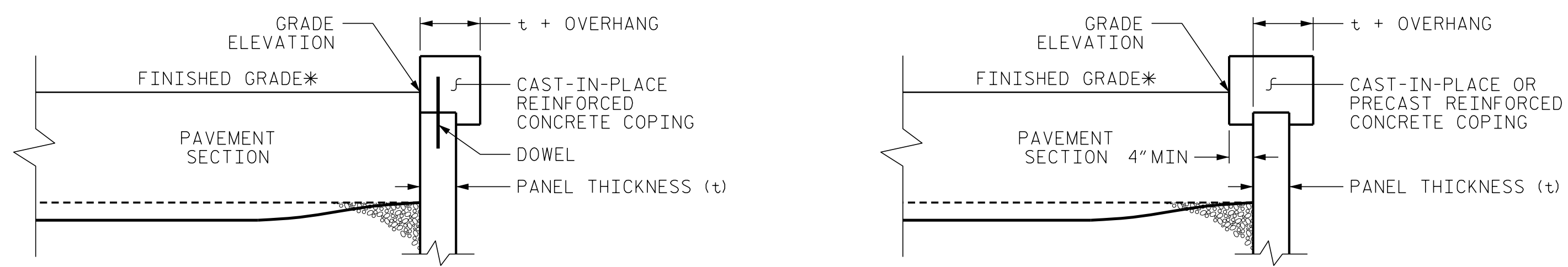


FRONT SLOPE WALL EMBEDMENT		
SLOPE IN FRONT OF STRUCTURES		MINIMUM EMBEDMENT DEPTH
HORIZONTAL	FOR WALLS	H/2.0
	FOR ABUTMENTS	H/1.0
3.0H:1.0V	WALLS	H/1.0
2.5H:1.0V	WALLS	H/8.5
2.0H:1.0V	WALLS	H/7
1.5H:1.0V	WALLS	H/5
1.25H:1.0V	WALLS	H/4
1.0H:1.0V	WALLS	H/3

NOTE:
 1) MAINTAIN A MINIMUM BENCH WIDTH OF 4.0 FT IN FRONT OF THE WALL.
 2) MINIMUM EMBEDMENT DEPTH OF 2 FT, UNLESS LARGER DEPTHS DICTATED BY ABOVE TABLE.
 3) MAXIMUM SLOPE OF 1H:1V WILL BE MAINTAINED ON FRONT SLOPES FOR THE ENTIRE LENGTH OF THE WALL.
 4) SUBMIT WITH THE WALL DESIGN INTERNAL AND EXTERNAL ANALYSES.
 REFERENCE MSE WALL PROVISION.

MSE WALL WITH PRECAST PANELS - TYPICAL SECTION

*SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.
 **SEE MSE RETAINING WALLS PROVISION AND IF APPLICABLE, MSE WALL NOTES FOR WALL EMBEDMENT AND REINFORCEMENT LENGTH REQUIREMENTS.



COPING DETAILS

AT THE CONTRACTOR'S OPTION, CONNECT COPING TO PANELS WITH DOWELS OR EXTEND COPING DOWN BACK OF PANELS.
 *SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.

PROJECT NO.: **A-0009CB**
GRAHAM COUNTY
 RETAINING WALL #10 STATION: **-L- 316+45, 42' RT TO 317+67, 39' RT**
 SHEET 2 OF 3

PREPARED BY: **DMB** DATE: **5/6/2022**
 REVIEWED BY: **REK** DATE: **5/6/2022**

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
 2400 CROWNPOINT EXECUTIVE DRIVE
 SUITE 800
 CHARLOTTE, NC 28227
 (980) 339-8684

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

REVISIONS						SHEET NO. W10-2
NO.	BY	DATE	NO.	BY	DATE	
1			3			
2			4			

NOTES:

FOR MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALLS, SEE MECHANICALLY STABILIZED EARTH RETAINING WALLS PROVISION.
 FOR STEEL BEAM GUARDRAIL, SEE ROADWAY PLANS AND SECTION 862 OF THE STANDARD SPECIFICATIONS.
 FOR FENCES OR HANDRAILS ON THE TOP OF THE RETAINING WALL, SEE ROADWAY PLANS FOR FENCE OR HANDRAIL ATTACHMENT DETAILS.
 AT THE CONTRACTOR'S OPTION, USE FINE AGGREGATE IN THE REINFORCED ZONE OF RETAINING WALL #10.
 A SEPARATION GEOTEXTILE IS REQUIRED AT THE BACK OF THE REINFORCED ZONE FOR RETAINING WALL #10.
 A DRAIN IS REQUIRED FOR RETAINING WALL #10.
 A SMOOTH ARCHITECTURAL FINISH IS REQUIRED FOR PRECAST CONCRETE PANELS FOR RETAINING WALL #10.
 BEFORE BEGINNING MSE WALL DESIGN FOR RETAINING WALL #10, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.

- DESIGN RETAINING WALL #10 FOR THE FOLLOWING:
 1) H = DESIGN HEIGHT + EMBEDMENT
 2) DESIGN LIFE = 75 YEARS
 3) MAXIMUM FACTORED VERTICAL PRESSURE ON FOUNDATION MATERIAL:
 RETAINING WALL #10: 3,100 PSF
 4) MINIMUM REINFORCEMENT
 RETAINING WALL #10: LENGTH (L) = 0.8xH OR 6 FT, WHICHEVER IS LONGER
 5) MINIMUM EMBEDMENT DEPTH = 2 FEET, SEE TABLE ON SHEET W10-1 AND MSE WALL PROVISION
 6) REINFORCED ZONE AGGREGATE PARAMETERS:

AGGREGATE TYPE*	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (ϕ) DEGREES	COHESION (c) PSF
COARSE	110	38	0
FINE	115	34	0

*SEE MSE RETAINING WALLS PROVISION FOR COARSE AND FINE AGGREGATE MATERIAL REQUIREMENTS.


8) IN-SITU ASSUMED MATERIAL PARAMETERS:

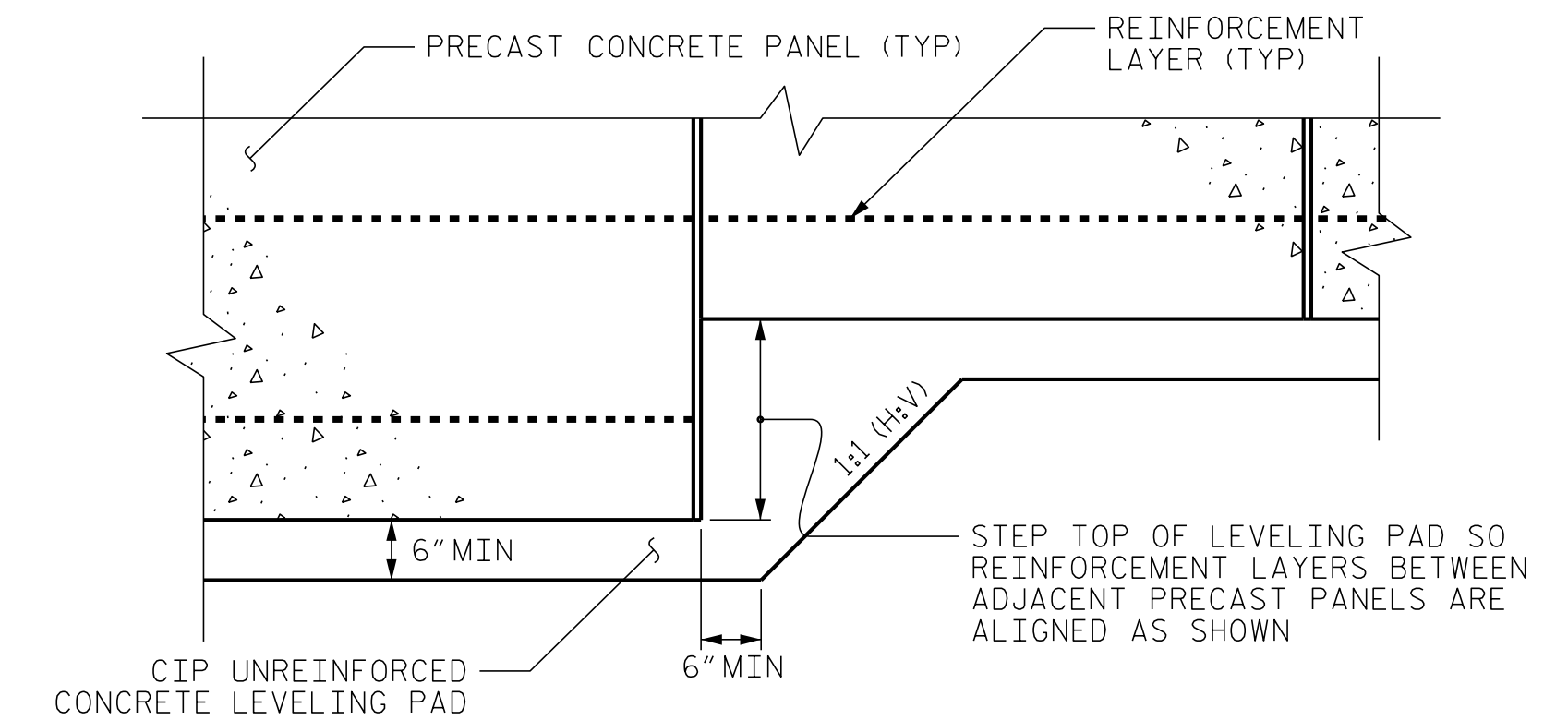
MATERIAL TYPE	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (ϕ) DEGREES	COHESION (c) PSF
BACKFILL	120	30	0
FOUNDATION	120	30	0

DESIGN RETAINING WALL #10 FOR A LIVE LOAD (TRAFFIC) SURCHARGE.
 FOUNDATIONS FOR SIGNS, LIGHTING OR SIGNALS MAY BE LOCATED BEHIND RETAINING WALL #10 AND MAY INTERFERE WITH REINFORCEMENT. BEFORE BEGINNING MSE WALL CONSTRUCTION, SUBMIT PROPOSED CONSTRUCTION METHODS FOR THESE FOUNDATIONS FOR APPROVAL.
 EXISTING OR FUTURE OBSTRUCTIONS SUCH AS GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH REINFORCEMENT FOR RETAINING WALL #10.
 DO NOT PLACE LEVELING PAD CONCRETE, AGGREGATE OR REINFORCEMENT FOR RETAINING WALL #10 UNTIL EXCAVATION DIMENSIONS AND FOUNDATION MATERIAL ARE APPROVED.
 AT THE CONTRACTOR'S OPTION, "TEMPORARY SHORING FOR WALL CONSTRUCTION" MAY BE USED TO CONSTRUCT RETAINING WALL #10. SEE MSE RETAINING WALLS PROVISION FOR TEMPORARY SHORING FOR WALL CONSTRUCTION.

SPECIAL NOTES:

UNDERCUTTING SOFT AND/OR WET SOILS IN THE VICINITY OF THE REINFORCED ZONE AND LEVELING PAD MAY BE REQUIRED TO IMPROVE BEARING RESISTANCE. IF REQUIRED BY THE ENGINEER, USE UNDERCUT EXCAVATION TO REMOVE SOFT SOILS AS DIRECTED BY THE ENGINEER. UNDERCUT TO SUITABLE FOUNDATION SOILS OR TO A DEPTH NO GREATER THAN 3 FEET BELOW THE TOP OF LEVELING PAD ELEVATION, WHICHEVER OCCURS FIRST. PLACE GEOTEXTILE FOR SOIL STABILIZATION IN THE BOTTOM OF THE EXCAVATION AND BACKFILL WITH SELECT GRANULAR MATERIAL. FOR UNDERCUT EXCAVATION AND SELECT GRANULAR MATERIAL SEE STANDARD SPECIFICATIONS. UNDERCUT EXCAVATION, SELECT GRANULAR MATERIAL, AND GEOTEXTILE FOR SOIL STABILIZATION WILL BE PAID AS SEPARATE ADDITIONAL QUANTITIES.
 GROUNDWATER WAS ENCOUNTERED NEAR THE PROPOSED TOP OF LEVELING PAD. THE CONTRACTOR SHOULD BE PREPARED TO DEWATER TO CONSTRUCT THE LEVELING PAD, REINFORCED ZONE, AND UNDERCUT AREAS, IF NECESSARY.

GEOTECHNICAL ENGINEER  Documented by: D. Matthew Brown 38812800A04C1462 SIGNATURE	ENGINEER 6/7/2022 DATE SIGNATURE DATE
--	---



**PRECAST PANELS
LEVELING PAD STEP DETAIL**

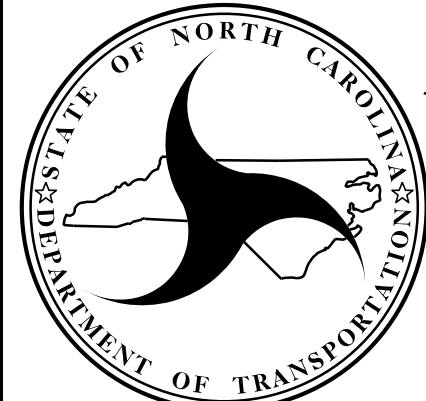
PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 RETAINING WALL #10 STATION: -L- 316+45, 42' RT TO 317+67, 39' RT
 SHEET 3 OF 3

PREPARED BY: DMB	DATE: 5/6/2022
REVIEWED BY: REK	DATE: 5/6/2022

Prepared in the Office of:



**CAROLINAS
GEOTECHNICAL
GROUP**
 2400 CROWNPOINT EXECUTIVE DRIVE
 SUITE 800
 CHARLOTTE, NC 28227
 (980) 339-8684



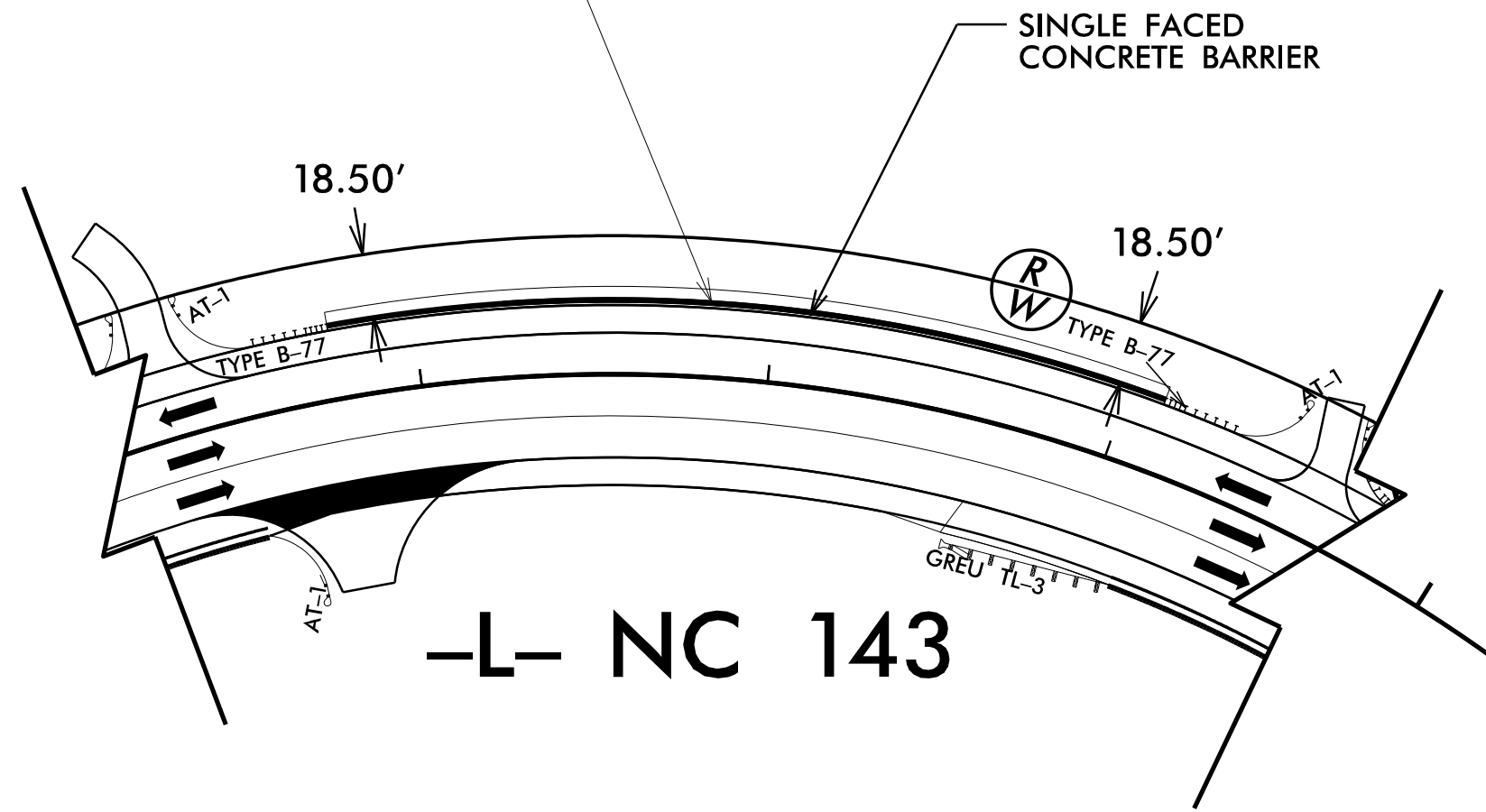
**NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS**

**GEOTECHNICAL
ENGINEERING UNIT**

REVISIONS						SHEET NO. W10-3
NO.	BY	DATE	NO.	BY	DATE	
1			3			
2			4			

RETAINING WALL #12:

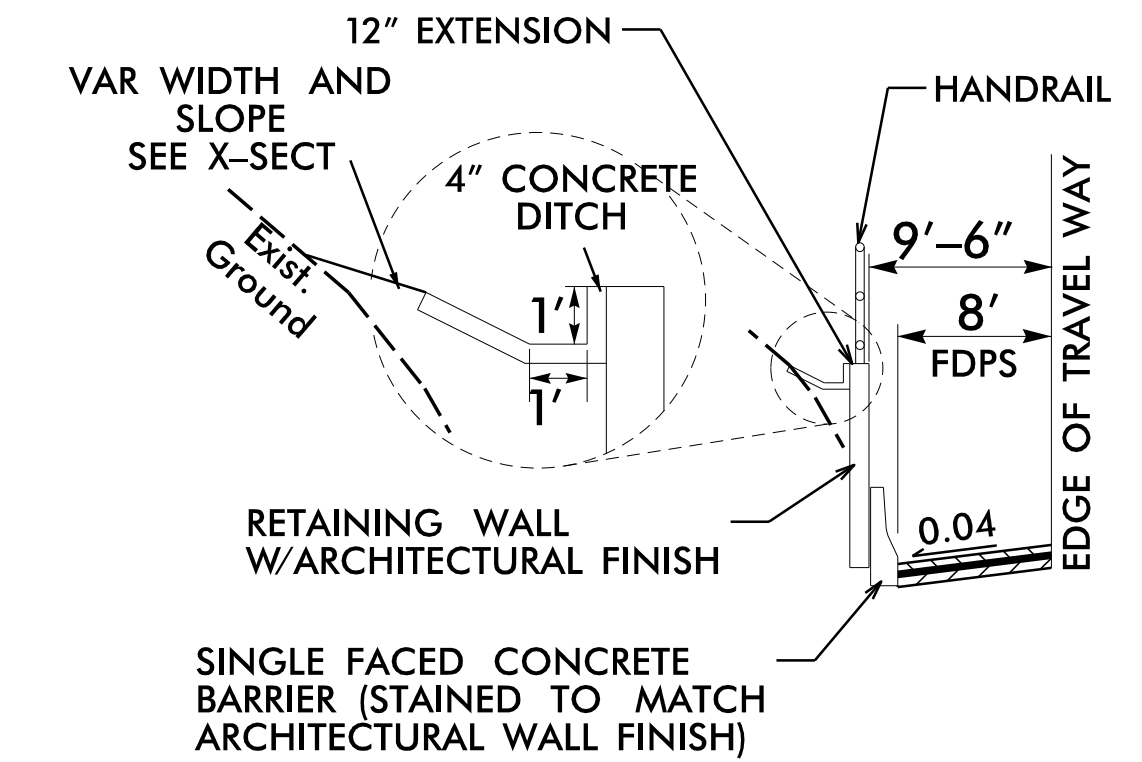
PROP. RETAINING WALL #12
W/CONCRETE DITCH
BEGIN -L- STA. 341+76.20
END -L- STA. 344+10.55



RETAINING WALL #12 - PLAN

NOT TO SCALE

345



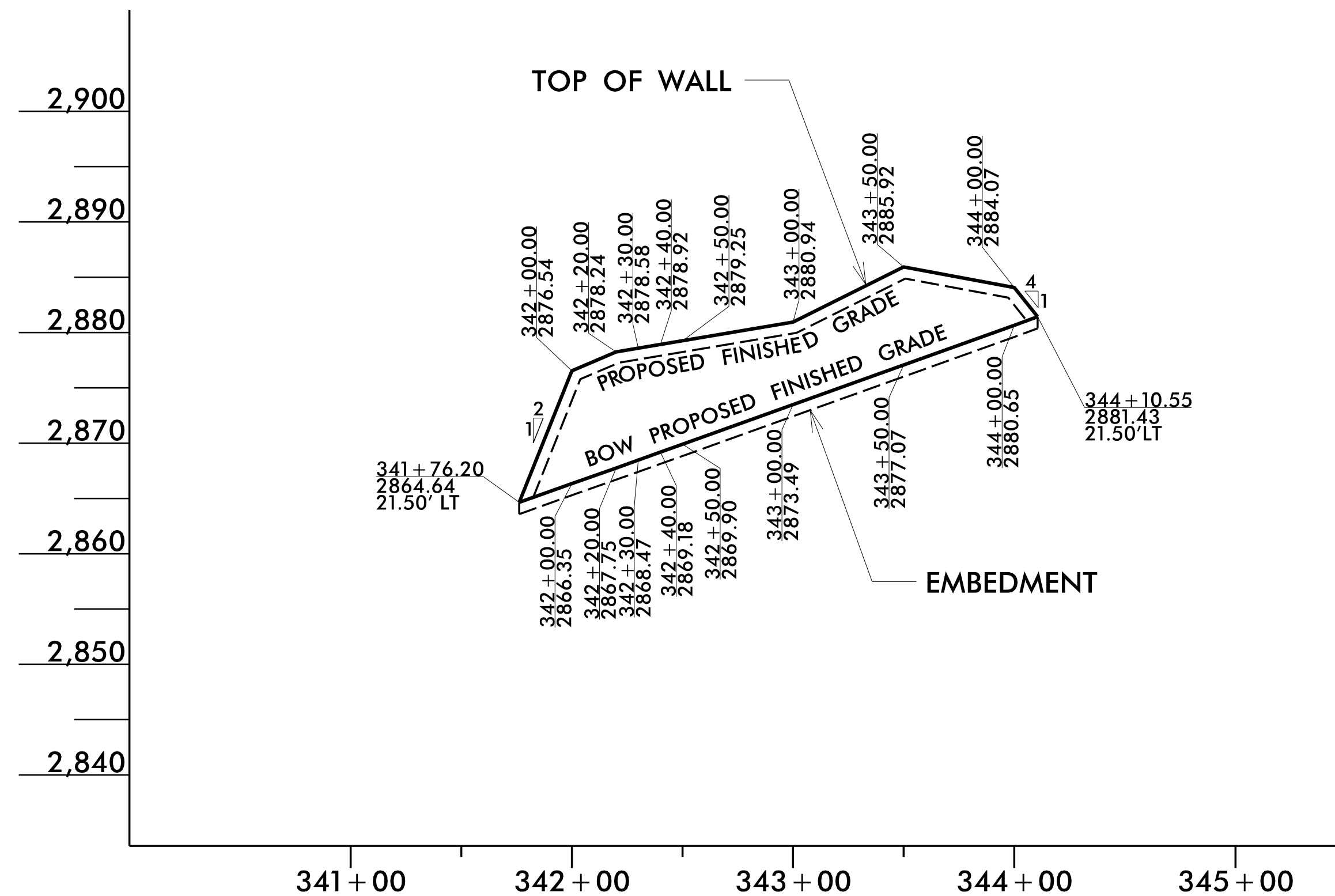
DETAIL FOR WALL #12

NOT TO SCALE

-L- STA. 341+76.20 TO -L- STA. 344+10.55, LT

ESTIMATED SOIL NAIL WALL QUANTITIES			
RETAINING WALL NO.	SOIL NAIL RETAINING WALLS (SQ. FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
12	2,030*	3	15
FORM LINER ARCHITECTURAL FINISH			2,030* SF
HORIZONTAL DRAINS (CONTINGENCY)			120 LF

*INCLUDES RETAINING WALL EMBEDMENT



RETAINING WALL #12 - ENVELOPE

NOT TO SCALE
BOW = BOTTOM OF WALL
(LOOKING AT FACE OF WALL)

SOIL NAIL RETAINING WALL #12						
STA. -L-	OFFSET FROM -L- (LT) FT.	ELEV. @ TOP OF WALL	BOW PROPOSED FINISHED GRADE	TOP OF LEVELING PAD	ESTIMATED WALL EMBEDMENT FT.	WALL DESIGN HEIGHT "H"
341+76.20	21.50	2864.64	2864.64	2863.64	1.00	1.00
342+00.00	21.50	2876.54	2866.35	2865.35	1.00	10.19
342+20.00	21.50	2878.24	2867.75	2866.75	1.00	10.49
342+30.00	21.50	2878.58	2868.47	2867.47	1.00	10.11
342+40.00	21.50	2878.92	2869.18	2868.18	1.00	9.74
342+50.00	21.50	2879.25	2869.90	2868.90	1.00	9.35
343+00.00	21.50	2880.94	2873.49	2872.49	1.00	7.45
343+50.00	21.50	2885.92	2877.07	2876.07	1.00	8.85
344+00.00	21.50	2884.07	2880.65	2879.65	1.00	3.42
344+10.55	21.50	2881.43	2881.43	2880.43	1.00	1.00

PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #12: -L- 341+76, 22' LT TO 344+11, 22' LT

SHEET 1 OF 3

PREPARED BY: R. KRAL
REVIEWED BY: M. BREWER

DATE: 6/2/2022
DATE: 6/2/2022
RETAINING WALL #12 ENVELOPE AND WALL LAYOUT PROVIDED BY TGS ENGINEERS, INC.

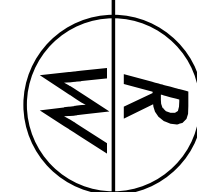
Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
2400 CROWNPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

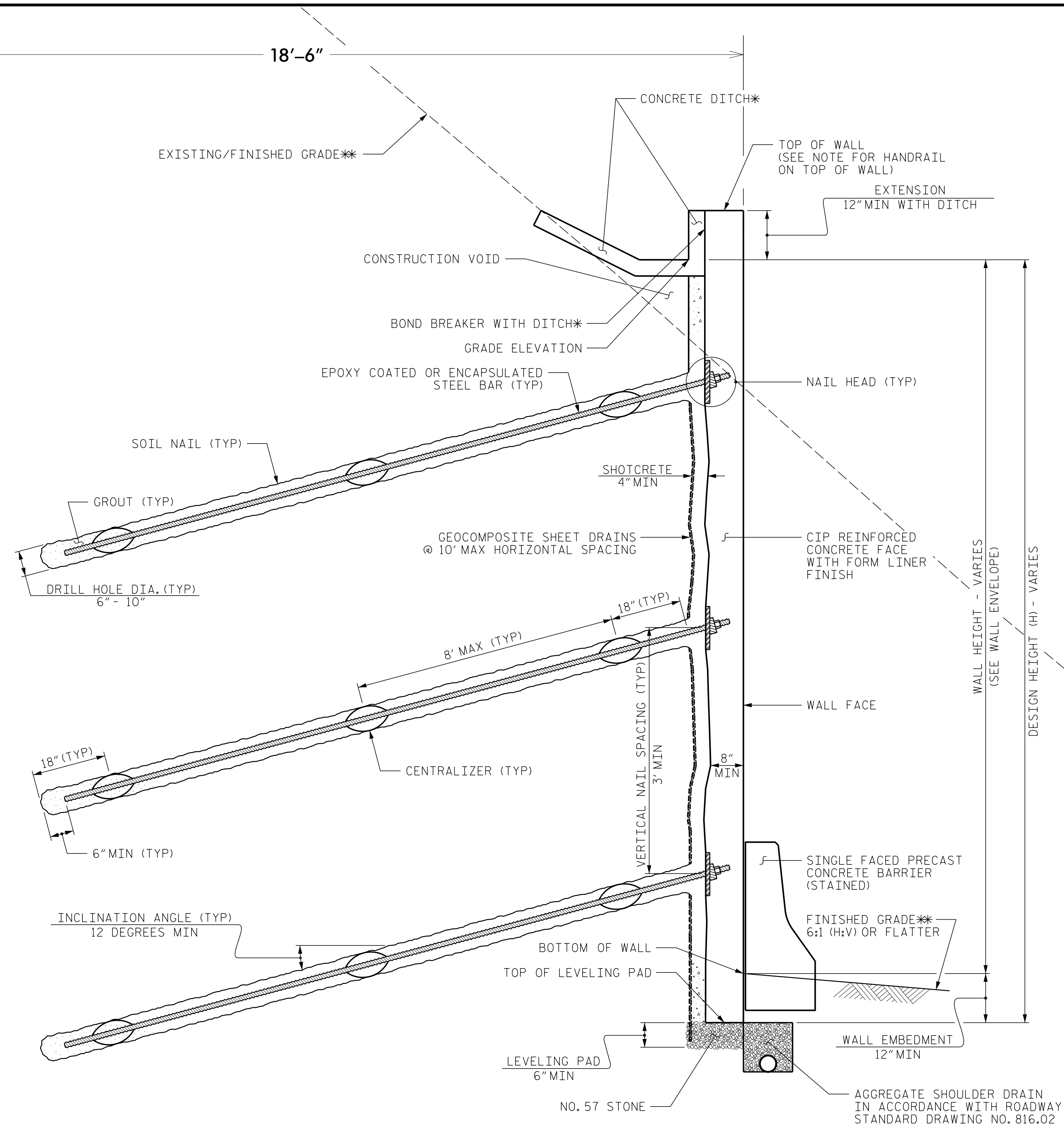
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W12-1
2			4			



RIGHT OF WAY



SOIL NAIL WALL - TYPICAL SECTION

*SEE CONCRETE DITCH BEHIND WALL DETAILS.
 **SEE PLANS FOR FINISHED GRADE.

GEOTECHNICAL ENGINEER Robert E. Kral	ENGINEER _____ SIGNATURE _____ DATE
DocuSigned by: SIGNATURE	06/08/2022 DATE
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	

NOTES:

- FOR SOIL NAIL RETAINING WALLS, SEE SOIL NAIL RETAINING WALLS PROVISION.
- FOR SINGLE FACED PRECAST CONCRETE BARRIER (STAINED), SEE ROADWAY PLANS, SECTION 857 OF THE STANDARD SPECIFICATION, AND SIMULATED STONE FORM LINER FINISH SPECIAL PROVISION.
- A HANDRAIL IS REQUIRED ON TOP OF RETAINING WALL #12. SEE ROADWAY PLANS FOR FENCE ATTACHMENT DETAILS.
- A FORM LINER ARCHITECTURAL FINISH IS REQUIRED FOR THE CIP REINFORCED CONCRETE FACE FOR RETAINING WALL #12. THE CONTRACTOR SHALL PROVIDE THE REQUESTED FINISH BEFORE BEGINNING CIP REINFORCED CONCRETE FACE CONSTRUCTION. THE APPEARANCE (STONE SIZE AND SHAPE, STONE COLOR, AND STONE TEXTURE, PATTERN, AND RELIEF) SHOULD MATCH NATURAL STONE AND ROCK. FOR FORM LINER ARCHITECTURAL FINISH, SEE THE SIMULATED STONE FORM LINER FINISH SPECIAL PROVISION.
- BEFORE BEGINNING SOIL NAIL WALL DESIGN FOR RETAINING WALL #12, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.
- DESIGN RETAINING WALL #12 FOR THE FOLLOWING:
 - 1) DESIGN HEIGHT (H) = WALL HEIGHT + WALL EMBEDMENT
 - 2) DESIGN LIFE = 75 YEARS
 - 3) MINIMUM WALL EMBEDMENT ELEVATION = VARIES (MIN. 1 FT BELOW PROPOSED FINISHED GRADE ELEVATION)
 - 4) IN-SITU ASSUMED MEDIUM STIFF TO STIFF RESIDUAL SOIL PARAMETERS:
 UNIT WEIGHT, $\gamma = 120$ PCF
 FRICTION ANGLE, $\phi = 30$ DEGREES
 COHESION, $c = 0$ PSF
 - 5) IN-SITU ASSUMED VERY STIFF TO HARD RESIDUAL SOIL PARAMETERS:
 UNIT WEIGHT, $\gamma = 125$ PCF
 FRICTION ANGLE, $\phi = 34$ DEGREES
 COHESION, $c = 0$ PSF
 - 6) IN-SITU ASSUMED WEATHERED ROCK (META-SANDSTONE) PARAMETERS:
 UNIT WEIGHT, $\gamma = 135$ PCF
 FRICTION ANGLE, $\phi = 32$ DEGREES
 COHESION, $c = 500$ PSF
 - 7) IN-SITU ASSUMED CRYSTALLINE ROCK (META-SANDSTONE) PARAMETERS:
 UNIT WEIGHT, $\gamma = 170$ PCF
 FRICTION ANGLE, $\phi = 34$ DEGREES
 COHESION, $c = 1,000$ PSF
 - 8) WHERE ROCK IS ENCOUNTERED IN THE WALL ENVELOPE, DESIGNERS SHOULD REFER TO THE FHWA PRESUMPTIVE STRENGTH PARAMETERS OR OTHER REPRESENTATIVE AND REPEATABLE VALUES AND PROVIDE SOURCE REFERENCES IN THEIR DESIGN SUBMITTAL.
- WHEN ANALYZING FOR INFINITE SLOPE CONDITIONS, DESIGNERS SHOULD ANALYZE UP TO TWO (2) TIMES THE WALL HEIGHT BEHIND THE WALL FACE FOR FAILURE PLANE SEARCHES. THIS INFORMATION SHOULD BE INCLUDED WITH THE DESIGN SUBMITTAL.
- EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH SOIL NAILS FOR RETAINING WALL #12.
- THE PROPOSED RIGHT OF WAY (ROW) BOUNDARY IS 18.5 FT FROM THE FACE OF RETAINING WALL #12. SOIL NAILS MAY NOT BE INSTALLED BEYOND THE ROW BOUNDARY. SEE "SOIL NAIL WALL - TYPICAL SECTION" DETAIL.
- IF GROUNDWATER IS ENCOUNTERED BEHIND THE FACE OF RETAINING WALL #12, HORIZONTAL DRAINS MAY BE REQUIRED AS DIRECTED BY THE ENGINEER. FOR HORIZONTAL DRAINS, SEE THE RETAINING WALL HORIZONTAL DRAIN DETAIL.
- WHERE ROCK IS PRESENT IN THE WALL ENVELOPE, CONTROLLED BLASTING IS RECOMMENDED, BUT NOT REQUIRED, TO MAINTAIN THE NEAT EXCAVATION LINE. VOIDS, RESULTING FROM BLASTING OR EXCAVATING, THAT EXTEND BEYOND THE NEAT LINES ARE TO BE FILLED WITH A COMBINATION OF SHORT SOIL NAILS, WELDED WIRE, AND SHOTCRETE, AT THE DISCRETION OF THE ENGINEER. THE COSTS ASSOCIATED WITH THIS WORK WILL BE CONSIDERED INCIDENTAL TO WALL CONSTRUCTION AND NO ADDITIONAL COMPENSATION WILL BE MADE. FOR BLASTING, SEE THE BLASTING PROVISION.
- WHERE CONSTRUCTION VOIDS EXIST ALONG THE TOP OF RETAINING WALL #12, THE CONTRACTOR SHOULD BE PREPARED TO FORM THE CANTILEVERED SECTION OF THE CIP REINFORCED CONCRETE FACE TO THE TOP OF WALL ELEVATION. THE CONSTRUCTION VOID SHOULD BE FILLED WITH CONCRETE OR SHOTCRETE PRIOR TO CONSTRUCTION OF THE CONCRETE DITCH. ADDITIONAL WALL FACE REINFORCEMENT OR SOIL NAILS MAY BE REQUIRED FOR TALLER THAN TYPICAL CANTILEVER FACE HEIGHTS.

PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 RETAINING WALL #12: -L- 341+76, 22' LT TO 344+11, 22' LT
 SHEET 2 OF 3

PREPARED BY: R. KRAL	DATE: 6/2/2022
REVIEWED BY: M. BREWER	DATE: 6/2/2022

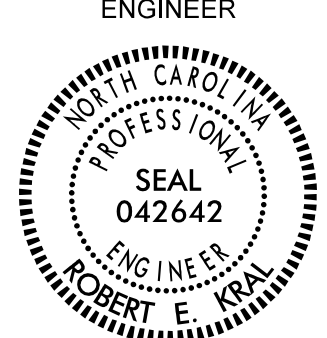
Prepared in the Office of:

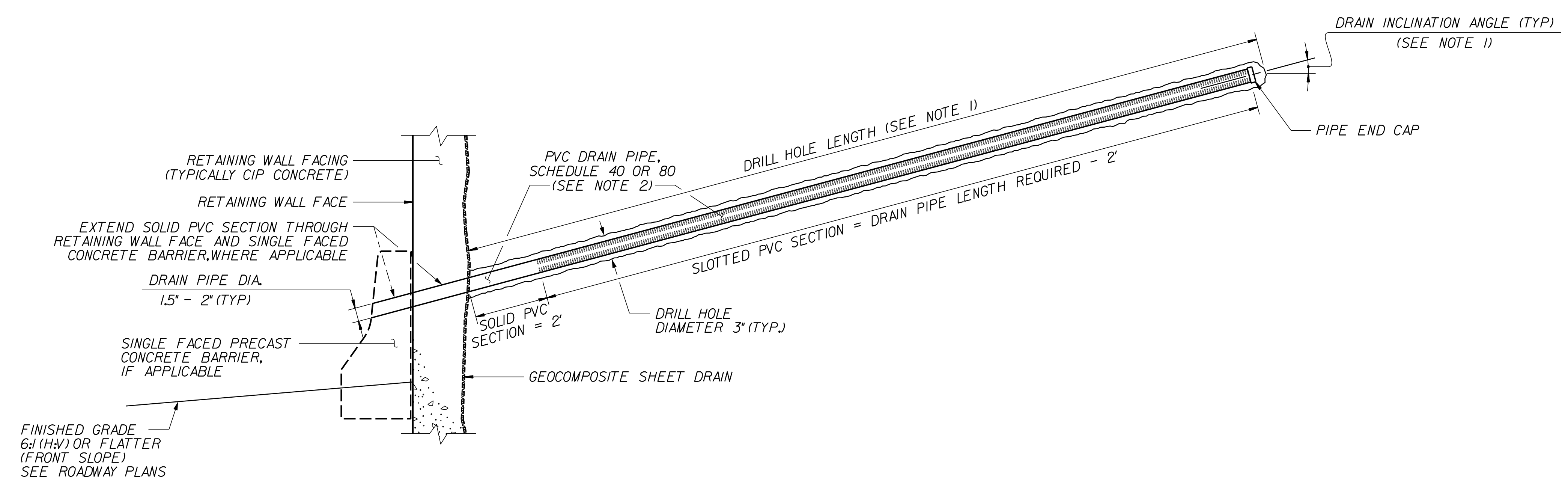
CAROLINAS GEOTECHNICAL GROUP
 2400 CROWNPOINT EXECUTIVE DRIVE
 SUITE 800
 CHARLOTTE, NC 28227
 (980) 339-8684

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

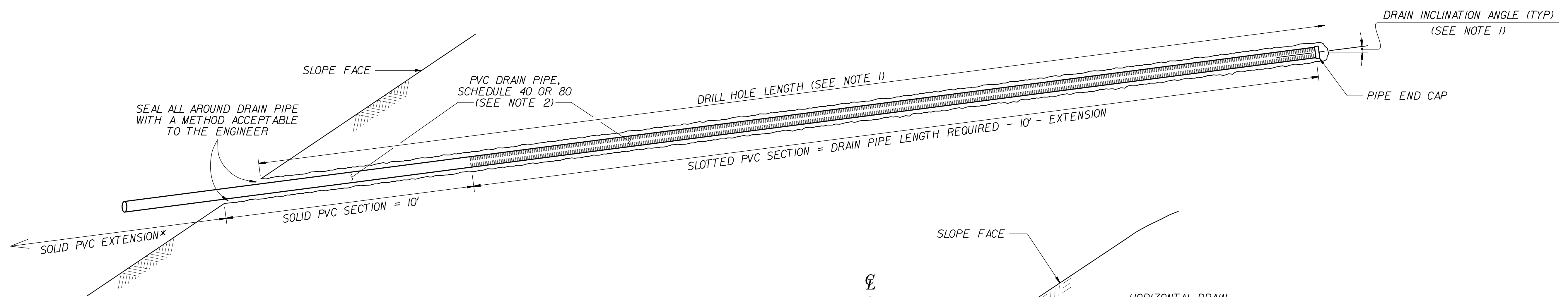
GEOTECHNICAL ENGINEERING UNIT

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W12-2
2			4			

GEOTECHNICAL ENGINEER  SEAL 042642 ROBERT E. KRAL	ENGINEER DATE: 06/08/2022 SIGNATURE: _____ DATE: _____
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



RETAINING WALL HORIZONTAL DRAIN



SLOPE HORIZONTAL DRAIN

*EXTEND SOLID PVC SECTION TO CONNECT PIPE TO A DRAINAGE SYSTEM OR DISCHARGE WATER AS DIRECTED

EXAMPLE CROSS-SECTION WITH SLOPE HORIZONTAL DRAIN
 *SEE NOTE 1 FOR DRAIN ELEVATIONS ABOVE (OR BELOW) GRADE

NOTES:

1. SEE ROADWAY SUMMARY SHEETS FOR APPROXIMATE KNOWN HORIZONTAL DRAIN LOCATIONS, ELEVATIONS, INCLINATION AND LENGTHS. ADDITIONAL DRAINS MAY BE REQUIRED AS DETERMINED BY THE ENGINEER.
2. DRAIN PIPES MAY BE OMITTED FOR SOME HORIZONTAL DRAINS. SEE ROADWAY SUMMARY SHEETS FOR DRAIN PIPE REQUIREMENTS INCLUDING THOSE DRAINS WITHOUT PIPES.
3. FOR HORIZONTAL DRAINS, SEE HORIZONTAL DRAINS SPECIAL PROVISION (GT-12).

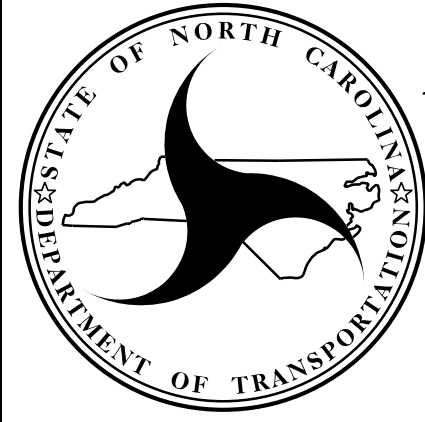
PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 RETAINING WALL #12: -L- 341+76, 22' LT TO 344+11, 22' LT
 SHEET 3 OF 3

PREPARED BY: R. KRAL	DATE: 6/2/2022
REVIEWED BY: M. BREWER	DATE: 6/2/2022

Prepared in the Office of:



CAROLINAS GEOTECHNICAL GROUP
 2400 CROWNPOINT EXECUTIVE DRIVE
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 CHARLOTTE, NC 28227
 (980) 339-8684

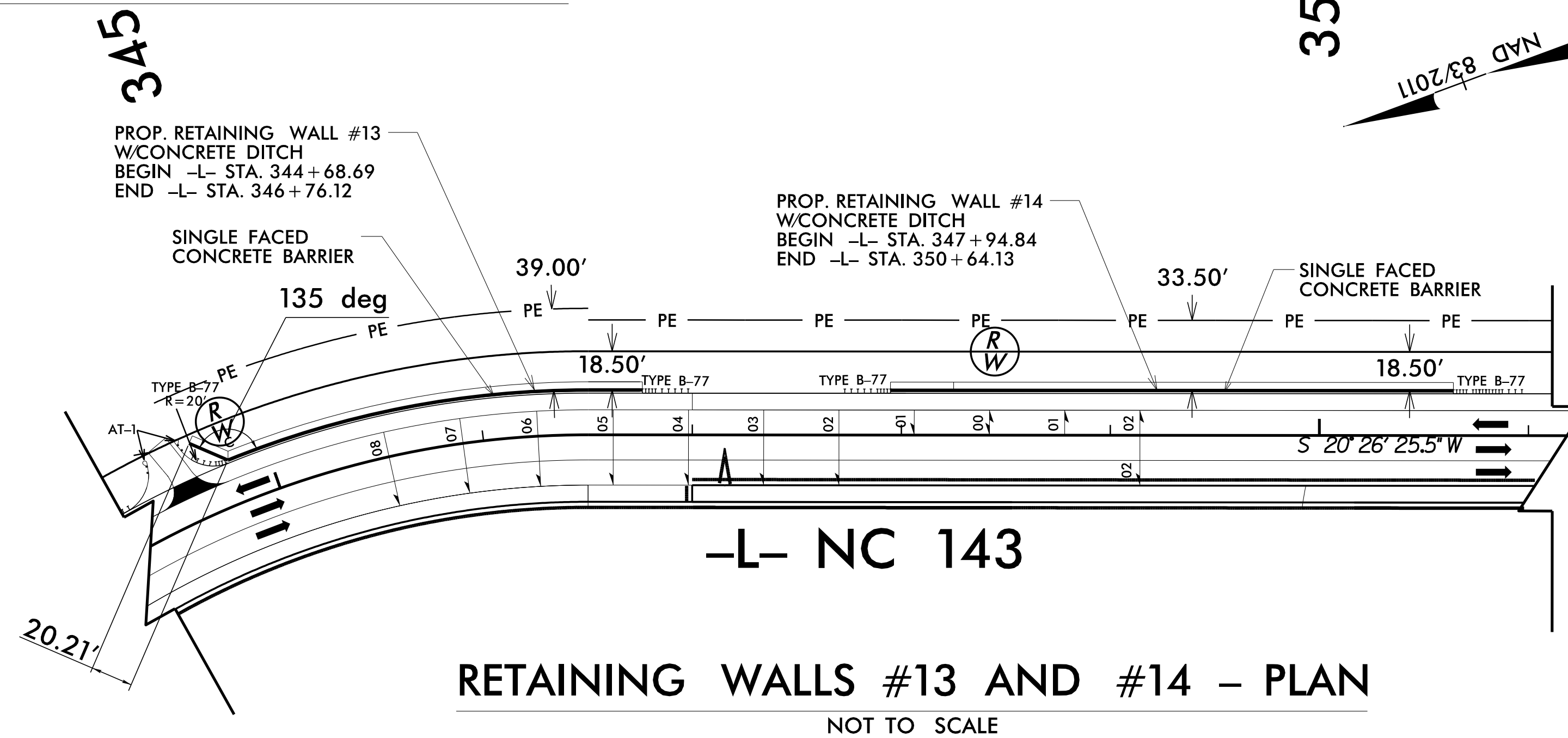


NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

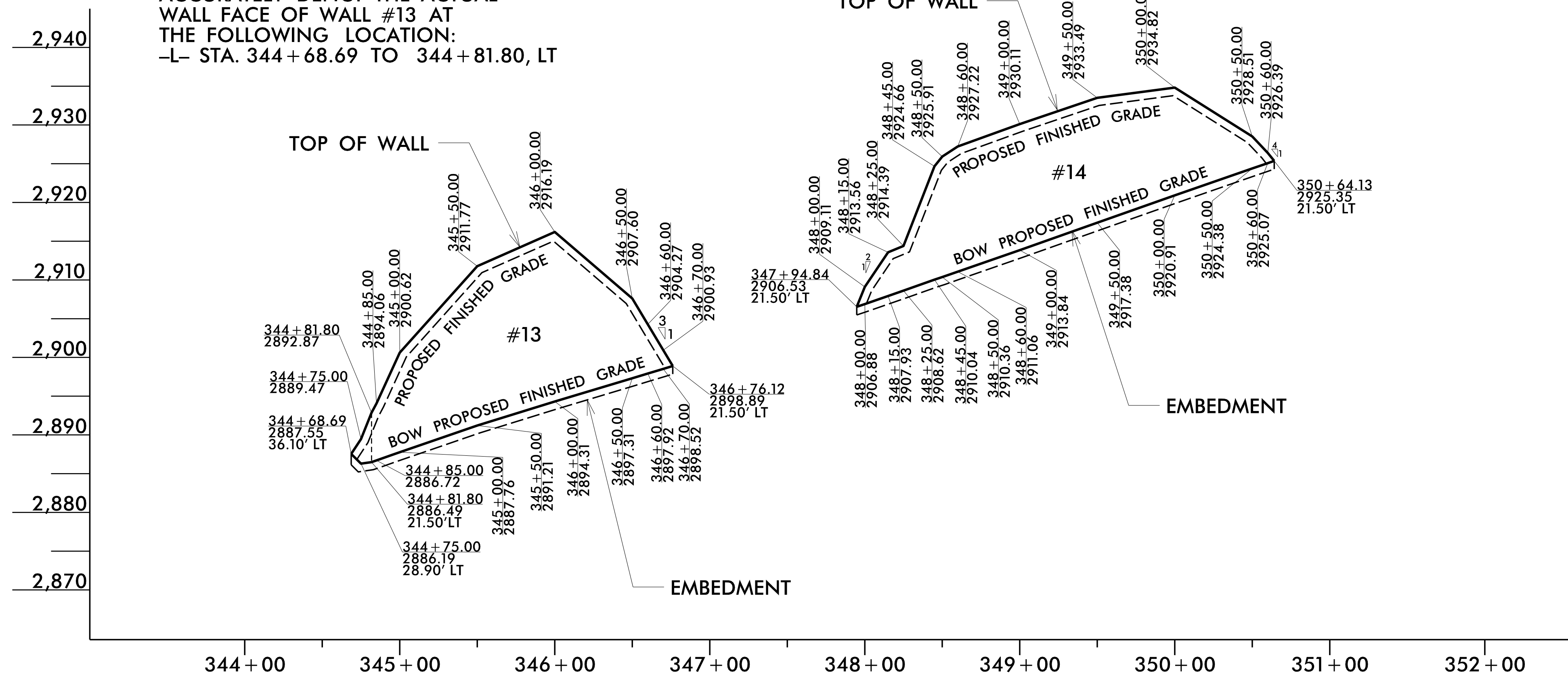
REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W12-3
2			4			

RETAINING WALL #13 AND #14:



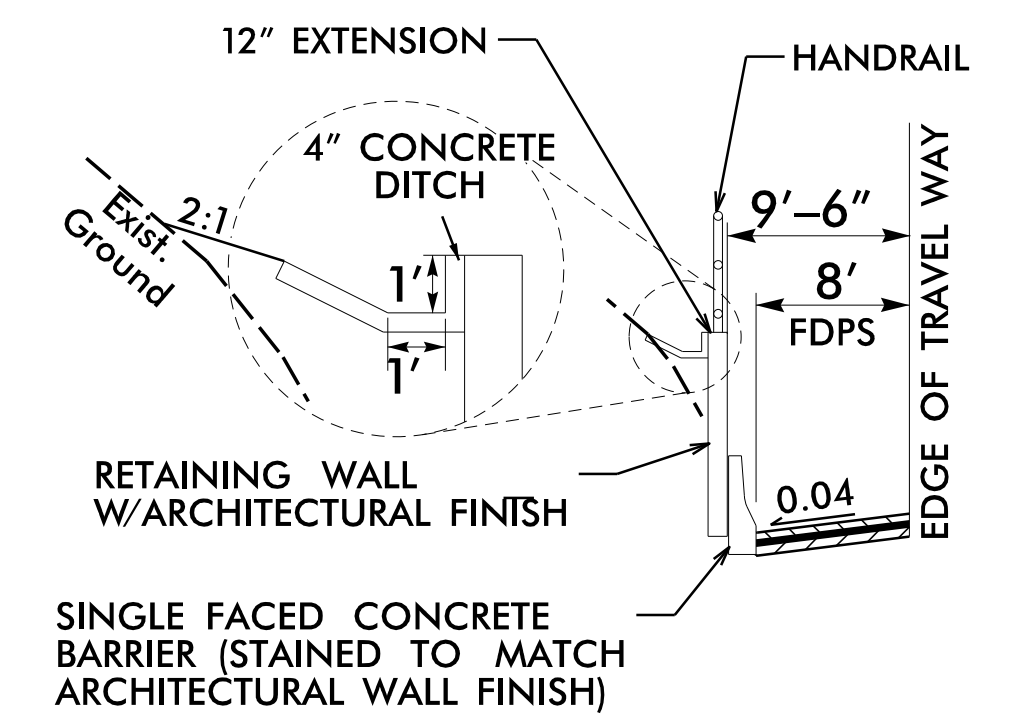
RETAINING WALLS #13 AND #14 - PLAN
NOT TO SCALE

THE WALL ENVELOPE DOES NOT ACCURATELY DEPICT THE ACTUAL WALL FACE OF WALL #13 AT THE FOLLOWING LOCATION:
-L- STA. 344 + 68.69 TO 344 + 81.80, LT



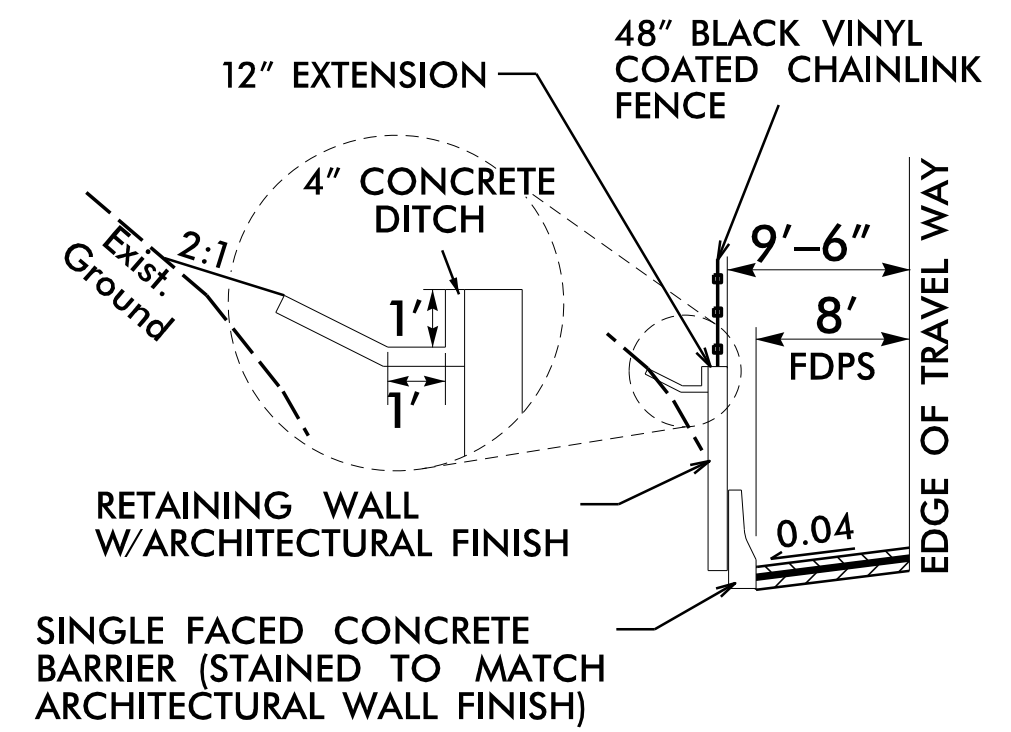
RETAINING WALL #13 AND #14 - ENVELOPES

NOT TO SCALE
BOW = BOTTOM OF WALL
(LOOKING AT FACE OF WALL)



DETAIL FOR WALL #13
NOT TO SCALE

-L- STA. 344 + 68.69 TO -L- STA. 346 + 76.12, LT



DETAIL FOR WALL #14
NOT TO SCALE

-L- STA. 347 + 94.84 TO -L- STA. 350 + 64.13, LT

PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #13: -L- 344+69, 36' LT TO 346+76, 22' LT

RETAINING WALL #14: -L- 347+95, 22' LT TO 350+64, 22' LT

SHEET 1 OF 4

PREPARED BY: R. KRAL
REVIEWED BY: M. BREWER

DATE: 6/2/2022
DATE: 6/2/2022
RETAINING WALL #13 AND #14 ENVELOPES AND WALL LAYOUTS PROVIDED BY TGS ENGINEERS, INC.

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
2400 CROWNPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W13-1
2			4			

ESTIMATED SOIL NAIL WALL QUANTITIES			
RETAINING WALL NO.	SOIL NAIL RETAINING WALLS (SQUARE FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
13	3,280*	3	15
FORM LINER ARCHITECTURAL FINISH			3,280* SF
HORIZONTAL DRAINS (CONTIGENCY)			105 LF

*INCLUDES RETAINING WALL EMBEDMENT

SOIL NAIL RETAINING WALL #13						
STA. -L-	OFFSET FROM -L- (LT) FT.	ELEV. @ TOP OF WALL	BOW PROPOSED FINISHED GRADE	TOP OF LEVELING PAD	ESTIMATED WALL EMBEDMENT FT.	WALL DESIGN HEIGHT "H"
344+68.69	36.10	2887.55	2887.55	2886.55	1.00	1.00
344+75.00	58.90	2889.47	2886.19	2885.19	1.00	3.28
344+81.80	21.50	2892.87	2886.49	2885.49	1.00	6.38
344+85.00	21.50	2894.06	2886.72	2885.72	1.00	7.34
345+00.00	21.50	2900.62	2887.76	2886.76	1.00	12.86
345+50.00	21.50	2911.77	2891.21	2890.21	1.00	20.56
346+00.00	21.50	2916.19	2894.31	2893.31	1.00	21.88
346+50.00	21.50	2907.60	2897.31	2896.31	1.00	10.29
346+60.00	21.50	2904.27	2897.92	2896.92	1.00	6.35
346+70.00	21.50	2900.93	2898.52	2897.52	1.00	2.41
346+76.12	21.50	2898.89	2898.89	2897.89	1.00	1.00

NOTES:

FOR SOIL NAIL RETAINING WALLS, SEE SOIL NAIL RETAINING WALLS PROVISION.

FOR SINGLE FACED PRECAST CONCRETE BARRIER (STAINED), SEE ROADWAY PLANS, SECTION 857 OF THE STANDARD SPECIFICATION, AND SIMULATED STONE FORM LINER FINISH SPECIAL PROVISION.

A HANDRAIL IS REQUIRED ON TOP OF RETAINING WALL #13. SEE ROADWAY PLANS FOR FENCE ATTACHMENT DETAILS.

A FENCE IS REQUIRED ON TOP OF RETAINING WALL #14. SEE ROADWAY PLANS FOR FENCE ATTACHMENT DETAILS.

A FORM LINER ARCHITECTURAL FINISH IS REQUIRED FOR THE CIP REINFORCED CONCRETE FACE FOR RETAINING WALL #13 AND #14. THE CONTRACTOR SHALL PROVIDE THE REQUESTED FINISH BEFORE BEGINNING CIP REINFORCED CONCRETE FACE CONSTRUCTION. THE APPEARANCE (STONE SIZE AND SHAPE, STONE COLOR, AND STONE TEXTURE, PATTERN, AND RELIEF) SHOULD MATCH NATURAL STONE AND ROCK. FOR FORM LINER ARCHITECTURAL FINISH, SEE THE SIMULATED STONE FORM LINER FINISH SPECIAL PROVISION.

BEFORE BEGINNING SOIL NAIL WALL DESIGN FOR RETAINING WALL #13 AND #14, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.

DESIGN RETAINING WALLS #13 AND #14 FOR THE FOLLOWING:

- DESIGN HEIGHT (H) = WALL HEIGHT + WALL EMBEDMENT
- DESIGN LIFE = 75 YEARS
- MINIMUM WALL EMBEDMENT ELEVATION = VARIES (MIN. 1 FT BELOW PROPOSED FINISHED GRADE ELEVATION)
- IN-SITU ASSUMED MEDIUM STIFF TO STIFF RESIDUAL SOIL PARAMETERS:
UNIT WEIGHT, γ = 120 PCF
FRICTION ANGLE, ϕ = 30 DEGREES
COHESION, c = 0 PSF
- IN-SITU ASSUMED VERY STIFF TO HARD RESIDUAL SOIL PARAMETERS:
UNIT WEIGHT, γ = 125 PCF
FRICTION ANGLE, ϕ = 36 DEGREES
COHESION, c = 0 PSF
- IN-SITU ASSUMED WEATHERED ROCK (META-SANDSTONE) PARAMETERS:
UNIT WEIGHT, γ = 135 PCF
FRICTION ANGLE, ϕ = 32 DEGREES
COHESION, c = 500 PSF
- IN-SITU ASSUMED CRYSTALLINE ROCK (META-SANDSTONE) PARAMETERS:
UNIT WEIGHT, γ = 170 PCF
FRICTION ANGLE, ϕ = 34 DEGREES
COHESION, c = 1,000 PSF
- WHERE ROCK IS ENCOUNTERED IN THE WALL ENVELOPE, DESIGNERS SHOULD REFER TO THE FHWA PRESUMPTIVE STRENGTH PARAMETERS OR OTHER REPRESENTATIVE AND REPEATABLE VALUES AND PROVIDE SOURCE REFERENCES IN THEIR DESIGN SUBMITTAL.

WHEN ANALYZING FOR INFINITE SLOPE CONDITIONS, DESIGNERS SHOULD ANALYZE UP TO TWO (2) TIMES THE WALL HEIGHT BEHIND THE WALL FACE FOR FAILURE PLANE SEARCHES. THIS INFORMATION SHOULD BE INCLUDED WITH THE DESIGN SUBMITTAL.

EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH SOIL NAILS FOR RETAINING WALLS #13 AND #14.

PREPARED BY: R. KRAL	DATE: 6/2/2022
REVIEWED BY: M. BREWER	DATE: 6/2/2022

ESTIMATED SOIL NAIL WALL QUANTITIES			
RETAINING WALL NO.	SOIL NAIL RETAINING WALLS (SQUARE FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
14	3,540*	3	15
FORM LINER ARCHITECTURAL FINISH			3,540* SF
HORIZONTAL DRAINS (CONTIGENCY)			135 LF

*INCLUDES RETAINING WALL EMBEDMENT

SOIL NAIL RETAINING WALL #14						
STA. -L-	OFFSET FROM -L- (LT) FT.	ELEV. @ TOP OF WALL	BOW PROPOSED FINISHED GRADE	TOP OF LEVELING PAD	ESTIMATED WALL EMBEDMENT FT.	WALL DESIGN HEIGHT "H"
347+94.84	21.50	2906.53	2906.53	2905.53	1.00	1.00
348+00.00	21.50	2909.11	2906.88	2905.88	1.00	2.23
348+15.00	21.50	2913.56	2907.93	2906.93	1.00	5.63
348+25.00	21.50	2914.39	2908.62	2907.62	1.00	5.77
348+45.00	21.50	2924.66	2910.04	2909.04	1.00	14.62
348+60.00	21.50	2927.22	2911.06	2910.06	1.00	16.16
349+00.00	21.50	2930.11	2913.84	2912.84	1.00	16.27
349+50.00	21.50	2933.29	2917.38	2916.38	1.00	15.91
350+00.00	21.50	2934.82	2920.91	2919.91	1.00	13.91
350+50.00	21.50	2928.51	2924.38	2923.38	1.00	4.13
350+60.00	21.50	2926.39	2925.07	2924.07	1.00	1.32
350+64.13	21.50	2925.35	2925.35	2924.35	1.00	1.00

NOTES (continued):

THE PROPOSED RIGHT OF WAY (ROW) BOUNDARY IS 18.5 FT FROM THE FACE OF RETAINING WALL #13 AND #14. THE PROPOSED PERMANENT EASEMENT (PE) IS 39.0 FEET AND 33.5 FEET FROM THE FACE OF RETAINING WALL #13 AND #14, RESPECTIVELY. SOIL NAILS MAY NOT BE INSTALLED BEYOND THE PE BOUNDARY. SEE "SOIL NAIL WALL - TYPICAL SECTION" DETAIL.

IF GROUNDWATER IS ENCOUNTERED BEHIND THE FACE OF RETAINING WALLS #13 AND #14, HORIZONTAL DRAINS MAY BE REQUIRED AS DIRECTED BY THE ENGINEER. FOR HORIZONTAL DRAINS, SEE THE RETAINING WALL HORIZONTAL DRAIN DETAIL.

WHERE ROCK IS PRESENT IN THE WALL ENVELOPE, CONTROLLED BLASTING IS RECOMMENDED, BUT NOT REQUIRED, TO MAINTAIN THE NEAT EXCAVATION LINE. VOIDS, RESULTING FROM BLASTING OR EXCAVATING, THAT EXTEND BEYOND THE NEAT LINES ARE TO BE FILLED WITH A COMBINATION OF SHORT SOIL NAILS, WELDED WIRE, AND SHOTCRETE, AT THE DISCRETION OF THE ENGINEER. THE COSTS ASSOCIATED WITH THIS WORK WILL BE CONSIDERED INCIDENTAL TO WALL CONSTRUCTION AND NO ADDITIONAL COMPENSATION WILL BE MADE. FOR BLASTING, SEE THE BLASTING PROVISION.

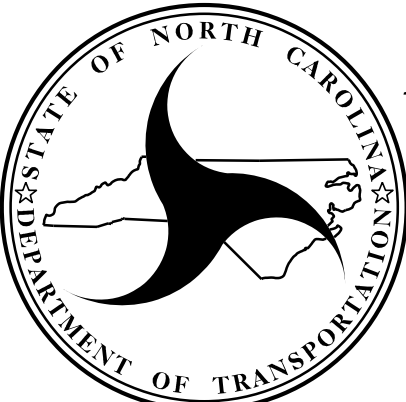
WHERE CONSTRUCTION VOIDS EXIST ALONG THE TOP OF RETAINING WALLS #13 AND #14, THE CONTRACTOR SHOULD BE PREPARED TO FORM THE CANTILEVERED SECTION OF THE CIP REINFORCED CONCRETE FACE TO THE TOP OF WALL ELEVATION. THE CONSTRUCTION VOID SHOULD BE FILLED WITH CONCRETE OR SHOTCRETE PRIOR TO CONSTRUCTION OF THE CONCRETE DITCH. ADDITIONAL WALL FACE REINFORCEMENT OR SOIL NAILS MAY BE REQUIRED FOR TALLER THAN TYPICAL CANTILEVER FACE HEIGHTS.

PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 RETAINING WALL #13: -L- 344+69, 36' LT TO 346+76, 22' LT
 RETAINING WALL #14: -L- 347+95, 22' LT TO 350+64, 22' LT
 SHEET 2 OF 4

Prepared in the Office of:



CAROLINUS GEOTECHNICAL GROUP
 2400 CROWNPOINT EXECUTIVE DRIVE
 SUITE 800
 CHARLOTTE, NC 28227
 (980) 339-8684



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS


GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #13 AND #14 SOIL NAIL RETAINING WALL

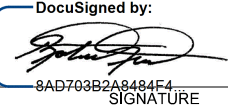
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SHEET NO. W13-2

GEOTECHNICAL ENGINEER



SEAL 042642
 ENGINEER
 ROBERT E. KRAL

DocuSigned by:  06/08/2022

DATE: 06/08/2022
 SIGNATURE: _____ DATE: _____

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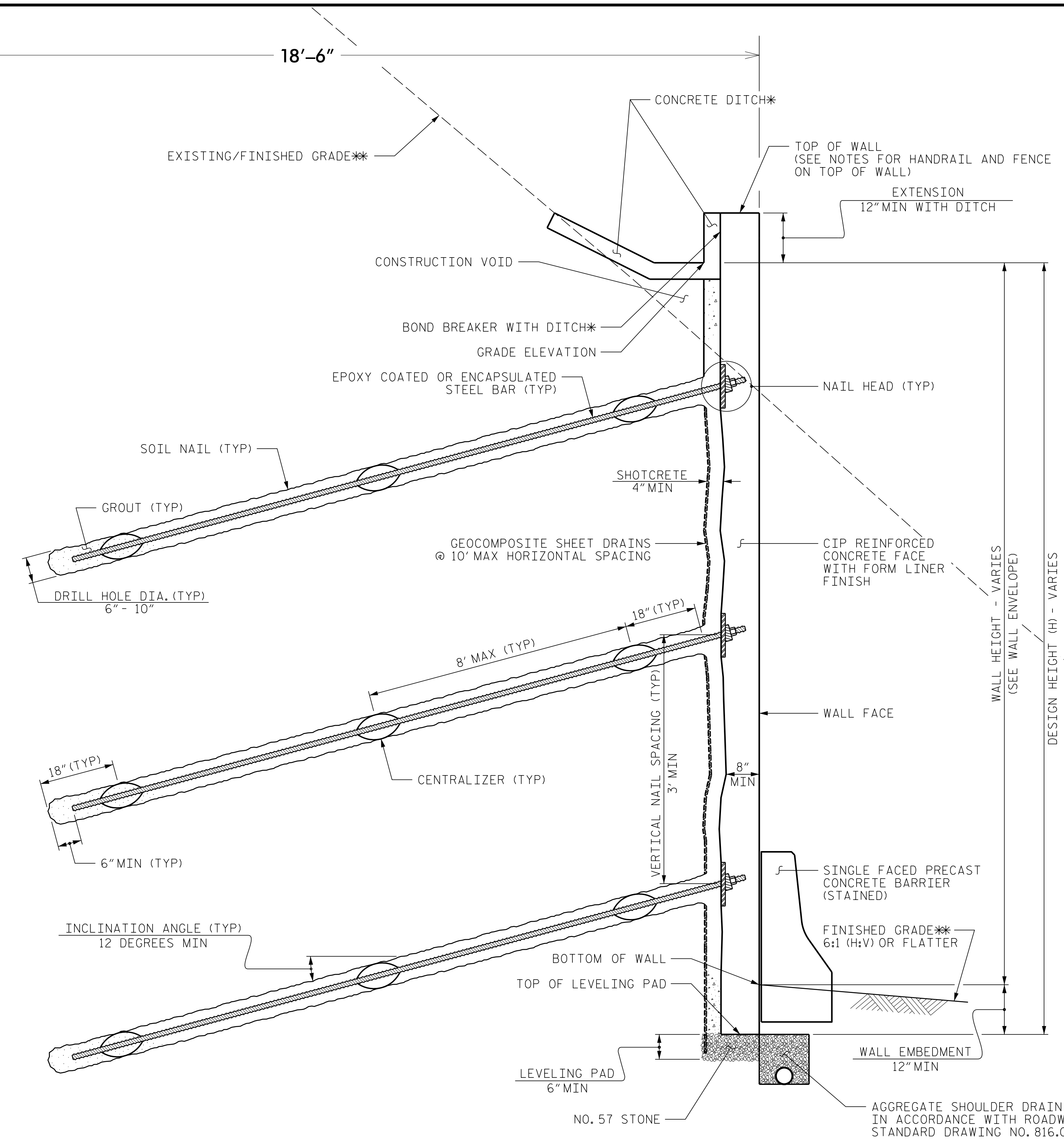
15.0' (RETAINING WALL #14)
20.5' (RETAINING WALL #13)

PE
PE
PE
PE
PE
PE

PERMANENT EASEMENT

RIGHT OF WAY

R
W



SOIL NAIL WALL - TYPICAL SECTION

*SEE CONCRETE DITCH BEHIND WALL DETAILS.
**SEE PLANS FOR FINISHED GRADE.

GEOTECHNICAL ENGINEER

ENGINEER

SEAL 042642

ROBERT E. KRAL

DocuSigned by: [Signature]

06/08/2022

DATE

SIGNATURE

DATE

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PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #13: -L- 344+69, 36' LT TO 346+76, 22' LT

RETAINING WALL #14: -L- 347+95, 22' LT TO 350+64, 22' LT

SHEET 3 OF 4

PREPARED BY: R. KRAL	DATE: 6/2/2022
REVIEWED BY: M. BREWER	DATE: 6/2/2022

Prepared in the Office of:

CGE CAROLINAS GEOTECHNICAL GROUP

2400 CROWNPOINT EXECUTIVE DRIVE
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CHARLOTTE, NC 28227
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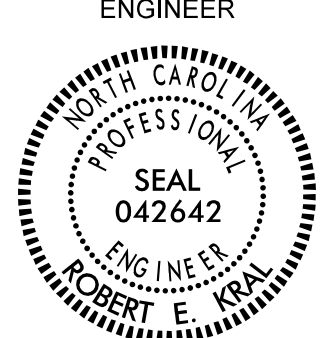
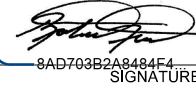
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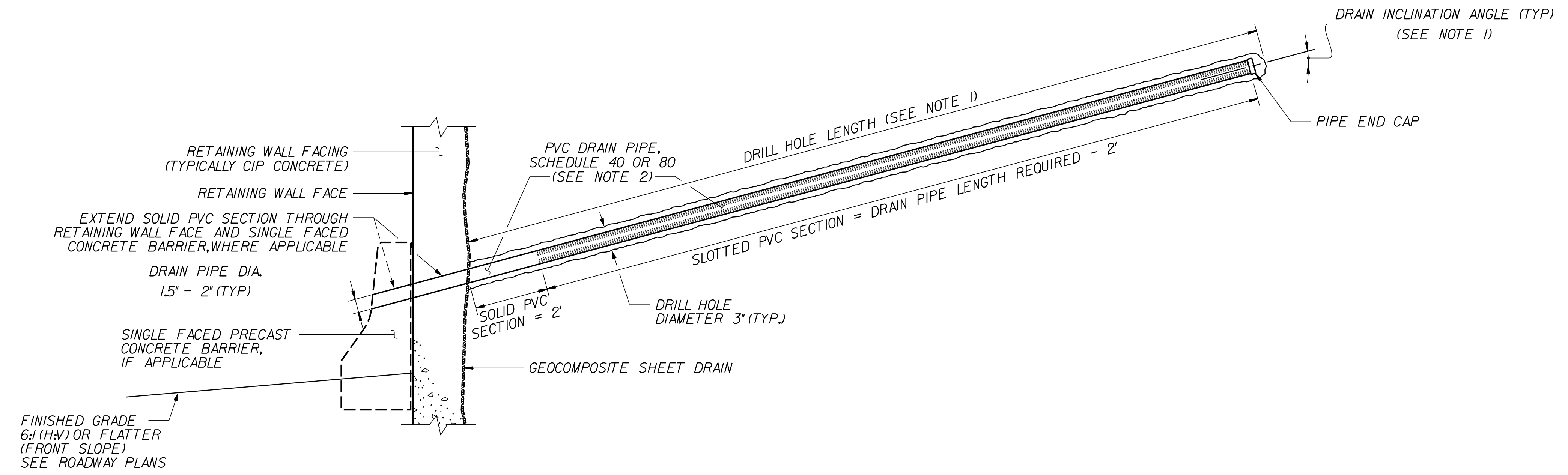
GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #13 AND #14 SOIL NAIL RETAINING WALL

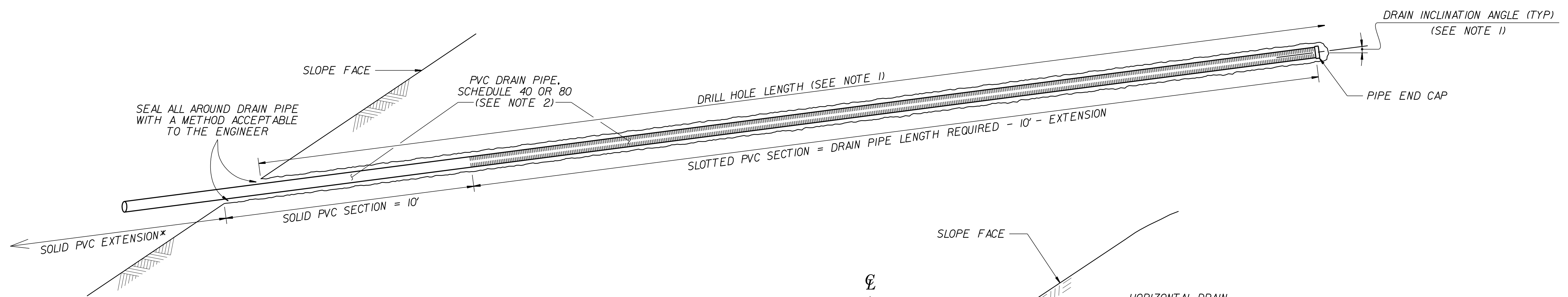
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SHEET NO. W13-3

GEOTECHNICAL ENGINEER  SEAL 042642 ROBERT E. KRAL	ENGINEER _____ SIGNATURE
DocuSigned by:  06/08/2022 DATE	_____ SIGNATURE
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RETAINING WALL HORIZONTAL DRAIN



SLOPE HORIZONTAL DRAIN

***EXTEND SOLID PVC SECTION TO CONNECT PIPE TO A DRAINAGE SYSTEM OR DISCHARGE WATER AS DIRECTED**

EXAMPLE CROSS-SECTION WITH SLOPE HORIZONTAL DRAIN

***SEE NOTE 1 FOR DRAIN ELEVATIONS ABOVE (OR BELOW) GRADE**

NOTES:

- SEE ROADWAY SUMMARY SHEETS FOR APPROXIMATE KNOWN HORIZONTAL DRAIN LOCATIONS, ELEVATIONS, INCLINATION AND LENGTHS. ADDITIONAL DRAINS MAY BE REQUIRED AS DETERMINED BY THE ENGINEER.
- DRAIN PIPES MAY BE OMITTED FOR SOME HORIZONTAL DRAINS. SEE ROADWAY SUMMARY SHEETS FOR DRAIN PIPE REQUIREMENTS INCLUDING THOSE DRAINS WITHOUT PIPES.
- FOR HORIZONTAL DRAINS, SEE HORIZONTAL DRAINS SPECIAL PROVISION (GT-12).


PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 RETAINING WALL #13: -L- 344+69, 36' LT TO 346+76, 22' LT
 RETAINING WALL #14: -L- 347+95, 22' LT TO 350+64, 22' LT
 SHEET 4 OF 4

PREPARED BY: R. KRAL	DATE: 6/2/2022
REVIEWED BY: M. BREWER	DATE: 6/2/2022

Prepared in the Office of:



CAROLINAS GEOTECHNICAL GROUP
 2400 CROWNPOINT EXECUTIVE DRIVE
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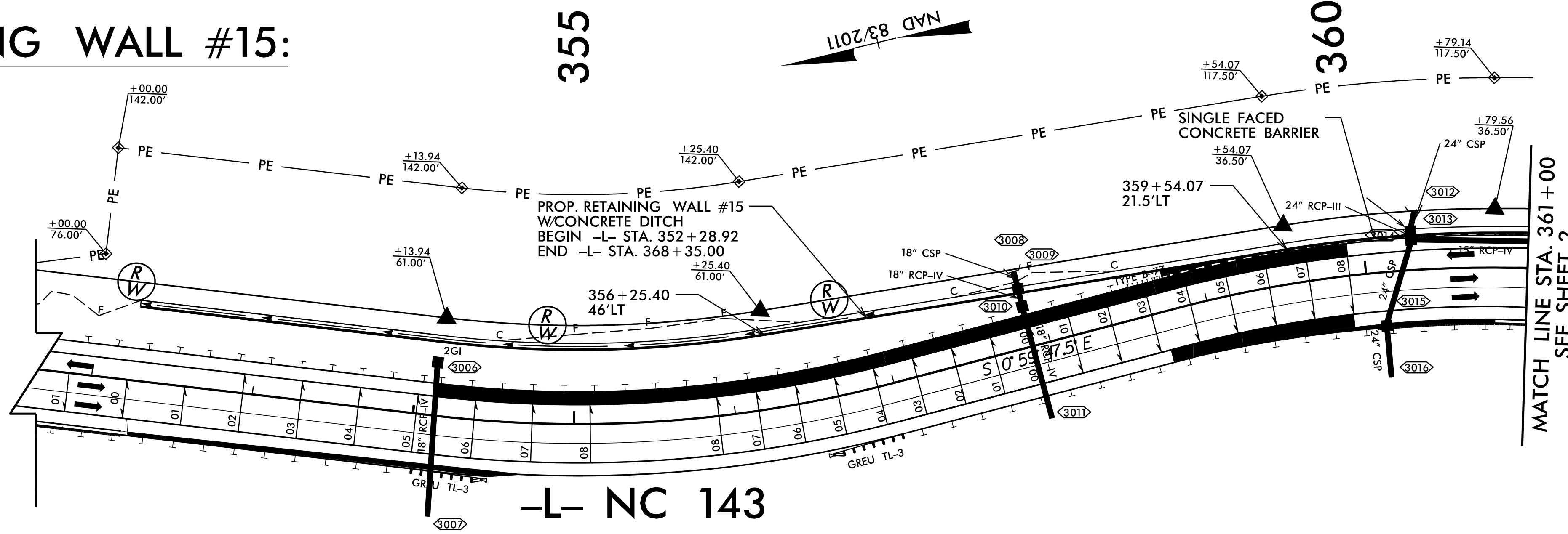


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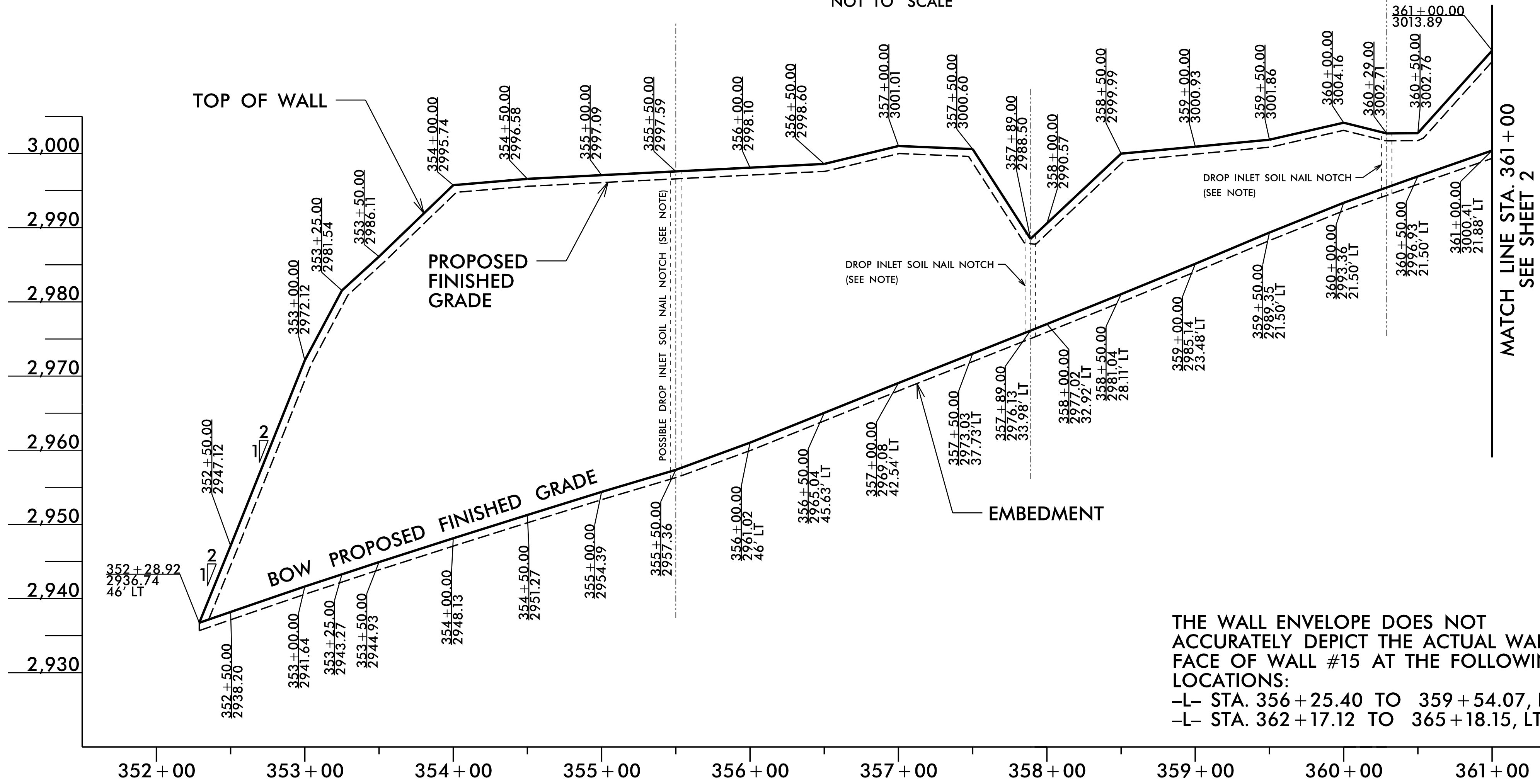
GEOTECHNICAL ENGINEERING UNIT

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NO.	BY	DATE	NO.	BY	DATE	
1			3			W13-4
2			4			

RETAINING WALL #15:



RETAINING WALL #15 - PLAN
NOT TO SCALE



RETAINING WALL #15 - ENVELOPE
NOT TO SCALE

BOW = BOTTOM OF WALL
(LOOKING AT FACE OF WALL)

THE WALL ENVELOPE DOES NOT ACCURATELY DEPICT THE ACTUAL WALL FACE OF WALL #15 AT THE FOLLOWING LOCATIONS:
 -L- STA. 356 + 25.40 TO 359 + 54.07, LT
 -L- STA. 362 + 17.12 TO 365 + 18.15, LT

GEOTECHNICAL ENGINEER

ENGINEER

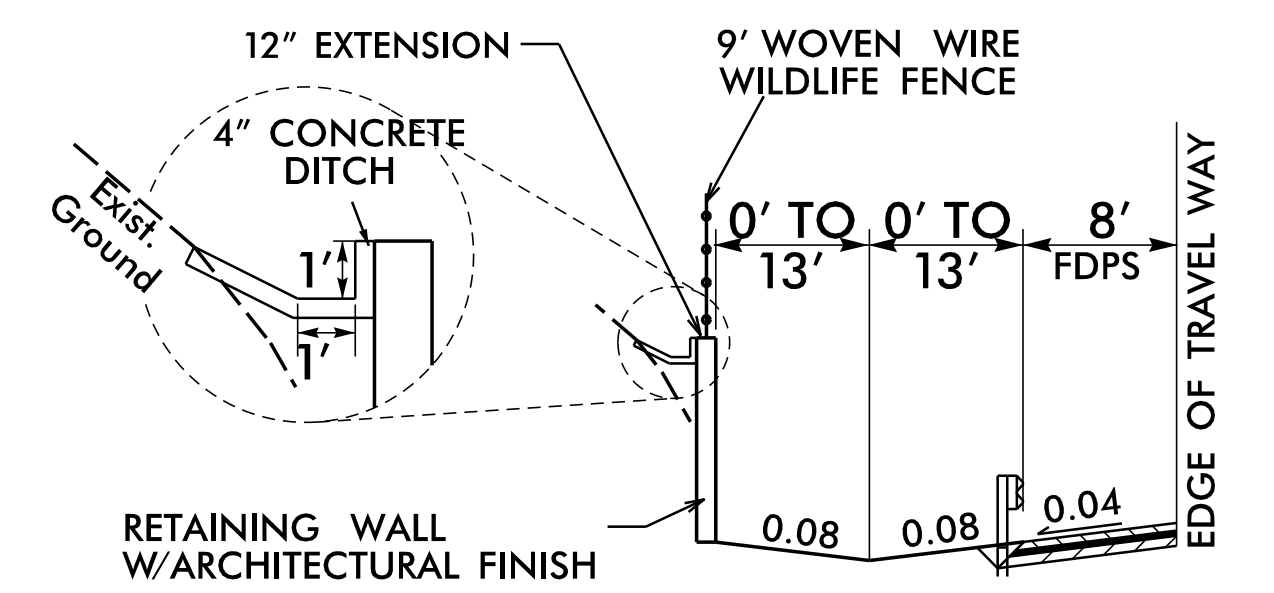
SEAL 042642

ROBERT E. KRAL

DocuSigned by: [Signature]

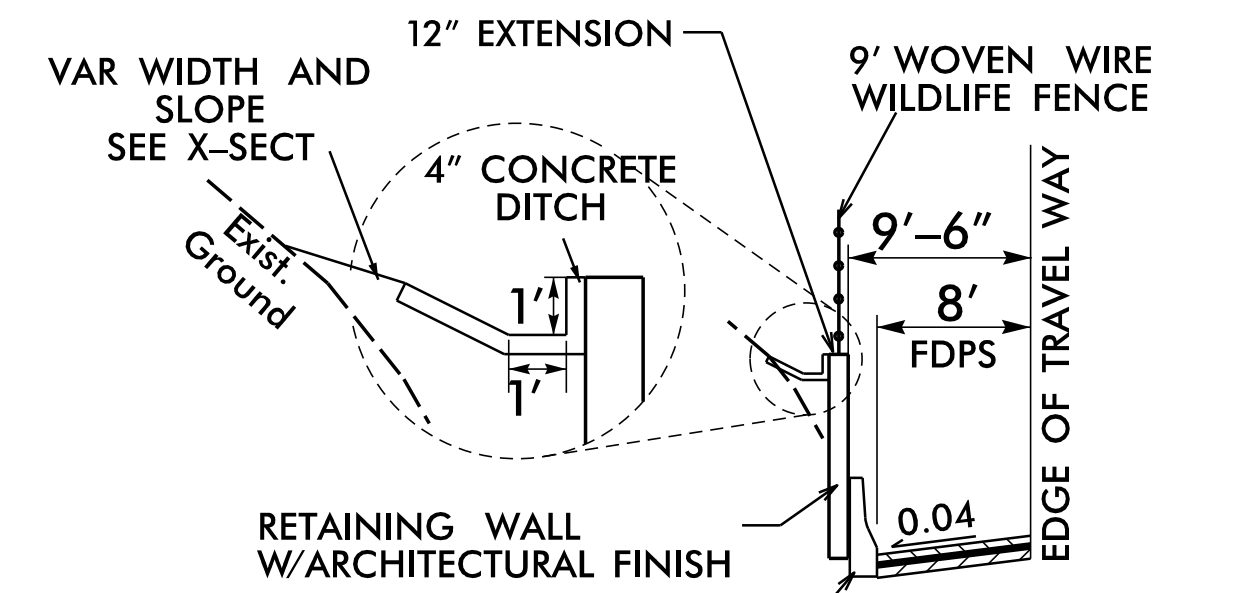
06/08/2022

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DETAIL A FOR WALL #15
NOT TO SCALE

-L- STA. 352 + 28.92 TO -L- STA. 358 + 77 ±, LT
 -L- STA. 362 + 94 ± TO -L- STA. 368 + 35.00, LT



DETAIL B FOR WALL #15
NOT TO SCALE

-L- STA. 358 + 77 ± TO -L- STA. 362 + 94 ±, LT

PROJECT NO.: A-0009CB

GRAHAM COUNTY
 RETAINING WALL #15: -L- 352+29, 46' LT TO 368+35, 52' LT

SHEET 1 OF 5

PREPARED BY: R. KRAL
 REVIEWED BY: M. BREWER

DATE: 5/27/2022
 DATE: 5/27/2022

RETAINING WALL #15 ENVELOPE AND WALL LAYOUT PROVIDED BY TGS ENGINEERS, INC.

Prepared in the Office of:

CGE CAROLINAS GEOTECHNICAL GROUP

2400 CROWNPOINT EXECUTIVE DRIVE
 SUITE 800
 CHARLOTTE, NC 28227
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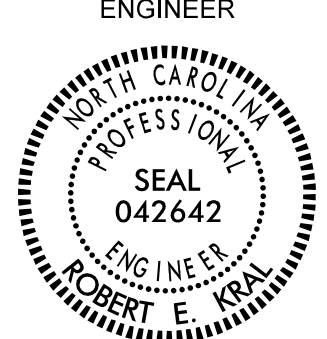
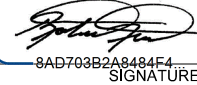
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

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2			4		

RETAINING WALL #15 SOIL NAIL RETAINING WALL

SHEET NO. W15-1

 <p style="text-align: center; font-size: small;">GEOTECHNICAL ENGINEER</p>	<p style="font-size: x-small;">ENGINEER</p>
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SOIL NAIL RETAINING WALL #15						
STA. -L-	OFFSET FROM -L- (LT) FT.	ELEV. @ TOP OF WALL	BOW PROPOSED FINISHED GRADE	TOP OF LEVELING PAD	ESTIMATED WALL EMBEDMENT FT.	WALL DESIGN HEIGHT "H"
352+28.92	46.00	2936.74	2936.74	2935.74	1.00	1.00
352+50.00	46.00	2947.12	2938.20	2937.20	1.00	8.92
353+00.00	46.00	2972.12	2941.64	2940.64	1.00	30.48
353+25.00	46.00	2981.54	2943.27	2942.27	1.00	38.27
353+50.00	46.00	2986.11	2944.93	2943.93	1.00	41.18
354+00.00	46.00	2995.74	2948.13	2947.13	1.00	47.61
354+50.00	46.00	2996.58	2951.27	2950.27	1.00	45.31
355+00.00	46.00	2997.09	2954.39	2953.39	1.00	42.70
355+50.00	46.00	2997.59	2957.36	2956.36	1.00	40.23
356+00.00	46.00	2998.10	2961.02	2960.02	1.00	37.08
356+50.00	45.63	2998.60	2965.04	2964.04	1.00	33.56
357+00.00	42.54	3001.01	2969.08	2968.08	1.00	31.93
357+50.00	37.73	3000.06	2973.03	2972.03	1.00	27.03
357+89.00	33.98	2988.50	2976.13	2975.13	1.00	12.37
358+00.00	32.92	2990.57	2977.02	2976.02	1.00	13.55
358+50.00	28.11	2999.99	2981.04	2980.04	1.00	18.95
359+00.00	23.48	3000.93	2985.14	2984.14	1.00	15.79
359+50.00	21.50	3001.86	2989.35	2988.35	1.00	12.51
360+00.00	21.50	3004.16	2993.36	2992.36	1.00	10.80
360+25.00	21.50	3002.71	2995.43	2994.43	1.00	7.28
360+50.00	21.50	3002.76	2996.93	2995.93	1.00	5.83
361+00.00	21.88	3013.89	3000.41	2999.41	1.00	13.48
361+50.00	22.81	3023.07	3003.83	3002.83	1.00	19.24
362+00.00	23.72	3024.18	3006.84	3005.84	1.00	17.34
362+50.00	25.34	3032.11	3009.59	3008.59	1.00	22.52
363+00.00	30.18	3028.17	3012.38	3011.38	1.00	15.79
363+50.00	36.81	3029.59	3015.23	3014.23	1.00	14.36
364+00.00	43.43	3040.24	3018.07	3017.07	1.00	22.17
364+50.00	49.14	3049.32	3020.91	3019.91	1.00	28.41
365+00.00	51.80	3057.86	3023.62	3022.62	1.00	34.24
365+50.00	52.00	3064.74	3026.43	3025.43	1.00	38.31
366+00.00	52.00	3072.46	3029.88	3028.88	1.00	42.58
366+50.00	52.00	3080.22	3033.50	3032.50	1.00	46.72
367+00.00	52.00	3077.41	3037.23	3036.23	1.00	40.18
367+50.00	52.00	3060.33	3041.21	3040.21	1.00	19.12
368+00.00	52.00	3054.79	3045.29	3044.29	1.00	9.50
368+21.00	47.50	3050.26	3046.85	3045.85	1.00	3.41
368+35.00	45.00	3047.23	3047.23	3046.23	1.00	0.00

NOTES:

FOR SOIL NAIL RETAINING WALLS, SEE SOIL NAIL RETAINING WALLS PROVISION.

FOR SINGLE FACED PRECAST CONCRETE BARRIER (STAINED), SEE ROADWAY PLANS, SECTION 857 OF THE STANDARD SPECIFICATION, AND SIMULATED STONE FORM LINER FINISH SPECIAL PROVISION.

RETAINING WALL #15 HAS SADDLES THAT REQUIRE DRAINAGE STRUCTURES TO BE INSTALLED BEHIND THE WALL. SEE ROADWAY AND HYDRAULIC PLANS FOR STRUCTURE TYPE AND LOCATION.

A FENCE IS REQUIRED ON TOP OF RETAINING WALL #15. SEE ROADWAY PLANS FOR FENCE ATTACHMENT DETAILS.

A FORM LINER ARCHITECTURAL FINISH IS REQUIRED FOR THE CIP REINFORCED CONCRETE FACE FOR RETAINING WALL #15. THE CONTRACTOR SHALL PROVIDE THE REQUESTED FINISH BEFORE BEGINNING CIP REINFORCED CONCRETE FACE CONSTRUCTION. THE APPEARANCE (STONE SIZE AND SHAPE, STONE COLOR, AND STONE TEXTURE, PATTERN, AND RELIEF) SHOULD MATCH NATURAL STONE AND ROCK. FOR FORM LINER ARCHITECTURAL FINISH, SEE THE SIMULATED STONE FORM LINER FNISH SPECIAL PROVISION.

BEFORE BEGINNING SOIL NAIL WALL DESIGN FOR RETAINING WALL #15, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.

- DESIGN RETAINING WALL #15 FOR THE FOLLOWING:
- 1) DESIGN HEIGHT (H) = WALL HEIGHT + WALL EMBEDMENT
 - 2) DESIGN LIFE = 75 YEARS
 - 3) MINIMUM WALL EMBEDMENT ELEVATION = VARIES (MIN. 1 FT BELOW PROPOSED FINISHED GRADE ELEVATION)
 - 4) IN-SITU ASSUMED DENSE RESIDUAL SOIL PARAMETERS:
 UNIT WEIGHT, $\gamma = 125$ PCF
 FRICTION ANGLE, $\phi = 36$ DEGREES
 COHESION, $c = 0$ PSF
 - 5) IN-SITU ASSUMED WEATHERED ROCK (META-SANDSTONE) PARAMETERS:
 UNIT WEIGHT, $\gamma = 135$ PCF
 FRICTION ANGLE, $\phi = 32$ DEGREES
 COHESION, $c = 500$ PSF
 - 6) IN-SITU ASSUMED CRYSTALLINE ROCK (META-SANDSTONE) PARAMETERS:
 UNIT WEIGHT, $\gamma = 170$ PCF
 FRICTION ANGLE, $\phi = 34$ DEGREES
 COHESION, $c = 1,000$ PSF
 - 7) WHERE ROCK IS ENCOUNTERED IN THE WALL ENVELOPE, DESIGNERS SHOULD REFER TO THE FHWA PRESUMPTIVE STRENGTH PARAMETERS OR OTHER REPRESENTATIVE AND REPEATABLE VALUES AND PROVIDE SOURCE REFERENCES IN THEIR DESIGN SUBMITTAL.

WHEN ANALYZING FOR INFINITE SLOPE CONDITIONS, DESIGNERS SHOULD ANALYZE UP TO TWO (2) TIMES THE WALL HEIGHT BEHIND THE WALL FACE FOR FAILURE PLANE SEARCHES. THIS INFORMATION SHOULD BE INCLUDED WITH THE DESIGN SUBMITTAL.

EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH SOIL NAILS FOR RETAINING WALL #15.

THE PROPOSED RIGHT OF WAY (ROW) AND PERMANENT EASEMENT (PE) BOUNDARY VARIES FROM THE FACE OF RETAINING WALL #15. SEE THE ROADWAY PLANS FOR OFFSET DISTANCES FROM THE FACE OF RETAINING WALL #15. SOIL NAILS MAY NOT BE INSTALLED BEYOND THE PE BOUNDARY. SEE "SOIL NAIL WALL - TYPICAL SECTION" DETAIL.

HORIZONTAL DRAINS WILL BE REQUIRED IN THE VICINITY OF THE EXISTING TIMBER RETAINING WALL. TREATMENT OF THE EXISTING HORIZONTAL DRAINS THAT REMAIN AFTER DEMOLITION OF THE EXISTING TIMBER RETAINING WALL WILL BE AS DIRECTED BY THE ENGINEER. FOR HORIZONTAL DRAINS, SEE THE RETAINING WALL HORIZONTAL DRAIN DETAIL.

IF GROUNDWATER IS ENCOUNTERED BEHIND THE FACE OF RETAINING WALL #15, HORIZONTAL DRAINS MAY BE REQUIRED AS DIRECTED BY THE ENGINEER. FOR HORIZONTAL DRAINS, SEE THE RETAINING WALL HORIZONTAL DRAIN DETAIL.

WHERE ROCK IS PRESENT IN THE WALL ENVELOPE, CONTROLLED BLASTING IS RECOMMENDED, BUT NOT REQUIRED, TO MAINTAIN THE NEAT EXCAVATION LINE. VOIDS, RESULTING FROM BLASTING OR EXCAVATING, THAT EXTEND BEYOND THE NEAT LINES ARE TO BE FILLED WITH A COMBINATION OF SHORT SOIL NAILS, WELDED WIRE, AND SHOTCRETE, AT THE DISCRETION OF THE ENGINEER. THE COSTS ASSOCIATED WITH THIS WORK WILL BE CONSIDERED INCIDENTAL TO WALL CONSTRUCTION AND NO ADDITIONAL COMPENSATION WILL BE MADE. FOR BLASTING, SEE THE BLASTING PROVISION.

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PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 RETAINING WALL #15: -L- 352+29, 46' LT TO 368+35, 52' LT
 SHEET 3 OF 5

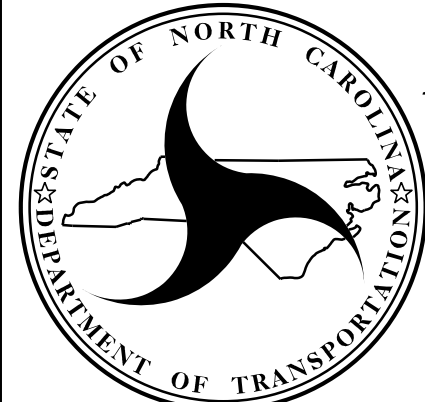
PREPARED BY: R. KRAL	DATE: 5/27/2022
REVIEWED BY: M. BREWER	DATE: 5/27/2022

Prepared in the Office of:



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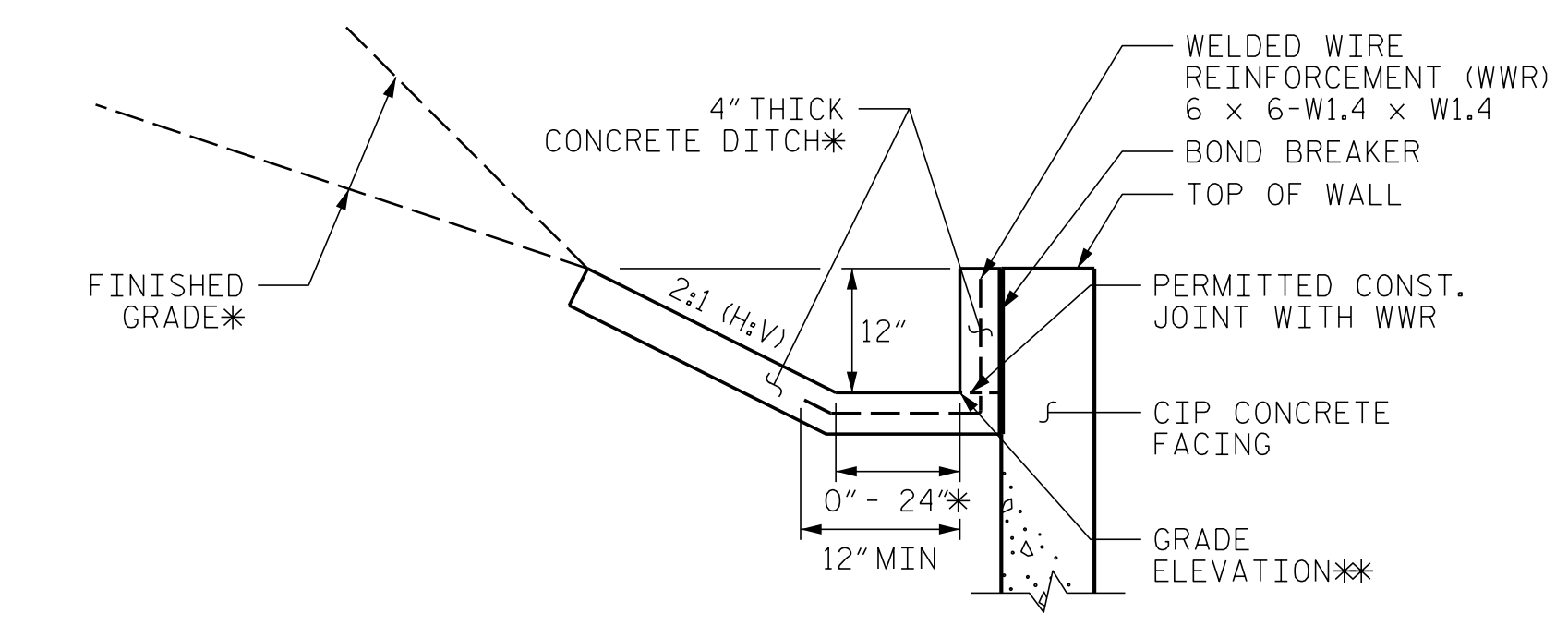
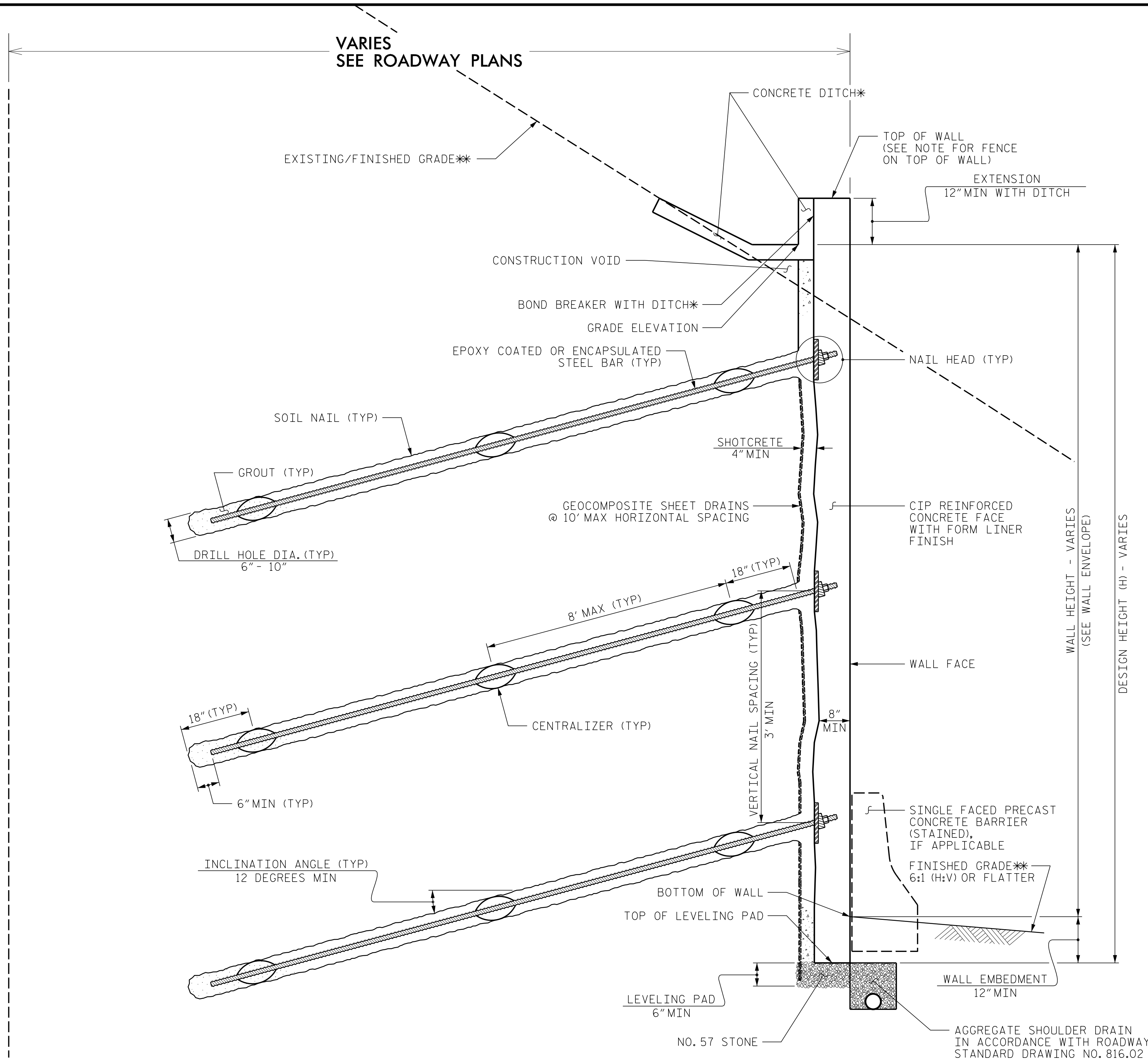
NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

GEOTECHNICAL
ENGINEERING UNIT

RETAINING WALL #15 SOIL NAIL RETAINING WALL					
REVISIONS					
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SHEET NO. W15-3


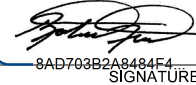
PERMANENT EASEMENT OR RIGHT OF WAY



CONCRETE DITCH BEHIND WALL WITH CONCRETE FACING
 *SEE ROADWAY PLANS FOR CONCRETE DITCH AND FINISHED GRADE DETAILS.
 **SEE WALL ENVELOPE FOR GRADE ELEVATIONS.

SOIL NAIL WALL - TYPICAL SECTION

*SEE CONCRETE DITCH BEHIND WALL DETAILS.
 **SEE PLANS FOR FINISHED GRADE.

GEOTECHNICAL ENGINEER  SEAL 042642 ROBERT E. KRAL	ENGINEER _____ DATE _____
DocuSigned by:  SIGNATURE	06/08/2022 DATE
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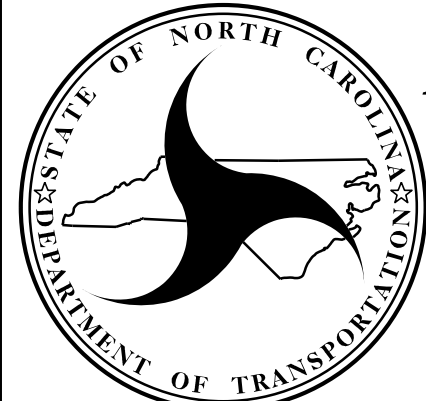
PROJECT NO.: A-0009CB
 GRAHAM COUNTY
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 SHEET 4 OF 5

PREPARED BY: R. KRAL	DATE: 5/27/2022
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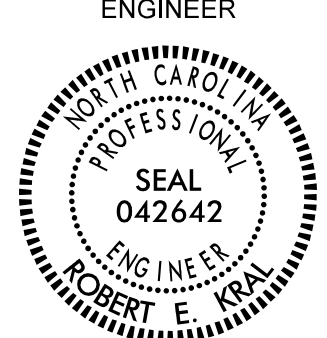


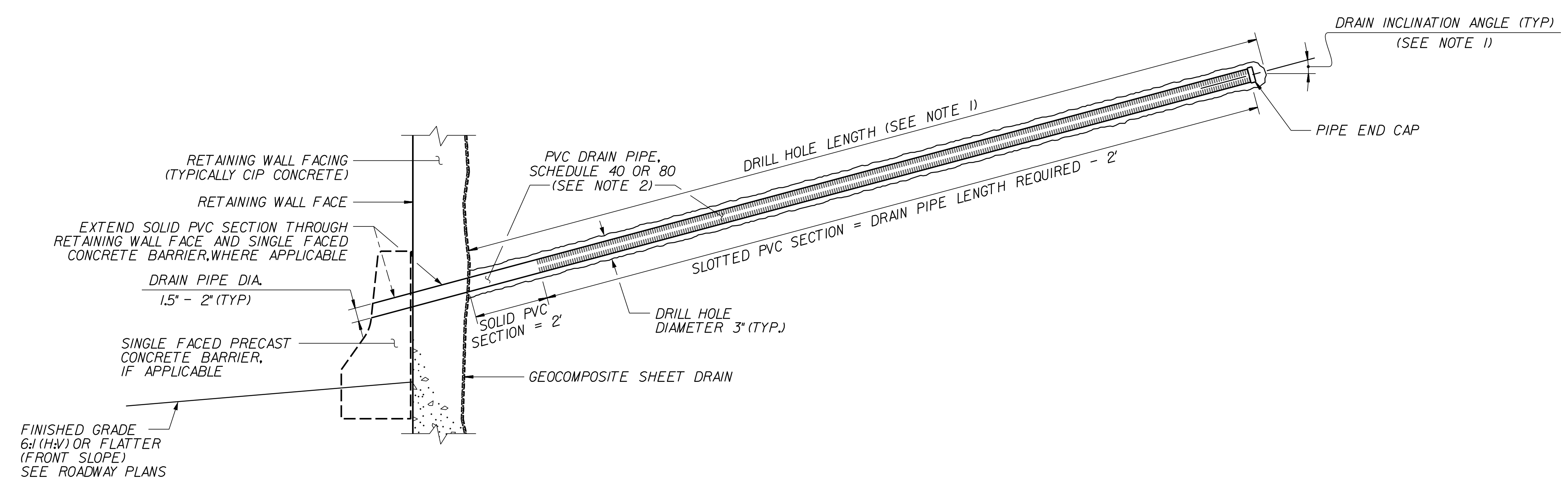
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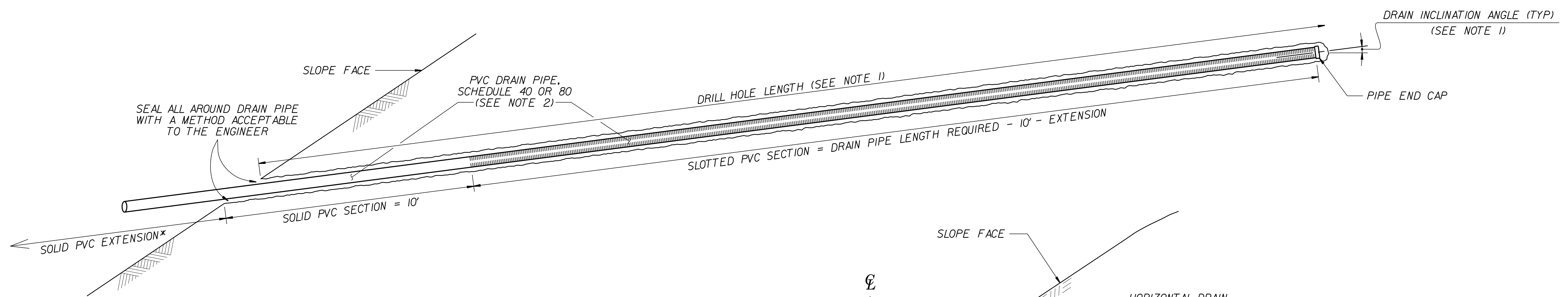
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2			4		

SHEET NO. W15-4

GEOTECHNICAL ENGINEER  SEAL 042642 ROBERT E. KRAL	ENGINEER DATE: 06/08/2022 SIGNATURE: _____ DATE: _____
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



RETAINING WALL HORIZONTAL DRAIN



SLOPE HORIZONTAL DRAIN

*EXTEND SOLID PVC SECTION TO CONNECT PIPE TO A DRAINAGE SYSTEM OR DISCHARGE WATER AS DIRECTED

EXAMPLE CROSS-SECTION WITH SLOPE HORIZONTAL DRAIN
 *SEE NOTE 1 FOR DRAIN ELEVATIONS ABOVE (OR BELOW) GRADE

NOTES:

1. SEE ROADWAY SUMMARY SHEETS FOR APPROXIMATE KNOWN HORIZONTAL DRAIN LOCATIONS, ELEVATIONS, INCLINATION AND LENGTHS. ADDITIONAL DRAINS MAY BE REQUIRED AS DETERMINED BY THE ENGINEER.
2. DRAIN PIPES MAY BE OMITTED FOR SOME HORIZONTAL DRAINS. SEE ROADWAY SUMMARY SHEETS FOR DRAIN PIPE REQUIREMENTS INCLUDING THOSE DRAINS WITHOUT PIPES.
3. FOR HORIZONTAL DRAINS, SEE HORIZONTAL DRAINS SPECIAL PROVISION (GT-12).

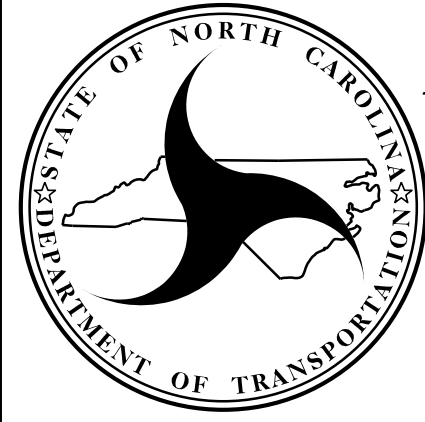
PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 RETAINING WALL #15: -L- 352+29, 46' LT TO 368+35, 52' LT
 SHEET 5 OF 5

PREPARED BY: R. KRAL	DATE: 5/27/2022
REVIEWED BY: M. BREWER	DATE: 5/27/2022

Prepared in the Office of:




CAROLINAS GEOTECHNICAL GROUP
 2400 CROWNPOINT EXECUTIVE DRIVE
 SUITE 800
 CHARLOTTE, NC 28227
 (980) 339-8684

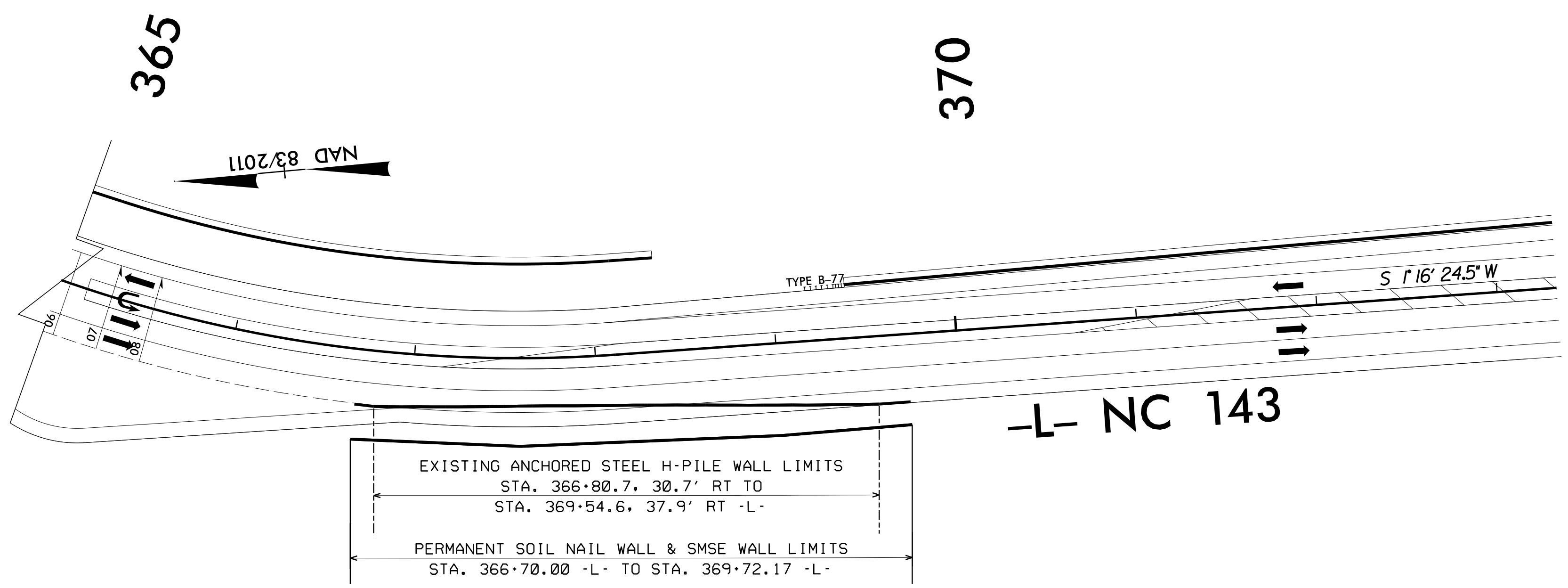


NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

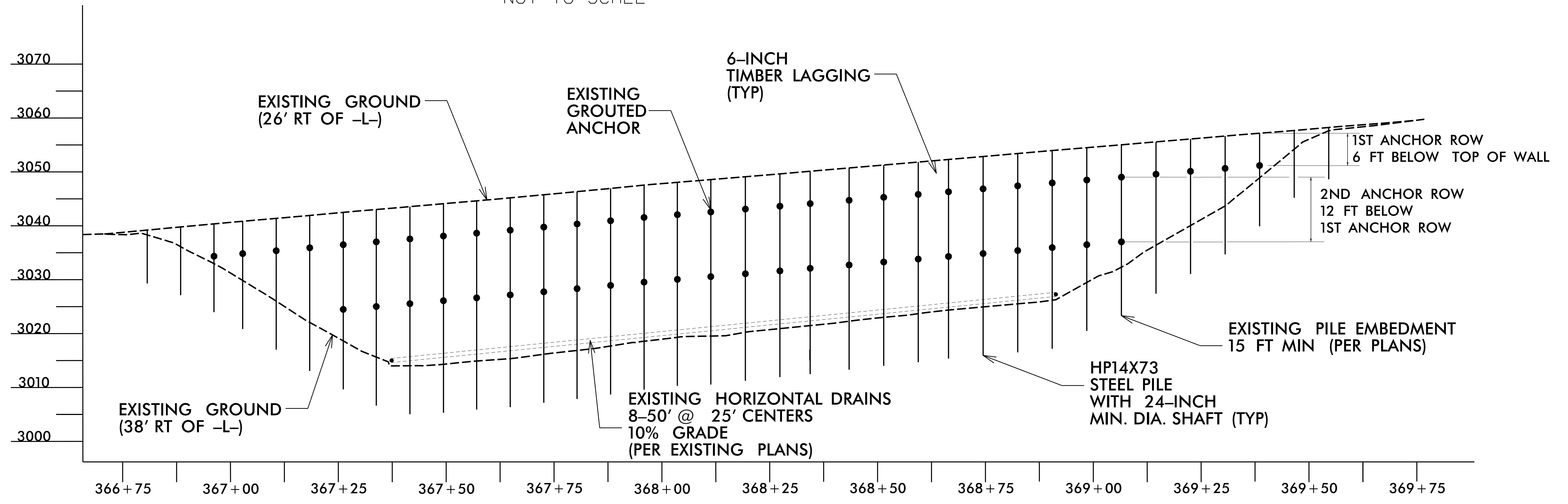
REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W15-5
2			4			

GEOTECHNICAL ENGINEER  SEAL 041986 ENGINEER M. MATTHEW BREWER	ENGINEER SIGNATURE DATE
DocuSigned by: D. Matthew Brewer 7/15/2022 SIGNATURE DATE	
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WALL LIMITS SKETCH

NOT TO SCALE



EXISTING WALL PROFILE

NOT TO SCALE
(LOOKING AT WALL FACE)

PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 STATION: -L-366+70, 50' RT TO 369+72, 50' RT
 SHEET 2 OF 8

EXISTING PLANS INDICATE MINIMUM GROUDED ANCHOR LENGTH = 40 FT
 MINIMUM UNBONDED LENGTH = 20 FT
 MINIMUM BONDED LENGTH = 20 FT
 ANCHOR AT 20 DEG. BELOW HORIZONTAL

EXISTING PILE LOCATIONS SURVEYED BY NCDOT.
 LOCATIONS SHOWN ARE FOR INFORMATION ONLY.

PREPARED BY: DMB DATE: 7/14/2022
 REVIEWED BY: REK DATE: 7/14/2022

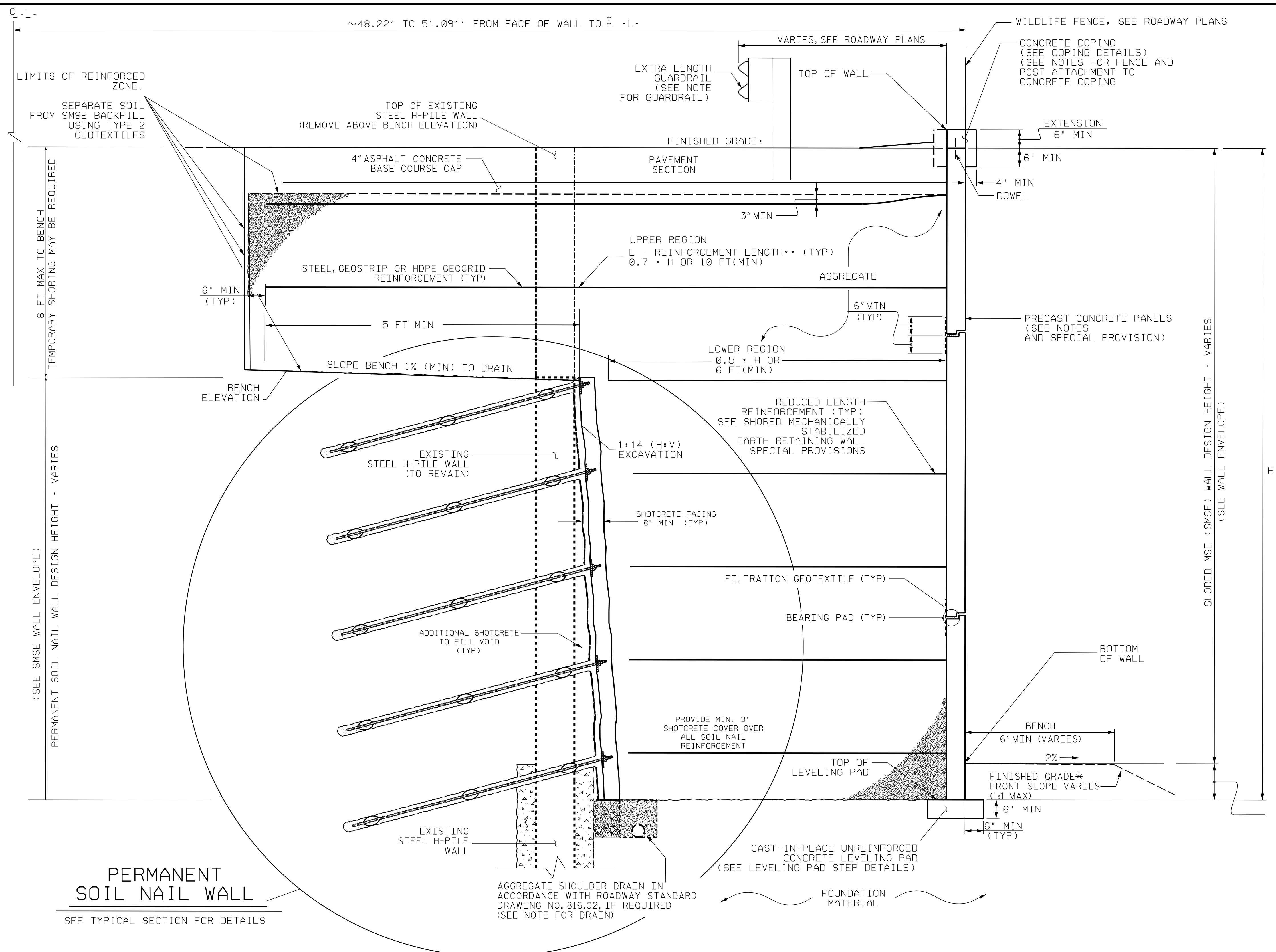
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**RETAINING WALL #16
 SHORED MECHANICALLY
 STABILIZED EARTH (SMSE) WALL**

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W16-2
2			4			



~48.22' TO 51.09' FROM FACE OF WALL TO C-L-L

VARIES, SEE ROADWAY PLANS

WILDLIFE FENCE, SEE ROADWAY PLANS

CONCRETE COPING (SEE COPING DETAILS) (SEE NOTES FOR FENCE AND POST ATTACHMENT TO CONCRETE COPING)

EXTENSION 6" MIN

6" MIN

4" MIN DOWEL

FINISHED GRADE*

PAVEMENT SECTION

EXTRA LENGTH GUARDRAIL (SEE NOTE FOR GUARDRAIL)

TOP OF WALL

TOP OF EXISTING STEEL H-PILE WALL (REMOVE ABOVE BENCH ELEVATION)

4" ASPHALT CONCRETE BASE COURSE CAP

3" MIN

UPPER REGION L - REINFORCEMENT LENGTH** (TYP) 0.7 * H OR 10 FT (MIN)

AGGREGATE

6" MIN (TYP)

PRECAST CONCRETE PANELS (SEE NOTES AND SPECIAL PROVISION)

LOWER REGION 0.5 * H OR 6 FT (MIN)

REDUCED LENGTH REINFORCEMENT (TYP) SEE SHORED MECHANICALLY STABILIZED EARTH RETAINING WALL SPECIAL PROVISIONS

1:14 (H:V) EXCAVATION

SHOTCRETE FACING 8" MIN (TYP)

FILTRATION GEOTEXTILE (TYP)

BEARING PAD (TYP)

ADDITIONAL SHOTCRETE TO FILL VOID (TYP)

PROVIDE MIN. 3" SHOTCRETE COVER OVER ALL SOIL NAIL REINFORCEMENT

TOP OF LEVELING PAD

BENCH 6' MIN (VARIES)

2%

FINISHED GRADE* FRONT SLOPE VARIES (1:1 MAX)

6" MIN

6" MIN (TYP)

EMBEDMENT 5' MIN

SHORED MSE (SMSE) WALL DESIGN HEIGHT - VARIES (SEE WALL ENVELOPE)

H

PERMANENT SOIL NAIL WALL SEE TYPICAL SECTION FOR DETAILS

PERMANENT SOIL NAIL WALL DESIGN HEIGHT - VARIES (SEE SMSE WALL ENVELOPE)

6 FT MAX TO BENCH TEMPORARY SHORING MAY BE REQUIRED

LIMITS OF REINFORCED ZONE. SEPARATE SOIL FROM SMSE BACKFILL USING TYPE 2 GEOTEXTILES

6" MIN (TYP)

5 FT MIN

SLOPE BENCH 1% (MIN) TO DRAIN

BENCH ELEVATION

EXISTING STEEL H-PILE WALL (TO REMAIN)

EXISTING STEEL H-PILE WALL

AGGREGATE SHOULDER DRAIN IN ACCORDANCE WITH ROADWAY STANDARD DRAWING NO. 816.02, IF REQUIRED (SEE NOTE FOR DRAIN)

FOUNDATION MATERIAL

CAST-IN-PLACE UNREINFORCED CONCRETE LEVELING PAD (SEE LEVELING PAD STEP DETAILS)

SMSE WALL WITH SOIL NAIL WALL > 2/3 H

-L- STATION 366+70 TO 369+72

*SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.

**SEE SMSE RETAINING WALLS SPECIAL PROVISION REINFORCEMENT LENGTH REQUIREMENTS.

GEOTECHNICAL ENGINEER

ENGINEER

PROFESSIONAL SEAL 041986

D. Matthew Brewer

7/15/2022

38812000001429

SIGNATURE DATE SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT NO.: A-0009CB

GRAHAM COUNTY

STATION: -L-366+70, 50' RT TO 369+72, 50' RT

SHEET 4 OF 8

PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022

Prepared in the Office of:

CGP CAROLINAS GEOTECHNICAL GROUP

2400 CROWNPOINT EXECUTIVE DRIVE SUITE 800 CHARLOTTE, NC 28227 (980) 339-8684

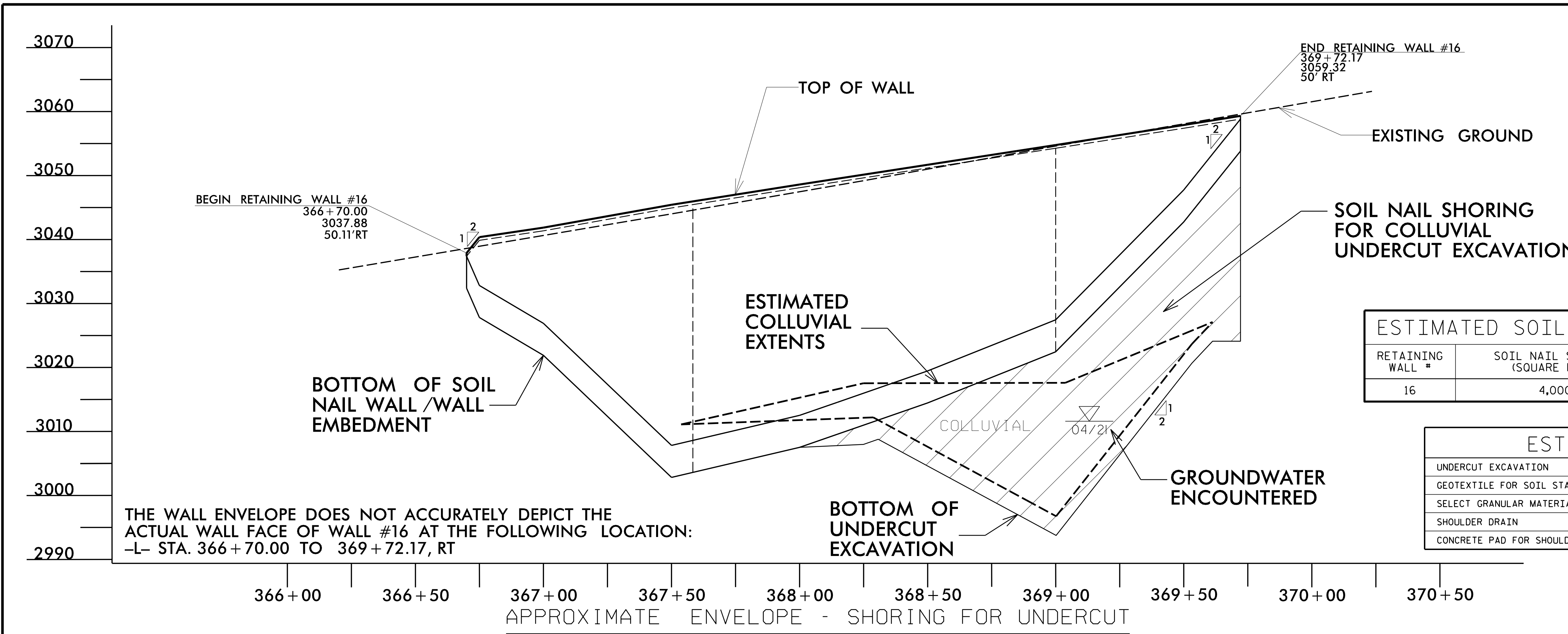
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #16 SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL

REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W16-4



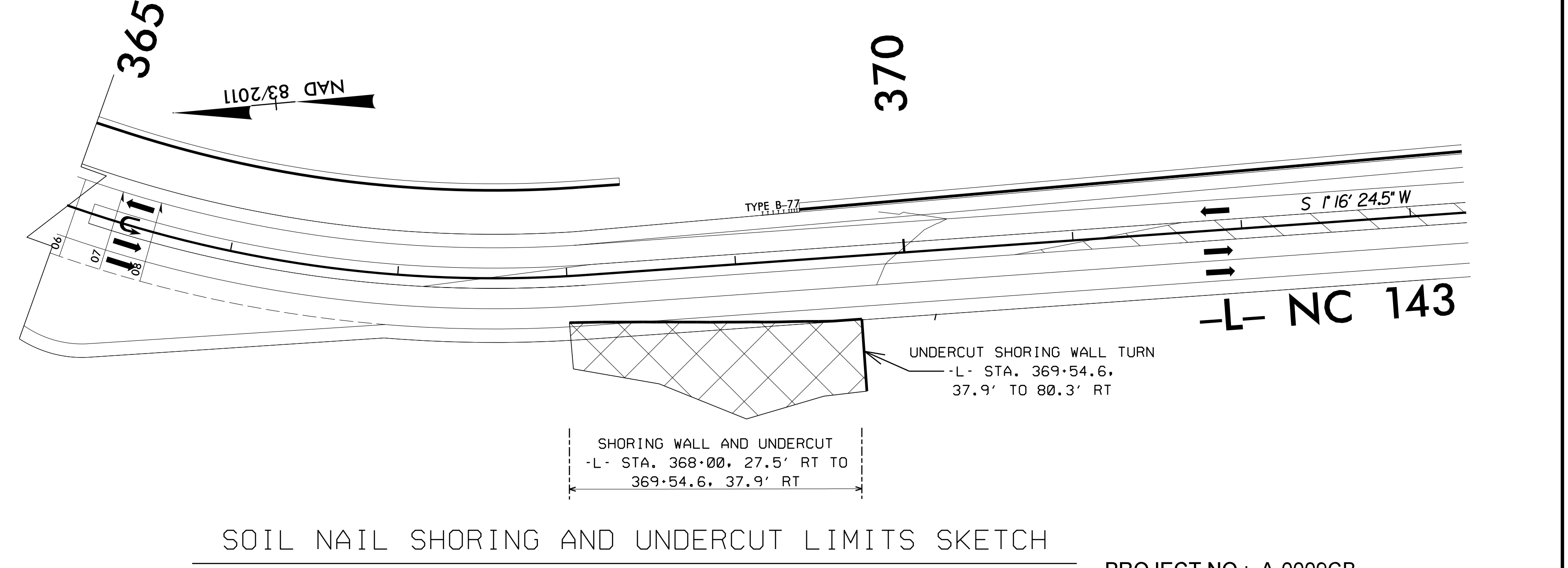
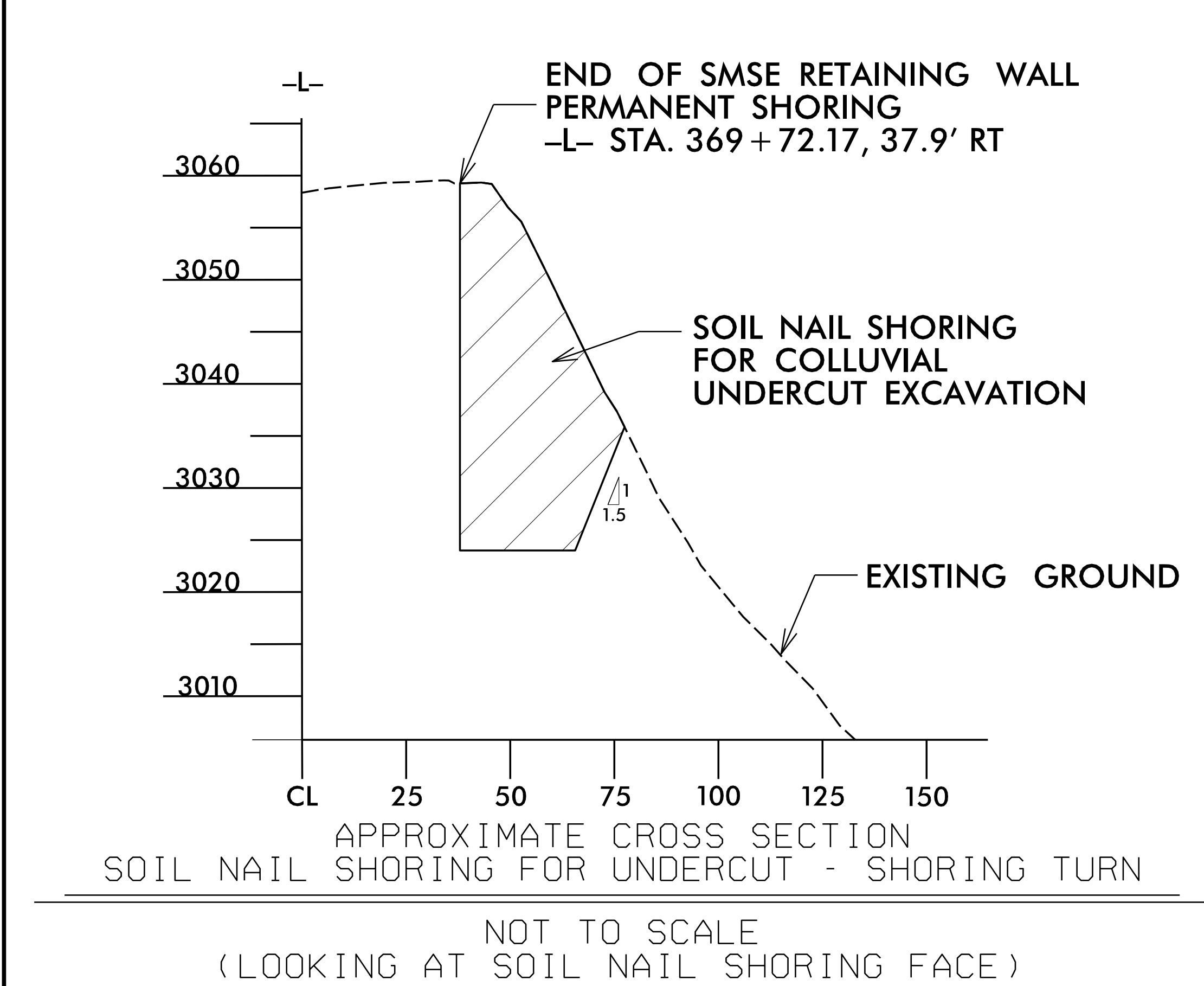
GEOTECHNICAL ENGINEER
 ENGINEER

 D. Matthew Brewer
 7/15/2022
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ESTIMATED SOIL NAIL SHORING QUANTITIES			
RETAINING WALL #	SOIL NAIL SHORING (SQ. FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
16	4,000	3	13

ESTIMATED QUANTITIES	
UNDERCUT EXCAVATION	4,550 CY
GEOTEXTILE FOR SOIL STABILIZATION	850 SY
SELECT GRANULAR MATERIAL	850 CY
SHOULDER DRAIN	650 LF
CONCRETE PAD FOR SHOULDER DRAIN PIPE OUTLET	4 EA

NOT TO SCALE
(LOOKING AT WALL FACE)



PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022


Prepared in the Office of:

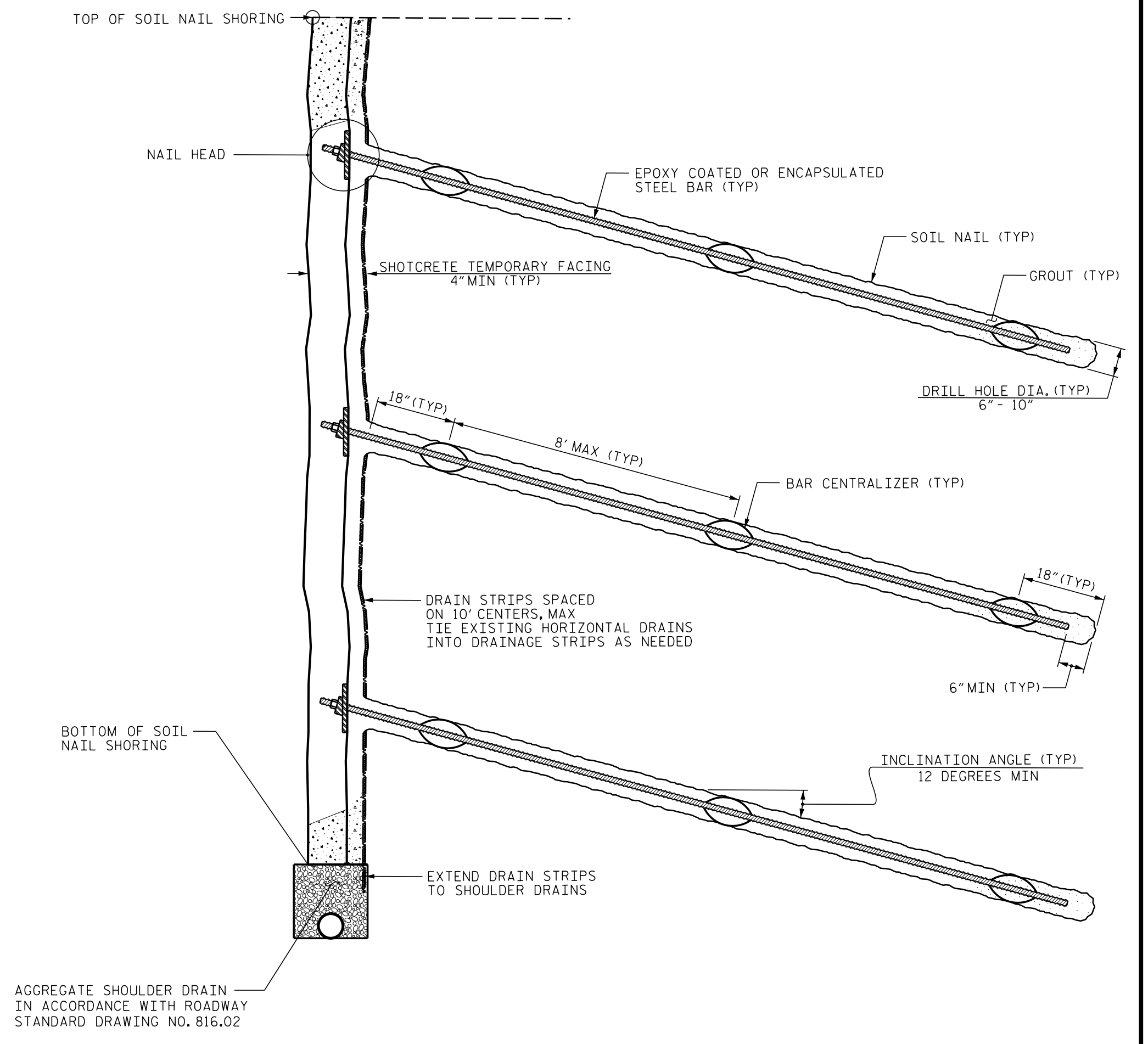
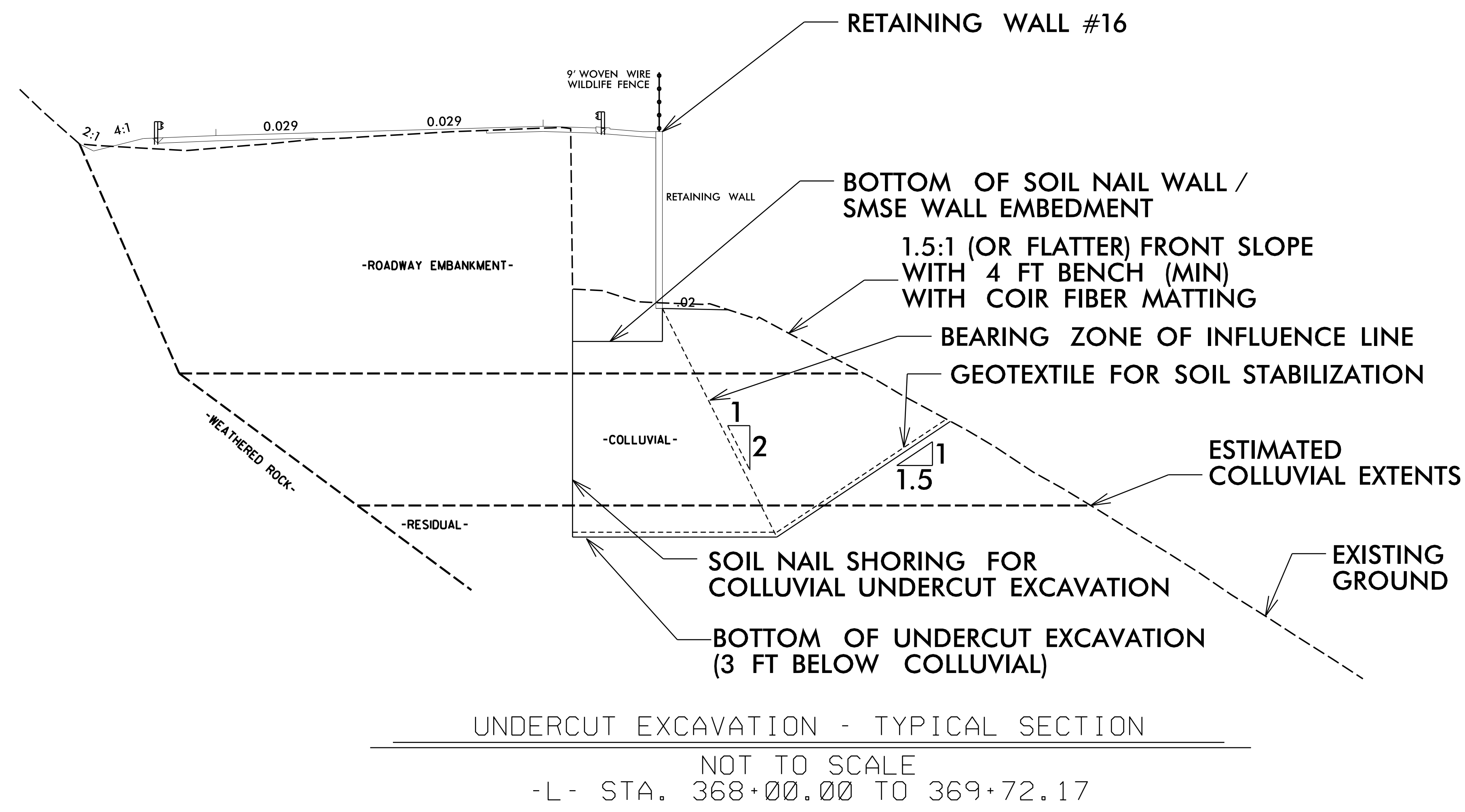
CAROLINAS GEOTECHNICAL GROUP
 2400 CROWNPOINT EXECUTIVE DRIVE
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 CHARLOTTE, NC 28227
 (980) 339-8684

PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 STATION: -L-366+70, 50' RT TO 369+72, 50' RT
 SHEET 6 OF 8

REVISIONS						SHEET NO. W16-6
NO.	BY	DATE	NO.	BY	DATE	
1			3			
2			4			

RETAINING WALL #16
SOIL NAIL SHORING FOR UNDERCUT EXCAVATION

GEOTECHNICAL ENGINEER  SEAL 041986 ENGINEER M. MATTHEW BREWER	ENGINEER _____ SIGNATURE
DocuSigned by: D. Matthew Brewer 38812008601482 SIGNATURE	7/15/2022 DATE
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 STATION: -L-366+70, 50' RT TO 369+72, 50' RT
 SHEET 7 OF 8

PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022


Prepared in the Office of:

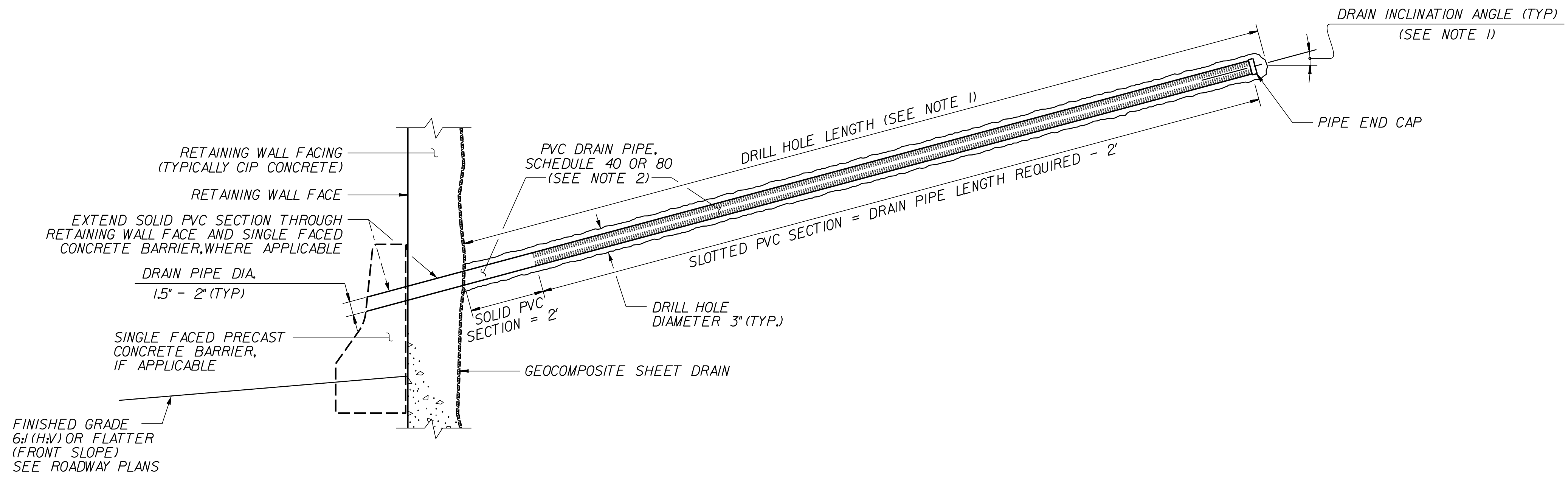
**CAROLINAS
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REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

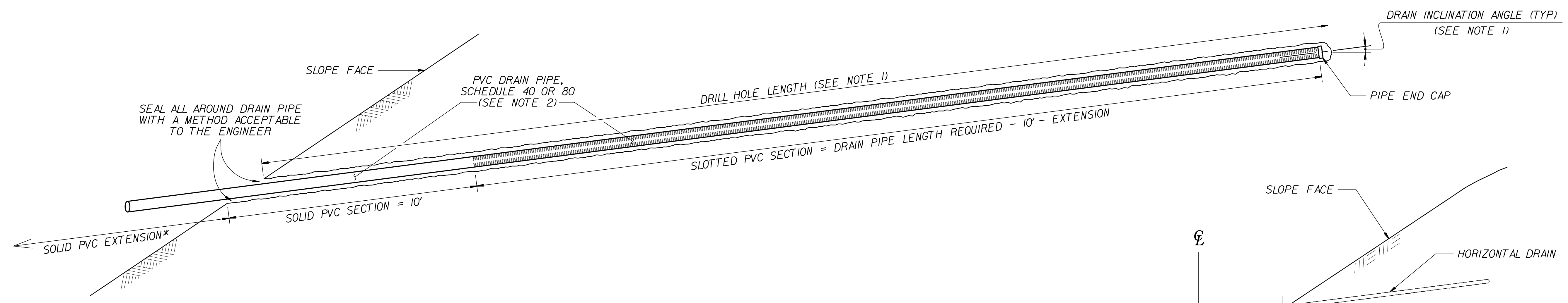
**RETAINING WALL #16
 SOIL NAIL SHORING FOR
 UNDERCUT EXCAVATION**

SHEET NO.
 W16-7

GEOTECHNICAL ENGINEER  D. Matthew Brewer 7/15/2022 SIGNATURE DATE	ENGINEER _____ SIGNATURE DATE
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



RETAINING WALL HORIZONTAL DRAIN



SLOPE HORIZONTAL DRAIN

*EXTEND SOLID PVC SECTION TO CONNECT PIPE TO A DRAINAGE SYSTEM OR DISCHARGE WATER AS DIRECTED

EXAMPLE CROSS-SECTION WITH SLOPE HORIZONTAL DRAIN

*SEE NOTE 1 FOR DRAIN ELEVATIONS ABOVE (OR BELOW) GRADE

NOTES:

1. SEE ROADWAY SUMMARY SHEETS FOR APPROXIMATE KNOWN HORIZONTAL DRAIN LOCATIONS, ELEVATIONS, INCLINATION AND LENGTHS. ADDITIONAL DRAINS MAY BE REQUIRED AS DETERMINED BY THE ENGINEER.
2. DRAIN PIPES MAY BE OMITTED FOR SOME HORIZONTAL DRAINS. SEE ROADWAY SUMMARY SHEETS FOR DRAIN PIPE REQUIREMENTS INCLUDING THOSE DRAINS WITHOUT PIPES.
3. FOR HORIZONTAL DRAINS, SEE HORIZONTAL DRAINS SPECIAL PROVISION.

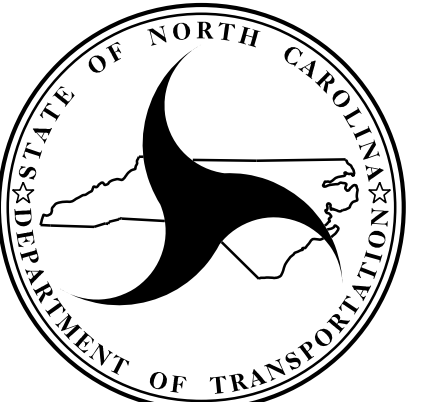
PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 STATION: -L-366+70, 50' RT TO 369+72, 50' RT
 SHEET 8 OF 8

PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022

Prepared in the Office of:



**CAROLINAS
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 2400 CROWNPPOINT EXECUTIVE DRIVE
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 (980) 339-8684



NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS

**GEOTECHNICAL
ENGINEERING UNIT**

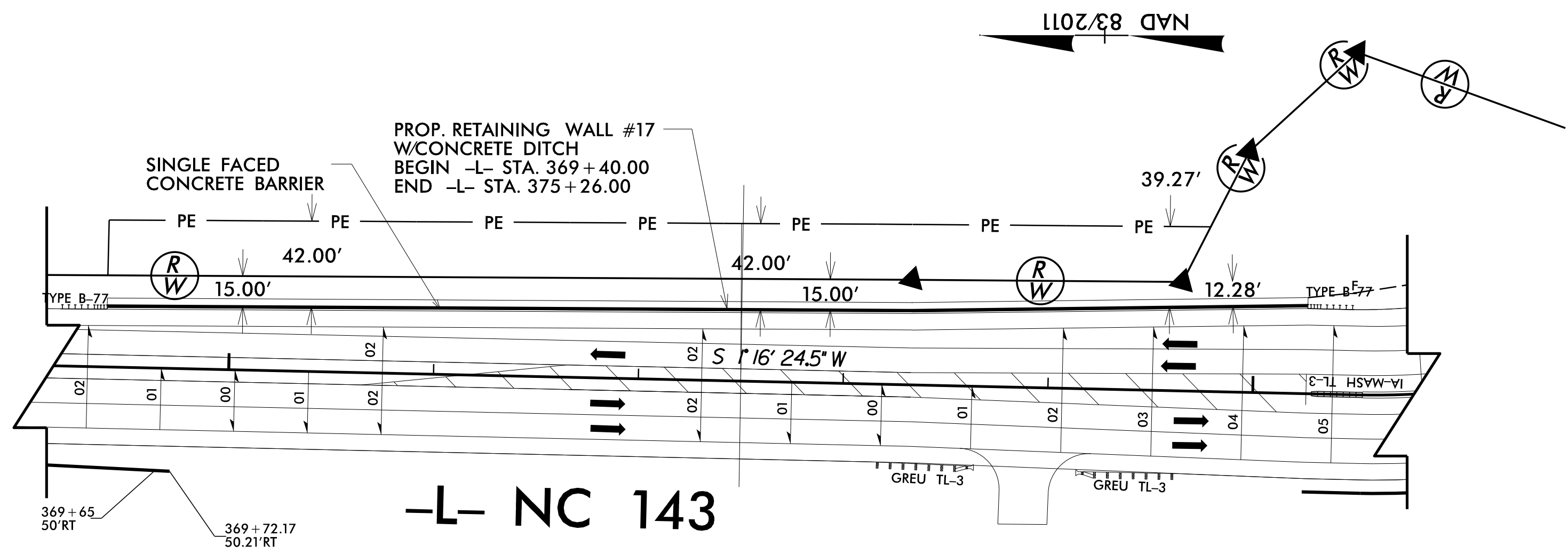
**RETAINING WALL #16
SHORED MECHANICALLY
STABILIZED EARTH (SMSE) WALL**

REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W16-8

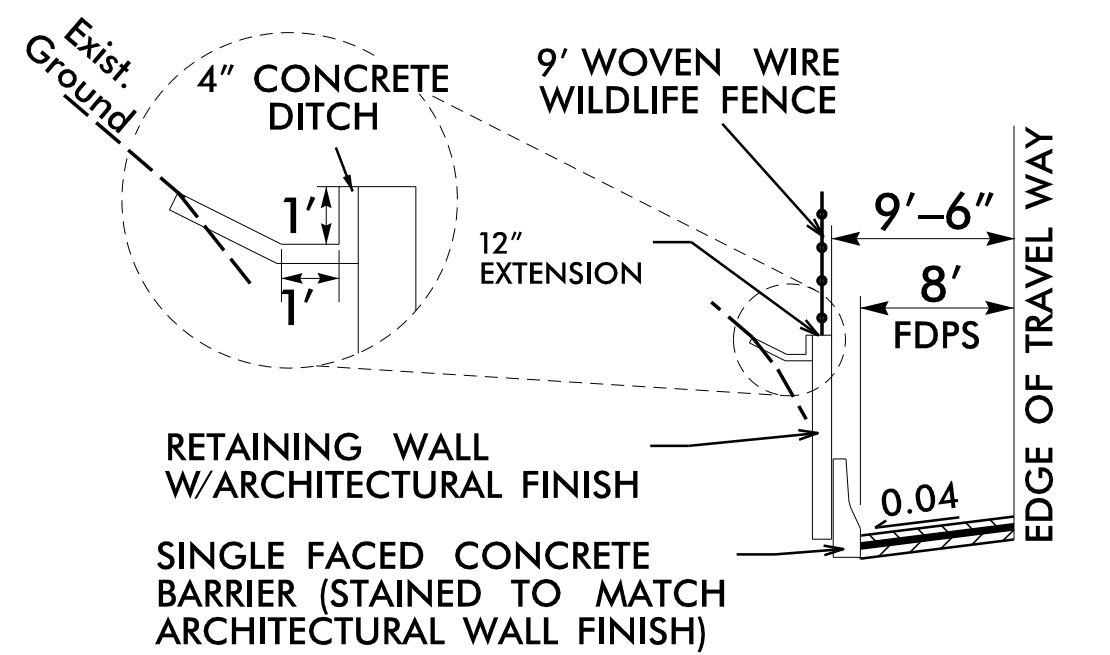
RETAINING WALL #17: 370

375



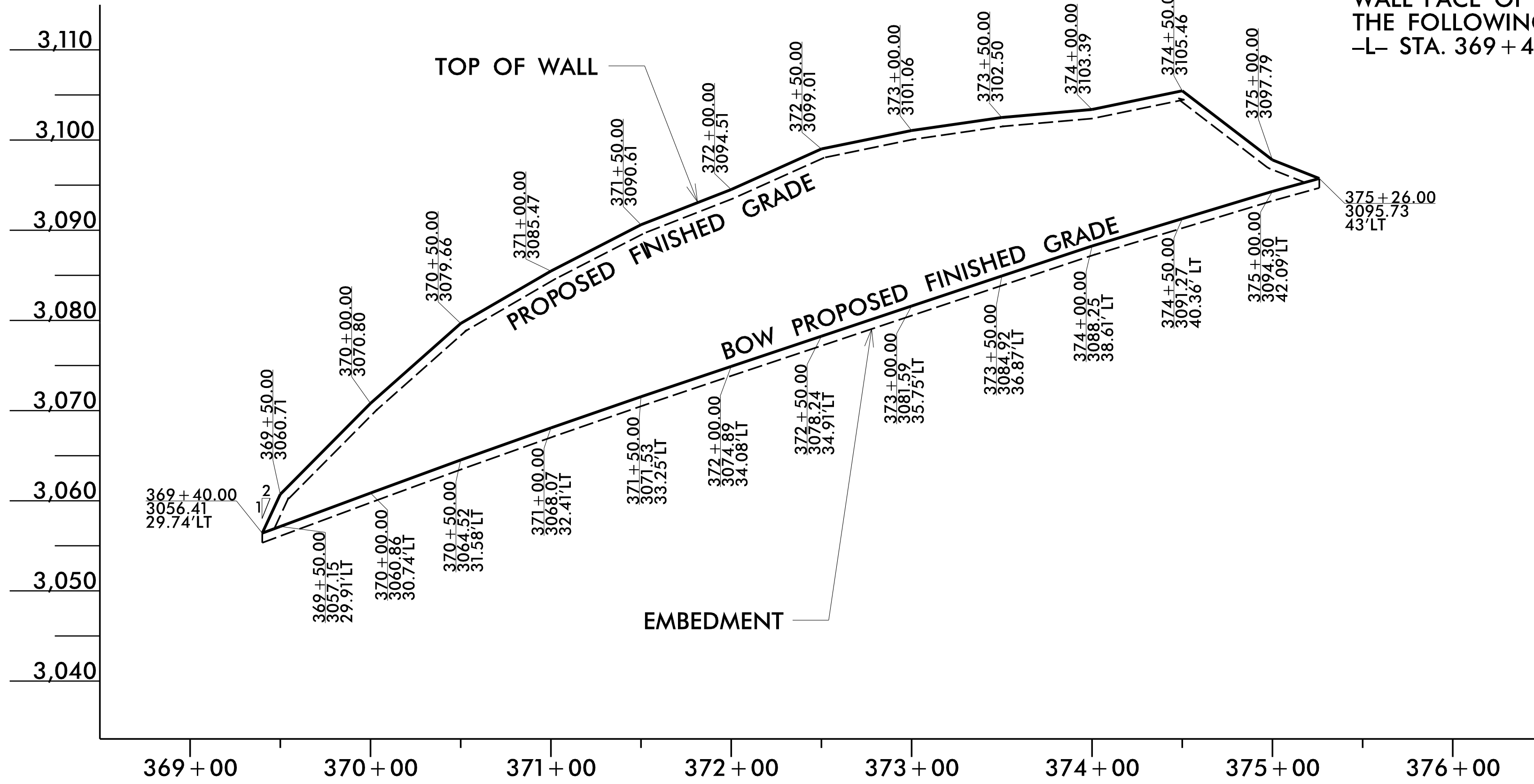
-L- NC 143

RETAINING WALL #17 - PLAN
NOT TO SCALE



DETAIL FOR WALL #17
NOT TO SCALE
-L- STA. 369+40.00 TO -L- STA. 375+26.00, LT

THE WALL ENVELOPE DOES NOT ACCURATELY DEPICT THE ACTUAL WALL FACE OF WALL #17 AT THE FOLLOWING LOCATION:
-L- STA. 369+40.00 TO 375+26.00, LT



RETAINING WALL #17 - ENVELOPE
NOT TO SCALE
BOW = BOTTOM OF WALL (LOOKING AT FACE OF WALL)

ESTIMATED SOIL NAIL WALL QUANTITIES			
RETAINING WALL NO.	SOIL NAIL RETAINING WALLS (SQ. FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
17	9,280*	5	45
FORM LINER ARCHITECTURAL FINISH			9,280* SF
HORIZONTAL DRAINS (CONTINGENCY)			295 LF

* INCLUDES RETAINING WALL EMBEDMENT

SOIL NAIL RETAINING WALL #17						
STA. -L-	OFFSET FROM -L- (LT) FT.	ELEV. @ TOP OF WALL	BOW PROPOSED FINISHED GRADE	TOP OF LEVELING PAD	ESTIMATED WALL EMBEDMENT FT.	WALL DESIGN HEIGHT "H"
369+40.00	29.74	3056.41	3056.41	3055.41	1.00	1.00
369+50.00	29.91	3060.71	3057.15	3056.15	1.00	3.56
370+00.00	30.74	3070.80	3060.86	3059.86	1.00	9.94
370+50.00	31.58	3079.66	3064.52	3063.52	1.00	15.14
371+00.00	32.41	3085.47	3068.07	3067.07	1.00	17.40
371+50.00	33.25	3090.61	3071.53	3070.53	1.00	19.08
372+00.00	34.08	3094.51	3074.89	3073.89	1.00	19.62
372+50.00	34.91	3099.01	3078.24	3077.24	1.00	20.77
373+00.00	35.75	3101.06	3081.59	3080.59	1.00	19.47
373+50.00	36.87	3102.50	3084.92	3083.92	1.00	17.58
374+00.00	38.61	3103.39	3088.25	3087.25	1.00	15.14
374+50.00	40.36	3105.46	3091.27	3090.27	1.00	14.19
375+00.00	42.09	3097.79	3094.30	3093.30	1.00	3.49
375+26.00	43.00	3095.73	3095.73	3094.73	1.00	1.00

PROJECT NO.: A-0009CB
GRAHAM COUNTY
RETAINING WALL #17: -L- 369+40, 30' LT TO 375+26, 43' LT
SHEET 1 OF 3

PREPARED BY: R. KRAL
REVIEWED BY: M. BREWER

DATE: 6/2/2022
DATE: 6/2/2022
RETAINING WALL #17 ENVELOPE AND WALL LAYOUT PROVIDED BY TGS ENGINEERS, INC.

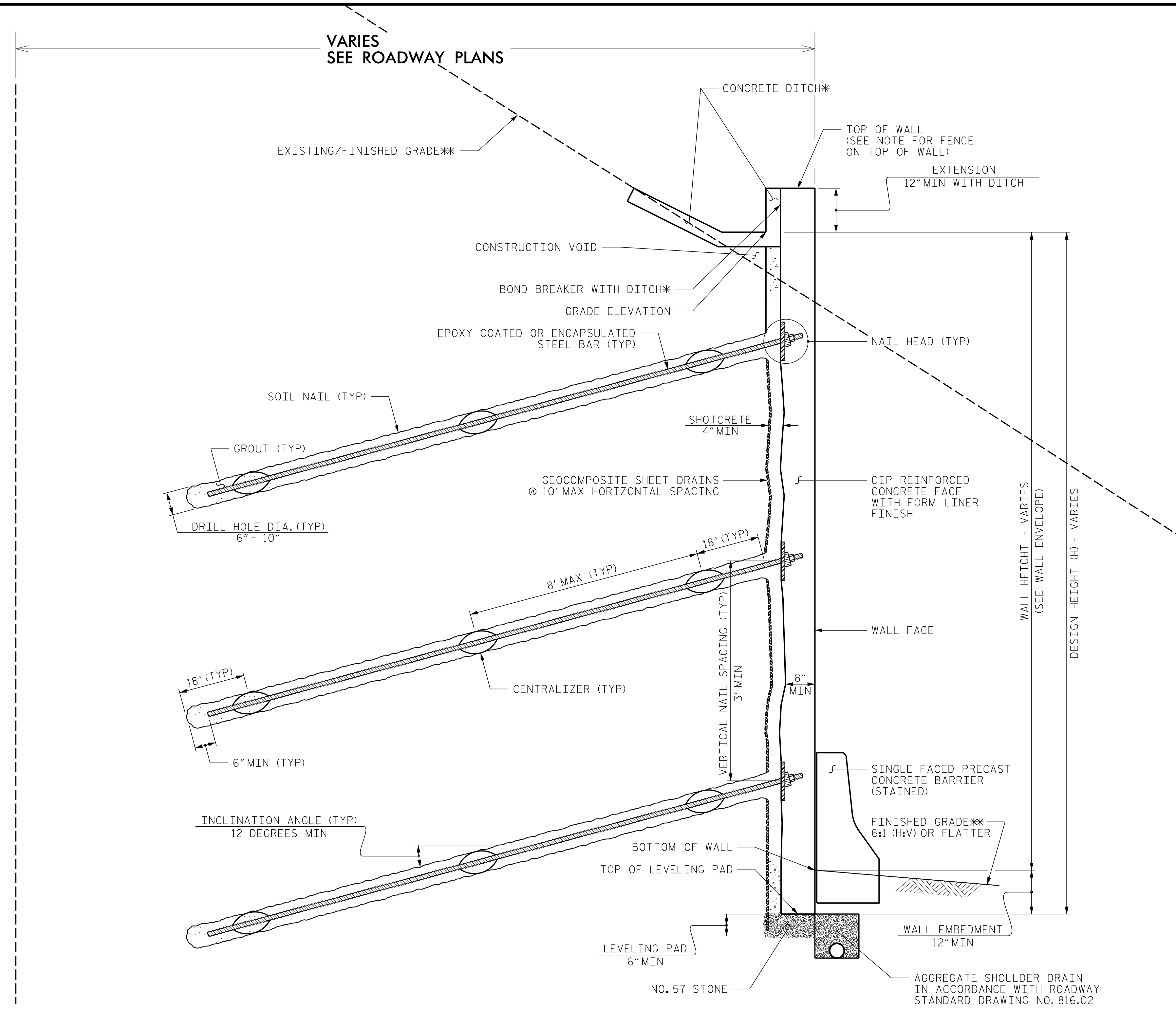
Prepared in the Office of:
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2400 CROWNPOINT EXECUTIVE DRIVE SUITE 800
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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W17-1
2			4			

GEOTECHNICAL ENGINEER
ENGINEER
SEAL 042642
ROBERT E. KRAL
DATE: 06/08/2022
SIGNATURE: [Signature]
DATE: [Blank]
SIGNATURE: [Blank]
DATE: [Blank]
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PERMANENT EASEMENT OR RIGHT OF WAY



VARIES
SEE ROADWAY PLANS

EXISTING/FINISHED GRADE**

CONCRETE DITCH*

TOP OF WALL
(SEE NOTE FOR FENCE
ON TOP OF WALL)

EXTENSION
12" MIN WITH DITCH

CONSTRUCTION VOID

BOND BREAKER WITH DITCH*

GRADE ELEVATION

EPOXY COATED OR ENCAPSULATED
STEEL BAR (TYP)

NAIL HEAD (TYP)

SOIL NAIL (TYP)

SHOTCRETE
4" MIN

GROUT (TYP)

GEOCOMPOSITE SHEET DRAINS
@ 10' MAX HORIZONTAL SPACING

CIP REINFORCED
CONCRETE FACE
WITH FORM LINER
FINISH

DRILL HOLE DIA. (TYP)
6" - 10"

8' MAX (TYP)

18" (TYP)

WALL HEIGHT - VARIES
(SEE WALL ENVELOPE)

DESIGN HEIGHT (H) - VARIES

CENTRALIZER (TYP)

WALL FACE

18" (TYP)

6" MIN (TYP)

INCLINATION ANGLE (TYP)
12 DEGREES MIN

BOTTOM OF WALL
TOP OF LEVELING PAD

SINGLE FACED PRECAST
CONCRETE BARRIER
(STAINED)

FINISHED GRADE**
6:1 (H:V) OR FLATTER

LEVELING PAD
6" MIN

WALL EMBEDMENT
12" MIN

NO. 57 STONE

AGGREGATE SHOULDER DRAIN
IN ACCORDANCE WITH ROADWAY
STANDARD DRAWING NO. 816.02

SOIL NAIL WALL - TYPICAL SECTION

*SEE CONCRETE DITCH BEHIND WALL DETAILS.
**SEE PLANS FOR FINISHED GRADE.

GEOTECHNICAL ENGINEER Robert E. Kral	ENGINEER _____ SIGNATURE
DocuSigned by: SIGNATURE	DATE: 06/08/2022 DATE
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	

NOTES:

- FOR SOIL NAIL RETAINING WALLS, SEE SOIL NAIL RETAINING WALLS PROVISION.
- FOR SINGLE FACED PRECAST CONCRETE BARRIER (STAINED), SEE ROADWAY PLANS, SECTION 857 OF THE STANDARD SPECIFICATION, AND SIMULATED STONE FORM LINER FINISH SPECIAL PROVISION.
- A FENCE IS REQUIRED ON TOP OF RETAINING WALL #17. SEE ROADWAY PLANS FOR FENCE ATTACHMENT DETAILS.
- A FORM LINER ARCHITECTURAL FINISH IS REQUIRED FOR THE CIP REINFORCED CONCRETE FACE FOR RETAINING WALL #17. THE CONTRACTOR SHALL PROVIDE THE REQUESTED FINISH BEFORE BEGINNING CIP REINFORCED CONCRETE FACE CONSTRUCTION. THE APPEARANCE (STONE SIZE AND SHAPE, STONE COLOR, AND STONE TEXTURE, PATTERN, AND RELIEF) SHOULD MATCH NATURAL STONE AND ROCK. FOR FORM LINER ARCHITECTURAL FINISH, SEE THE SIMULATED STONE FORM LINER FINISH SPECIAL PROVISION.
- BEFORE BEGINNING SOIL NAIL WALL DESIGN FOR RETAINING WALL #17, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.
- DESIGN RETAINING WALL #17 FOR THE FOLLOWING:
 - 1) DESIGN HEIGHT (H) = WALL HEIGHT + WALL EMBEDMENT
 - 2) DESIGN LIFE = 75 YEARS
 - 3) MINIMUM WALL EMBEDMENT ELEVATION = VARIES (MIN. 1 FT BELOW PROPOSED FINISHED GRADE ELEVATION)
 - 4) IN-SITU ASSUMED DENSE RESIDUAL SOIL PARAMETERS:
 UNIT WEIGHT, $\gamma = 125$ PCF
 FRICTION ANGLE, $\phi = 36$ DEGREES
 COHESION, $c = 0$ PSF
 - 5) IN-SITU ASSUMED WEATHERED ROCK (META-SANDSTONE) PARAMETERS:
 UNIT WEIGHT, $\gamma = 135$ PCF
 FRICTION ANGLE, $\phi = 32$ DEGREES
 COHESION, $c = 500$ PSF
 - 6) IN-SITU ASSUMED CRYSTALLINE ROCK (META-SANDSTONE) PARAMETERS:
 UNIT WEIGHT, $\gamma = 170$ PCF
 FRICTION ANGLE, $\phi = 34$ DEGREES
 COHESION, $c = 1,000$ PSF
 - 7) WHERE ROCK IS ENCOUNTERED IN THE WALL ENVELOPE, DESIGNERS SHOULD REFER TO THE FHWA PRESUMPTIVE STRENGTH PARAMETERS OR OTHER REPRESENTATIVE AND REPEATABLE VALUES AND PROVIDE SOURCE REFERENCES IN THEIR DESIGN SUBMITTAL.
- WHEN ANALYZING FOR INFINITE SLOPE CONDITIONS, DESIGNERS SHOULD ANALYZE UP TO TWO (2) TIMES THE WALL HEIGHT BEHIND THE WALL FACE FOR FAILURE PLANE SEARCHES. THIS INFORMATION SHOULD BE INCLUDED WITH THE DESIGN SUBMITTAL.
- EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH SOIL NAILS FOR RETAINING WALL #17.
- THE PROPOSED RIGHT OF WAY (ROW) AND PERMANENT EASEMENT (PE) BOUNDARY VARIES FROM THE FACE OF RETAINING WALL #17. SEE THE ROADWAY PLANS FOR OFFSET DISTANCES FROM THE FACE OF RETAINING WALL #17. SOIL NAILS MAY NOT BE INSTALLED BEYOND THE PE BOUNDARY. SEE "SOIL NAIL WALL - TYPICAL SECTION" DETAIL.
- IF GROUNDWATER IS ENCOUNTERED BEHIND THE FACE OF RETAINING WALL #17, HORIZONTAL DRAINS MAY BE REQUIRED AS DIRECTED BY THE ENGINEER. FOR HORIZONTAL DRAINS, SEE THE RETAINING WALL HORIZONTAL DRAIN DETAIL.
- WHERE ROCK IS PRESENT IN THE WALL ENVELOPE, CONTROLLED BLASTING IS RECOMMENDED, BUT NOT REQUIRED, TO MAINTAIN THE NEAT EXCAVATION LINE. VOIDS, RESULTING FROM BLASTING OR EXCAVATING, THAT EXTEND BEYOND THE NEAT LINES ARE TO BE FILLED WITH A COMBINATION OF SHORT SOIL NAILS, WELDED WIRE, AND SHOTCRETE, AT THE DISCRETION OF THE ENGINEER. THE COSTS ASSOCIATED WITH THIS WORK WILL BE CONSIDERED INCIDENTAL TO WALL CONSTRUCTION AND NO ADDITIONAL COMPENSATION WILL BE MADE. FOR BLASTING, SEE THE BLASTING PROVISION.
- WHERE CONSTRUCTION VOIDS EXIST ALONG THE TOP OF RETAINING WALL #17, THE CONTRACTOR SHOULD BE PREPARED TO FORM THE CANTILEVERED SECTION OF THE CIP REINFORCED CONCRETE FACE TO THE TOP OF WALL ELEVATION. THE CONSTRUCTION VOID SHOULD BE FILLED WITH CONCRETE OR SHOTCRETE PRIOR TO CONSTRUCTION OF THE CONCRETE DITCH. ADDITIONAL WALL FACE REINFORCEMENT OR SOIL NAILS MAY BE REQUIRED FOR TALLER THAN TYPICAL CANTILEVER FACE HEIGHTS.

PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 RETAINING WALL #17: -L- 369+40, 30' LT TO 375+26, 43' LT
 SHEET 2 OF 3

PREPARED BY: R. KRAL	DATE: 6/2/2022
REVIEWED BY: M. BREWER	DATE: 6/2/2022

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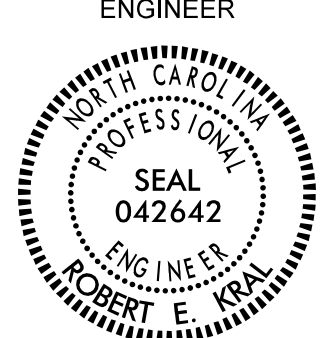
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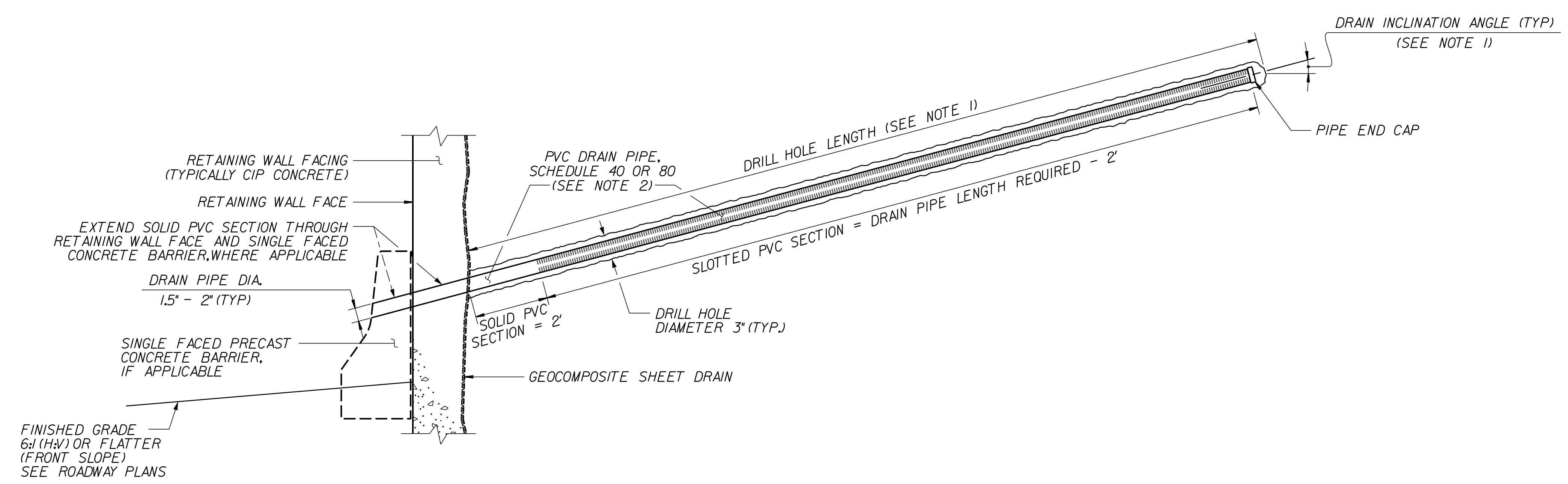
**NORTH CAROLINA
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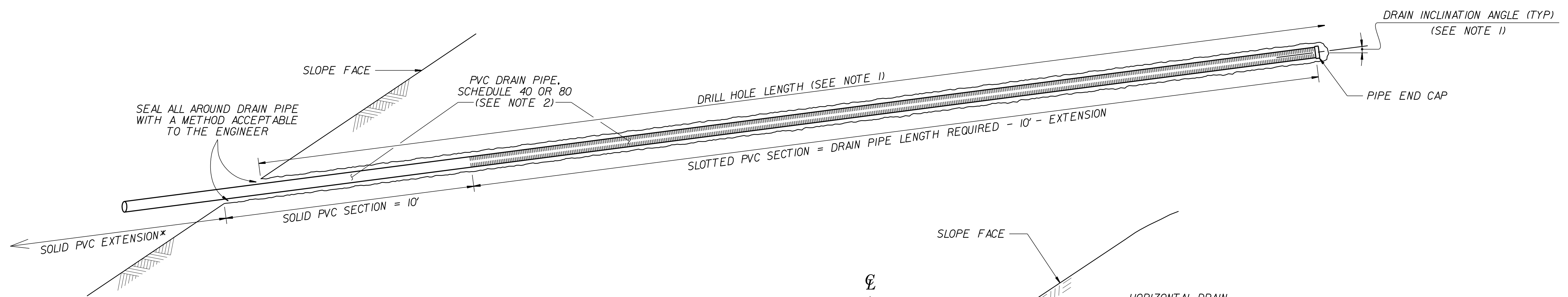
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SHEET NO. W17-2

GEOTECHNICAL ENGINEER  SEAL 042642 ROBERT E. KRAL	ENGINEER DATE: 06/08/2022 SIGNATURE: _____ DATE: _____
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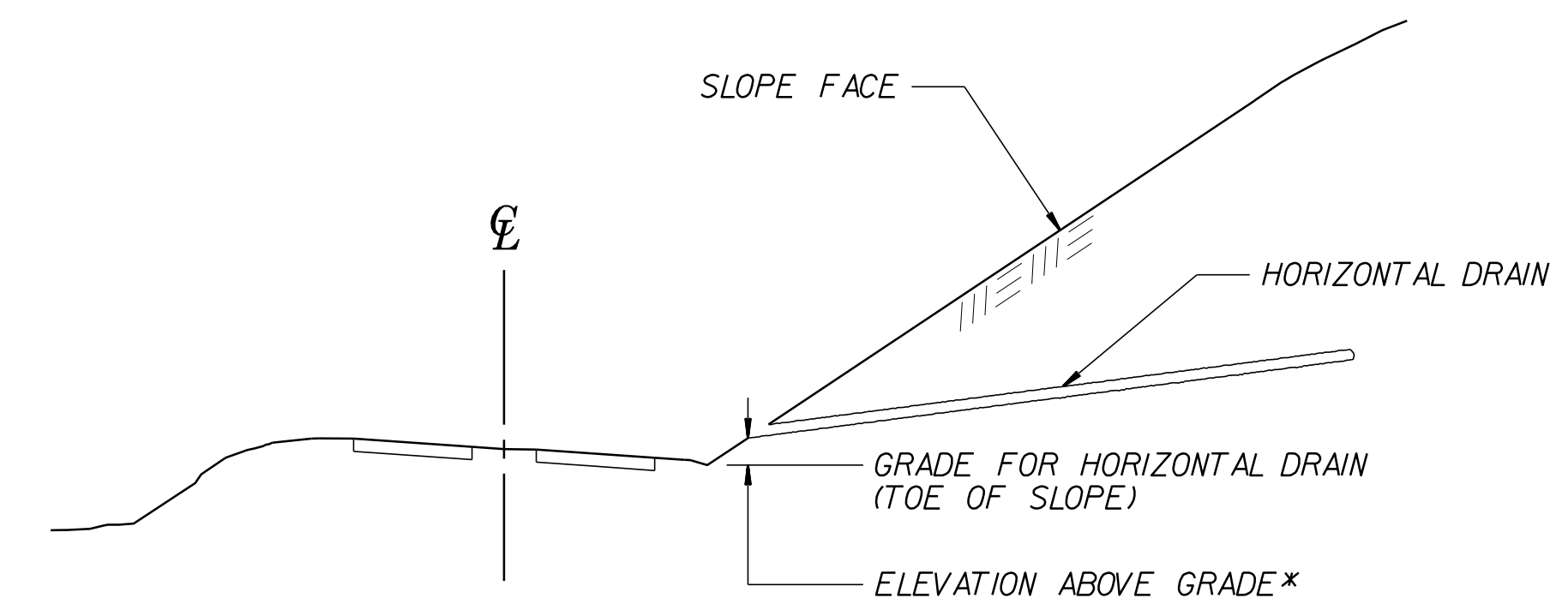


RETAINING WALL HORIZONTAL DRAIN



SLOPE HORIZONTAL DRAIN

*EXTEND SOLID PVC SECTION TO CONNECT PIPE TO A DRAINAGE SYSTEM OR DISCHARGE WATER AS DIRECTED



EXAMPLE CROSS-SECTION WITH SLOPE HORIZONTAL DRAIN

*SEE NOTE 1 FOR DRAIN ELEVATIONS ABOVE (OR BELOW) GRADE

NOTES:

1. SEE ROADWAY SUMMARY SHEETS FOR APPROXIMATE KNOWN HORIZONTAL DRAIN LOCATIONS, ELEVATIONS, INCLINATION AND LENGTHS. ADDITIONAL DRAINS MAY BE REQUIRED AS DETERMINED BY THE ENGINEER.
2. DRAIN PIPES MAY BE OMITTED FOR SOME HORIZONTAL DRAINS. SEE ROADWAY SUMMARY SHEETS FOR DRAIN PIPE REQUIREMENTS INCLUDING THOSE DRAINS WITHOUT PIPES.
3. FOR HORIZONTAL DRAINS, SEE HORIZONTAL DRAINS SPECIAL PROVISION (GT-12).

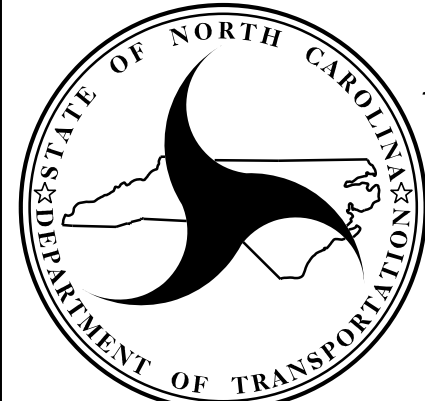
PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 RETAINING WALL #17: -L- 369+40, 30' LT TO 375+26, 43' LT
 SHEET 3 OF 3

PREPARED BY: R. KRAL	DATE: 6/2/2022
REVIEWED BY: M. BREWER	DATE: 6/2/2022

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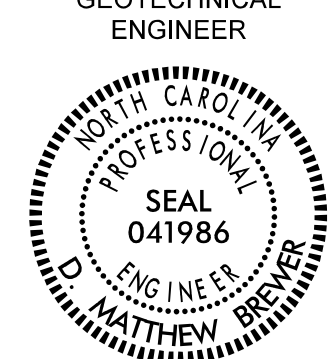


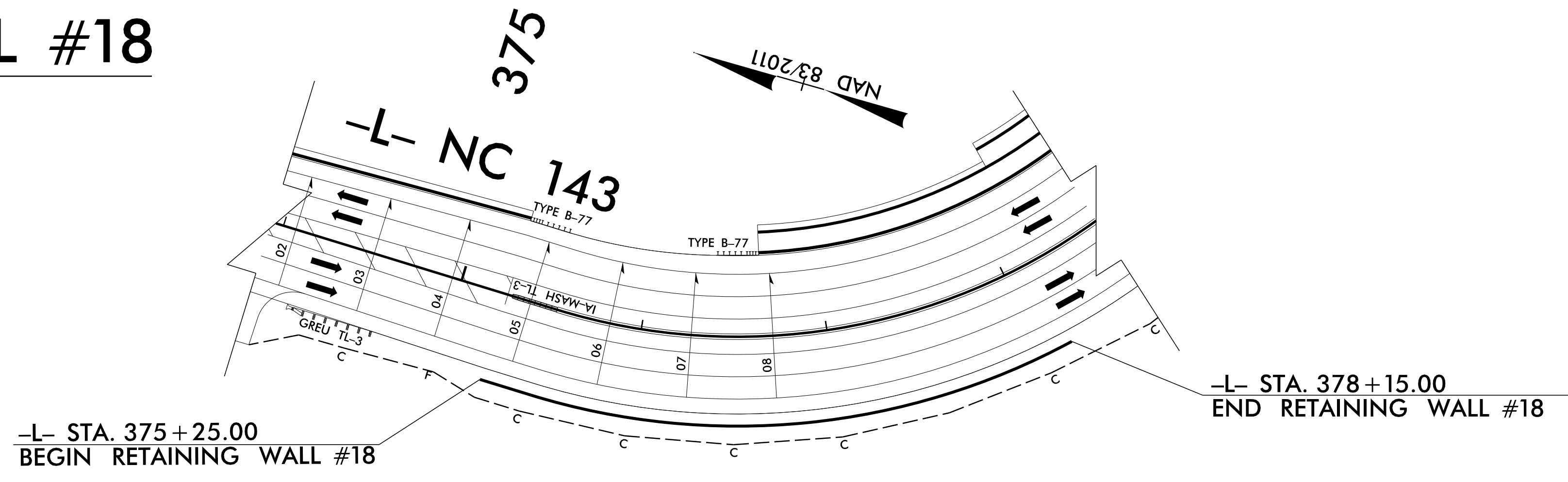
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

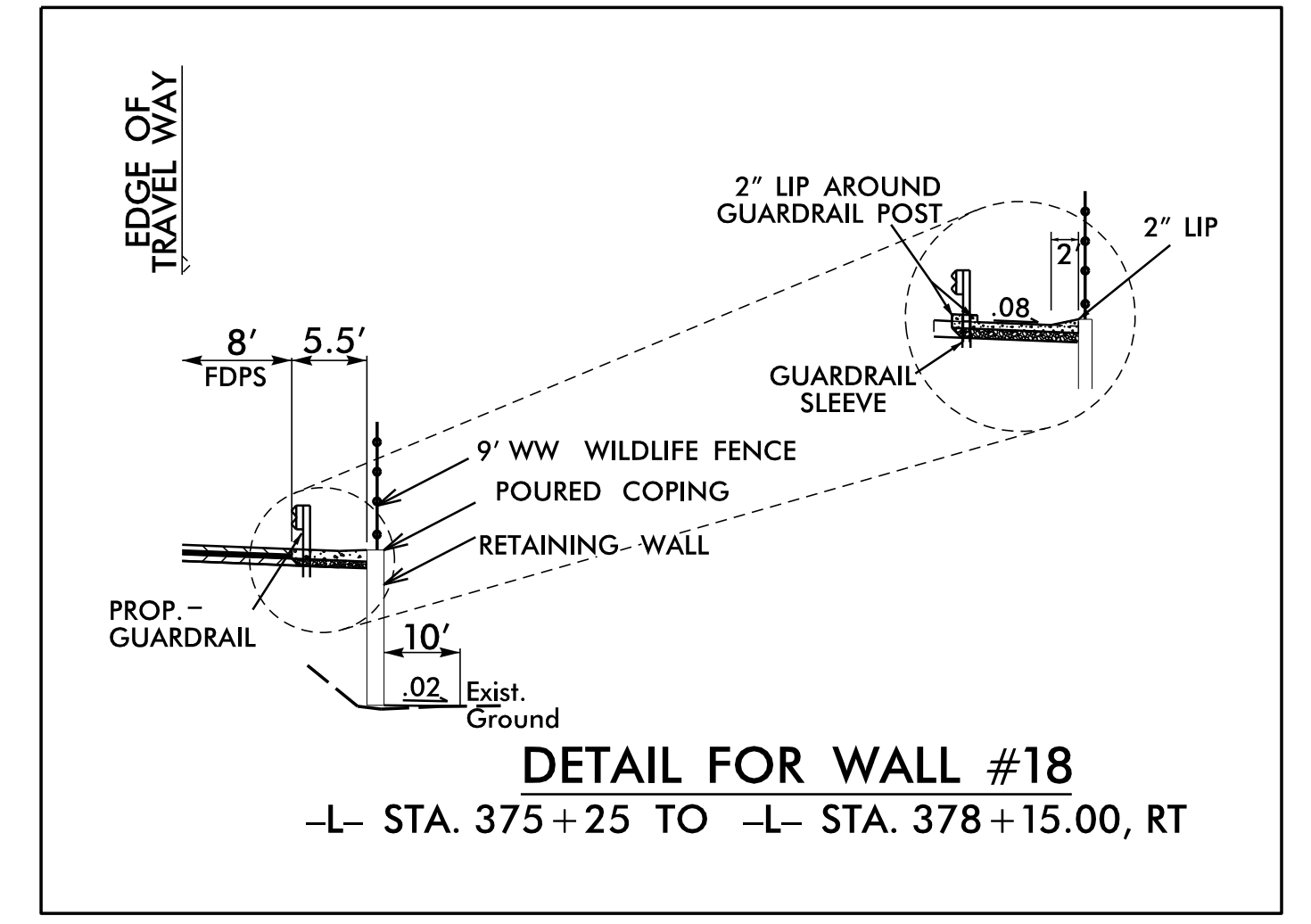
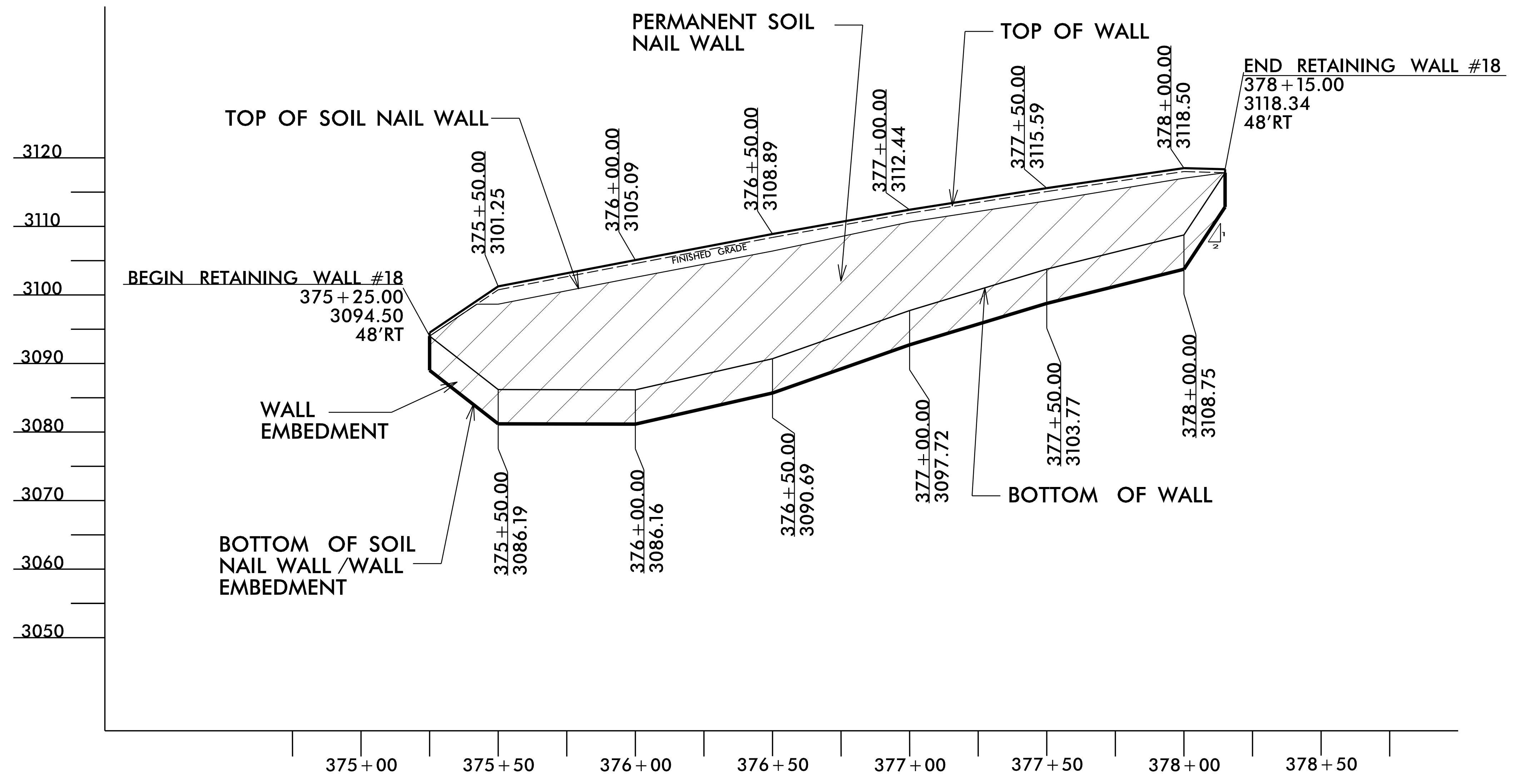
REVISIONS						SHEET NO. W17-3
NO.	BY	DATE	NO.	BY	DATE	
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2			4			

RETAINING WALL #18

GEOTECHNICAL ENGINEER  D. Matthew Brewer SIGNATURE	ENGINEER DATE: 7/15/2022 SIGNATURE: _____ DATE: _____
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PLAN VIEW
SCALE 50 FT = 1 IN



DETAIL FOR WALL #18
-L- STA. 375+25 TO -L- STA. 378+15.00, RT
TYPICAL WALL SECTION
NOT TO SCALE

PROJECT NO.: A-0009CB
GRAHAM COUNTY
STATION: -L-375+25, 48' RT TO 378+15, 48' RT
SHEET 1 OF 6

SMSE WALL ENVELOPE
NOT TO SCALE
(LOOKING AT WALL FACE)

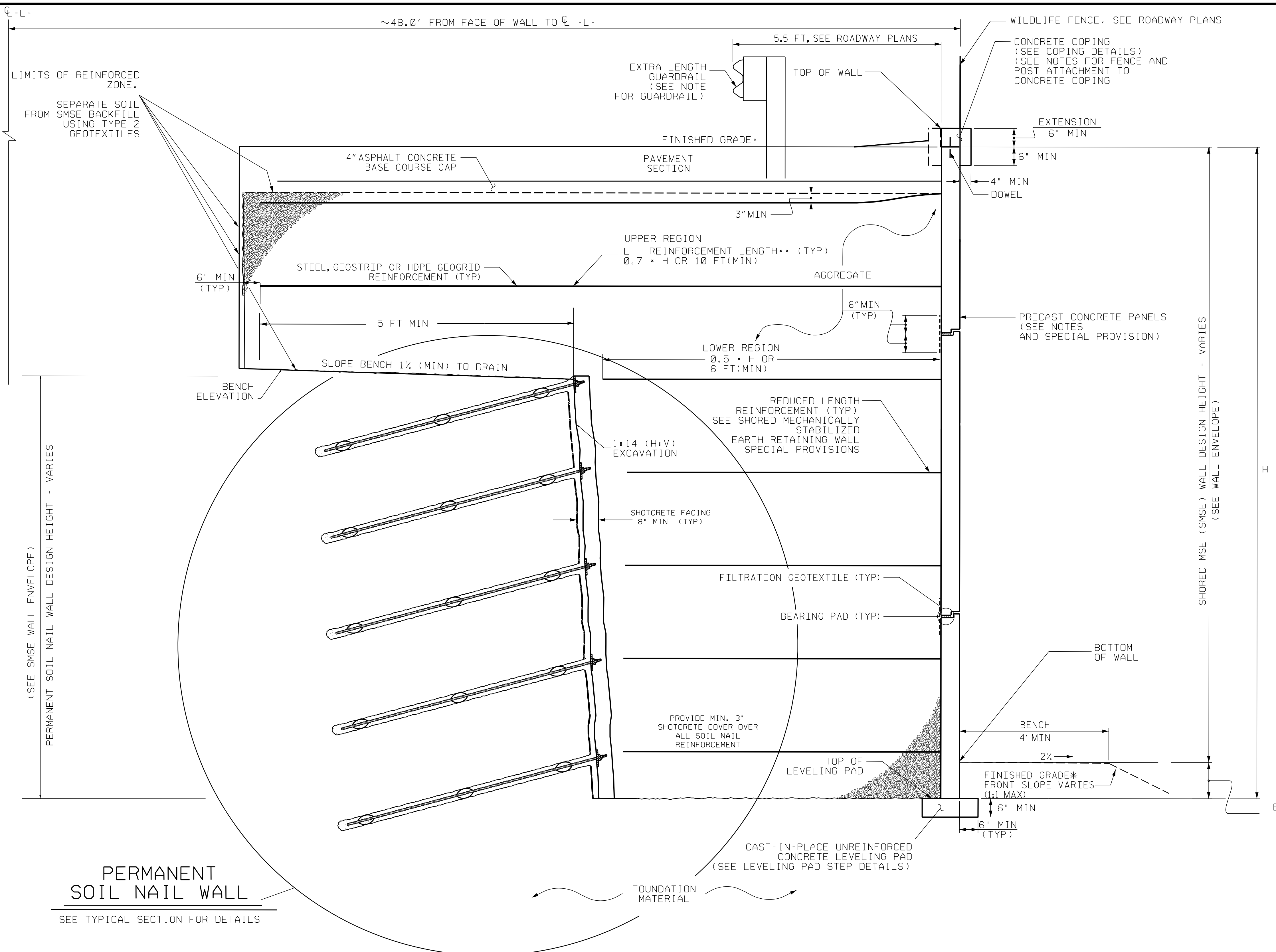
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REVISIONS						SHEET NO. W18-1
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1			3			
2			4			

PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022



GEOTECHNICAL ENGINEER

ENGINEER

SEAL 041986

D. Matthew Brewer

7/15/2022

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PERMANENT SOIL NAIL WALL SEE TYPICAL SECTION FOR DETAILS

SMSE WALL WITH SOIL NAIL WALL > 2/3 H

-L- STATION 375+25 TO 378+15

*SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.

**SEE SMSE RETAINING WALLS SPECIAL PROVISION REINFORCEMENT LENGTH REQUIREMENTS.

PROJECT NO.: A-0009CB

GRAHAM COUNTY

STATION: -L-375+25, 48' RT TO 378+15, 48' RT

SHEET 3 OF 6

PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #18 SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL

REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W18-3

NOTES:

FOR SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL RETAINING WALLS, SEE SHORED MECHANICALLY STABILIZED EARTH RETAINING WALLS SPECIAL PROVISION.
 FOR MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALLS, SEE MECHANICALLY STABILIZED EARTH RETAINING WALLS PROVISION.
 FOR STEEL BEAM GUARDRAIL, SEE ROADWAY PLANS AND SECTION 862 OF THE STANDARD SPECIFICATIONS.
 USE AN SMSE WALL SYSTEM WITH PRECAST PANELS FOR THIS RETAINING WALL.
 DO NOT USE FINE AGGREGATE IN THE REINFORCED ZONE OF RETAINING WALL #18.
 A SMOOTH ARCHITECTURAL FINISH IS REQUIRED FOR PRECAST CONCRETE PANELS FOR RETAINING WALL #18.
 A SEPARATION GEOTEXTILE IS REQUIRED AT THE BACK OF THE REINFORCED ZONE FOR RETAINING WALL #18.
 BEFORE BEGINNING SMSE WALL DESIGN FOR RETAINING WALL #18, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.
 DESIGN RETAINING WALL #18 FOR WALL HEIGHTS EQUAL TO THE DESIGN HEIGHT (DIFFERENCE BETWEEN FINISHED GRADE/TOP OF WALL ELEVATION AND BOTTOM OF WALL ELEVATION) PLUS EMBEDMENT (DIFFERENCE BETWEEN BOTTOM OF WALL ELEVATION AND TOP OF LEVELING PAD ELEVATION).

DESIGN RETAINING WALL #18 FOR THE FOLLOWING:

- 1) H = DESIGN HEIGHT + EMBEDMENT
- 2) DESIGN LIFE = 75 YEARS
- 3) MAXIMUM FACTORED VERTICAL PRESSURE ON FOUNDATION MATERIAL = 4,100 PSF
- 4) MINIMUM MSE REINFORCEMENT LENGTH (L) = VARIES, SEE TABLE ON SHEET W18-2
- 5) MINIMUM SOIL NAIL REINFORCEMENT LENGTHS ARE BASED ON SNAIL.
- 6) MINIMUM EMBEDMENT DEPTH = 5 FT (MIN), SEE TABLE ON SHEET W18-2
- 7) REINFORCED ZONE AGGREGATE PARAMETERS:

AGGREGATE TYPE*	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (φ) DEGREES	COHESION (C) PSF
COARSE	110	38	0
FINE	115	34	0

* SEE MSE RETAINING WALLS PROVISION FOR COARSE AND FINE AGGREGATE MATERIAL REQUIREMENTS.

9) IN-SITU ASSUMED MATERIAL PARAMETERS:

MATERIAL TYPE	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (φ) DEGREES	COHESION (C) PSF
BACKFILL	120	32	0
FOUNDATION	120	32	0

DESIGN RETAINING WALL #18 FOR A LIVE LOAD (TRAFFIC) SURCHARGE.

EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH MSE AND SOIL NAIL REINFORCEMENT FOR RETAINING WALL #18.

DO NOT PLACE LEVELING PAD CONCRETE, AGGREGATE OR REINFORCEMENT FOR MSE WALL PORTION OF RETAINING WALL #18 UNTIL EXCAVATION DIMENSIONS AND FOUNDATION MATERIAL ARE APPROVED.

FOR WILDLIFE FENCES ON THE TOP OF THE RETAINING WALL, SEE ROADWAY PLANS FOR FENCE ATTACHMENT DETAILS.

FOR SOIL NAIL RETAINING WALLS, SEE SMSE RETAINING WALL SPECIAL PROVISION.

THE SMSE WALL DESIGNER SHALL CONSULT WITH THE SOIL NAIL WALL DESIGNER TO VERIFY LOCATIONS WHERE "TEMPORARY SHORING" MAY BE REQUIRED FOR THE RETAINING WALL IN ACCORDANCE WITH THE TEMPORARY SHORING PROVISION. SEE TRAFFIC CONTROL PLANS. IN LOCATIONS WHERE "PERMANENT SOIL NAIL WALL" IS USED, PAYMENT WILL NOT BE MADE FOR "TEMPORARY SHORING" FOR TRAFFIC CONTROL.

THE PERMANENT SOIL NAIL WALL HEIGHT IS AN ESTIMATE ONLY, THAT IS BASED ON THE ANTICIPATED EXCAVATION PLUS THE MINIMUM EMBEDMENT LISTED.

WHERE APPLICABLE, DESIGN SOIL NAIL WALL REINFORCEMENT INCLINATION TO ACCOUNT FOR EXISTING OR FUTURE UTILITY CONFLICTS BEHIND THE SOIL NAIL WALL. VERIFY UTILITY LOCATION AND ELEVATION BEFORE BEGINNING SOIL NAIL WALL DESIGN OR CONSTRUCTION.

TOP OF SOIL NAIL WALL AS SHOWN IN THE WALL ENVELOPE REPRESENTS THE APPROXIMATE GRADE ELEVATION AT A DISTANCE OF 0.5 TIMES THE PROPOSED WALL HEIGHT ("H") AT THAT STATION OR ELEVATION AT THE TOP OF THE EXISTING WALL.

THE ESTIMATED SOIL NAIL WALL QUANTITY IS BASED ON 0.5 TIMES "H" (SMSE DESIGN HEIGHT) INCLUDING THE MINIMUM EMBEDMENT LISTED IN THE DESIGN TABLE ON SHEET W18-2. THESE VALUES ARE PROVIDED AS AN ESTIMATE ONLY AND MAY VARY DUE TO SITE CONDITIONS.

THE SOIL NAIL WALL DESIGNER IS RESPONSIBLE FOR DETERMINING GLOBAL STABILITY BASED ON THE FINISHED SMSE WALL. A MINIMUM FACTOR OF SAFETY OF 1.35 IS REQUIRED FOR GLOBAL STABILITY. SUBMIT THESE RESULTS WITH THE WALL DESIGN PACKAGE. VERIFY UTILITY LOCATIONS AND ELEVATIONS BEFORE BEGINNING MSE WALL DESIGN OR CONSTRUCTION.

CONTRACTOR SHALL BE MADE AWARE THAT GRAVELLY SOILS AND BOULDER FILL WERE USED IN THE EXISTING ROADWAY EMBANKMENT AND MAY BE ENCOUNTERED DURING SOIL NAIL WALL CONSTRUCTION.

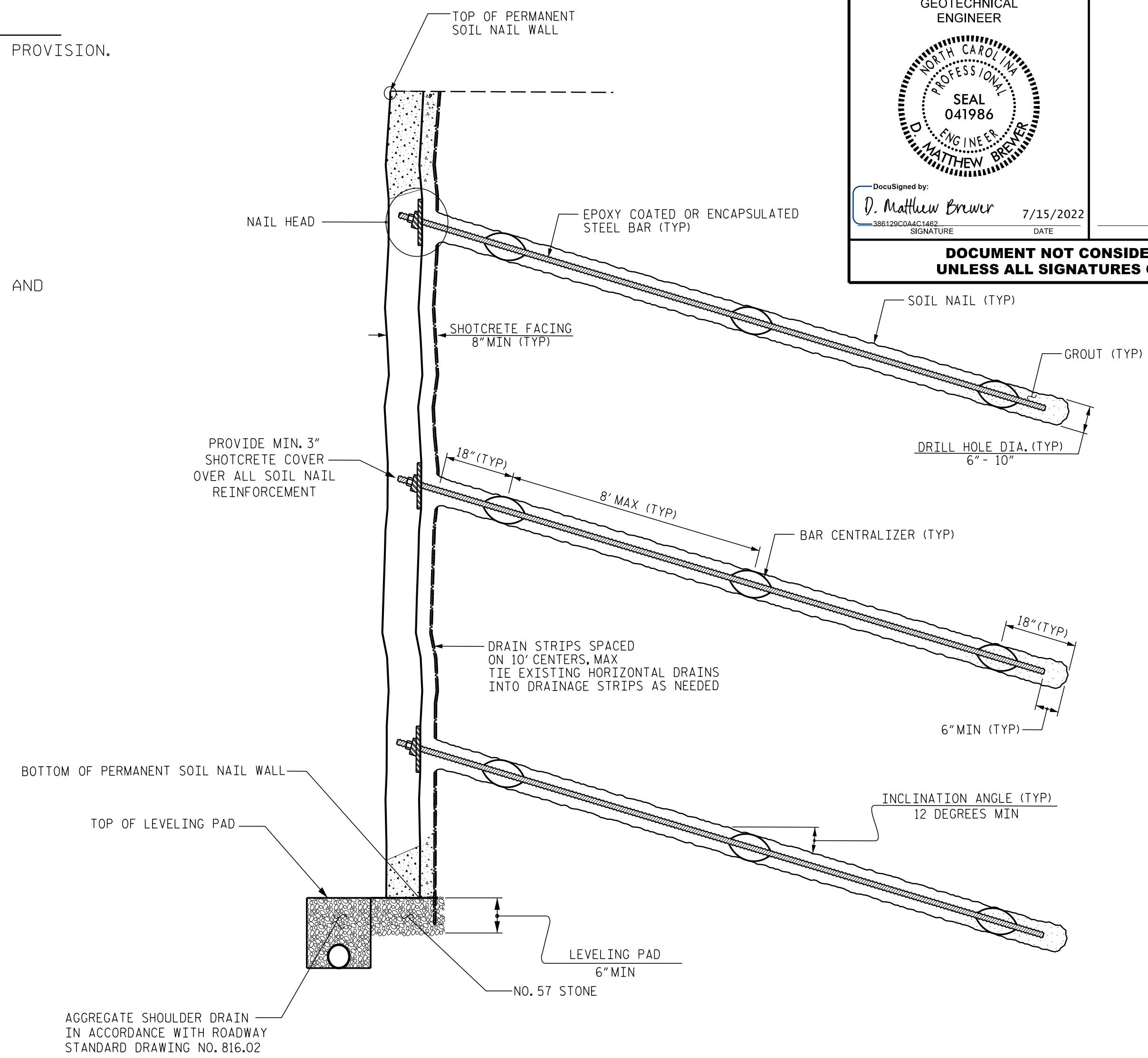
SPECIAL NOTES:

UNDERCUTTING COLLUVIAL SOILS BELOW THE SMSE WALL IS REQUIRED AS SHOWN ON SHEET W18-5. USE UNDERCUT EXCAVATION TO REMOVE SOILS AS DIRECTED BY THE ENGINEER. PLACE GEOTEXTILE FOR SOIL STABILIZATION WHEN NEEDED IN THE BOTTOM OF THE EXCAVATION AND BACKFILL WITH SUITABLE EMBANKMENT MATERIAL. FOR UNDERCUT EXCAVATION SEE STANDARD SPECIFICATIONS. UNDERCUT EXCAVATION AND GEOTEXTILE FOR SOIL STABILIZATION WILL BE PAID AS SEPARATE ADDITIONAL QUANTITIES.

EXTEND SOIL NAIL SHORING TO BOTTOM OF UNDERCUT EXCAVATION. DESIGN SOIL NAIL SHORING FOR THE HEIGHT EQUAL TO THE DIFFERENCE BETWEEN THE EXISTING ROADWAY GRADE AND THE BOTTOM OF THE UNDERCUT EXCAVATION. SOIL NAIL SHORING FOR UNDERCUT EXCAVATION WILL BE PAID IN ACCORDANCE WITH THE TEMPORARY SOIL NAIL SHORING FOR COLLUVIAL UNDERCUT SPECIAL PROVISION.

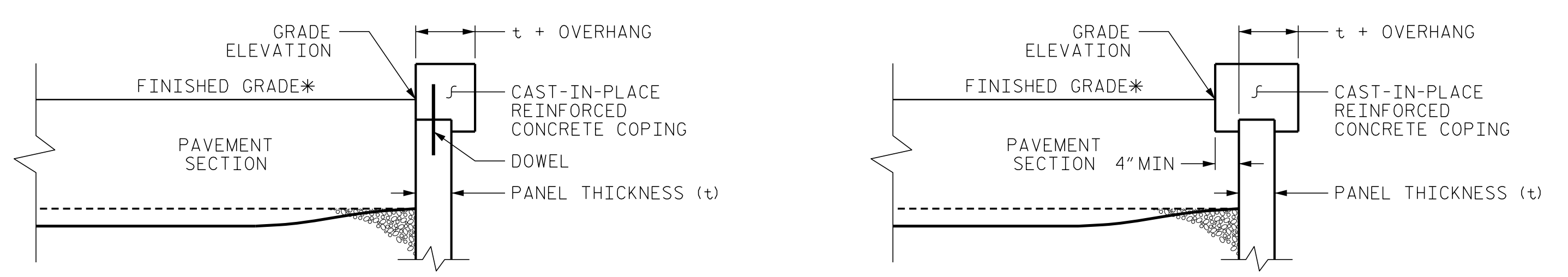
THE COLLUVIAL SOILS ARE SUITABLE FOR USE AS EMBANKMENT BUT WILL REQUIRE SIGNIFICANT DRYING TO ACHIEVE THE REQUIRED DENSITY. DO NOT USE COLLUVIAL SOILS IN THE UPPER 3 FEET OF EMBANKMENT DUE TO THE PRESENCE OF BOULDERS AND COBBLES. NO ADDITIONAL COMPENSATION WILL BE PROVIDED TO DRY COLLUVIAL SOILS OR FOR DOUBLE-HANDLING SOILS.

CONTROL GROUNDWATER DURING AND AT THE BOTTOM OF UNDERCUT EXCAVATION USING DITCHING, SUMPS, AND PERMANENT SHOULDER DRAINS AS DIRECTED BY THE ENGINEER. OUTLET SHOULDER DRAINS EVERY 50 TO 100 FEET AS DIRECTED BY THE ENGINEER.



PERMANENT SOIL NAIL WALL - TYPICAL SECTION

NOT TO SCALE



COPING DETAILS

AT THE CONTRACTOR'S OPTION, CONNECT COPING TO PANELS WITH DOWELS OR EXTEND COPING DOWN BACK OF PANELS. *SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.

GEOTECHNICAL ENGINEER SEAL 041986 ENGINEER M. MATTHEW BREWER	ENGINEER SIGNATURE DATE
DocuSigned by: D. Matthew Brewer 38812000001482 SIGNATURE	7/15/2022 DATE
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PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022

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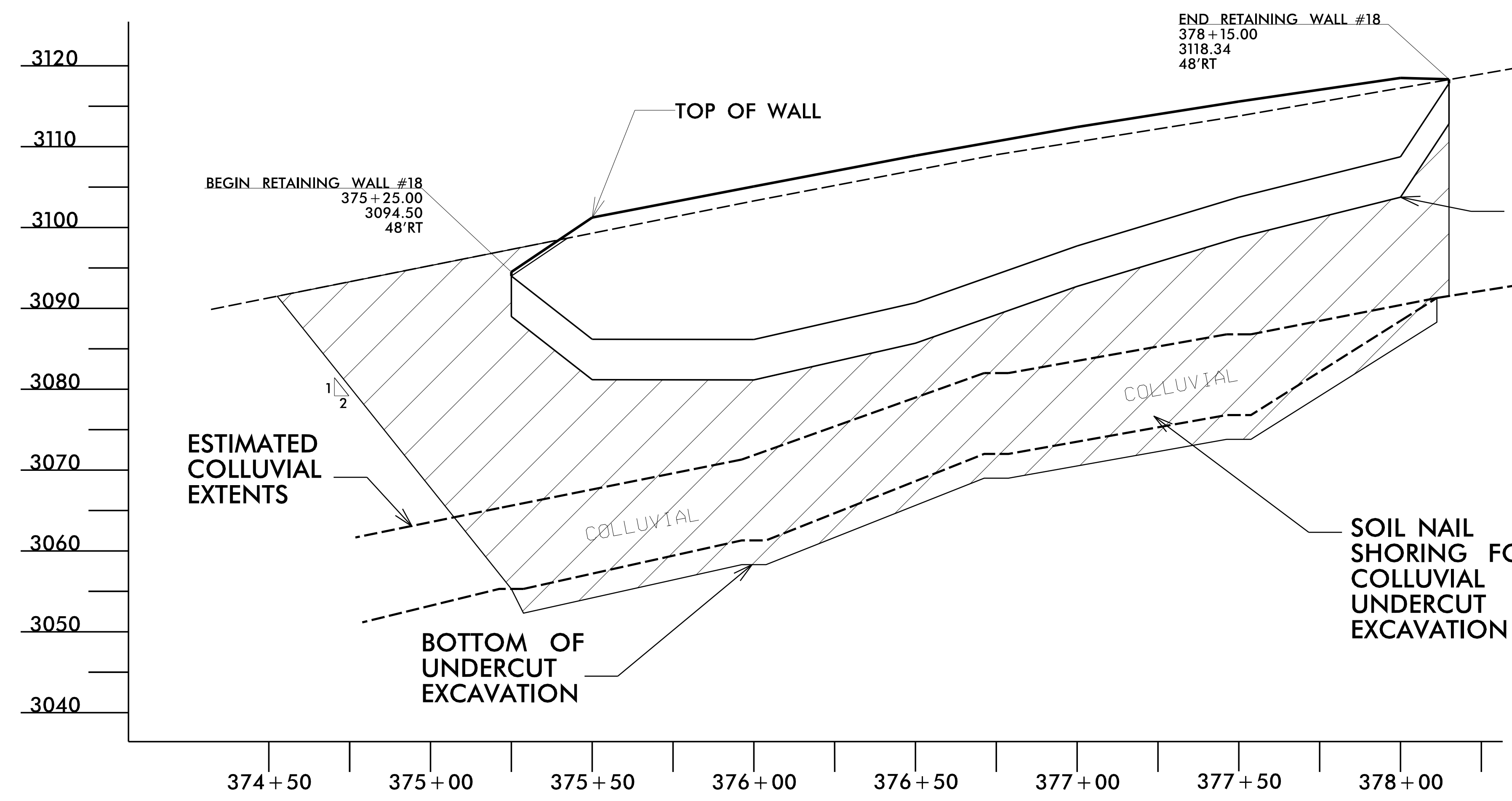
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**GEOTECHNICAL
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PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 STATION: -L-375+25, 48' RT TO 378+15, 48' RT
 SHEET 4 OF 6

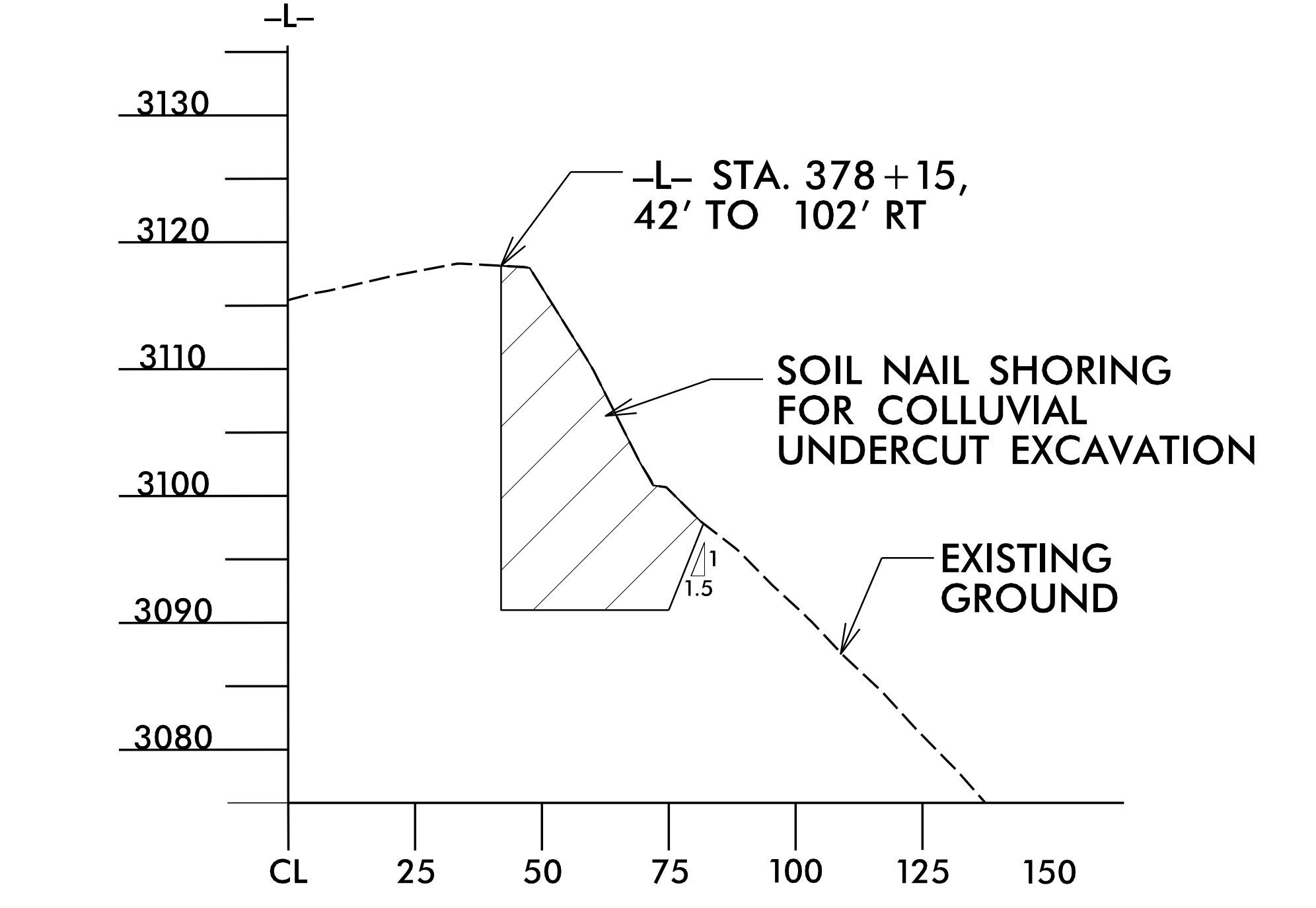
REVISIONS						SHEET NO. W18-4
NO.	BY	DATE	NO.	BY	DATE	
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DocuSigned by: D. Matthew Brewer 7/15/2022 _____ SIGNATURE DATE	
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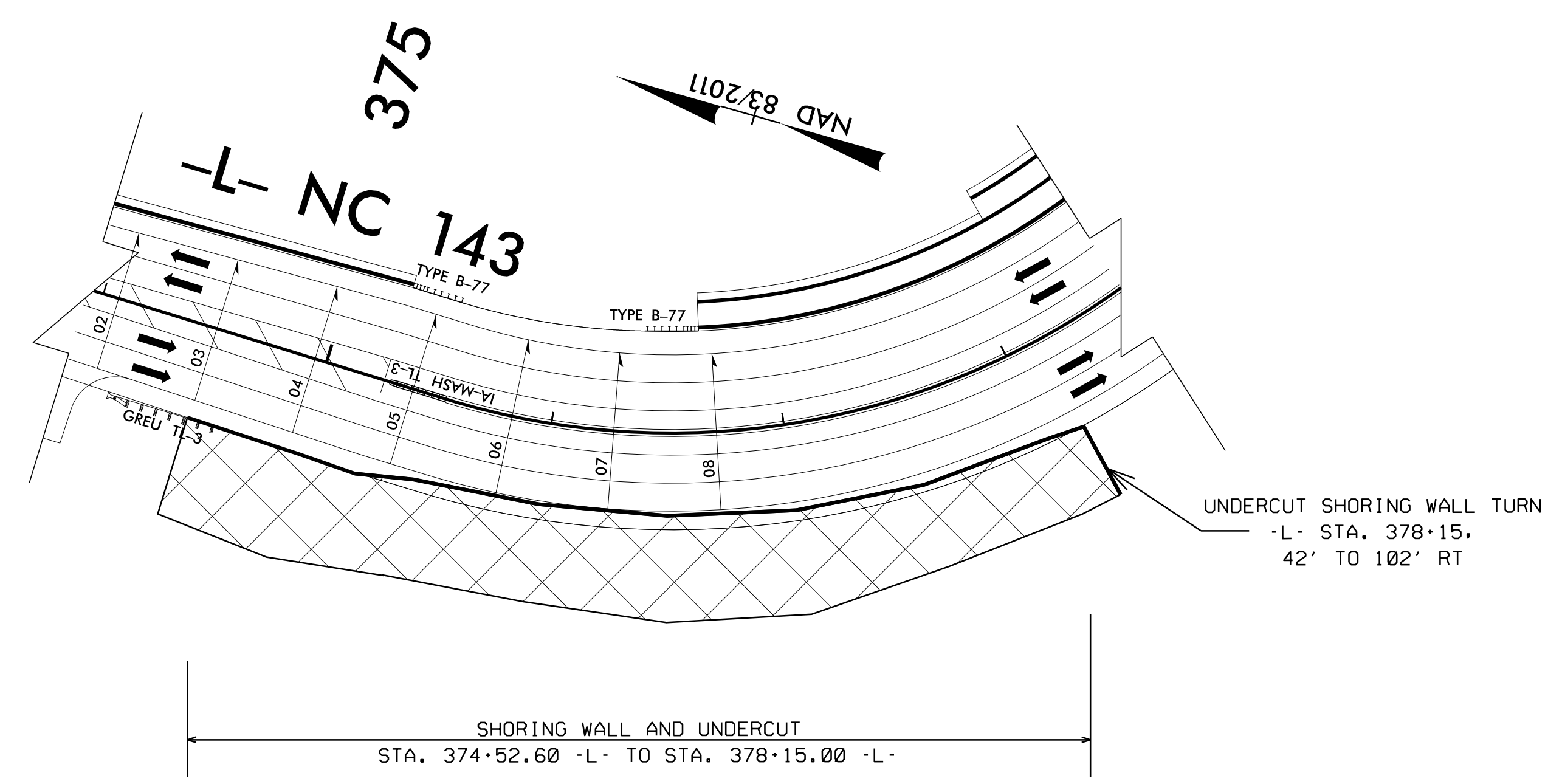


ESTIMATED SOIL NAIL SHORING QUANTITIES			
RETAINING WALL #	SOIL NAIL SHORING (SQ. FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
18	9,000	4	30

ESTIMATED QUANTITIES	
UNDERCUT EXCAVATION	10,200 CY
GEOTEXTILE FOR SOIL STABILIZATION	1,700 SY
SELECT GRANULAR MATERIAL	1,700 CY
SHOULDER DRAIN	750 LF
CONCRETE PAD FOR SHOULDER DRAIN PIPE OUTLET	5 EA



APPROXIMATE CROSS SECTION
SOIL NAIL SHORING FOR UNDERCUT - SHORING TURN
NOT TO SCALE
(LOOKING AT SOIL NAIL SHORING FACE)



SOIL NAIL SHORING AND UNDERCUT LIMITS SKETCH
SCALE: 50' = 1"

PROJECT NO.: A-0009CB
GRAHAM COUNTY
STATION: -L-375+25, 48' RT TO 378+15, 48' RT
SHEET 5 OF 6

PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022

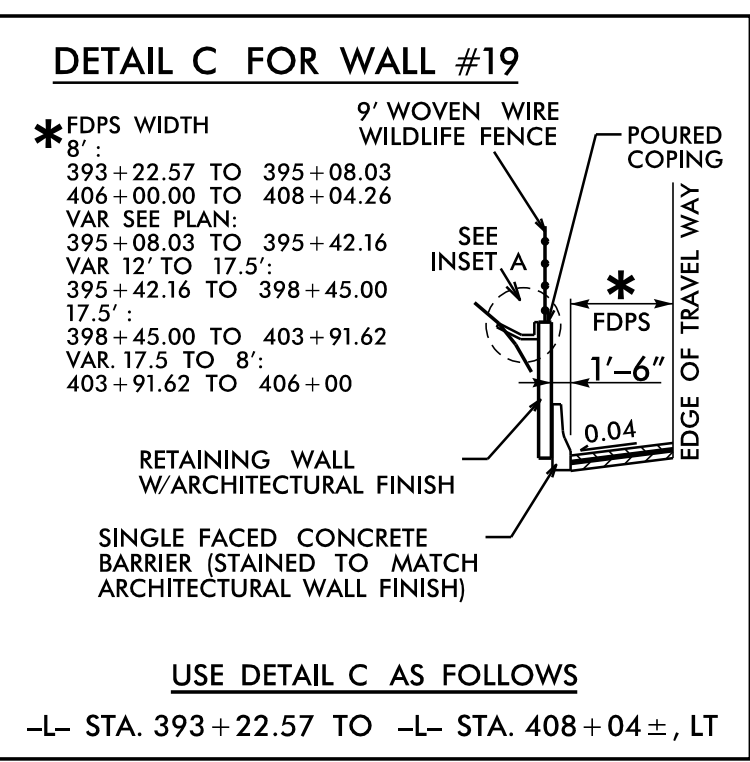
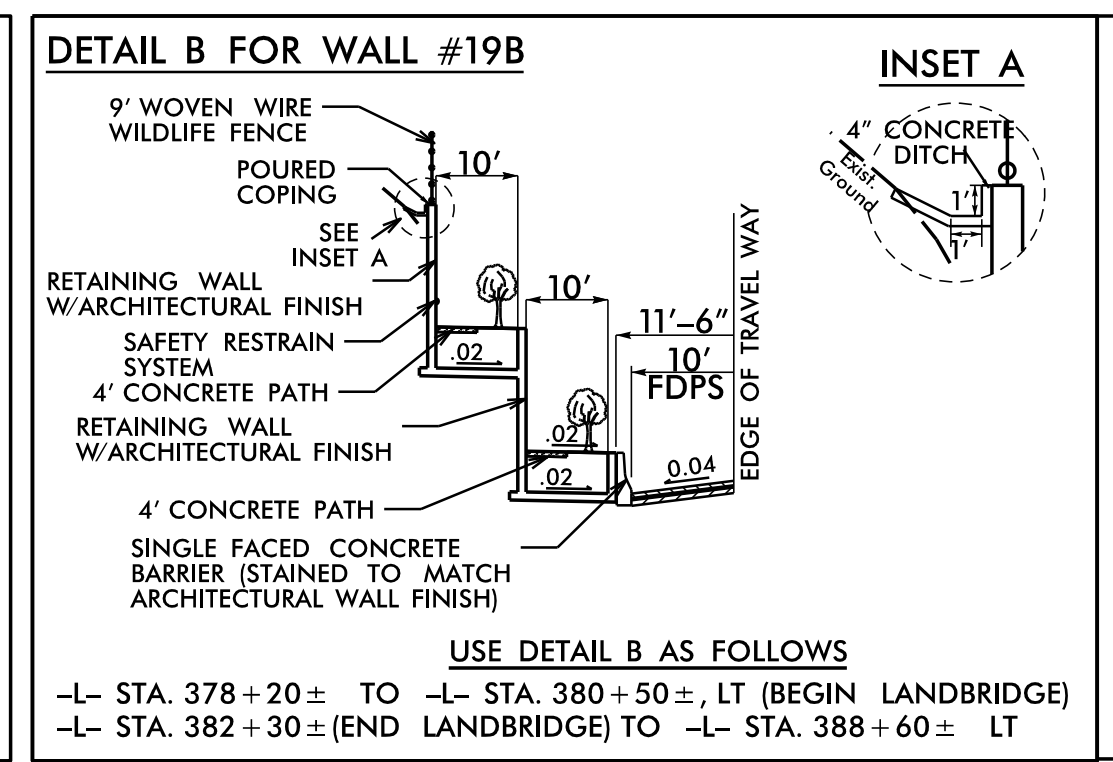
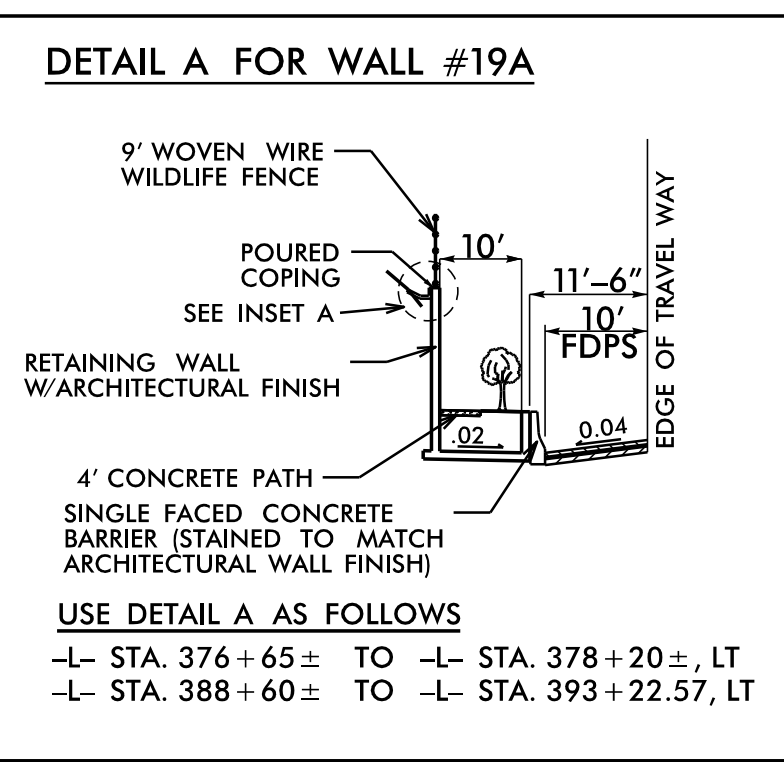
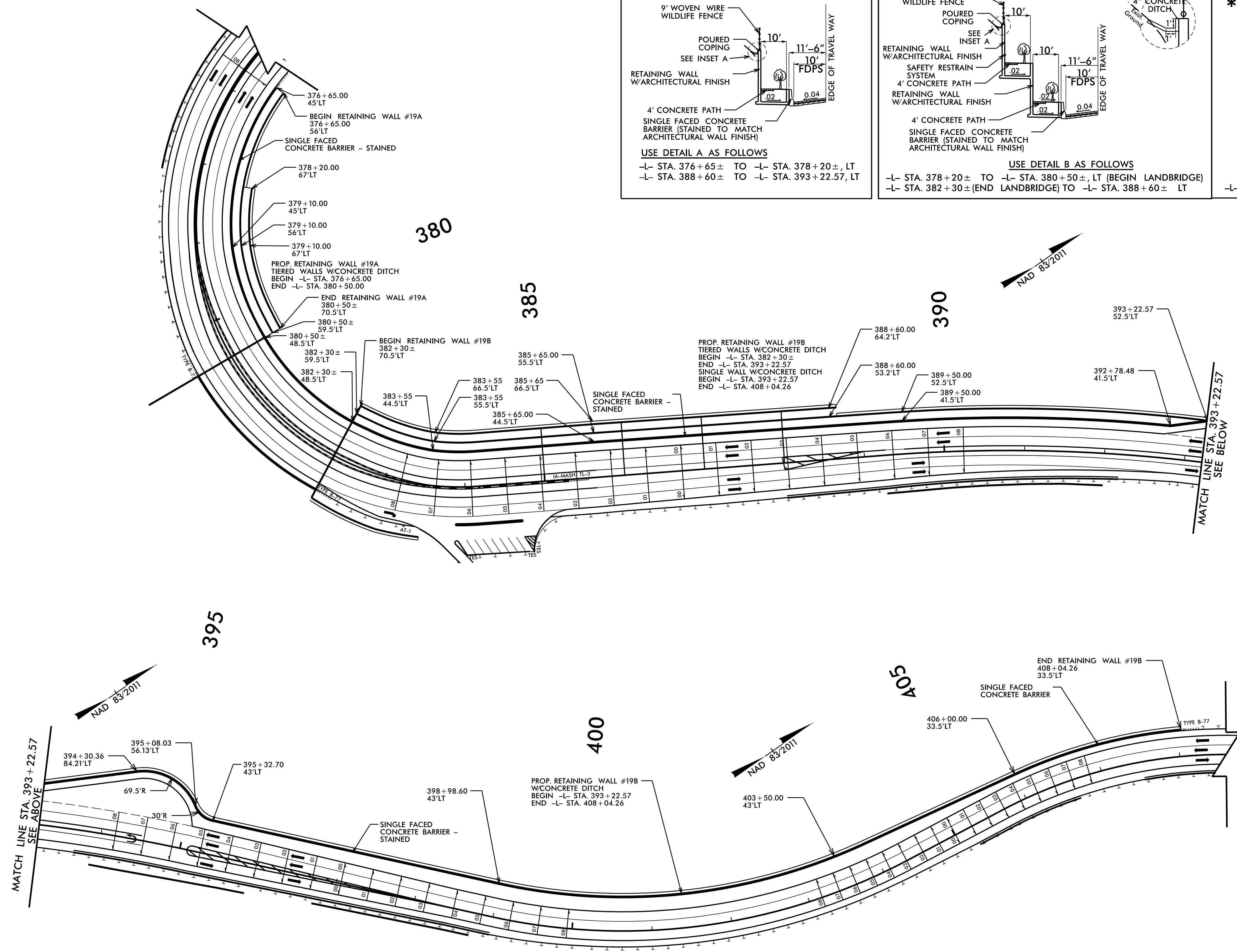
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REVISIONS						SHEET NO. W18-5
NO.	BY	DATE	NO.	BY	DATE	
1			3			
2			4			

RETAINING WALL #19A & #19B:



GEOTECHNICAL ENGINEER

ENGINEER

Seal: NORTH CAROLINA PROFESSIONAL ENGINEERS SEAL 042642 ROBERT E. KRAL

DocuSigned by: [Signature] DATE: 7/14/2022

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RETAINING WALL NO.	TIERED SOIL NAIL RETAINING WALLS (SQUARE FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
19A	14,840*	5	50
19B	74,180*	25	235
LAND BRIDGE PERMANENT SHORING**	10,340*	1	25
SIMULATED STONE FORM LINER SYSTEM AND SURFACE FINISH**			89,020* SF
HORIZONTAL DRAINS (CONTINGENCY)			900 LF
CLASS VI SELECT MATERIAL**			800 TON
SEPARATION GEOTEXTILE**			7,100 SY

* INCLUDES RETAINING WALL EMBEDMENT
** INCIDENTAL PAY ITEMS!

ITEM	LOCATION	LOCATION
SIMULATED STONE FORM LINER SYSTEM AND SURFACE FINISH**	TIER 1 FACE	10,330 SF
SIMULATED STONE FORM LINER SYSTEM AND SURFACE FINISH**	TIER 2 FACE	6,250 SF
CLASS A CONCRETE (PLANTER BOX)	TIER 1 & TIER 2	1,610 CY
REINFORCING STEEL (PLANTER BOX)	TIER 1 & TIER 2	318,700* LB
CLASS VI SELECT MATERIAL**	TIER 1 & TIER 2	750 TON
SUBSURFACE DRAIN**	TIER 1 & TIER 2	10,250 LF
SEPARATION GEOTEXTILE**	TIER 1 & TIER 2	6,000 SY
4" SLOPE PROTECTION	TIER 1 & TIER 2	50 SY

* ASSUMES STEEL IS 1.5% THE VOLUME OF CONCRETE.
** INCIDENTAL PAY ITEMS!

ITEM	QUANTITY
SAFETY RESTRAINT SYSTEM	1 LS
PLANTER BOX BACKFILL, SEE LANDSCAPING PROVISIONS *	4,300 CY

* INCIDENTAL PAY ITEMS!

RETAINING WALL #19A & 19B - PLAN
NOT TO SCALE

PROJECT NO.: A-0009CB
GRAHAM COUNTY
RETAINING WALL #19A: -L- 376+65, 45'-56' LT TO 380+50, 48.5'-70.5' LT
RETAINING WALL #19B: -L- 382+30, 48.5'-70.5' LT TO 408+04, 33.5' LT
SHEET 1 OF 11

PREPARED BY: R. KRAL DATE: 7/13/2022
REVIEWED BY: M. BREWER DATE: 7/13/2022

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GEOTECHNICAL ENGINEERING UNIT


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RETAINING WALL #19A & #19B TIERED SOIL NAIL RETAINING WALL

W19-1

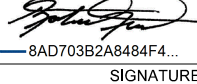
RETAINING WALL #19A & #19B:

GEOTECHNICAL ENGINEER



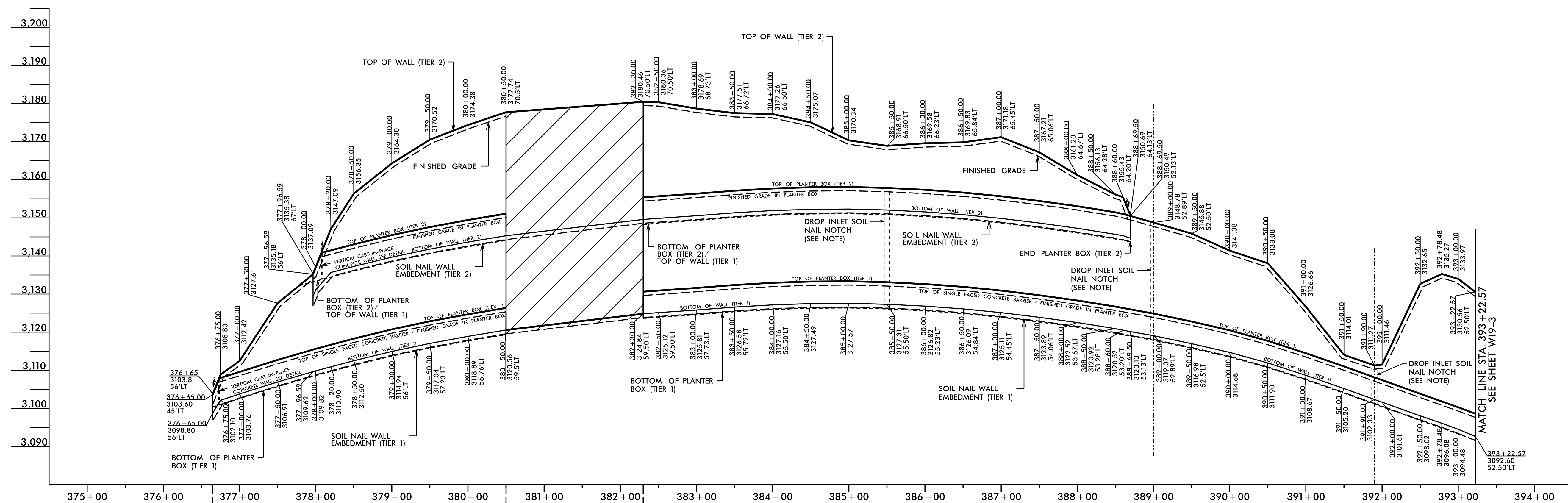
ROBERT E. KRAL

ENGINEER

DocuSigned by:

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7/14/2022

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RETAINING WALL #19A

LAND BRIDGE PERMANENT SHORING

RETAINING WALL #19B

RETAINING WALL #19A & #19B - ENVELOPE

NOT TO SCALE
(LOOKING AT FACE OF WALL)

PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #19A: -L- 376+65, 45'-56' LT TO 380+50, 48.5'-70.5' LT

RETAINING WALL #19B: -L- 382+30, 48.5'-70.5' LT TO 408+04, 33.5' LT

SHEET 2 OF 11


PREPARED BY: R. KRAL	DATE: 7/13/2022
REVIEWED BY: M. BREWER	DATE: 7/13/2022

Prepared in the Office of:



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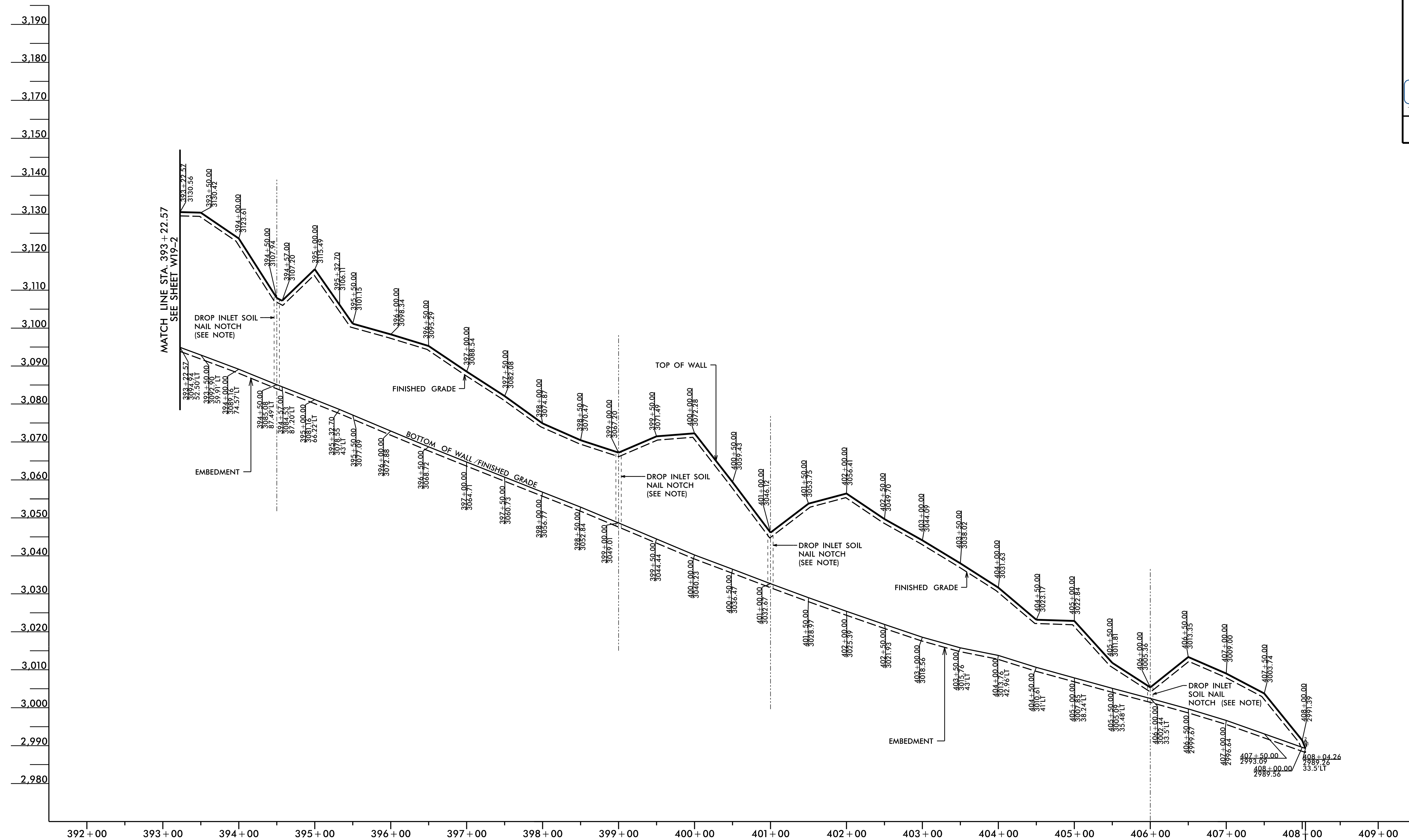
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RETAINING WALL #19A & #19B TIERED SOIL NAIL RETAINING WALL

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SHEET NO.
W19-2

RETAINING WALL #19A & #19B:



RETAINING WALL #19B

RETAINING WALL #19A & #19B - ENVELOPE (CONTINUED)

NOT TO SCALE
(LOOKING AT FACE OF WALL)

PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #19A: -L- 376+65, 45'-56' LT TO 380+50, 48.5'-70.5' LT

RETAINING WALL #19B: -L- 382+30, 48.5'-70.5' LT TO 408+04, 33.5' LT

SHEET 3 OF 11

GEOTECHNICAL ENGINEER

ENGINEER

SEAL 042642

ROBERT E. KRAL

DocuSigned by: 7/14/2022

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PREPARED BY: R. KRAL	DATE: 7/13/2022
REVIEWED BY: M. BREWER	DATE: 7/13/2022

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
2400 CROWPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #19A & #19B
TIERED SOIL NAIL RETAINING WALL

REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W19-3

SOIL NAIL RETAINING WALL #19B							
STA. -L-	OFFSET FROM -L- (LT) TIER 1	OFFSET FROM -L- (LT) TIER 2	ELEV. @ TOP OF WALL	BOW PROPOSED FINISHED GRADE ELEV.	TOP OF LEVELING PAD ELEV.	ESTIMATED WALL EMBEDMENT	WALL DESIGN HEIGHT "H"
382+30.00	59.50	70.50	3180.46	3124.84	3123.84	1.00	55.62
382+50.00	59.50	70.50	3180.36	3125.12	3124.12	1.00	55.24
383+00.00	57.73	68.73	3178.69	3125.81	3124.81	1.00	52.88
383+50.00	55.72	66.72	3177.51	3126.58	3125.58	1.00	50.93
384+00.00	55.50	66.50	3177.26	3127.16	3126.16	1.00	50.10
384+50.00	55.50	66.50	3175.07	3127.49	3126.49	1.00	47.58
385+00.00	55.50	66.50	3170.34	3127.57	3126.57	1.00	42.77
385+50.00	55.50	66.50	3168.91	3127.31	3126.31	1.00	41.60
386+00.00	55.23	66.23	3169.58	3126.82	3125.82	1.00	42.76
386+50.00	54.84	65.84	3169.83	3126.09	3125.09	1.00	43.74
387+00.00	54.45	65.45	3171.18	3125.11	3124.11	1.00	46.07
387+50.00	54.06	65.06	3167.21	3123.89	3122.89	1.00	43.32
388+00.00	53.67	64.67	3161.20	3122.52	3121.52	1.00	38.68
388+50.00	53.28	64.28	3156.13	3120.92	3119.92	1.00	35.21
388+60.00	53.20	64.20	3155.43	3120.52	3119.52	1.00	34.91
388+69.50	-	64.13	3150.69	3120.13	3119.13	1.00	30.56
388+69.50	53.13	-	3150.49	3120.13	3119.13	1.00	30.36
389+00.00	52.89	-	3148.78	3119.07	3118.07	1.00	29.71
389+50.00	52.50	-	3145.88	3116.98	3115.98	1.00	28.90
390+00.00	52.50	-	3141.38	3114.68	3113.68	1.00	26.70
390+50.00	52.50	-	3138.08	3111.90	3110.90	1.00	26.18
391+00.00	52.50	-	3126.66	3108.67	3107.67	1.00	17.99
391+50.00	52.50	-	3114.01	3105.20	3104.20	1.00	8.81
391+90.00	52.50	-	3111.27	3102.33	3101.33	1.00	8.94
392+00.00	52.50	-	3111.46	3101.61	3100.61	1.00	9.85
392+50.00	52.50	-	3132.65	3098.02	3097.02	1.00	34.63
392+78.48	52.50	-	3135.27	3096.08	3095.08	1.00	39.19
393+00.00	52.50	-	3133.97	3094.48	3093.48	1.00	39.49
393+22.57	52.50	-	3130.56	3092.60	3091.60	1.00	37.96
393+22.57	52.50	-	3130.56	3094.94	3093.94	1.00	35.62
393+50.00	59.91	-	3130.42	3092.90	3091.90	1.00	37.52
394+00.00	74.57	-	3123.61	3089.16	3088.16	1.00	34.45
394+50.00	87.49	-	3107.94	3085.08	3084.08	1.00	22.86
394+57.00	87.20	-	3107.20	3084.53	3083.53	1.00	22.67
395+00.00	66.22	-	3115.49	3081.16	3080.16	1.00	34.33
395+32.70	43.00	-	3106.11	3078.55	3077.55	1.00	27.56
395+50.00	43.00	-	3101.15	3077.09	3076.09	1.00	24.06
396+00.00	43.00	-	3098.34	3072.88	3071.88	1.00	25.46
396+50.00	43.00	-	3095.29	3068.72	3067.72	1.00	26.57
397+00.00	43.00	-	3088.54	3064.71	3063.71	1.00	23.83
397+50.00	43.00	-	3082.08	3060.73	3059.73	1.00	21.35
398+00.00	43.00	-	3074.87	3056.77	3055.77	1.00	18.10
398+50.00	43.00	-	3070.47	3052.84	3051.84	1.00	17.63
399+00.00	43.00	-	3067.20	3049.01	3048.01	1.00	18.19
399+50.00	43.00	-	3071.49	3044.44	3043.44	1.00	27.05
400+00.00	43.00	-	3072.28	3040.23	3039.23	1.00	32.05
400+50.00	43.00	-	3059.43	3036.47	3035.47	1.00	22.96
401+00.00	43.00	-	3046.12	3032.67	3031.67	1.00	13.45
401+50.00	43.00	-	3053.75	3028.97	3027.97	1.00	24.78
402+00.00	43.00	-	3056.41	3025.39	3024.39	1.00	31.02
402+50.00	43.00	-	3049.70	3021.93	3020.93	1.00	27.77
403+00.00	43.00	-	3044.09	3018.56	3017.56	1.00	25.53
403+50.00	43.00	-	3038.02	3015.76	3014.76	1.00	22.26
404+00.00	42.96	-	3031.63	3013.76	3012.76	1.00	17.87
404+50.00	41.00	-	3023.17	3010.61	3009.61	1.00	12.56

ALL MEASUREMENTS IN FEET

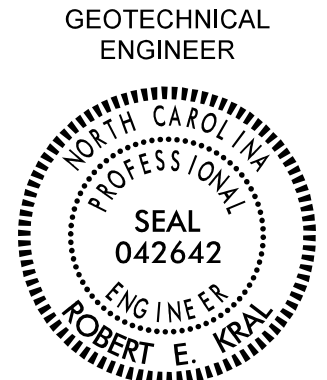

PREPARED BY: R. KRAL	DATE: 7/13/2022
REVIEWED BY: M. BREWER	DATE: 7/13/2022

SOIL NAIL RETAINING WALL #19B (CONTINUED)							
STA. -L-	OFFSET FROM -L- (LT) TIER 1	OFFSET FROM -L- (LT) TIER 2	ELEV. @ TOP OF WALL	BOW PROPOSED FINISHED GRADE ELEV.	TOP OF LEVELING PAD ELEV.	ESTIMATED WALL EMBEDMENT	WALL DESIGN HEIGHT "H"
405+00.00	38.24	-	3022.84	3007.85	3006.85	1.00	14.99
405+50.00	35.48	-	3011.81	3005.09	3004.09	1.00	6.72
406+00.00	33.50	-	3005.36	3002.44	3001.44	1.00	2.92
406+50.00	33.50	-	3013.35	2999.67	2998.67	1.00	13.68
407+00.00	33.50	-	3009.00	2996.64	2995.64	1.00	12.36
407+50.00	33.50	-	3003.74	2993.09	2992.09	1.00	10.65
408+00.00	33.50	-	2991.39	2989.56	2988.56	1.00	1.83
408+04.26	33.50	-	2989.26	2989.26	2988.26	1.00	0.00


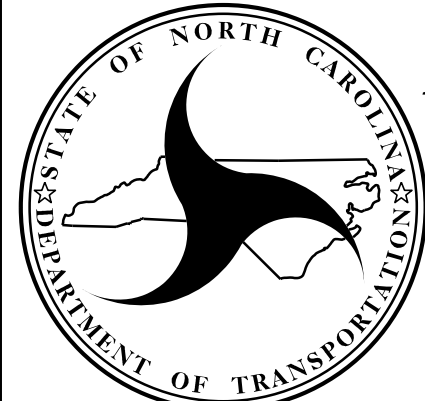
ALL MEASUREMENTS IN FEET

SOIL NAIL RETAINING WALL #19A							
STA. -L-	OFFSET FROM -L- (LT) TIER 1	OFFSET FROM -L- (LT) TIER 2	ELEV. @ TOP OF WALL	BOW PROPOSED FINISHED GRADE ELEV.	TOP OF LEVELING PAD ELEV.	ESTIMATED WALL EMBEDMENT	WALL DESIGN HEIGHT "H"
376+65.00	56.00	-	3103.80	3098.80	3097.80	1.00	5.00
376+75.00	56.00	-	3108.80	3102.10	3101.10	1.00	6.70
377+00.00	56.00	-	3112.42	3103.76	3102.76	1.00	8.66
377+50.00	56.00	-	3127.61	3106.91	3105.91	1.00	20.70
377+96.59	56.00	-	3135.18	3109.62	3108.62	1.00	25.56
377+96.59	56.00	67.00	3135.38	3109.62	3108.62	1.00	25.76
378+00.00	56.00	67.00	3137.09	3109.82	3108.82	1.00	27.27
378+20.00	56.00	67.00	3147.09	3110.90	3109.90	1.00	36.19
378+50.00	56.00	67.00	3156.35	3112.50	3111.50	1.00	43.85
379+00.00	56.00	67.00	3164.30	3114.94	3113.94	1.00	49.36
379+50.00	57.23	68.23	3170.52	3117.04	3116.04	1.00	53.48
380+00.00	56.76	67.76	3174.38	3118.89	3117.89	1.00	55.49
380+50.00	59.50	70.50	3177.74	3120.56	3119.56	1.00	57.18

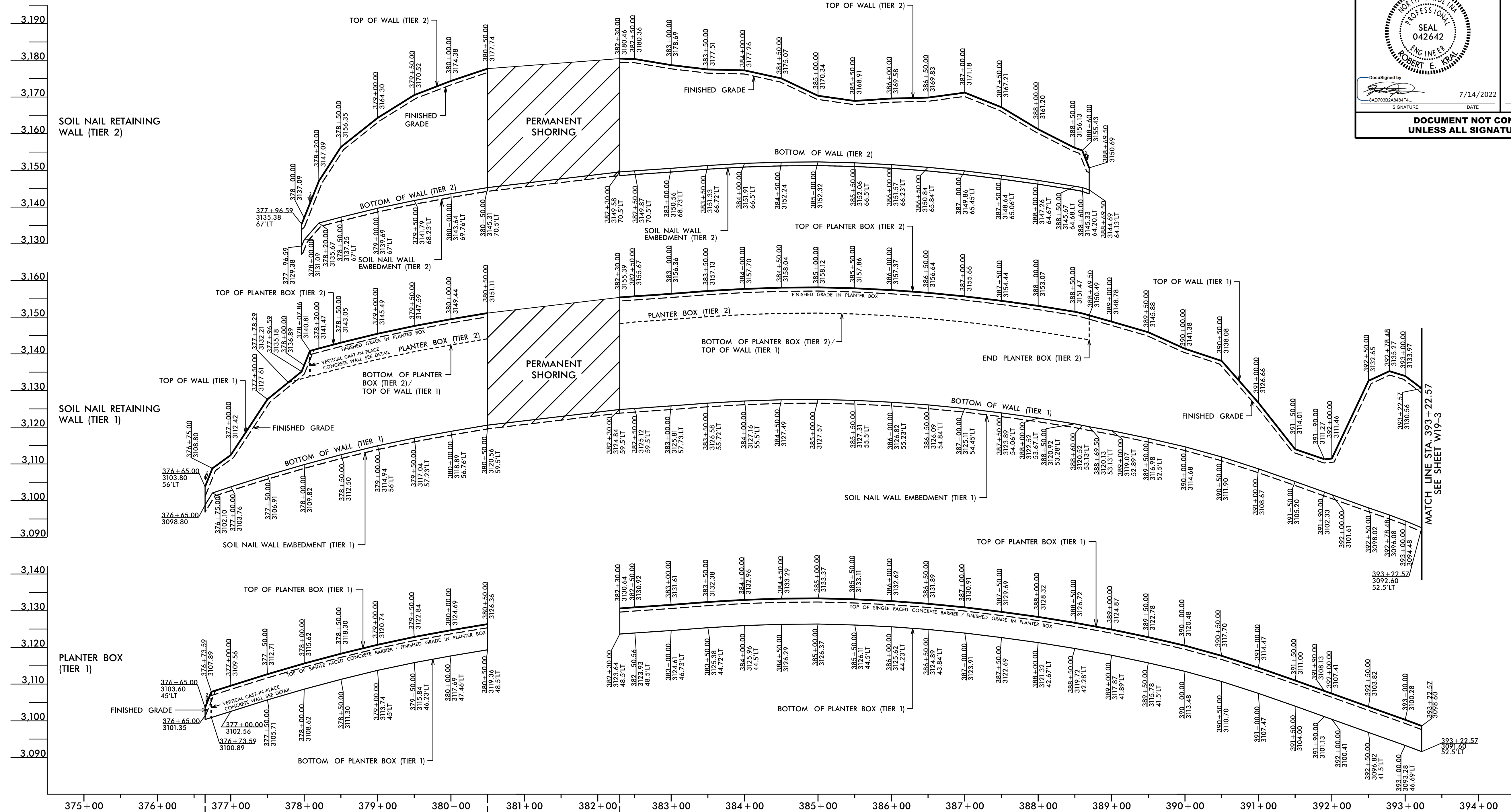
ALL MEASUREMENTS IN FEET

 GEOTECHNICAL ENGINEER SEAL 042642 ROBERT E. KRAL	ENGINEER
Documented by:  Signature: _____ Date: 7/14/2022	Signature: _____ Date: _____
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	

PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 RETAINING WALL #19A: -L- 376+65, 45'-56' LT TO 380+50, 48.5'-70.5' LT
 RETAINING WALL #19B: -L- 382+30, 48.5'-70.5' LT TO 408+04, 33.5' LT
 SHEET 4 OF 11

Prepared in the Office of:  CARLINAS GEOTECHNICAL GROUP 2400 CROWNPOINT EXECUTIVE DRIVE SUITE 800 CHARLOTTE, NC 28227 (980) 339-8684	 NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS GEOTECHNICAL ENGINEERING UNIT	RETAINING WALL #19A & #19B TIERED SOIL NAIL RETAINING WALL				
REVISIONS						
NO.	BY	DATE	NO.	BY	DATE	SHEET NO.
1			3			W19-4
2			4			

RETAINING WALL #19A & #19B:



GEOTECHNICAL ENGINEER

ENGINEER

SEAL 042642

ROBERT E. KRAL

7/14/2022

DATE

DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

RETAINING WALL #19A

LAND BRIDGE PERMANENT SHORING

RETAINING WALL #19B

RETAINING WALL #19A & #19B - ENVELOPE

NOT TO SCALE (LOOKING AT FACE OF WALL)

PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #19A: -L- 376+65, 45'-56' LT TO 380+50, 48.5'-70.5' LT

RETAINING WALL #19B: -L- 382+30, 48.5'-70.5' LT TO 408+04, 33.5' LT

SHEET 5 OF 11

PREPARED BY: R. KRAL

DATE: 7/13/2022

REVIEWED BY: M. BREWER

DATE: 7/13/2022

Prepared in the Office of:

CGE CAROLINAS GEOTECHNICAL GROUP

2400 CROWPOINT EXECUTIVE DRIVE SUITE 800 CHARLOTTE, NC 28227 (980) 339-8684

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #19A & #19B TIERED SOIL NAIL RETAINING WALL

REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W19-5

PLANTER BOX - TIER 1				
STA. -L-	OFFSET FROM -L- (LT)	ELEV. @ TOP OF PLANTER BOX	ELEV. @ BOTTOM OF PLANTER BOX	WALL DESIGN HEIGHT "H _{P1} "
376+65.00	45.00	3103.60	3100.35	3.25
376+73.59	45.00	3107.89	3100.89	7.00
377+00.00	45.00	3109.56	3102.56	7.00
377+50.00	45.00	3112.71	3105.71	7.00
378+00.00	45.00	3115.62	3108.62	7.00
378+50.00	45.00	3118.30	3111.30	7.00
379+00.00	45.00	3120.74	3113.74	7.00
379+50.00	46.23	3122.84	3115.84	7.00
380+00.00	47.46	3124.69	3117.69	7.00
380+50.00	48.50	3126.36	3119.36	7.00
382+30.00	48.50	3130.64	3123.64	7.00
382+50.00	48.50	3130.92	3123.92	7.00
382+50.56	48.50	3130.93	3123.93	7.00
383+00.00	46.73	3131.61	3124.61	7.00
383+50.00	44.72	3132.38	3125.38	7.00
384+00.00	44.50	3132.96	3125.96	7.00
384+50.00	44.50	3133.29	3126.29	7.00
385+00.00	44.50	3133.37	3126.37	7.00
385+50.00	44.50	3133.11	3126.11	7.00
386+00.00	44.23	3132.62	3125.62	7.00
386+50.00	43.84	3131.89	3124.89	7.00
387+00.00	43.84	3130.91	3123.91	7.00
387+50.00	43.84	3129.69	3122.69	7.00
388+00.00	42.67	3128.32	3121.32	7.00
388+50.00	42.28	3126.72	3119.72	7.00
389+00.00	41.89	3124.87	3117.87	7.00
389+50.00	41.50	3122.78	3115.78	7.00
390+00.00	41.50	3120.48	3113.48	7.00
390+50.00	41.50	3117.70	3110.70	7.00
391+00.00	41.50	3114.47	3107.47	7.00
391+50.00	41.50	3111.00	3104.00	7.00
391+90.00	41.50	3108.13	3101.13	7.00
392+00.00	41.50	3107.41	3100.41	7.00
392+50.00	41.50	3103.82	3096.82	7.00
393+00.00	46.69	3100.28	3093.28	7.00
393+22.57	52.50	3098.60	3091.60	7.00

ALL MEASUREMENTS IN FEET

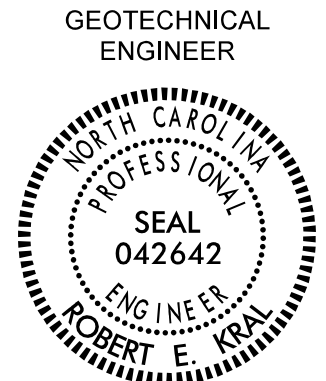
PLANTER BOX - TIER 2				
STA. -L-	OFFSET FROM -L- (LT)	ELEV. @ TOP OF PLANTER BOX	ELEV. @ BOTTOM OF PLANTER BOX	WALL DESIGN HEIGHT "H _{P2} "
377+78.29	56.00	3132.21	3132.21	0.00
377+96.59	56.00	3135.18	3133.20	1.98
378+00.00	56.00	3136.89	3133.39	3.50
378+07.86	56.00	3140.81	3133.81	7.00
378+20.00	56.00	3141.47	3134.47	7.00
378+50.00	56.00	3143.05	3136.05	7.00
379+00.00	56.00	3145.49	3138.49	7.00
379+50.00	57.23	3147.59	3140.59	7.00
380+00.00	56.76	3149.44	3142.44	7.00
380+50.00	59.50	3151.11	3144.11	7.00
382+30.00	59.50	3155.39	3148.39	7.00
382+50.00	59.50	3155.67	3148.67	7.00
383+00.00	57.73	3156.36	3149.36	7.00
383+50.00	55.72	3157.13	3150.13	7.00
384+00.00	55.50	3157.70	3150.70	7.00
384+50.00	55.50	3158.04	3151.04	7.00
385+00.00	55.50	3158.12	3151.12	7.00
385+50.00	55.50	3157.86	3150.86	7.00
386+00.00	55.23	3157.37	3150.37	7.00
386+50.00	54.84	3156.64	3149.64	7.00
387+00.00	54.45	3155.66	3148.66	7.00
387+50.00	54.06	3154.44	3147.44	7.00
388+00.00	53.67	3153.07	3146.07	7.00
388+50.00	53.28	3151.47	3144.47	7.00
388+69.50	53.28	3150.49	3143.49	7.00

ALL MEASUREMENTS IN FEET

SOIL NAIL RETAINING WALL #19A & #19B - TIER 1						
STA. -L-	OFFSET FROM -L- (LT)	ELEV. @ TOP OF WALL	BOW PROPOSED FINISHED GRADE ELEV.	TOP OF LEVELING PAD ELEV.	ESTIMATED WALL EMBEDMENT	WALL DESIGN HEIGHT "H ₁ "
376+65.00	56.00	3103.80	3098.80	3097.80	1.00	5.00
376+75.00	56.00	3108.80	3102.10	3101.10	1.00	6.70
377+00.00	56.00	3112.42	3103.76	3102.76	1.00	8.66
377+50.00	56.00	3127.61	3106.91	3105.91	1.00	20.70
377+78.29	56.00	3132.21	3108.56	3107.56	1.00	23.65
377+96.59	56.00	3133.20	3109.82	3108.82	1.00	24.38
378+00.00	56.00	3133.39	3112.50	3111.50	1.00	21.89
378+07.86	56.00	3133.81	3114.94	3113.94	1.00	19.87
378+20.00	56.00	3134.47	3117.04	3116.04	1.00	18.43
378+50.00	56.00	3136.05	3118.89	3117.89	1.00	18.16
379+00.00	56.00	3138.49	3120.56	3119.56	1.00	18.93
379+50.00	57.23	3140.59	3117.04	3116.04	1.00	24.55
380+00.00	56.76	3142.44	3118.89	3117.89	1.00	24.55
380+50.00	59.50	3144.11	3120.56	3119.56	1.00	24.55
382+30.00	59.50	3148.39	3124.84	3123.84	1.00	24.55
382+50.00	59.50	3148.67	3125.12	3124.12	1.00	24.55
383+00.00	57.73	3149.36	3125.81	3124.81	1.00	24.55
383+50.00	55.72	3150.13	3126.58	3125.58	1.00	24.55
384+00.00	55.50	3150.70	3127.16	3126.16	1.00	24.54
384+50.00	55.50	3151.04	3127.49	3126.49	1.00	24.55
385+00.00	55.50	3151.12	3127.57	3126.57	1.00	24.55

ALL MEASUREMENTS IN FEET

GEOTECHNICAL ENGINEER



ROBERT E. KRAL

ENGINEER

DocuSigned by:
[Signature]
8AD70B2A84AF4

7/14/2022

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

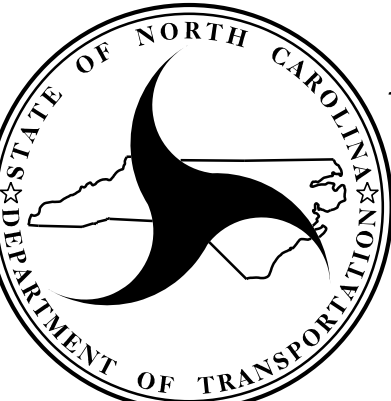
PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 RETAINING WALL #19A: -L- 376+65, 45'-56' LT TO 380+50, 48.5'-70.5' LT
 RETAINING WALL #19B: -L- 382+30, 48.5'-70.5' LT TO 408+04, 33.5' LT
 SHEET 6 OF 11

PREPARED BY: R. KRAL DATE: 7/13/2022
 REVIEWED BY: M. BREWER DATE: 7/13/2022

Prepared in the Office of:



**CAROLINAS
GEOTECHNICAL
GROUP**
 2400 CROWNPPOINT EXECUTIVE DRIVE
 SUITE 800
 CHARLOTTE, NC 28227
 (980) 339-8684



**NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS**

**GEOTECHNICAL
ENGINEERING UNIT**

REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W19-6

SOIL NAIL RETAINING WALL #19A & #19B - TIER 1 (CONTINUED)

STA. -L-	OFFSET FROM -L- (LT)	ELEV. @ TOP OF WALL	BOW PROPOSED FINISHED GRADE ELEV.	TOP OF LEVELING PAD ELEV.	ESTIMATED WALL EMBEDMENT	WALL DESIGN HEIGHT "H ₁ "
385+50.00	55.50	3150.86	3127.31	3126.31	1.00	24.55
386+00.00	55.23	3150.37	3126.82	3125.82	1.00	24.55
386+50.00	54.84	3149.64	3126.09	3125.09	1.00	24.55
387+00.00	54.45	3148.66	3125.11	3124.11	1.00	24.55
387+50.00	54.06	3147.44	3123.89	3122.89	1.00	24.55
388+00.00	53.67	3146.07	3122.52	3121.52	1.00	24.55
388+50.00	53.28	3144.47	3120.92	3119.92	1.00	24.55
388+69.50	53.28	3143.49	3120.13	3119.13	1.00	24.36
389+00.00	52.89	3148.78	3119.07	3118.07	1.00	29.71
389+50.00	52.50	3145.88	3116.98	3115.98	1.00	28.90
390+00.00	52.50	3141.38	3114.68	3113.68	1.00	26.70
390+50.00	52.50	3138.08	3111.90	3110.90	1.00	26.18
391+00.00	52.50	3126.66	3108.67	3107.67	1.00	17.99
391+50.00	52.50	3114.01	3105.20	3104.20	1.00	8.81
391+90.00	52.50	3111.27	3102.23	3101.23	1.00	9.04
392+00.00	52.50	3111.46	3101.61	3100.61	1.00	9.85
392+50.00	52.50	3132.65	3098.02	3097.02	1.00	34.63
392+78.48	52.50	3135.27	3096.08	3095.08	1.00	39.19
393+00.00	52.50	3133.97	3094.48	3093.48	1.00	39.49
393+22.57	52.50	3130.56	3092.60	3091.60	1.00	37.96
393+22.57	52.50	3130.56	3094.94	3093.94	1.00	35.62
393+50.00	59.91	3130.42	3092.90	3091.90	1.00	37.52
394+00.00	74.57	3123.61	3089.16	3088.16	1.00	34.45
394+50.00	87.49	3107.94	3085.08	3084.08	1.00	22.86
394+57.00	66.22	3107.20	3081.16	3080.16	1.00	26.04
395+00.00	43.00	3115.49	3078.55	3077.55	1.00	36.94
395+50.00	43.00	3101.15	3077.09	3076.09	1.00	24.06
396+00.00	43.00	3098.34	3072.88	3071.88	1.00	25.46
396+50.00	43.00	3095.29	3068.72	3067.72	1.00	26.57
397+00.00	43.00	3088.54	3064.71	3063.71	1.00	23.83
397+50.00	43.00	3082.08	3060.73	3059.73	1.00	21.35
398+00.00	43.00	3074.87	3056.77	3055.77	1.00	18.10
398+50.00	43.00	3070.47	3052.84	3051.84	1.00	17.63
399+00.00	43.00	3067.20	3049.01	3048.01	1.00	18.19
399+50.00	43.00	3071.49	3044.44	3043.44	1.00	27.05
400+00.00	43.00	3072.28	3040.23	3039.23	1.00	32.05
400+50.00	43.00	3059.43	3036.47	3035.47	1.00	22.96
401+00.00	43.00	3046.12	3032.67	3031.67	1.00	13.45
401+50.00	43.00	3053.75	3028.97	3027.97	1.00	24.78
402+00.00	43.00	3056.41	3025.39	3024.39	1.00	31.02
402+50.00	43.00	3049.70	3021.93	3020.93	1.00	27.77
403+00.00	43.00	3044.09	3018.56	3017.56	1.00	25.53
403+50.00	43.00	3038.02	3015.76	3014.76	1.00	22.26
404+00.00	42.96	3031.63	3013.76	3012.76	1.00	17.87
404+50.00	41.00	3023.17	3010.61	3009.61	1.00	12.56
405+00.00	38.24	3022.84	3007.85	3006.85	1.00	14.99
405+50.00	35.48	3011.81	3005.09	3004.09	1.00	6.72
406+00.00	33.50	3005.36	3002.44	3001.44	1.00	2.92
406+50.00	33.50	3013.35	2999.67	2998.67	1.00	13.68
407+00.00	33.50	3009.00	2996.64	2995.64	1.00	12.36
407+50.00	33.50	3003.74	2993.09	2992.09	1.00	10.65
408+00.00	33.50	2991.39	2989.56	2988.56	1.00	1.83
408+04.26	33.50	2989.26	2989.26	0.00	1.00	33.50

ALL MEASUREMENTS IN FEET

PREPARED BY: R. KRAL DATE: 7/13/2022
 REVIEWED BY: M. BREWER DATE: 7/13/2022

SOIL NAIL RETAINING WALL #19A & #19B - TIER 2

STA. -L-	OFFSET FROM -L- (LT)	ELEV. @ TOP OF WALL	BOW PROPOSED FINISHED GRADE ELEV.	TOP OF LEVELING PAD ELEV.	ESTIMATED WALL EMBEDMENT	WALL DESIGN HEIGHT "H ₂ "
377+96.59	67.00	3135.38	3129.38	3128.38	1.00	6.00
378+00.00	67.00	3137.09	3131.09	3130.09	1.00	6.00
378+20.00	67.00	3147.09	3135.67	3134.67	1.00	11.42
378+50.00	67.00	3156.35	3137.25	3136.25	1.00	19.10
379+00.00	67.00	3164.30	3139.69	3138.69	1.00	24.61
379+50.00	68.23	3170.52	3141.79	3140.79	1.00	28.73
380+00.00	69.76	3174.38	3143.64	3142.64	1.00	30.74
380+50.00	70.50	3177.74	3145.31	3144.31	1.00	32.43
382+30.00	70.50	3180.46	3149.58	3148.58	1.00	30.88
382+50.00	70.50	3180.36	3149.87	3148.87	1.00	30.49
383+00.00	68.73	3178.69	3150.56	3149.56	1.00	28.13
383+50.00	66.72	3177.51	3151.33	3150.33	1.00	26.18
384+00.00	66.50	3177.26	3151.91	3150.91	1.00	25.35
384+50.00	66.50	3175.07	3152.24	3151.24	1.00	22.83
385+00.00	66.50	3170.34	3152.32	3151.32	1.00	18.02
385+50.00	66.50	3168.91	3152.06	3151.06	1.00	16.85
386+00.00	66.23	3169.58	3151.57	3150.57	1.00	18.01
386+50.00	65.84	3169.83	3150.84	3149.84	1.00	18.99
387+00.00	65.45	3171.18	3149.86	3148.86	1.00	21.32
387+50.00	65.06	3167.21	3148.64	3147.64	1.00	18.57
388+00.00	64.67	3161.20	3147.26	3146.26	1.00	13.94
388+50.00	64.68	3156.13	3145.67	3144.67	1.00	10.46
388+60.00	64.20	3155.43	3145.33	3144.33	1.00	10.10
388+69.50	64.13	3150.69	3144.69	3143.69	1.00	6.00

ALL MEASUREMENTS IN FEET

GEOTECHNICAL ENGINEER

ROBERT E. KRAL

ENGINEER

DocuSigned by:

 8AD70B2A84AF4

7/14/2022

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 UNLESS ALL SIGNATURES COMPLETED

PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 RETAINING WALL #19A: -L- 376+65, 45'-56' LT TO 380+50, 48.5'-70.5' LT
 RETAINING WALL #19B: -L- 382+30, 48.5'-70.5' LT TO 408+04, 33.5' LT
 SHEET 7 OF 11

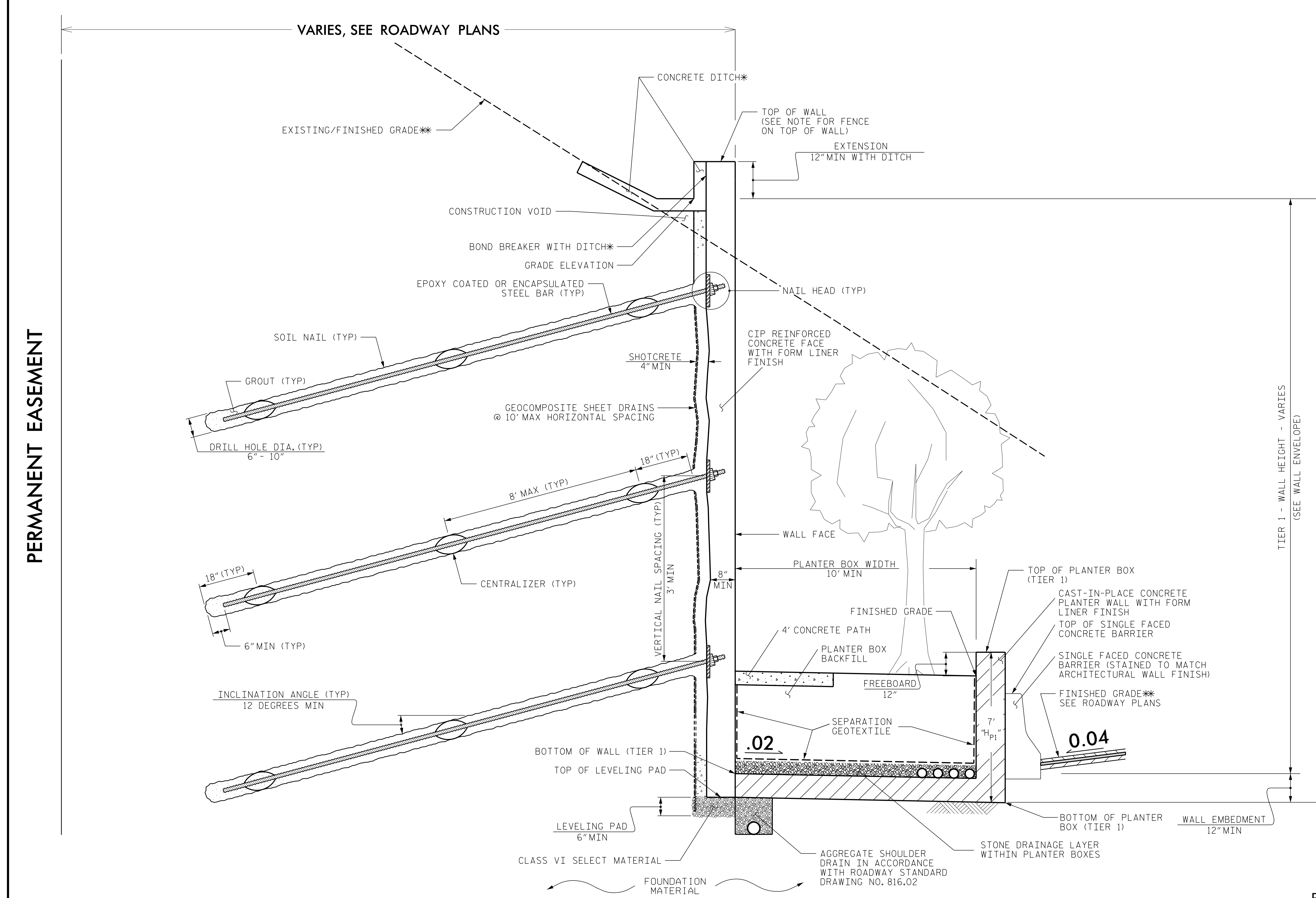
Prepared in the Office of:

**CAROLINAS
 GEOTECHNICAL
 GROUP**
 2400 CROWNPPOINT EXECUTIVE DRIVE
 SUITE 800
 CHARLOTTE, NC 28227
 (980) 339-8684

**NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS**

**GEOTECHNICAL
 ENGINEERING UNIT**

REVISIONS						SHEET NO. W19-7
NO.	BY	DATE	NO.	BY	DATE	
1			3			
2			4			



PERMANENT EASEMENT

GEOTECHNICAL ENGINEER SEAL 042642 ROBERT E. KRAL	ENGINEER SIGNATURE _____ DATE _____
DocuSigned by: SIGNATURE DATE 7/14/2022	SIGNATURE DATE
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SINGLE TIERED WALL - TYPICAL SECTION

*SEE CONCRETE DITCH BEHIND WALL DETAILS.
*SEE PLANS FOR FINISHED GRADE.

PROJECT NO.: A-0009CB
GRAHAM COUNTY
RETAINING WALL #19A: -L- 376+65, 45'-56' LT TO 380+50, 48.5'-70.5' LT
RETAINING WALL #19B: -L- 382+30, 48.5'-70.5' LT TO 408+04, 33.5' LT
SHEET 9 OF 11

PREPARED BY: R. KRAL	DATE: 7/13/2022
REVIEWED BY: M. BREWER	DATE: 7/13/2022


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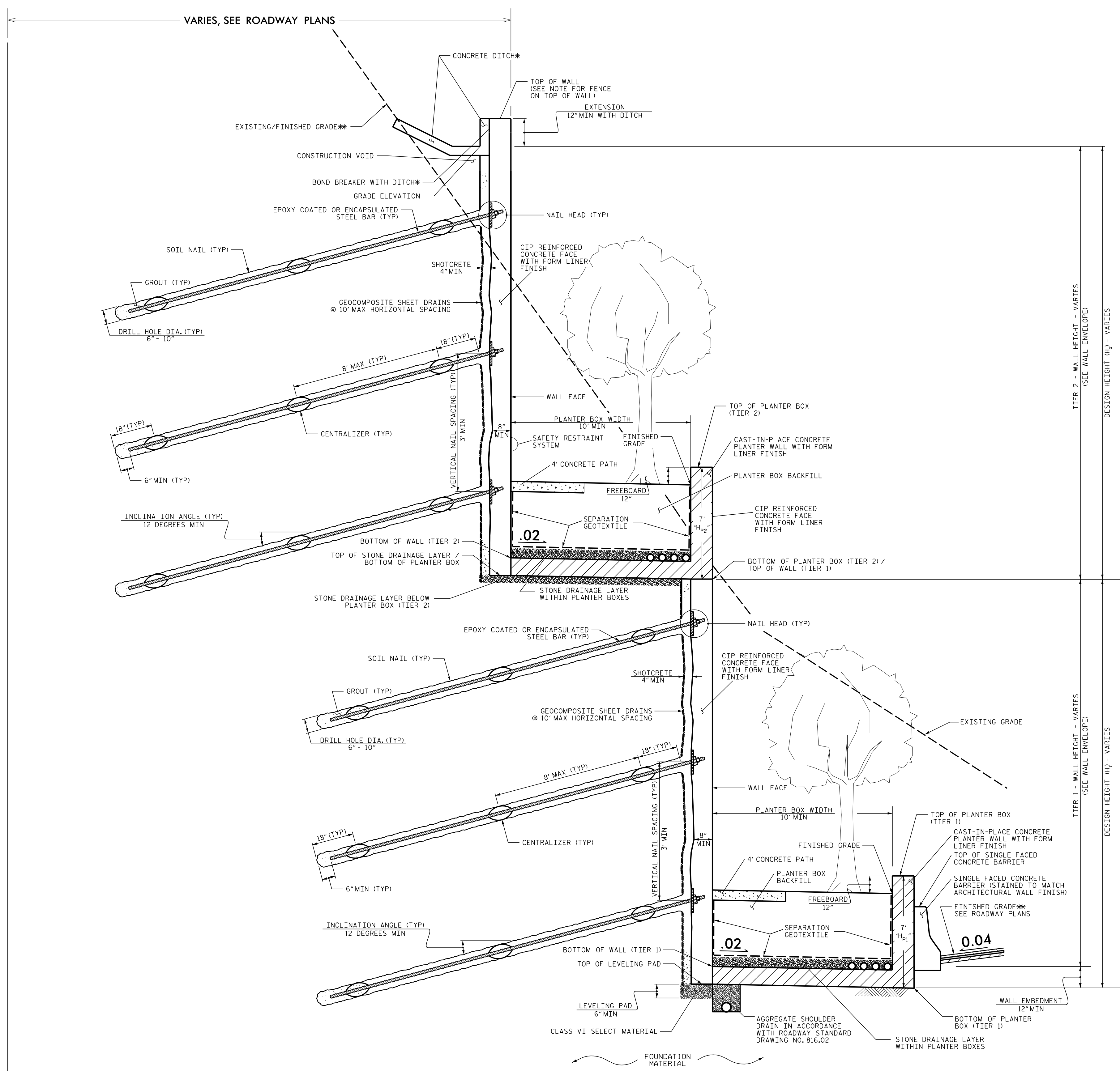
**NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS**

**GEOTECHNICAL
ENGINEERING UNIT**

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W19-9
2			4			

GEOTECHNICAL ENGINEER  SEAL 042642 ROBERT E. KRAL	ENGINEER DATE: 7/14/2022 SIGNATURE: _____
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PERMANENT EASEMENT



NOTES:

- FOR SOIL NAIL RETAINING WALLS, SEE TIERED SOIL NAIL RETAINING WALLS SPECIAL PROVISION.
- FOR TIERED SOIL NAIL RETAINING WALLS, SEE TIERED SOIL NAIL RETAINING WALLS SPECIAL PROVISION.
- FOR SINGLE FACED PRECAST CONCRETE BARRIER (STAINED), SEE ROADWAY PLANS, SECTION 857 OF THE STANDARD SPECIFICATION, AND SIMULATED STONE FORM LINER FINISH SPECIAL PROVISION.
- RETAINING WALL #9 HAS A SADDLE THAT REQUIRES A DRAINAGE STRUCTURE BE INSTALLED BEHIND THE WALL. SEE ROADWAY AND HYDRAULIC PLANS FOR STRUCTURE TYPE AND LOCATION.
- FOR PLANTER BOX, SEE TIERED SOIL NAIL RETAINING WALLS SPECIAL PROVISION.
- FOR SAFETY RESTRAINT SYSTEM, SEE TIERED SOIL NAIL RETAINING WALLS SPECIAL PROVISION.
- A FORM LINER ARCHITECTURAL FINISH IS REQUIRED FOR THE CIP REINFORCED CONCRETE FACE FOR RETAINING WALL #9A, #9B, PLANTER BOXES, AND SLOPE PROTECTION. THE CONTRACTOR SHALL PROVIDE THE REQUESTED FINISH BEFORE BEGINNING CIP REINFORCED CONCRETE FACE CONSTRUCTION. THE APPEARANCE (STONE SIZE AND SHAPE, STONE COLOR, AND STONE TEXTURE, PATTERN, AND RELIEF) SHOULD MATCH NATURAL STONE AND ROCK. FOR FORM LINER ARCHITECTURAL FINISH, SEE THE SIMULATED STONE FORM LINER FINISH SPECIAL PROVISION.
- BEFORE BEGINNING SOIL NAIL WALL DESIGN FOR RETAINING WALL #9A AND #9B, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.
- DESIGN RETAINING WALL #9A AND #9B FOR THE FOLLOWING:
 - 1) DESIGN HEIGHT (H) = WALL HEIGHT + WALL EMBEDMENT
 - 2) DESIGN LIFE = 75 YEARS
 - 3) MINIMUM WALL EMBEDMENT ELEVATION = VARIES (MIN. 1 FT BELOW FINISHED GRADE ELEVATION)
 - 4) IN-SITU ASSUMED DENSE RESIDUAL SOIL PARAMETERS:
 - UNIT WEIGHT, $\gamma = 125$ PCF
 - FRICTION ANGLE, $\phi = 36$ DEGREES
 - COHESION, $c = 0$ PSF
 - 5) IN-SITU ASSUMED WEATHERED ROCK (META-SANDSTONE) PARAMETERS:
 - UNIT WEIGHT, $\gamma = 135$ PCF
 - FRICTION ANGLE, $\phi = 32$ DEGREES
 - COHESION, $c = 500$ PSF
 - 6) IN-SITU ASSUMED CRYSTALLINE ROCK (META-SANDSTONE) PARAMETERS:
 - UNIT WEIGHT, $\gamma = 170$ PCF
 - FRICTION ANGLE, $\phi = 34$ DEGREES
 - COHESION, $c = 1,000$ PSF
- 7) WHERE ROCK IS ENCOUNTERED IN THE WALL ENVELOPE, DESIGNERS SHOULD REFER TO THE FHWA PRESUMPTIVE STRENGTH PARAMETERS OR OTHER REPRESENTATIVE AND REPEATABLE VALUES AND PROVIDE SOURCE REFERENCES IN THEIR DESIGN SUBMITTAL.
- WHEN ANALYZING FOR INFINITE SLOPE CONDITIONS, DESIGNERS SHOULD ANALYZE UP TO TWO (2) TIMES THE WALL HEIGHT BEHIND THE WALL FACE FOR FAILURE PLANE SEARCHES. THIS INFORMATION SHOULD BE INCLUDED WITH THE DESIGN SUBMITTAL.
- EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH SOIL NAILS FOR RETAINING WALL #9A AND #9B.
- THE PROPOSED RIGHT OF WAY (ROW) AND PERMANENT EASEMENT (PE) BOUNDARY VARIES FROM THE FACE OF RETAINING WALL #9A AND #9B. SEE THE ROADWAY PLANS FOR OFFSET DISTANCES FROM THE FACE OF RETAINING WALL #9A AND #9B. SOIL NAILS MAY NOT BE INSTALLED BEYOND THE PE BOUNDARY. SEE TYPICAL SECTIONS ON SHEET W19-8, W19-9, AND W19-10.
- IF GROUNDWATER IS ENCOUNTERED BEHIND THE FACE OF RETAINING WALL #9A AND #9B, HORIZONTAL DRAINS MAY BE REQUIRED AS DIRECTED BY THE ENGINEER. FOR HORIZONTAL DRAINS, SEE THE RETAINING WALL HORIZONTAL DRAIN DETAIL.
- WHERE ROCK IS PRESENT IN THE WALL ENVELOPE, CONTROLLED BLASTING IS RECOMMENDED, BUT NOT REQUIRED, TO MAINTAIN THE NEAT EXCAVATION LINE. VOIDS, RESULTING FROM BLASTING OR EXCAVATING, THAT EXTEND BEYOND THE NEAT LINES ARE TO BE FILLED WITH A COMBINATION OF SHORT SOIL NAILS, WELDED WIRE, AND SHOTCRETE, AT THE DISCRETION OF THE ENGINEER. THE COSTS ASSOCIATED WITH THIS WORK WILL BE CONSIDERED INCIDENTAL TO WALL CONSTRUCTION AND NO ADDITIONAL COMPENSATION WILL BE MADE. FOR BLASTING, SEE THE BLASTING PROVISION.
- WHERE CONSTRUCTION VOIDS EXIST ALONG THE TOP OF RETAINING WALL CONTRACTOR SHOULD BE PREPARED TO FORM THE CANTILEVERED SECTION OF THE CIP REINFORCED CONCRETE FACE TO THE TOP OF WALL ELEVATION. THE CONSTRUCTION VOID SHOULD BE FILLED WITH CONCRETE OR SHOTCRETE PRIOR TO CONSTRUCTION OF THE CONCRETE FACE. THE WALL FACE REINFORCEMENT OR SOIL NAILS MAY BE REQUIRED FOR TALLER THAN TYPICAL CANTILEVER FACE HEIGHTS.
- FOR LAND BRIDGE PERMANENT SHORING, SEE SOIL NAIL WALLS SPECIAL PROVISION.
- A CAST-IN-PLACE CONCRETE WALL IS REQUIRED WITHIN PLANTER BOX (TIER 1) AND PANTER BOX (TIER 2) AT STATION -L- 376+73.59 AND 378+07.86, RESPECTIVELY.
- SLOPE PROTECTION WITH FORM LINER ARCHITECTURAL FINISH IS REQUIRED IN PLANTER BOX (TIER 1) AND PLANTER BOX (TIER 2) FROM STATION -L- 376+65.00 TO 376+73.59 AND 377+78.29 TO 378+07.86, RESPECTIVELY. FOR SLOPE PROTECTION, SEE SECTION 462 OF THE STANDARD SPECIFICATIONS.

DOUBLE TIERED WALL - TYPICAL SECTION

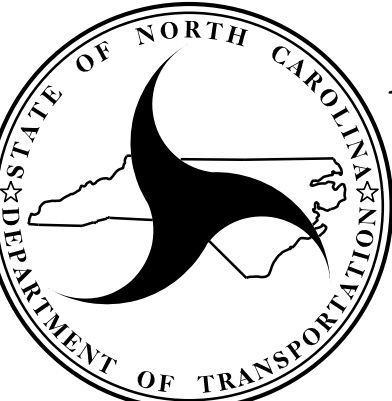
*SEE CONCRETE DITCH BEHIND WALL DETAILS.
 **SEE PLANS FOR FINISHED GRADE.

PREPARED BY: R. KRAL	DATE: 7/13/2022
REVIEWED BY: M. BREWER	DATE: 7/13/2022

Prepared in the Office of:



**CAROLINAS
GEOTECHNICAL
GROUP**
 2400 CROWNPPOINT EXECUTIVE DRIVE
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 CHARLOTTE, NC 28227
 (980) 339-8684



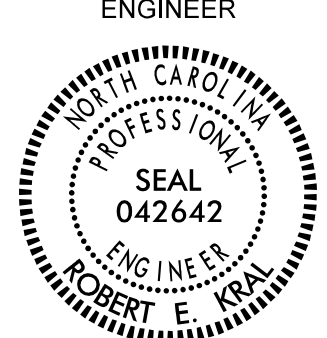
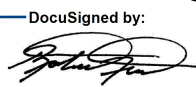
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DIVISION OF HIGHWAYS**

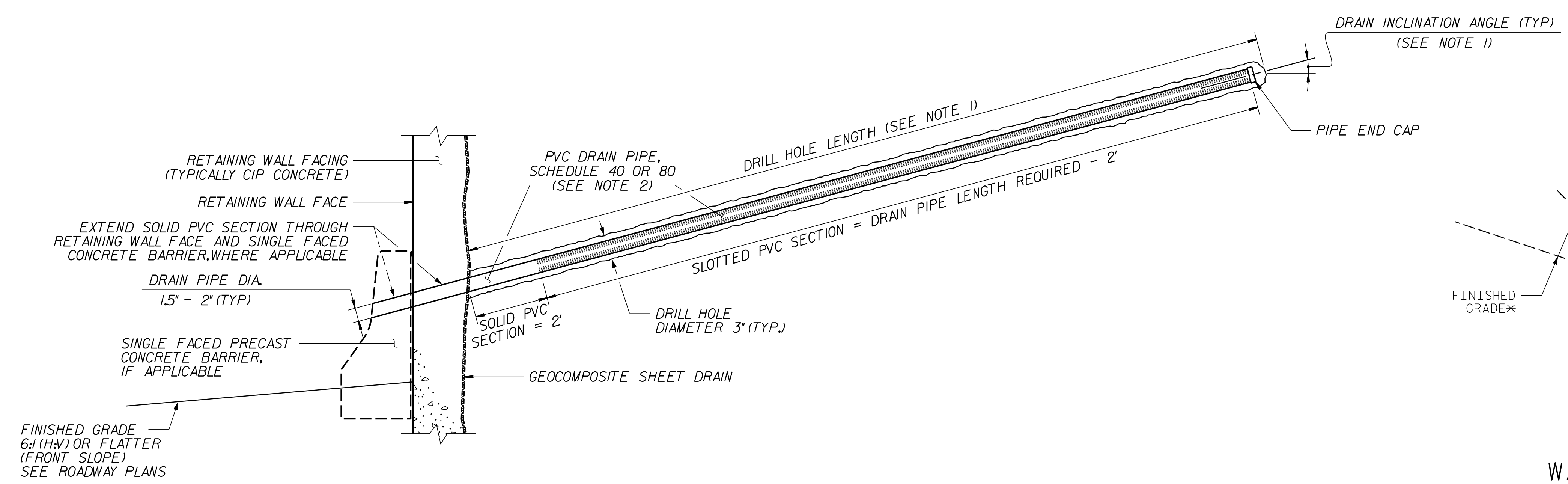
**GEOTECHNICAL
ENGINEERING UNIT**

**RETAINING WALL #19A & #19B
TIERED SOIL NAIL RETAINING WALL**

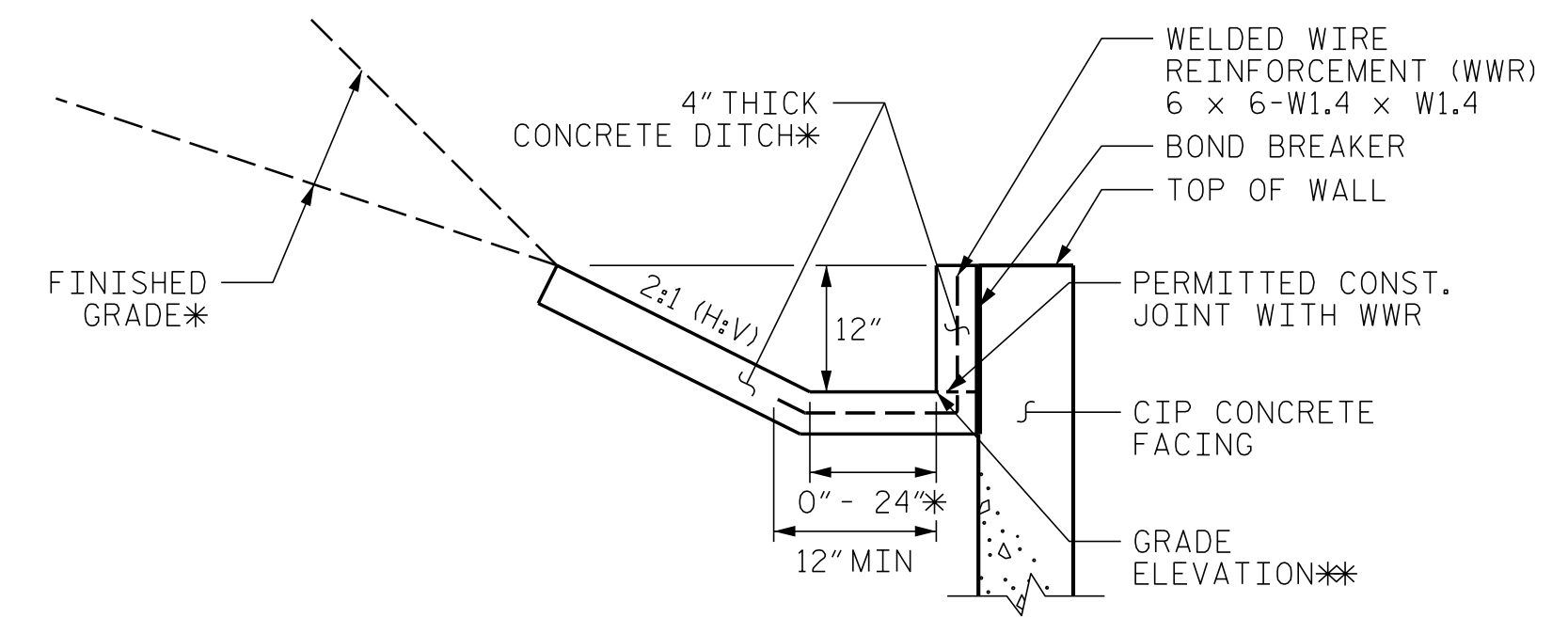
REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W19-10
2			4			

PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 RETAINING WALL #19A: -L- 376+65, 45'-56' LT TO 380+50, 48.5'-70.5' LT
 RETAINING WALL #19B: -L- 382+30, 48.5'-70.5' LT TO 408+04, 33.5' LT
 SHEET 10 OF 11

GEOTECHNICAL ENGINEER  SEAL 042642 ROBERT E. KRAL	ENGINEER _____ SIGNATURE DATE
DocuSigned by:  7/14/2022	_____ SIGNATURE DATE
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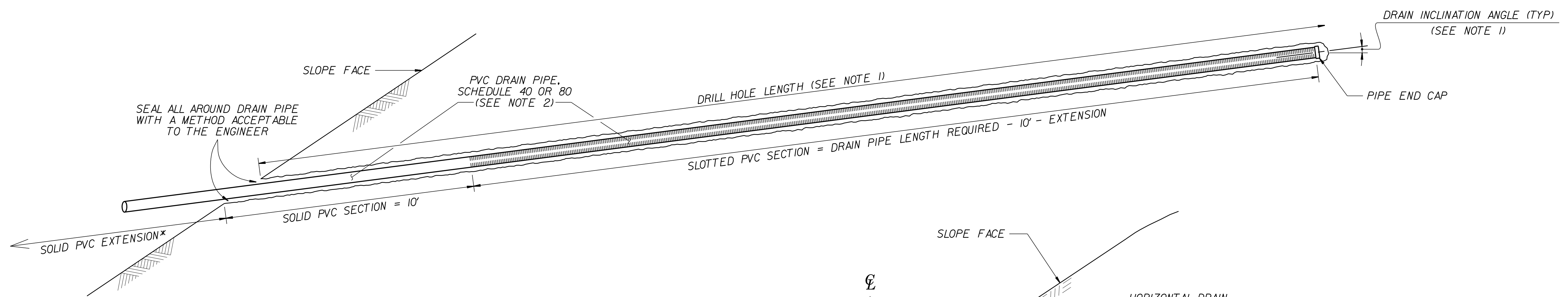


RETAINING WALL HORIZONTAL DRAIN



CONCRETE DITCH BEHIND WALL WITH CONCRETE FACING

*SEE ROADWAY PLANS FOR CONCRETE DITCH AND FINISHED GRADE DETAILS.
**SEE WALL ENVELOPE FOR GRADE ELEVATIONS.



SLOPE HORIZONTAL DRAIN

*EXTEND SOLID PVC SECTION TO CONNECT PIPE TO A DRAINAGE SYSTEM OR DISCHARGE WATER AS DIRECTED

EXAMPLE CROSS-SECTION WITH SLOPE HORIZONTAL DRAIN
*SEE NOTE 1 FOR DRAIN ELEVATIONS ABOVE (OR BELOW) GRADE

NOTES:

- SEE ROADWAY SUMMARY SHEETS FOR APPROXIMATE KNOWN HORIZONTAL DRAIN LOCATIONS, ELEVATIONS, INCLINATION AND LENGTHS. ADDITIONAL DRAINS MAY BE REQUIRED AS DETERMINED BY THE ENGINEER.
- DRAIN PIPES MAY BE OMITTED FOR SOME HORIZONTAL DRAINS. SEE ROADWAY SUMMARY SHEETS FOR DRAIN PIPE REQUIREMENTS INCLUDING THOSE DRAINS WITHOUT PIPES.
- FOR HORIZONTAL DRAINS, SEE HORIZONTAL DRAINS SPECIAL PROVISION (GT-12).


PROJECT NO.: A-0009CB
GRAHAM COUNTY
RETAINING WALL #19A: -L- 376+65, 45'-56' LT TO 380+50, 48.5'-70.5' LT
RETAINING WALL #19B: -L- 382+30, 48.5'-70.5' LT TO 408+04, 33.5' LT
SHEET 11 OF 11

PREPARED BY: R. KRAL	DATE: 7/13/2022
REVIEWED BY: M. BREWER	DATE: 7/13/2022

Prepared in the Office of:



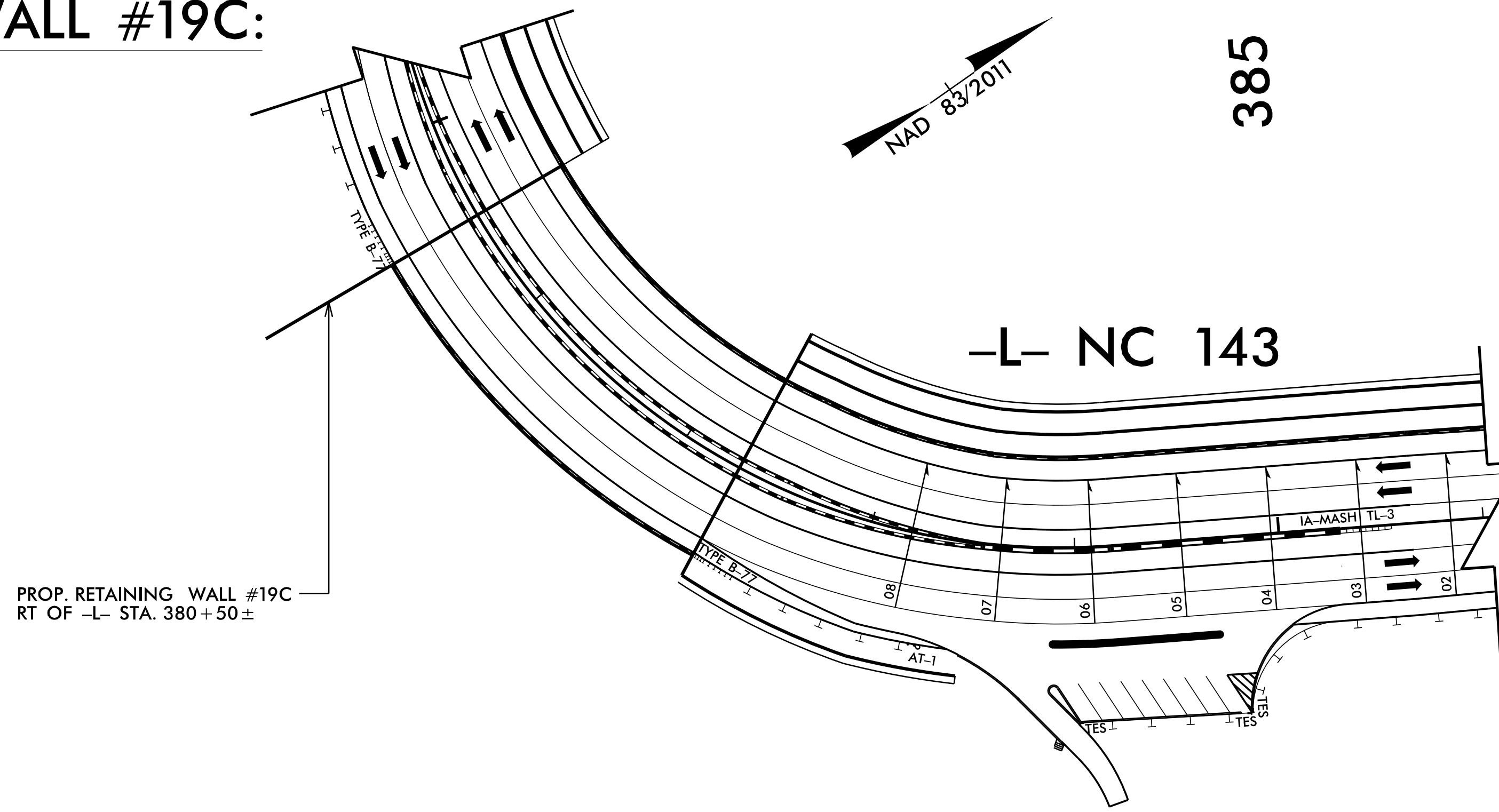
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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W19-11
2			4			

RETAINING WALL #19C:

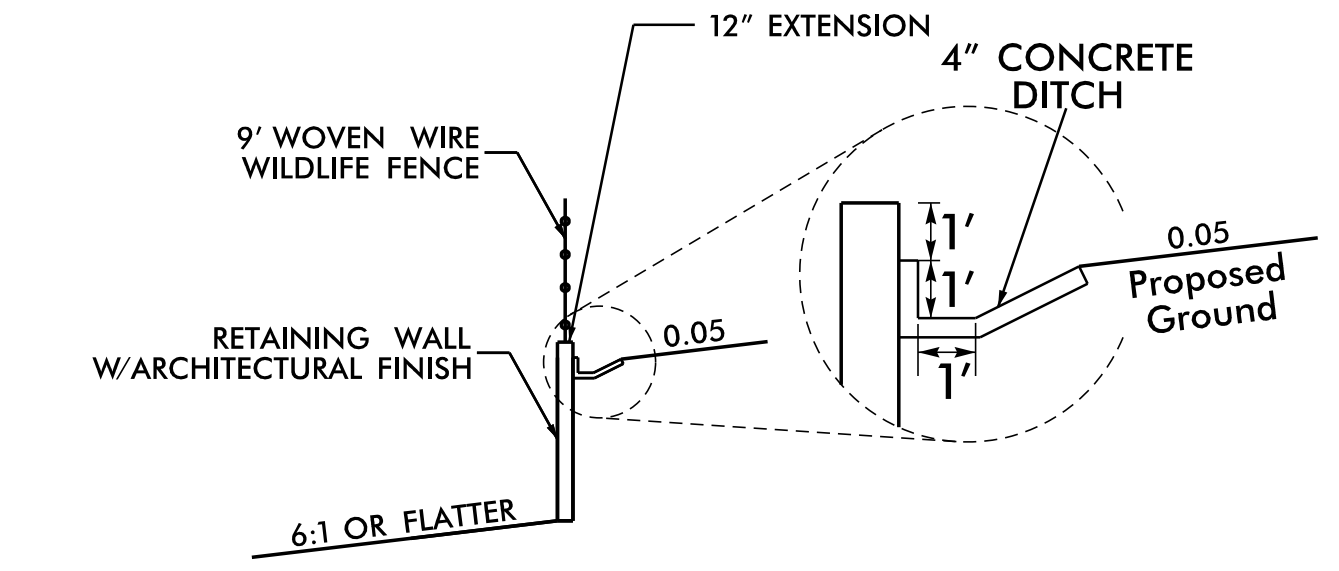


PROP. RETAINING WALL #19C
RT OF -L- STA. 380+50±

RETAINING WALL #19C - PLAN

NOT TO SCALE

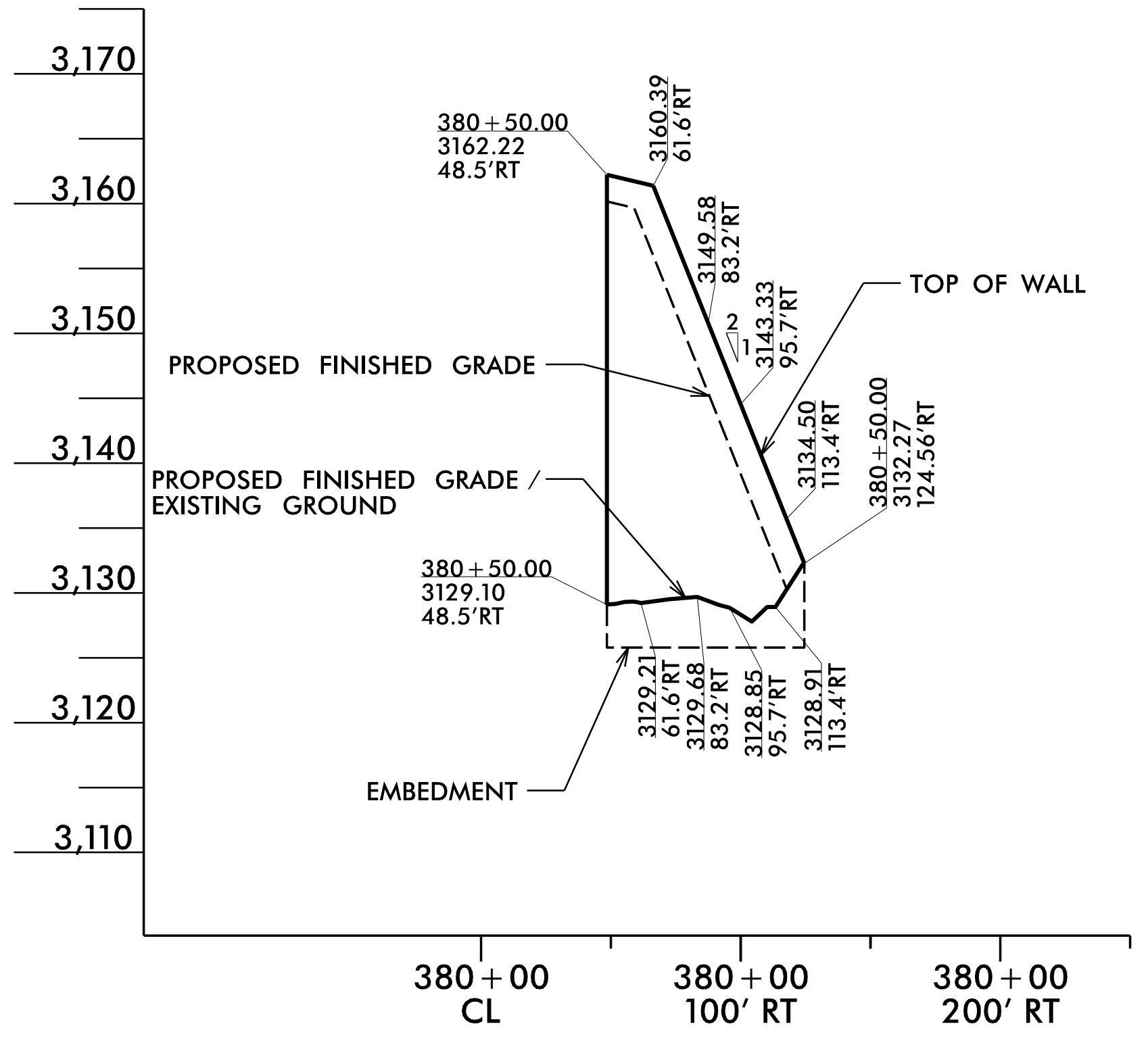
GEOTECHNICAL ENGINEER SEAL 042642 ROBERT E. KRAL	ENGINEER
DocuSigned by: SIGNATURE	7/14/2022 DATE
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DETAIL FOR WALL #19C
NOT TO SCALE
-L- 380+50, 48.5' RT TO 380+50, 120.3' RT

ESTIMATED MSE RETAINING WALL QUANTITIES	
MSE RETAINING WALLS	1,870 * SF
SIMULATED STONE FORM LINER SYSTEM AND SURFACE FINISH	1,600 SF

* INCLUDES RETAINING WALL EMBEDMENT



RETAINING WALL #19C - ENVELOPE

NOT TO SCALE
(LOOKING AT FACE OF WALL)

RETAINING WALL #19C					
STA. -L-	OFFSET FROM -L- (RT) FT.	ELEV. @ TOP OF WALL FT.	* PROPOSED FINISHED GRADE FT.	* EXPOSED WALL HEIGHT FT.	** DESIGN WALL HEIGHT "H" FT.
380+00.00	48.50	3162.22	3129.10	33.12	34.44
380+00.00	61.60	3160.39	3129.21	31.18	32.61
380+00.00	83.20	3149.58	3129.68	19.90	21.80
380+00.00	95.70	3143.33	3128.85	14.48	15.55
380+00.00	113.40	3134.50	3128.91	5.59	6.72
380+00.00	124.56	3132.27	3132.27	0.00	2.99

* ELEVATION @ PROPOSED FINISHED GRADE AND EXPOSED WALL HEIGHT DO NOT INCLUDE EMBEDMENT DEPTH
 ** FOR DESIGN WALL HEIGHT "H" AND ADDITIONAL CONSTRUCTION DETAILS SEE MECHANICALLY STABILIZED EARTH RETAINING WALL DETAILS ON SHEET 2 OF 2

PROJECT NO.: A-0009CB
 GRAHAM COUNTY
 RETAINING WALL #19C: -L- 380+50, 48.5' RT TO 380+50, 124.6' RT
 SHEET 1 OF 2

PREPARED BY: R. KRAL
 DATE: 7/14/2022
 REVIEWED BY: M. BREWER
 DATE: 7/14/2022
 RETAINING WALL #19C ENVELOPE AND WALL LAYOUT PROVIDED BY TGS ENGINEERS, INC.

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
 2400 CROWNPOINT EXECUTIVE DRIVE
 SUITE 800
 CHARLOTTE, NC 28227
 (980) 339-8684

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #19C MECHANICALLY STABILIZED EARTH RETAINING WALL WITH CAST-IN-PLACE CONCRETE FACE					
REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W19C-1