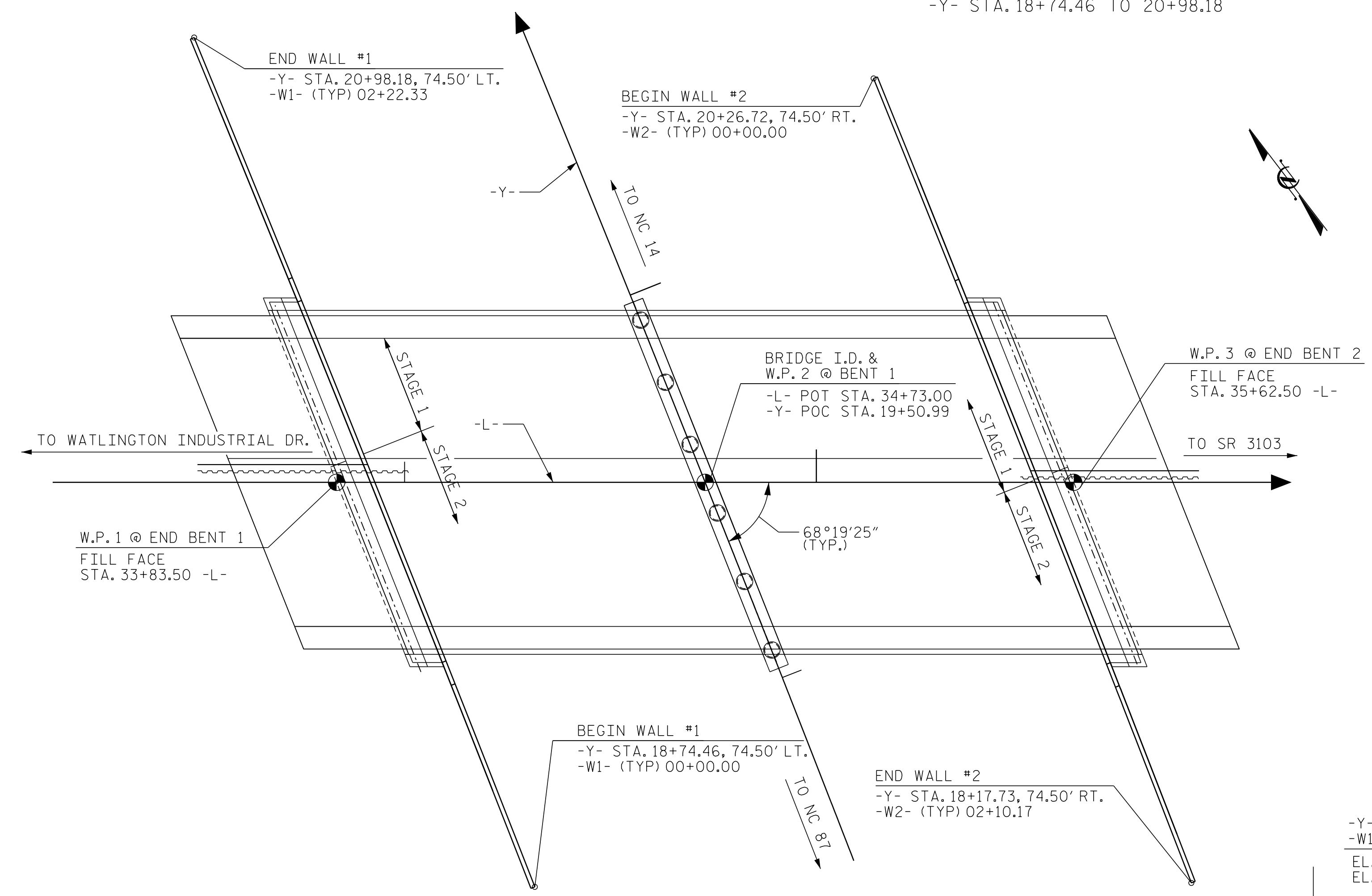
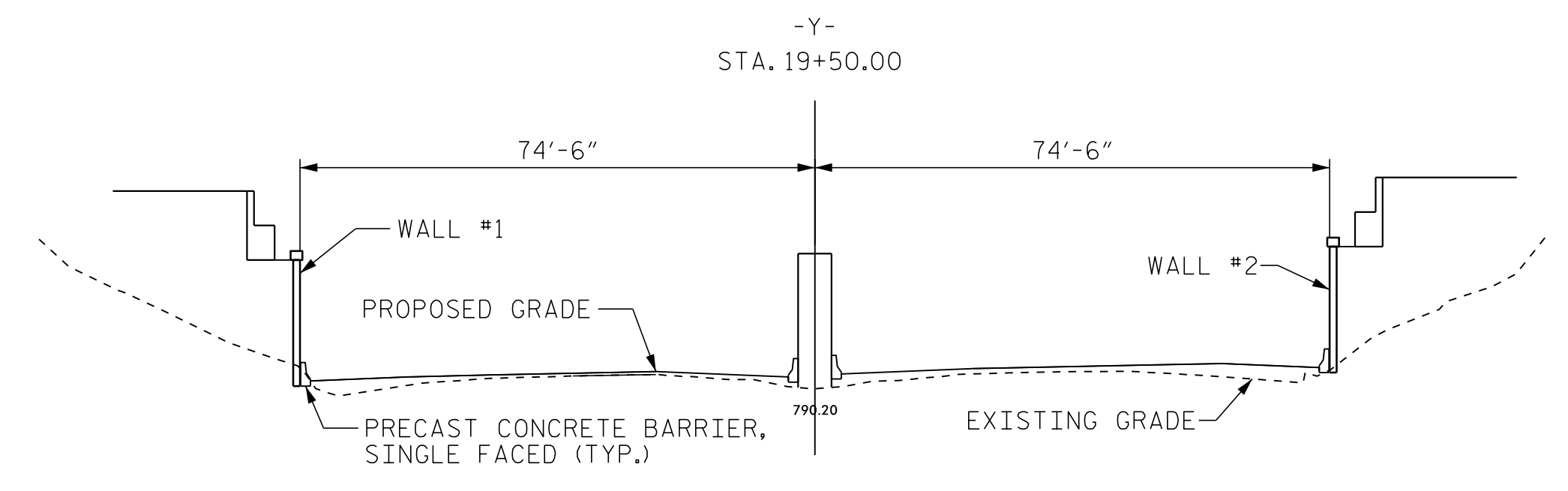


# RETAINING WALL NO. 1

-Y- STA. 18+74.46 TO 20+98.18

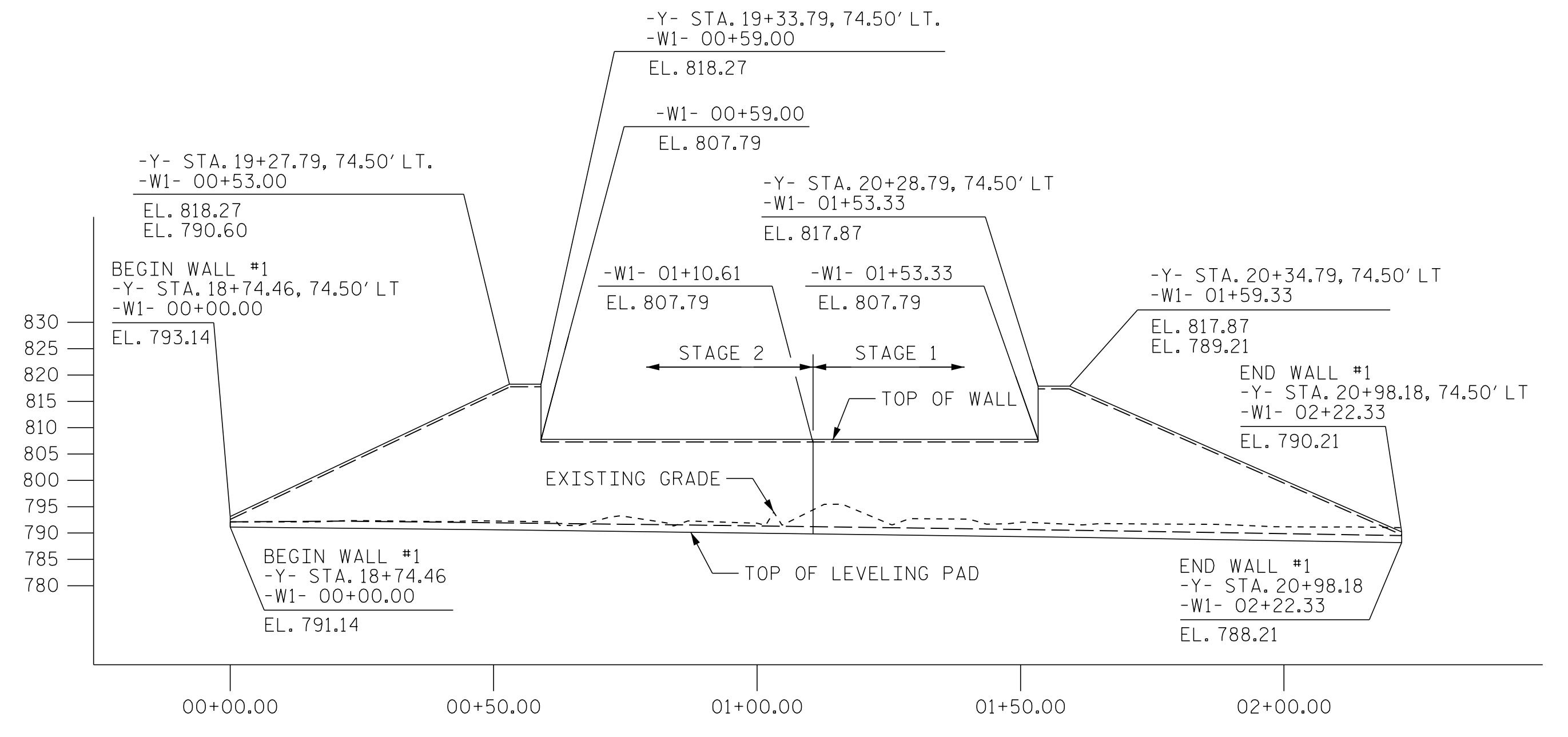


PLAN VIEW




TYPICAL SECTION AT STA. 19+50

ESTIMATED MSE WALL QUANTITY (SQUARE FEET)	
MSE RETAINING WALL NO. 1	3790 SF



WALL #1 ENVELOPE (AT END BENT 1)  
(LOOKING AT FRONT FACE OF WALL)

GEOTECHNICAL ENGINEER  SEAL 052709 ENGINEER MATTHEW MARK LATTIN	ENGINEER     SIGNATURE _____ DATE _____
Documented by: <i>Matthew Mark Lattin</i> DATE: 02/16/2023 SIGNATURE _____ DATE _____	
<b>DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED</b>	

PROJECT NO.: BR-0041  
 ROCKINGHAM COUNTY  
 STATION: -Y- STA. 18+74.46 TO 20+98.18  
 SHEET 1 OF 3

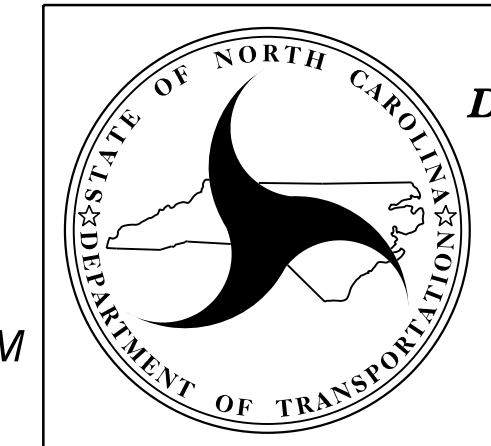
REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

## RETAINING WALL NO. 1 PLAN VIEW AND WALL ENVELOPE

PREPARED BY: C.R. PASTRANA      DATE: 02/2023  
 REVIEWED BY: M.M. LATTIN      DATE: 02/2023



ESP ASSOCIATES, INC.  
 7011 ALBERT PICK RD  
 SUITE E  
 GREENSBORO, NC 27409  
 FIRM # C-0587  
 WWW.ESPASSOCIATES.COM



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

SHEET NO.  
W-1

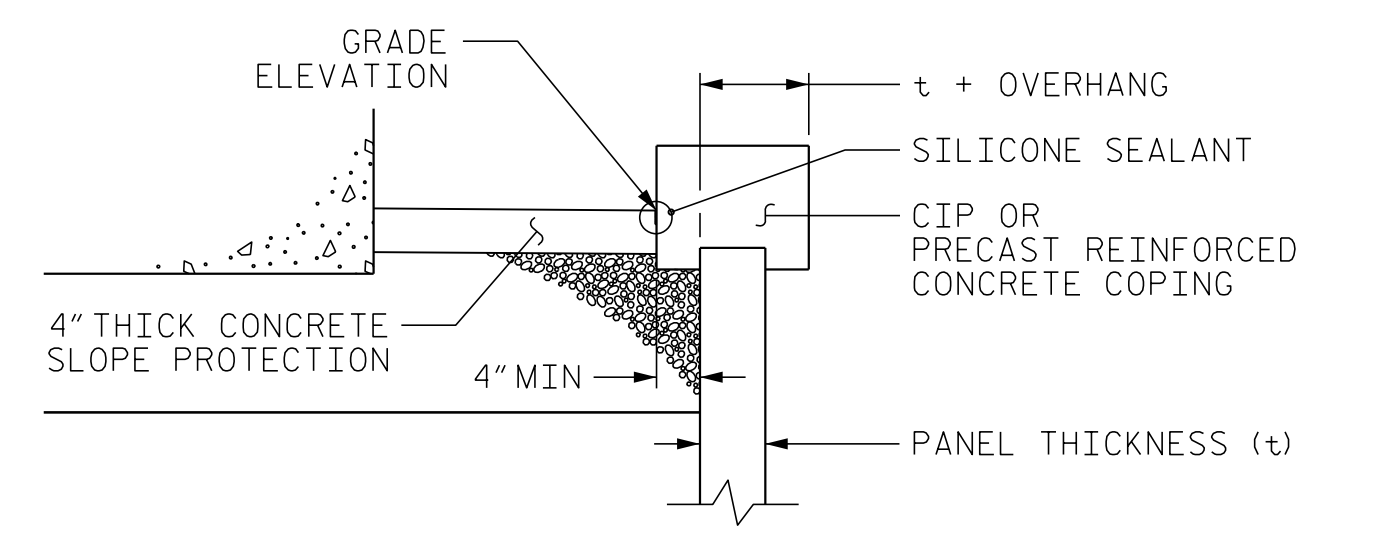
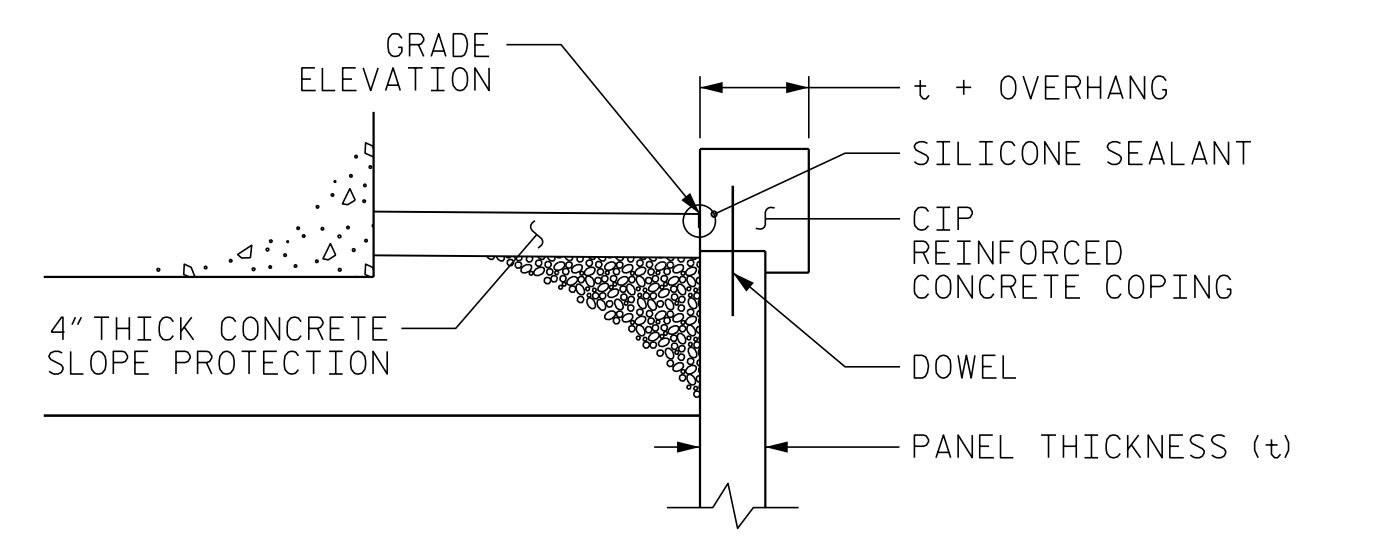
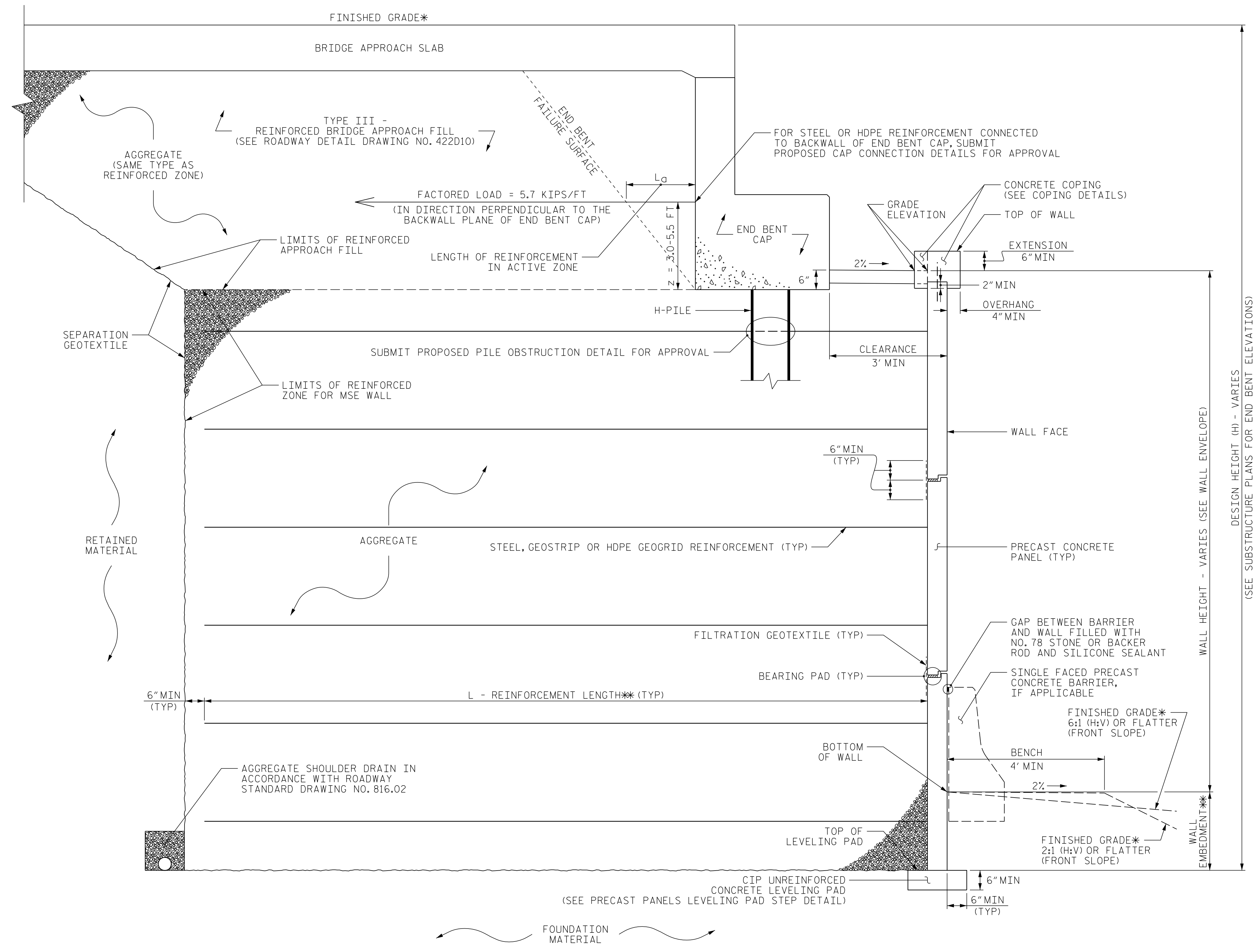
GEOTECHNICAL ENGINEER

ENGINEER

SEAL 052709

DATE: 02/16/2023

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



**COPING DETAILS**

AT THE CONTRACTOR'S OPTION, CONNECT COPING TO PANELS WITH DOWELS OR EXTEND COPING DOWN BACK OF PANELS.

**MSE ABUTMENT 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.

PROJECT NO.: BR-0041  
 ROCKINGHAM COUNTY  
 STATION: -Y- STA. 18+74.46 TO 20+98.18  
 SHEET 2 OF 3

**RETAINING WALL NO. 1  
 TYPICAL & COPING  
 DETAILS**

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

PREPARED BY: C.R. PASTRANA DATE: 02/2023  
 REVIEWED BY: M.M. LATTIN DATE: 02/2023

**ESP** ASSOCIATES, INC.  
 7011 ALBERT PICK RD  
 SUITE E  
 GREENSBORO, NC 27409  
 FIRM # C-0587  
 WWW.ESPASSOCIATES.COM

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

**GEOTECHNICAL  
 ENGINEERING UNIT**

SHEET NO. W-2

**NOTES:**

FOR MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALLS, SEE MECHANICALLY STABILIZED EARTH RETAINING WALLS PROVISION.  
 FOR TYPE III REINFORCED BRIDGE APPROACH FILL, SEE BRIDGE APPROACH FILLS PROVISION AND ROADWAY DETAIL DRAWING NO. 422D10.  
 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.  
 AT THE CONTRACTOR'S OPTION, USE FINE AGGREGATE IN THE REINFORCED ZONE OF RETAINING WALL NO. 1.  
 A SEPARATION GEOTEXTILE IS REQUIRED AT THE BACK OF THE REINFORCED ZONE FOR RETAINING WALL NO. 1.  
 A DRAIN IS REQUIRED FOR RETAINING WALL NO. 1.  
 BEFORE BEGINNING MSE WALL DESIGN FOR RETAINING WALL NO. 1, 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 NO. 1 FOR THE FOLLOWING:

- 1) DESIGN HEIGHT (H) = WALL HEIGHT + WALL EMBEDMENT
- 2) DESIGN LIFE = 100 YEARS
- 3) MAXIMUM FACTORED VERTICAL PRESSURE = 3.2 KSF
- 4) MINIMUM REINFORCEMENT LENGTH (L) = 0.7H OR 6 FT, WHICHEVER IS LONGER
- 5) MINIMUM EMBEDMENT DEPTH, SEE MECHANICALLY STABILIZED EARTH RETAINING WALLS PROVISION
- 6) REINFORCED ZONE AGGREGATE PARAMETERS:

AGGREGATE TYPE*	UNIT WEIGHT ( $\gamma$ ) PCF	FRICTION ANGLE ( $\phi$ ) DEGREES	COHESION (c) PSF
COARSE	110	38	0
FINE	115	34	0

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

7) IN-SITU ASSUMED MATERIAL PARAMETERS:

MATERIAL TYPE	UNIT WEIGHT ( $\gamma$ ) PCF	FRICTION ANGLE ( $\phi$ ) DEGREES	COHESION (c) PSF
BACKFILL	115	30	0
FOUNDATION	120	30	0

DESIGN RETAINING WALL NO. 1 FOR A LIVE LOAD (TRAFFIC) SURCHARGE.

DESIGN REINFORCEMENT CONNECTED TO END BENT CAPS FOR FACTORED LOAD AND LENGTH OF REINFORCEMENT IN ACTIVE ZONE ( $L_d$ ) SHOWN. CAST REINFORCEMENT OR CONNECTORS INTO CAP BACKWALL FOR END BENT NO. 1 LOCATED AT STATION 33+83.50 -L-.

FOUNDATIONS FOR SIGNS, LIGHTING or SIGNALS MAY BE LOCATED BEHIND RETAINING WALL NO. 1 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 FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH REINFORCEMENT FOR RETAINING WALL NO. 1.

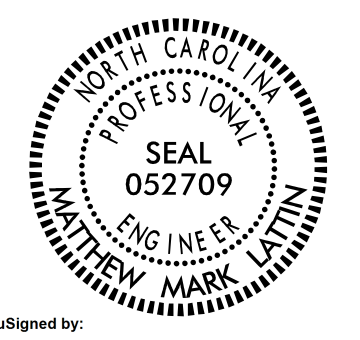
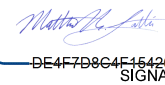
FOUNDATIONS FOR END BENT NO. 1 LOCATED AT STATION 33+83.50 -L- WILL INTERFERE WITH REINFORCEMENT FOR RETAINING WALL NO. 1. SEE "FOUNDATION LAYOUT" SHEET FOR FOUNDATION LOCATIONS.

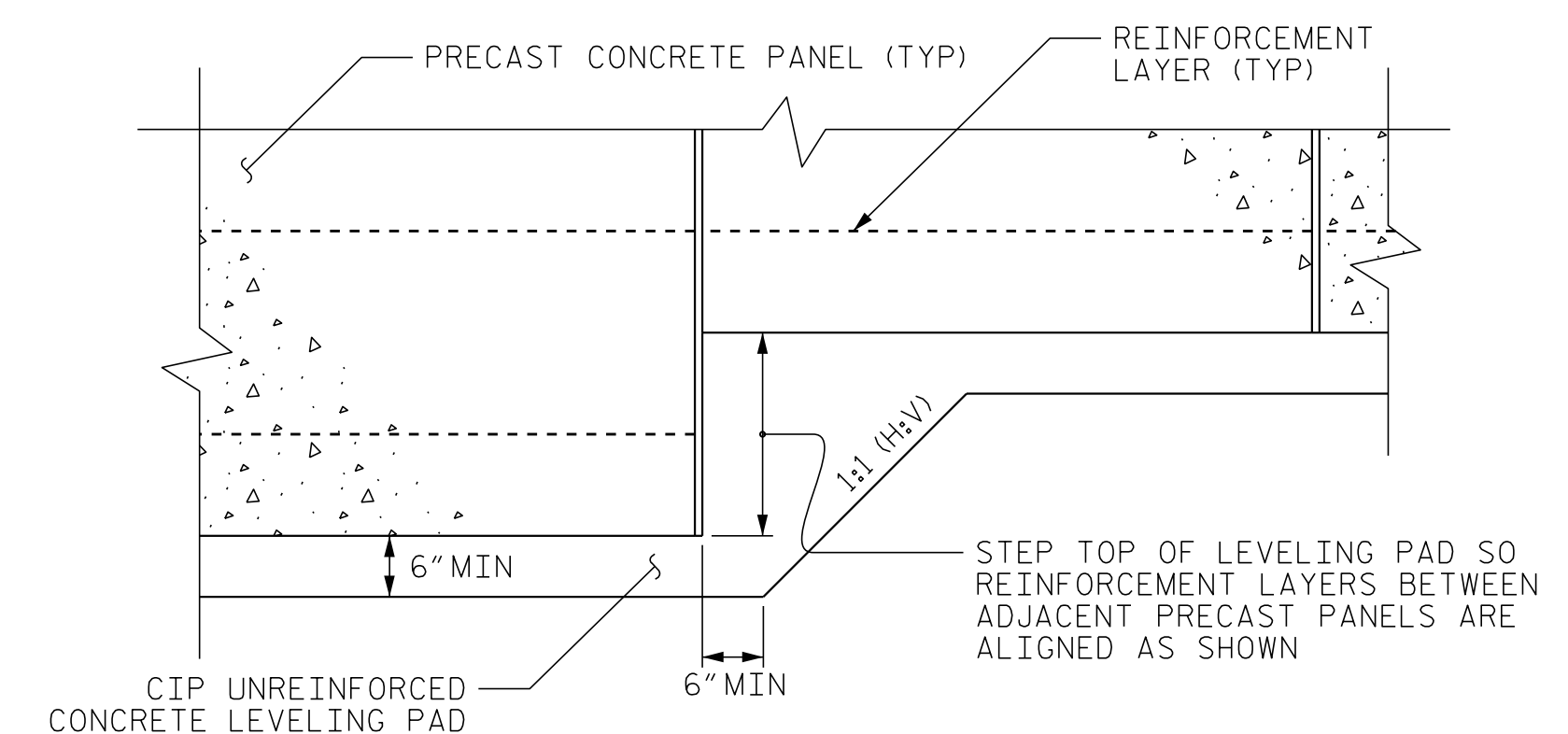
DO NOT PLACE LEVELING PAD CONCRETE, AGGREGATE OR REINFORCEMENT FOR RETAINING WALL NO. 1 UNTIL EXCAVATION DIMENSIONS AND FOUNDATION MATERIAL ARE APPROVED.

"TEMPORARY SHORING" MAY BE REQUIRED FOR RETAINING WALL NO. 1 IN ACCORDANCE WITH THE TEMPORARY SHORING PROVISION. SEE ROADWAY, STRUCTURE or TRAFFIC CONTROL PLANS.

AT THE CONTRACTOR'S OPTION, "TEMPORARY SHORING FOR WALL CONSTRUCTION" MAY BE USED TO CONSTRUCT RETAINING WALL NO. 1. SEE MSE RETAINING WALLS PROVISION FOR TEMPORARY SHORING FOR WALL CONSTRUCTION.

FROM APPROXIMATE -W1- STATION 0+00 TO 0+25 SOFT COHESIVE SOILS AND OVERLYING EXISTING ROADWAY EMBANKMENT FILL SHALL BE UNDERCUT FROM THE FRONT OF THE WALL TOWARDS END BENT 1 A, WIDTH OF APPROXIMATELY 5 FEET AND A DEPTH OF APPROXIMATELY 3 FEET. GEOTEXTILE SHALL BE PLACED AT THE BASE OF THE UNDERCUT. BACKFILL TO FINISHED GRADE WITH COMPACTED FILL.

GEOTECHNICAL ENGINEER   DocuSigned by: 	ENGINEER     DATE: 02/16/2023 SIGNATURE: _____ DATE: _____
<b>DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED</b>	

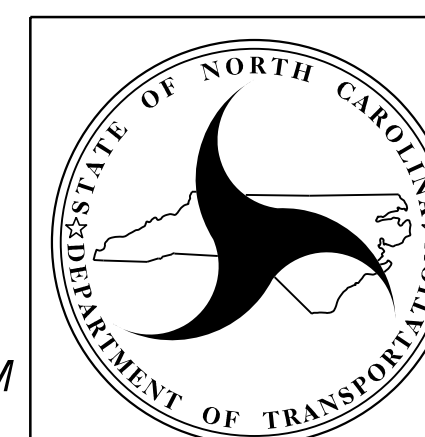


PRECAST PANELS  
LEVELING PAD STEP DETAIL

PROJECT NO.: BR-0041  
 ROCKINGHAM COUNTY  
 STATION: -Y- STA. 18+74.46 TO 20+98.18  
 SHEET 3 OF 3



ESP ASSOCIATES, INC.  
 7011 ALBERT PICK RD  
 SUITE E  
 GREENSBORO, NC 27409  
 FIRM # C-0587  
 WWW.ESPASSOCIATES.COM



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


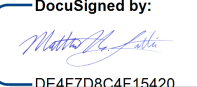
**RETAINING WALL NO. 1  
NOTES & LEVELING PAD  
STEP DETAILS**

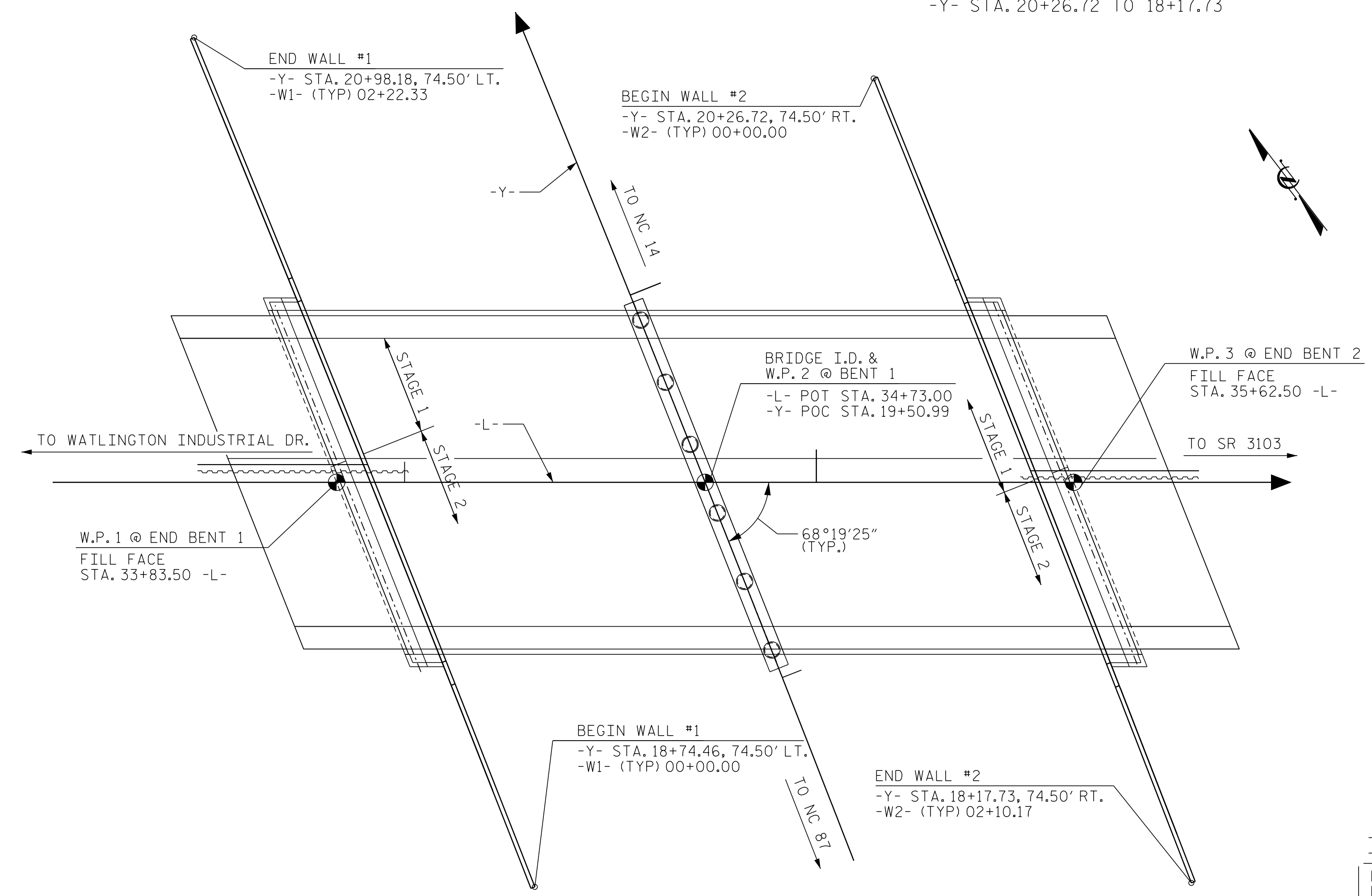
REVISIONS						SHEET NO. W-3
NO.	BY	DATE	NO.	BY	DATE	
1			3			
2			4			

PREPARED BY: C.R. PASTRANA	DATE: 02/2023
REVIEWED BY: M.M. LATTIN	DATE: 02/2023

# RETAINING WALL NO. 2

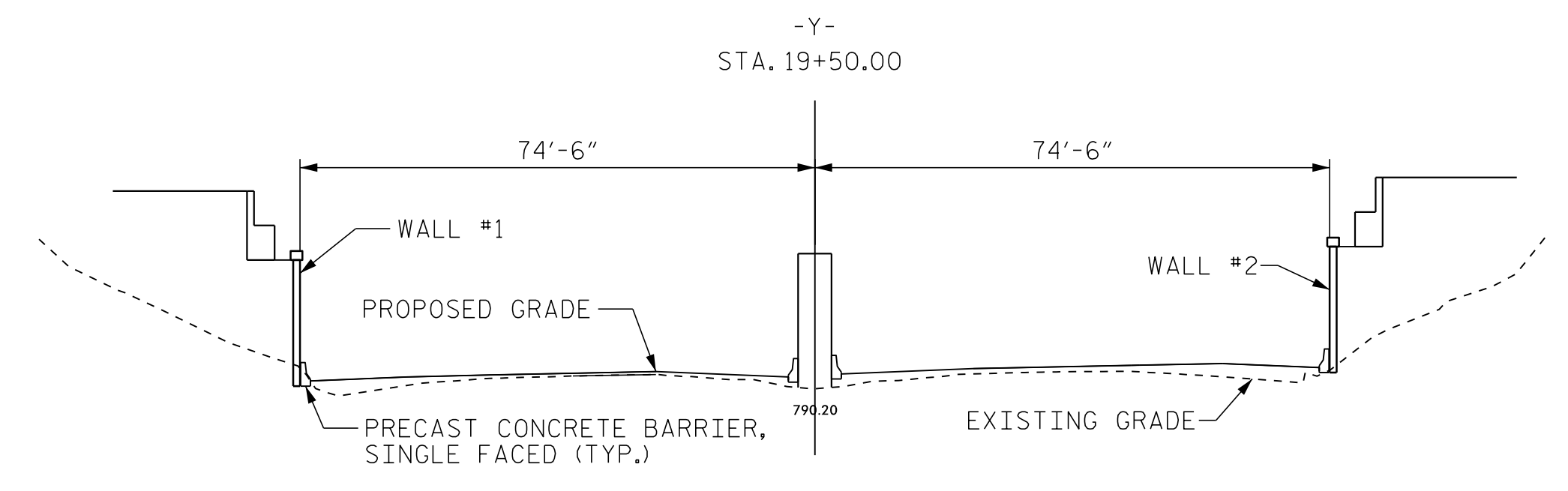
-Y- STA. 20+26.72 TO 18+17.73

GEOTECHNICAL ENGINEER  SEAL 052709 ENGINEER MATTHEW MARK LATTIN	ENGINEER    SIGNATURE _____ DATE _____
DocuSigned by:  02/16/2023 DEPARTMENT OF TRANSPORTATION SIGNATURE _____ DATE _____	
<b>DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED</b>	

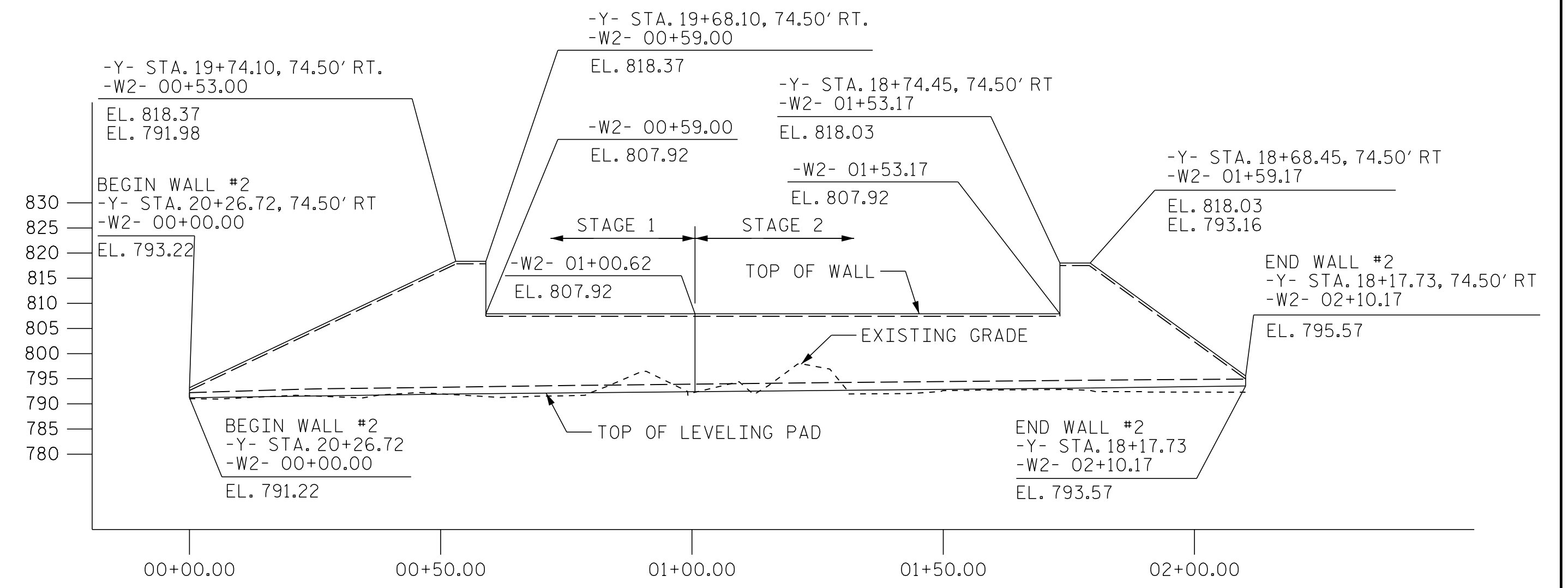


PLAN VIEW

ESTIMATED MSE WALL QUANTITY (SQUARE FEET)	
MSE RETAINING WALL NO. 2	3370 SF



TYPICAL SECTION AT STA. 19+50



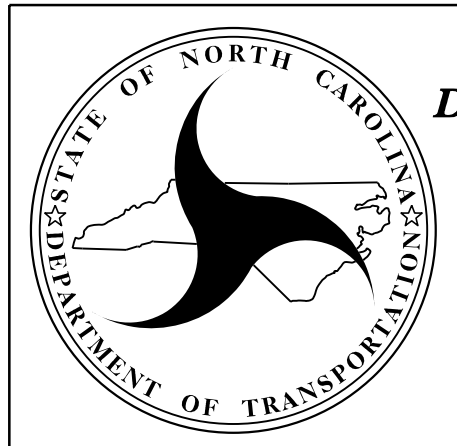
WALL #2 ENVELOPE (AT END BENT 2)  
(LOOKING AT FRONT FACE OF WALL)

PROJECT NO.: BR-0041  
 ROCKINGHAM COUNTY  
 STATION: -Y- STA. 20+26.72 TO 18+17.73  
 SHEET 1 OF 3

PREPARED BY: C.R. PASTRANA	DATE: 02/2023
REVIEWED BY: M.M. LATTIN	DATE: 02/2023



ESP ASSOCIATES, INC.  
 7011 ALBERT PICK RD  
 SUITE E  
 GREENSBORO, NC 27409  
 FIRM # C-0587  
 WWW.ESPASSOCIATES.COM



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

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

SHEET NO. W-4

## RETAINING WALL NO. 2 PLAN VIEW AND WALL ENVELOPE

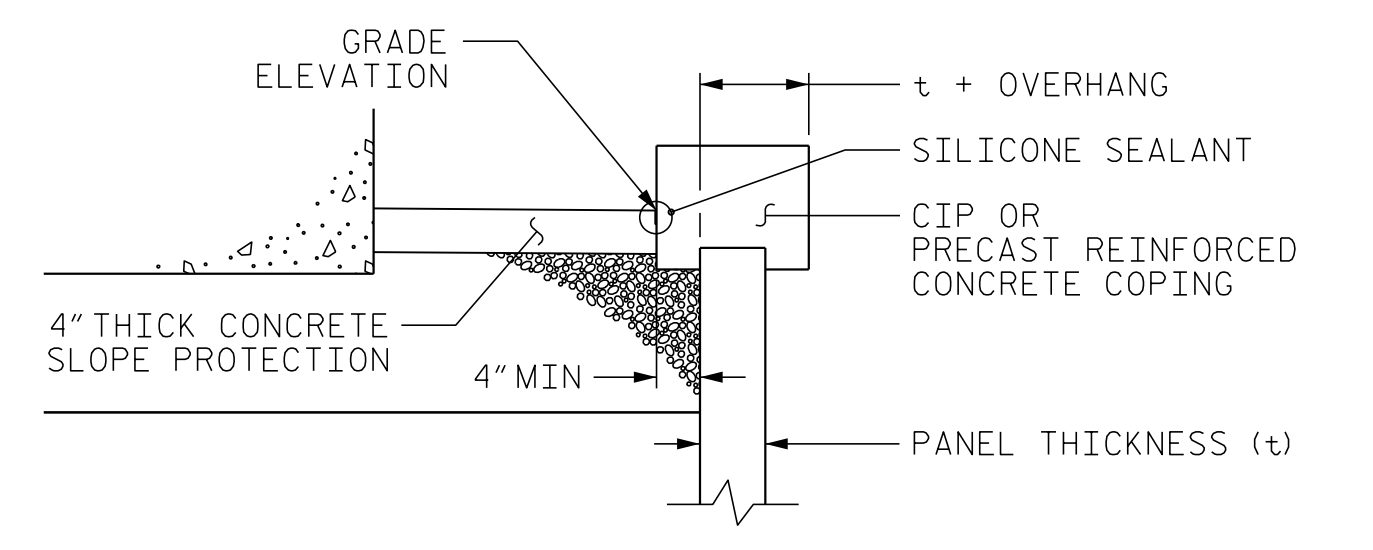
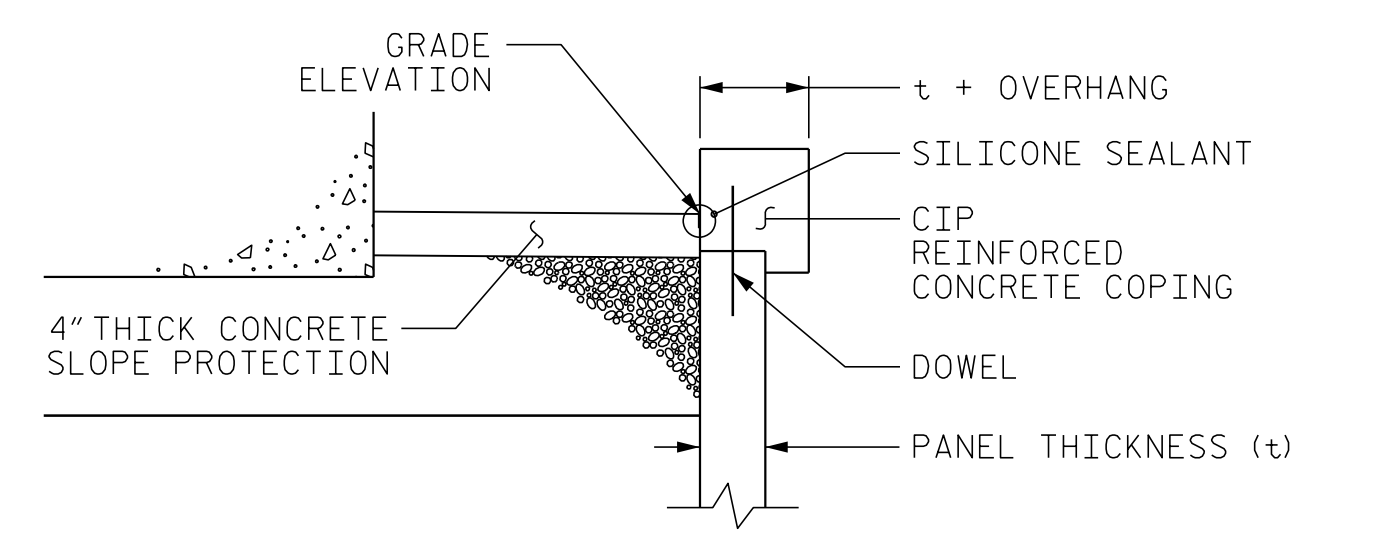
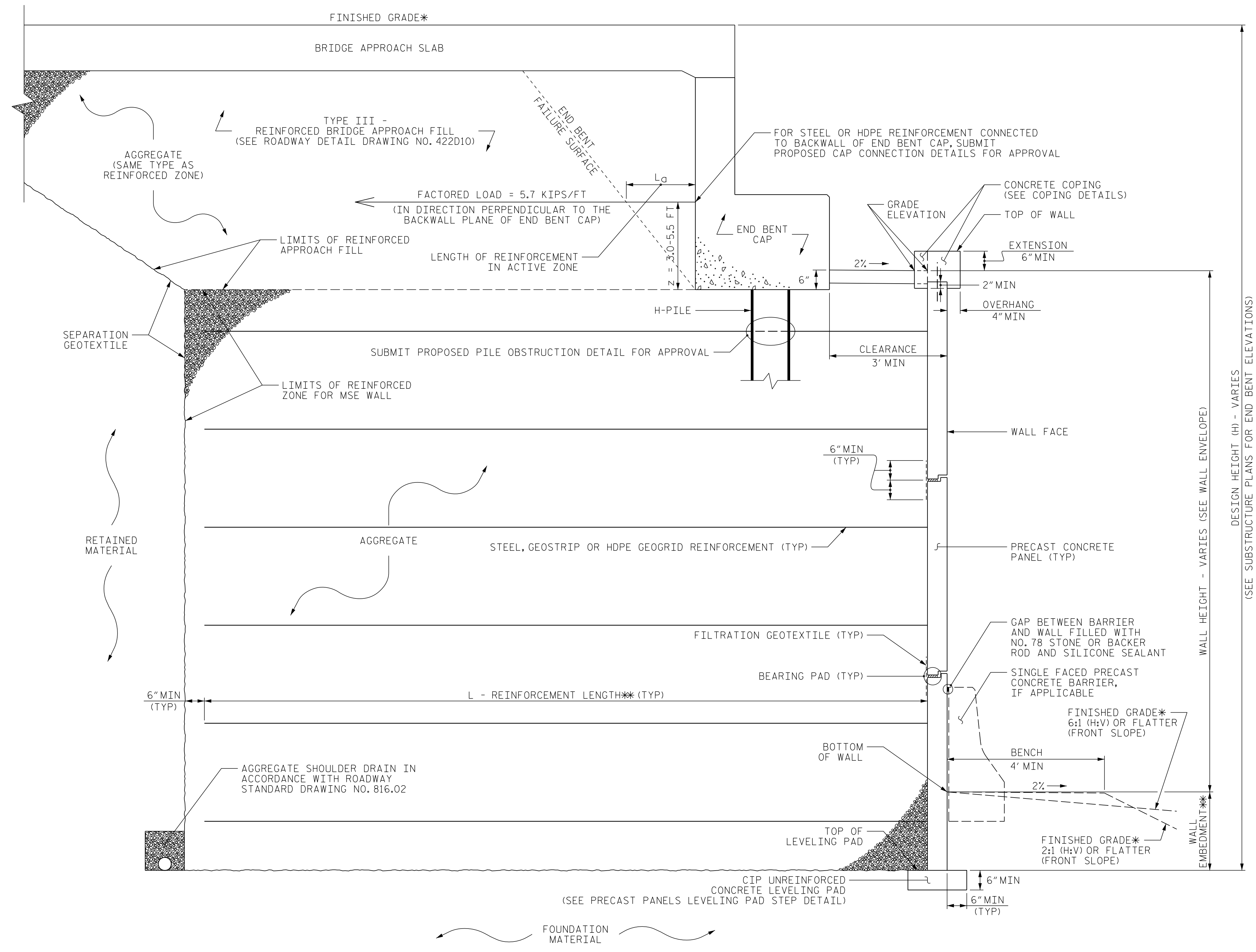
GEOTECHNICAL ENGINEER

ENGINEER

SEAL 052709

DATE: 02/16/2023

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



**COPING DETAILS**

AT THE CONTRACTOR'S OPTION, CONNECT COPING TO PANELS WITH DOWELS OR EXTEND COPING DOWN BACK OF PANELS.

**MSE ABUTMENT 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.

PROJECT NO.: BR-0041  
 ROCKINGHAM COUNTY  
 STATION: -Y- STA. 20+26.72 TO 18+17.73  
 SHEET 2 OF 3

PREPARED BY: C.R. PASTRANA DATE: 02/2023  
 REVIEWED BY: M.M. LATTIN DATE: 02/2023

**ESP** ESP ASSOCIATES, INC.  
 7011 ALBERT PICK RD  
 SUITE E  
 GREENSBORO, NC 27409  
 FIRM # C-0587  
 WWW.ESPASSOCIATES.COM

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

**RETAINING WALL NO. 2 TYPICAL & COPING DETAILS**

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

SHEET NO. W-5

**NOTES:**

FOR MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALLS, SEE MECHANICALLY STABILIZED EARTH RETAINING WALLS PROVISION.  
 FOR TYPE III REINFORCED BRIDGE APPROACH FILL, SEE BRIDGE APPROACH FILLS PROVISION AND ROADWAY DETAIL DRAWING NO. 422D10.  
 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.  
 AT THE CONTRACTOR'S OPTION, USE FINE AGGREGATE IN THE REINFORCED ZONE OF RETAINING WALL NO. 2.  
 A SEPARATION GEOTEXTILE IS REQUIRED AT THE BACK OF THE REINFORCED ZONE FOR RETAINING WALL NO. 2.  
 A DRAIN IS REQUIRED FOR RETAINING WALL NO. 2.  
 BEFORE BEGINNING MSE WALL DESIGN FOR RETAINING WALL NO. 2, 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 NO. 2 FOR THE FOLLOWING:

- 1) DESIGN HEIGHT (H) = WALL HEIGHT + WALL EMBEDMENT
- 2) DESIGN LIFE = 100 YEARS
- 3) MAXIMUM FACTORED VERTICAL PRESSURE = 4.1 KSF
- 4) MINIMUM REINFORCEMENT LENGTH (L) = 0.7H OR 6 FT, WHICHEVER IS LONGER
- 5) MINIMUM EMBEDMENT DEPTH, SEE MECHANICALLY STABILIZED EARTH RETAINING WALLS PROVISION
- 6) REINFORCED ZONE AGGREGATE PARAMETERS:

AGGREGATE TYPE*	UNIT WEIGHT ( $\gamma$ ) PCF	FRICTION ANGLE ( $\phi$ ) DEGREES	COHESION (c) PSF
COARSE	110	38	0
FINE	115	34	0

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

7) IN-SITU ASSUMED MATERIAL PARAMETERS:

MATERIAL TYPE	UNIT WEIGHT ( $\gamma$ ) PCF	FRICTION ANGLE ( $\phi$ ) DEGREES	COHESION (c) PSF
BACKFILL	115	30	0
FOUNDATION	120	30	0

DESIGN RETAINING WALL NO. 2 FOR A LIVE LOAD (TRAFFIC) SURCHARGE.

DESIGN REINFORCEMENT CONNECTED TO END BENT CAPS FOR FACTORED LOAD AND LENGTH OF REINFORCEMENT IN ACTIVE ZONE ( $L_d$ ) SHOWN. CAST REINFORCEMENT OR CONNECTORS INTO CAP BACKWALL FOR END BENT NO. 2 LOCATED AT STATION 35+62.50 -L-.

FOUNDATIONS FOR SIGNS, LIGHTING or SIGNALS MAY BE LOCATED BEHIND RETAINING WALL NO. 2 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 FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH REINFORCEMENT FOR RETAINING WALL NO. 2.

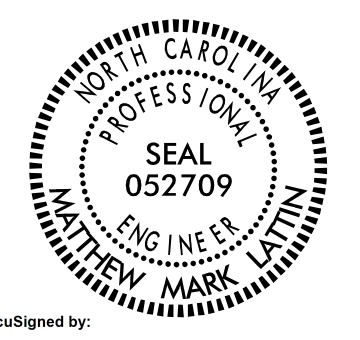
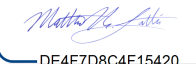
FOUNDATIONS FOR END BENT NO. 2 LOCATED AT STATION 35+62.50 WILL INTERFERE WITH REINFORCEMENT FOR RETAINING WALL NO. 2. SEE "FOUNDATION LAYOUT" SHEET FOR FOUNDATION LOCATIONS.

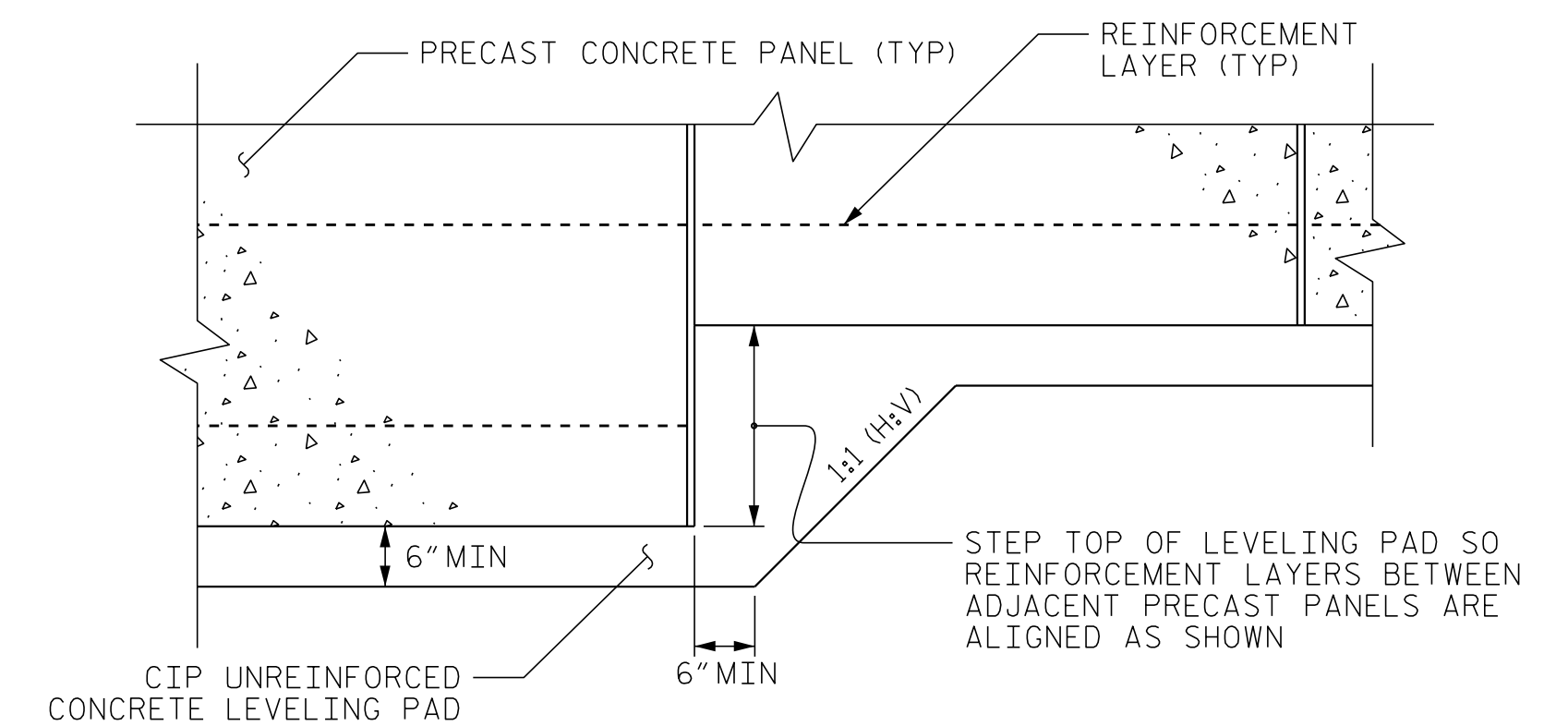
DO NOT PLACE LEVELING PAD CONCRETE, AGGREGATE OR REINFORCEMENT FOR RETAINING WALL NO. 2 UNTIL EXCAVATION DIMENSIONS AND FOUNDATION MATERIAL ARE APPROVED.

"TEMPORARY SHORING" MAY BE REQUIRED FOR RETAINING WALL NO. 2 IN ACCORDANCE WITH THE TEMPORARY SHORING PROVISION. SEE ROADWAY, STRUCTURE or TRAFFIC CONTROL PLANS.

AT THE CONTRACTOR'S OPTION, "TEMPORARY SHORING FOR WALL CONSTRUCTION" MAY BE USED TO CONSTRUCT RETAINING WALL NO. 2. SEE MSE RETAINING WALLS PROVISION FOR TEMPORARY SHORING FOR WALL CONSTRUCTION.

FROM APPROXIMATE -W2- STATION 0+00 TO 1+75 SOFT COHESIVE SOILS AND OVERLYING EXISTING ROADWAY EMBANKMENT FILL SHALL BE UNDERCUT FROM THE FRONT OF THE WALL TOWARDS END BENT 2 A, WIDTH OF APPROXIMATELY 5 FEET AND A DEPTH OF APPROXIMATELY 3 FEET. GEOTEXTILE SHALL BE PLACED AT THE BASE OF THE UNDERCUT. BACKFILL TO FINISHED GRADE WITH COMPACTED FILL.

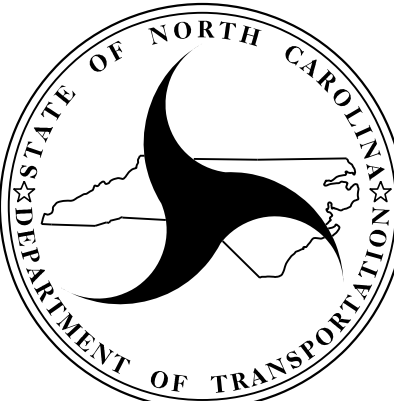
GEOTECHNICAL ENGINEER   DocuSigned by: 	ENGINEER     DATE: 02/16/2023 SIGNATURE: _____ DATE: _____
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



**PRECAST PANELS  
LEVELING PAD STEP DETAIL**

PROJECT NO.: BR-0041  
 ROCKINGHAM COUNTY  
 STATION: -Y- STA. 20+26.72 TO 18+17.73  
 SHEET 3 OF 3


**ESP ASSOCIATES, INC.**  
 7011 ALBERT PICK RD  
 SUITE E  
 GREENSBORO, NC 27409  
 FIRM # C-0587  
 WWW.ESPASSOCIATES.COM

NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 DIVISION OF HIGHWAYS  
  

**GEOTECHNICAL  
ENGINEERING UNIT**

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

PREPARED BY: C.R. PASTRANA	DATE: 02/2023
REVIEWED BY: M.M. LATTIN	DATE: 02/2023

**RETAINING WALL NO. 2  
NOTES & LEVELING PAD  
STEP DETAILS**