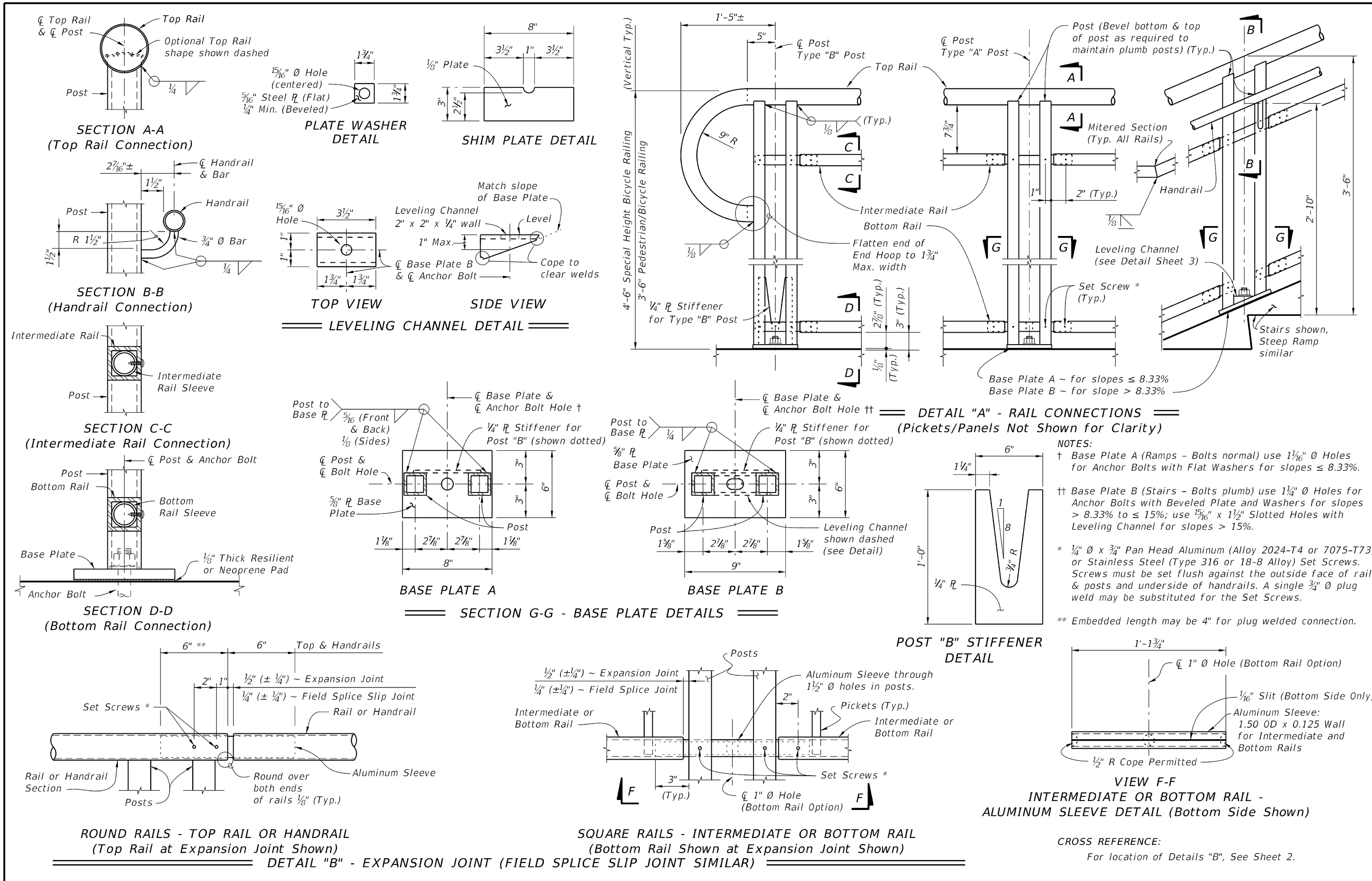

LAST REVISION	REVISION	DESCRIPTION:	FDOT DESIGN STANDARDS 2013	ALUMINUM PEDESTRIAN/BICYCLE RAILING	INDEX NO.	SHEET NO.
07/01/12					862	4

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Certificate of Authorization # 3428
Principal-in-Charge: Andrew M. Holesko, C.M.
Project Manager: Christopher Nardone, AIA
Designed by: Emily Bredestege

Revisions

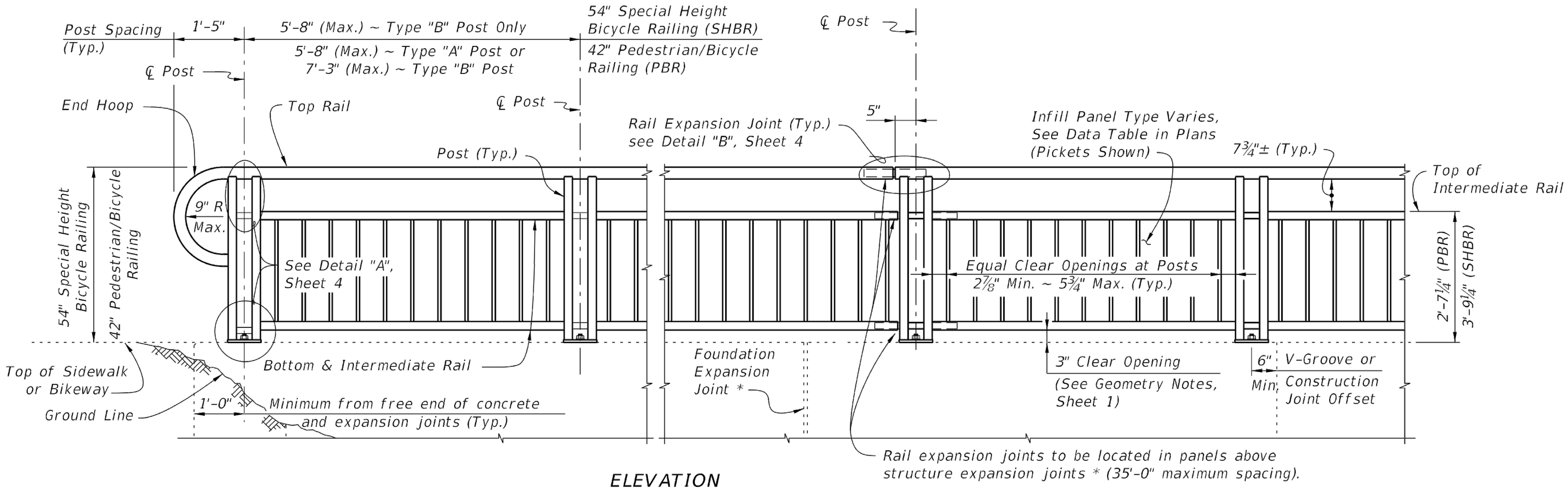
No.	Date	By	Description

FDOT ALUMINUM RAILING DETAILS

Amelia River Waterfront Stabilization
Parking Lots C & D
Town/City: Fernandina Beach
County: Nassau State: Florida

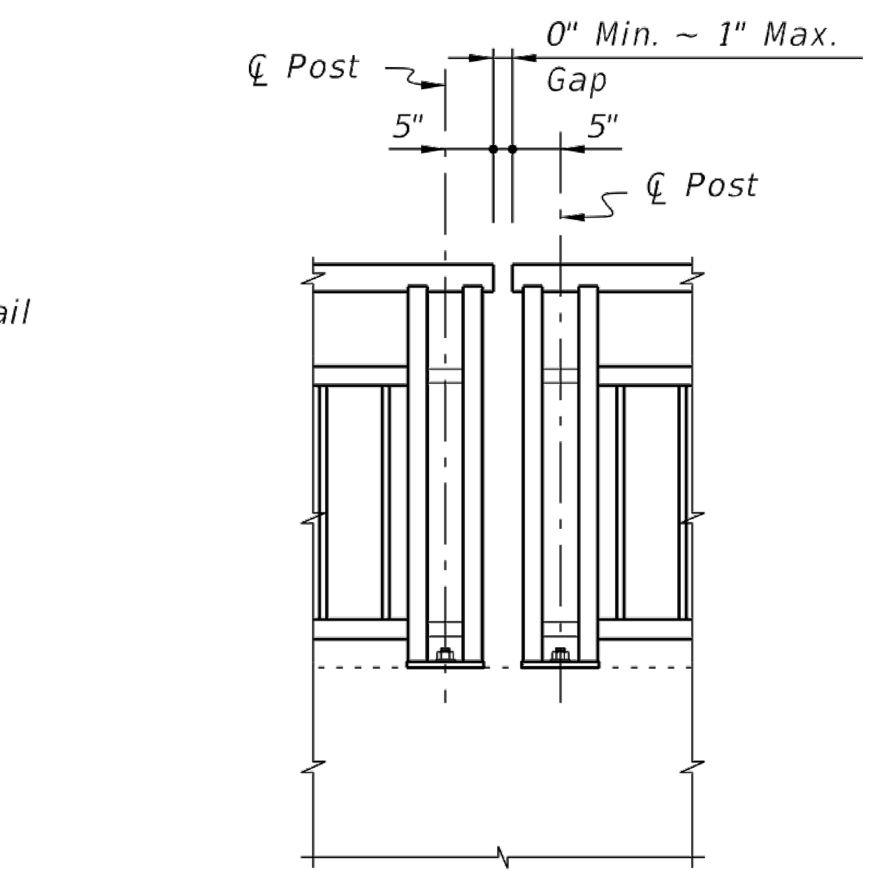
Project No. 99000047.0095
Drawing No. **C4-2**
Date April 26, 2021

Drawing name: F:\PASSERO\FHB\99000047.0095 FHB Waterfront\Airport\C4-01_FDOT-RAIL-DETL.dwg C4-2_FDOT-RAIL May 04, 2021 2:26am by: EBredestege



ELEVATION
(Showing Outside Face of Railing with Type "A" Posts)

TYPICAL RAILING DETAILS & RAILINGS ON GRADES 0% TO 5%
(Type 1 - Picket Railing Shown, Other Types Similar)

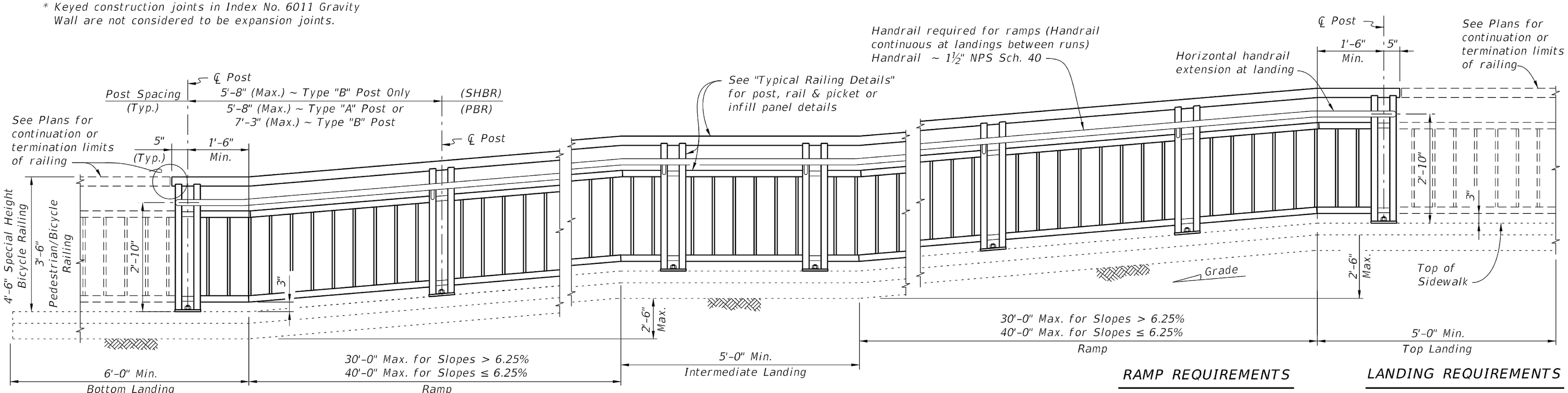


Note: Non-continuous corners are permitted when handrails are not required.

EXPANDED ELEVATION AT CORNERS

DETAIL FOR NON-CONTINUOUS RAILING AT CORNERS

NOTES:
* Keyed construction joints in Index No. 6011 Gravity Wall are not considered to be expansion joints.



RAMP REQUIREMENTS

For slopes greater than 5%:
Max. ramp slope = 8.33%
Max. ramp cross-slope = 2.0%

LANDING REQUIREMENTS

Max. landing slope = 2%
Max. landing cross-slope = 2%

ELEVATION
(Showing Inside Face of Railing with Type "A" Posts)

RAILINGS ON GRADES STEEPER THAN 5%
(Type 1 - Picket Railing Shown, Other Types Similar)

LAST REVISION	REVISION	DESCRIPTION:	FDOT DESIGN STANDARDS 2013	ALUMINUM PEDESTRIAN/BICYCLE RAILING	INDEX NO.	SHEET NO.
01/01/11					862	2

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C:\d\projects\standards\structures\2013book\00862-2of8.dgn rd960rh 11:38:10 AM 6/28/2012

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FDOT ALUMINUM RAILING DETAILS

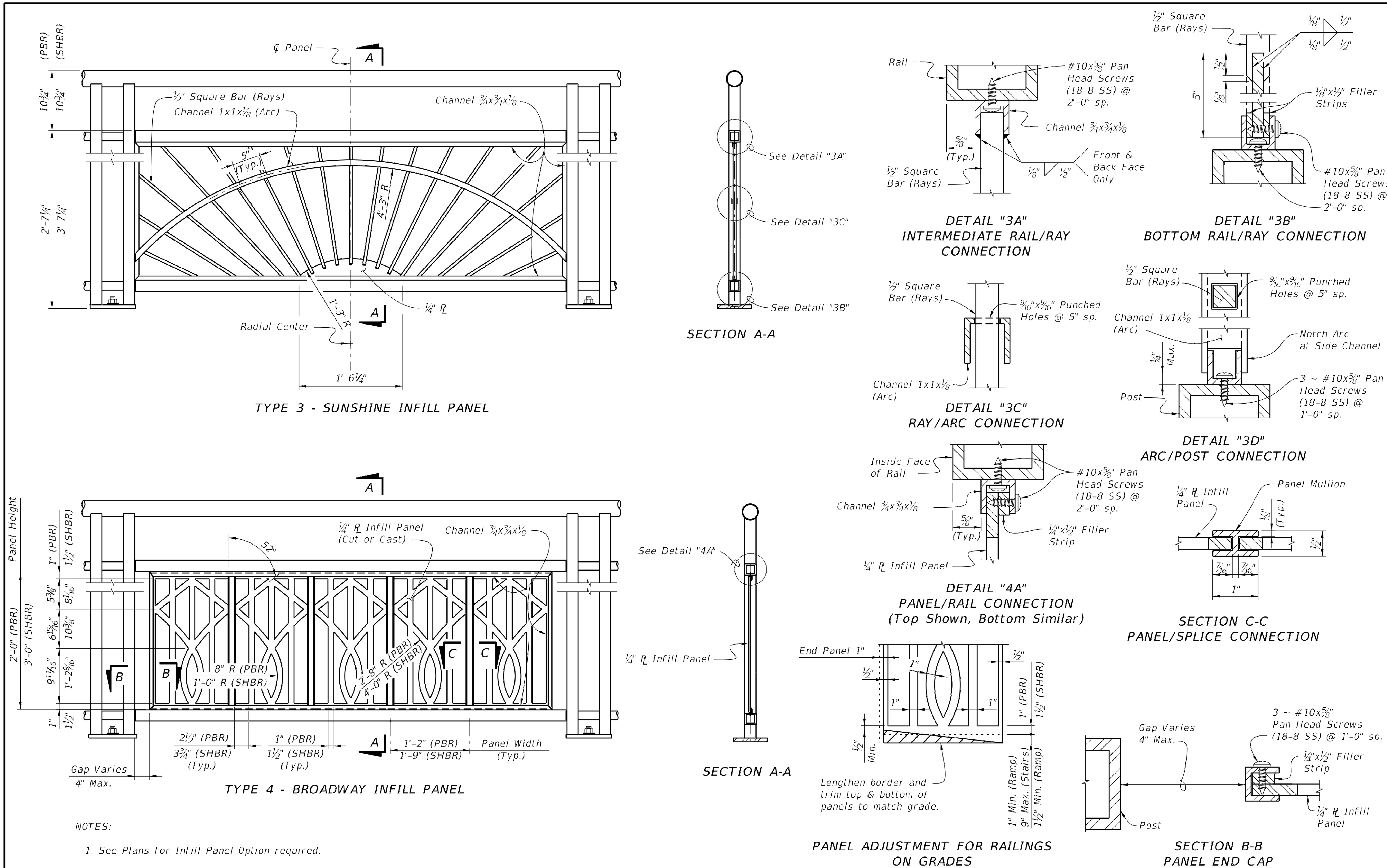
Amelia River Waterfront Stabilization
Parking Lots C & D

Town/City: Fernandina Beach
County: Nassau State: Florida

Project No.
99000047.0095

Drawing No.
C4-3

Date
April 26, 2021



NOTES:

1. See Plans for Infill Panel Option required.

LAST REVISION	REVISION	DESCRIPTION:	FDOT DESIGN STANDARDS 2013	ALUMINUM PEDESTRIAN/BICYCLE RAILING	INDEX NO.	SHEET NO.
01/01/11					862	6

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No.	Date	By	Description

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FDOT ALUMINUM RAILING DETAILS

Amelia River Waterfront Stabilization
Parking Lots C & D

Town/City: Fernandina Beach
County: Nassau State: Florida

Project No. 99000047.0095

Drawing No. **C4-4**

Date April 26, 2021

Drawing name: F:\PASSERO\FHB\99000047.0095 FHB Waterfront\Airport\C4-01_FDOT-RAIL-DETL.dwg C4-4_FDOT-RAIL May 04, 2021 2:30am by: EBredestege

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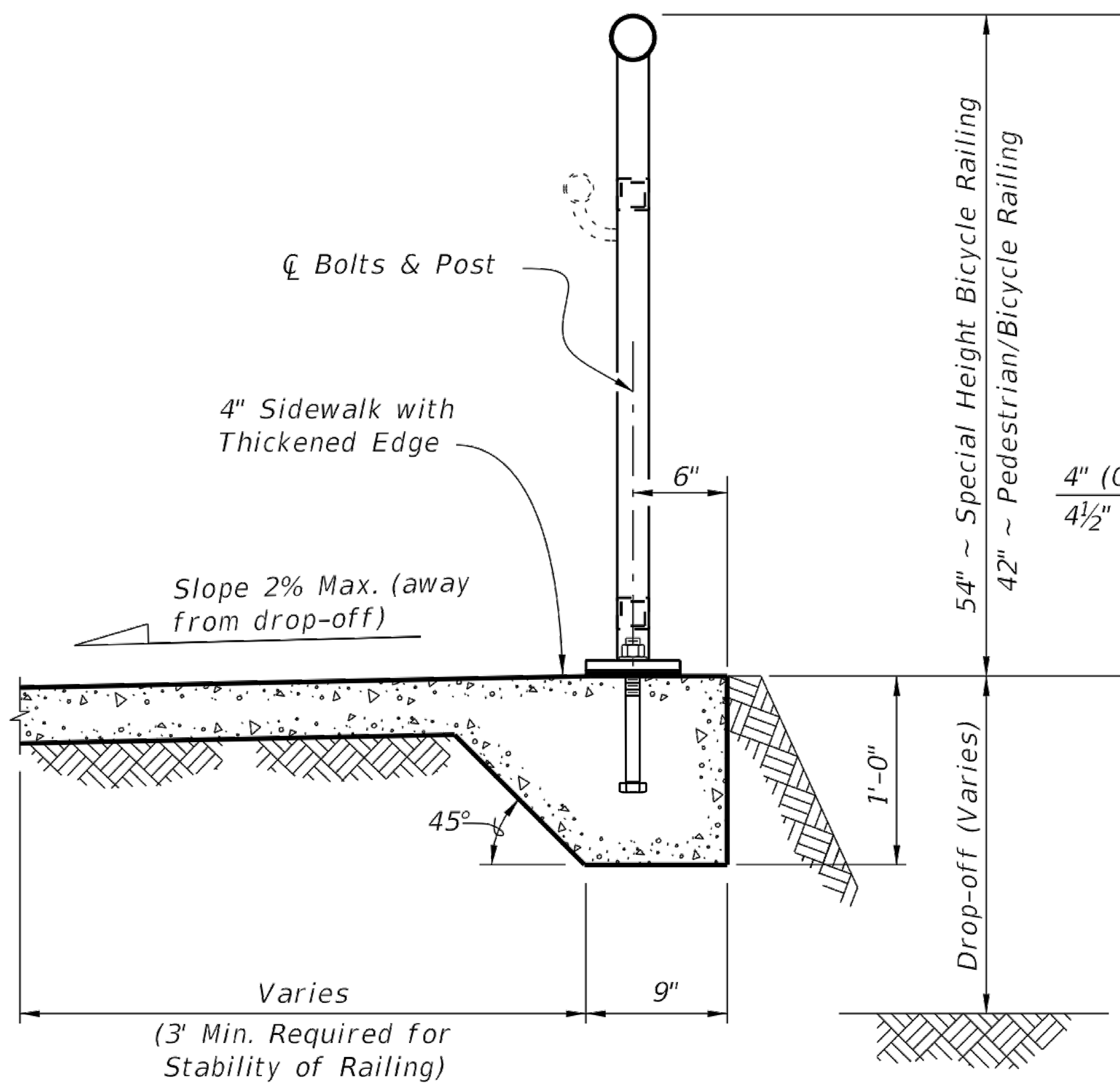
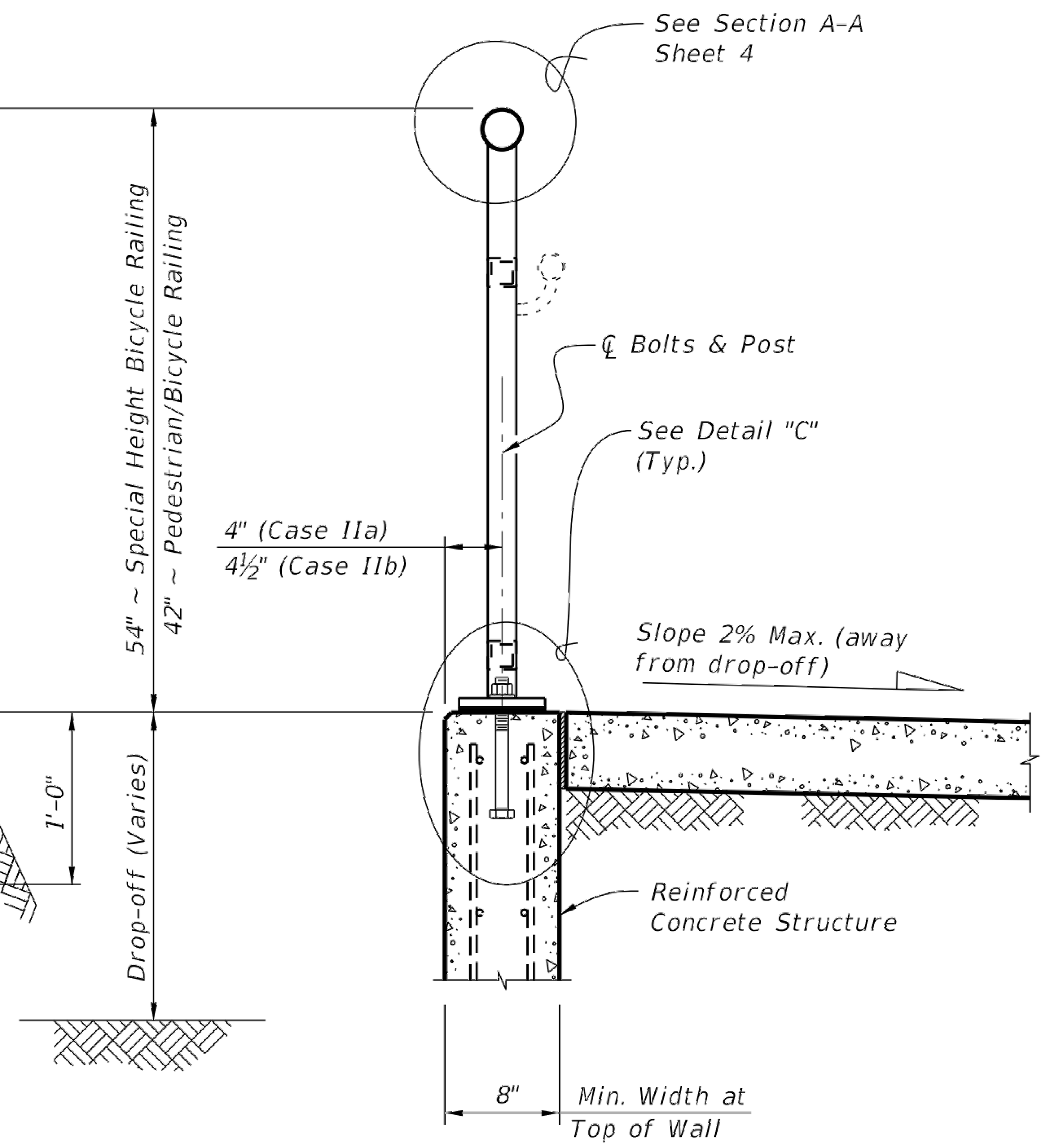
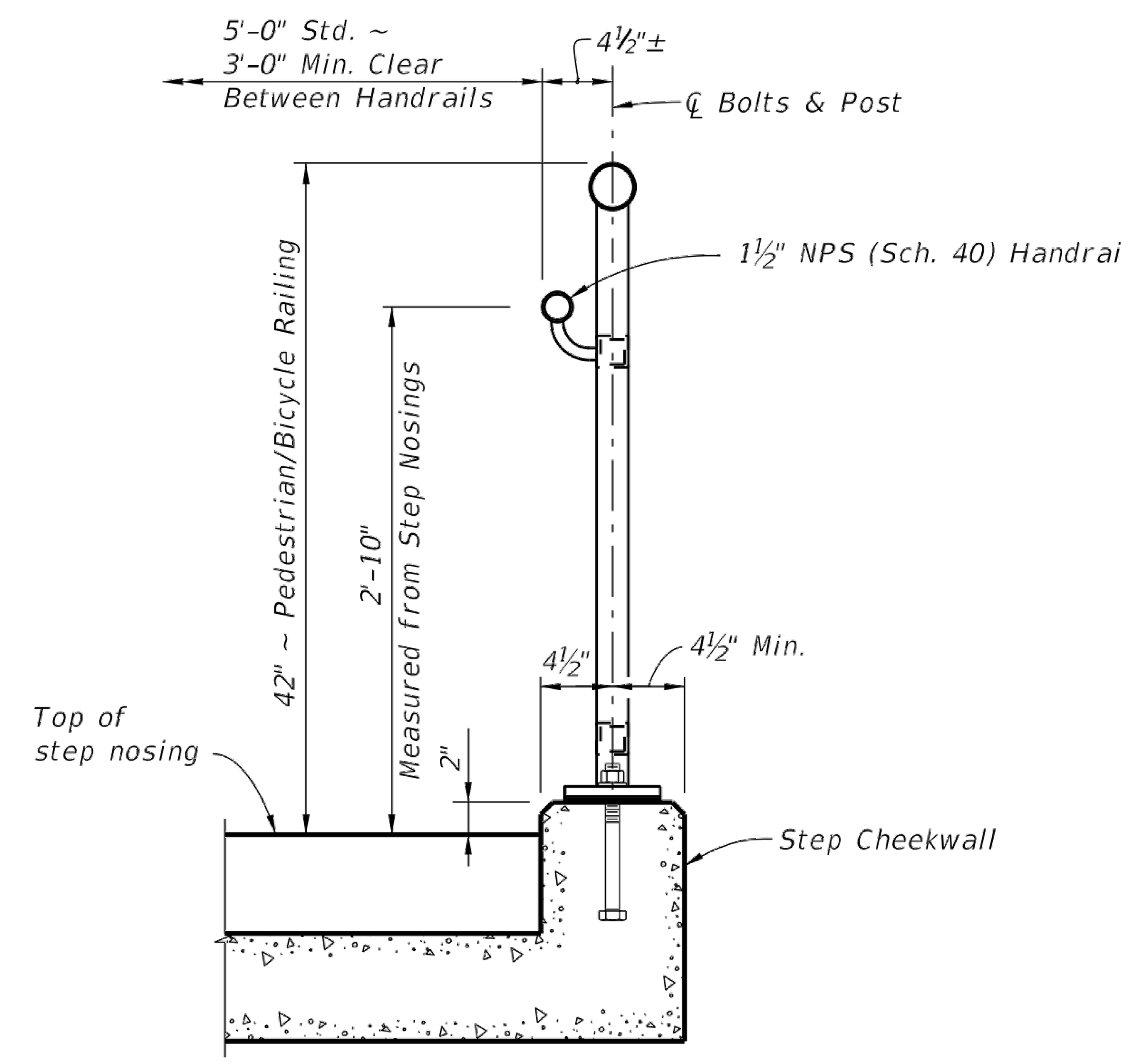


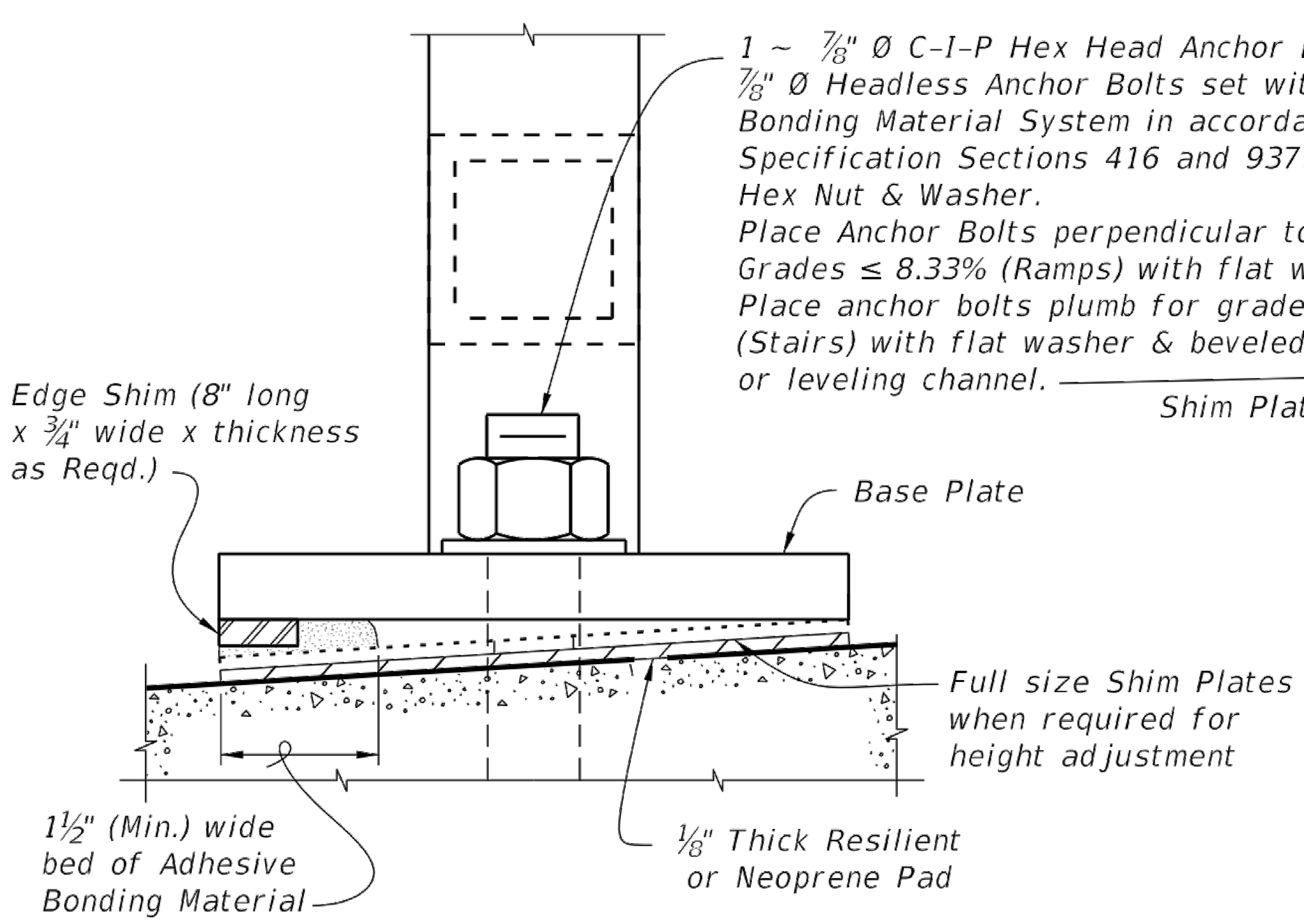
TYPICAL SECTION ON CONCRETE SIDEWALK
(Case I)



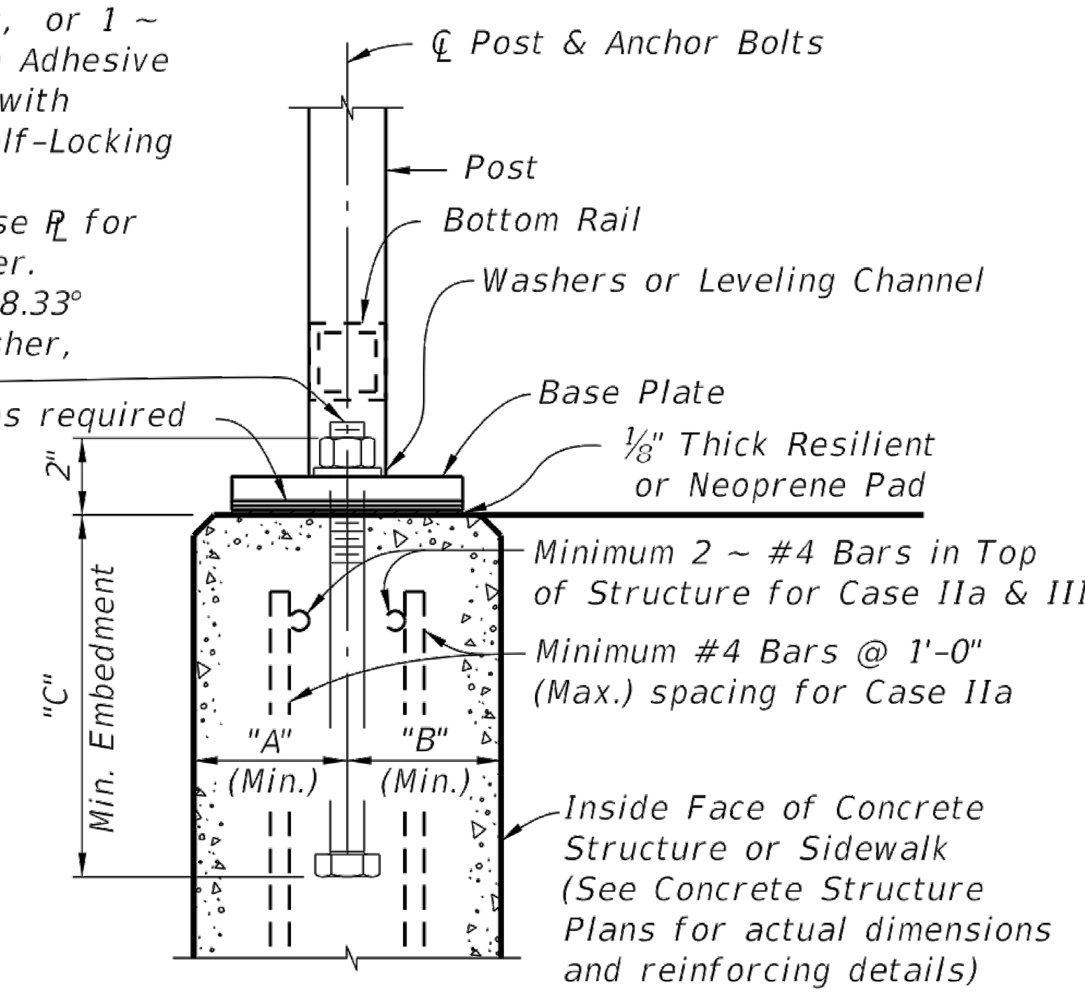
TYPICAL SECTION ON RETAINING WALL
(Case II)



TYPICAL SECTION ON STEPS & STAIRS
(Case III)



DETAIL "D" (OPTIONAL SHIMMING DETAIL FOR CROSS SLOPE CORRECTION)
(Used in lieu of Beveled Shim Plates)



DETAIL "C"
(Cast-In-Place Anchor Bolts shown, Adhesive Anchors similar)

ANCHOR BOLT TABLE

CASE	STRUCTURE TYPE	DIMENSIONS			ANCHOR LENGTH		ANCHOR SIZE
		"A" Edge Dist.	"B" Edge Dist.	"C" Embedment	C.I.P Hex Head Bolt	Adhesive Anchor	
I	Unreinforced Concrete	6"	1'-2"	9"	10½"	11"	⅞" Ø
IIa	Reinforced Concrete	4"	4"	9"	10½"	11"	⅞" Ø
IIb	Gravity Wall Index No. 6011	4½"	3½" @ top	1'-0" *	1'-1½"	1'-2"	⅞" Ø
III	Step Cheekwall	4½"	4½"	9"	10½"	11"	⅞" Ø

* Embedment length "C" may be reduced to 9" for the 42" height railings for Case IIb, when the post spacing does not exceed 5'-0".

LAST REVISION	REVISION	DESCRIPTION:	FDOT DESIGN STANDARDS 2013	ALUMINUM PEDESTRIAN/BICYCLE RAILING	INDEX NO.	SHEET NO.
07/01/12					862	8

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Project Manager Christopher Nardone, AIA
Designed by Emily Bredestege

Revisions

No.	Date	By	Description

FDOT ALUMINUM RAILING DETAILS

Amelia River Waterfront Stabilization
Parking Lots C & D

Town/City: Fernandina Beach
County: Nassau State: Florida

Project No.
99000047.0095

Drawing No.
C4-5

Date
April 26, 2021

Drawing name: F:\PASSERO\FHB\99000047.0095 FHB Waterfront\Airport\C4-01_FDOT-RAIL-DETL.dwg C4-5_FDOT-RAIL May 04, 2021 2:31am by: EBredestege
6/28/2012 11:38:26 AM rd960rh C:\d\projects\standards\structures\2013book\00862-8of8.dgn

NOTES:

1. Shop Drawings are required.
2. Work with Specification 515.
3. Materials:

   A. Pan Head Set Screws: Aluminum Alloy 2024-74 or 7075-T73 or Stainless Steel (SS) Type 316 or 18-8 Alloy.

   B. Base Plates and Cap Plates: ASTM B209, Alloy 6061-T6

   C. Structural Pipe Tube and Bars: ASTM B221 or ASTM B429, Alloy 6061-T6

   D. End Rails 90° bends and corner bends with a maximum 4 foot spacing: Alloy 6063-T5 is permitted.

RAILING MEMBER DIMENSIONS TABLE

MEMBER	DESIGNATION	OUTSIDE DIMENSION	WALL THICKNESS
Posts	2" NPS (Sch. 40)	2.375"	0.154"
Rails	2" NPS (Sch. 40)	2.375"	0.154"
Rail Joint/Splice Sleeves	1½" NPS (Sch. 40)	1.900"	0.145"
Handrails Joint/Splice Sleeves	1" NPS (Sch. 40) 1.50 ODx0.125 Wall	1.315" 1.500"	0.133" 0.125"
Handrails	1½" NPS (Sch. 40)	1.900"	0.145"
Handrail Support Bar	1" Ø Round Bar	1.000"	N/A

   E. Galvanized Steel Fasteners:
      a. Hex Head Bolts: ASTM A 307 Type 1 or ASTM F1554 Grade 36
      b. Adhesive Anchors: ASTM F1554 Grade 36 fully threaded rods
      c. Hex Nuts: ASTM A563
      d. Flat Washers: ASTM F436

   F. Aluminum Shims: ASTM B209, Alloy 6061

   G. Bearing Pads: Plain, Fabric Reinforced, or Fabric Laminated meeting requirements of Specifications 515 & 932.

4. Fabrication:

   A. Place expansion joints at a maximum of 30'-0" spacing
   B. Field splices are similar to the expansion joint detail and may be approved by the Engineer to facilitate handling; but top rail must be continuous across a minimum of two posts.
   C. Continuity field splice (Detail "E"); only use to make the railing continuous for unforeseen field adjustments
   D. Corners and changes in tangential longitudinal alignment may be made continuous with a 9" bend radius or terminated at adjoining sections with a standard end hoop when handrails are not required.
   E. For curved longitudinal alignments, shop bend top and bottom rails and handrails to match the alignment radius.
   F. For changes in tangential longitudinal alignment greater than 45°, position posts a maximum of 2'-0" each side of the corner, not at the corner apex.

5. Handrails are required and must be continuous at landings for:

   A. Grades Steeper than 5%
   B. Three or more steps

6. Cutting of reinforcing steel is permitted for post installed anchor bolts.

10/14/2019 11:04:35 AM

LAST REVISION 11/01/18	REVISION	DESCRIPTION:	FDOT	FY 2020-21 STANDARD PLANS	PIPE GUIDERAIL (ALUMINUM)	INDEX 515-070	SHEET 1 of 5

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Project Manager Christopher Nardone, AIA
Designed by Emily Bredestege

Revisions

No.	Date	By	Description

FDOT GUIDERAIL (ALUMINUM)

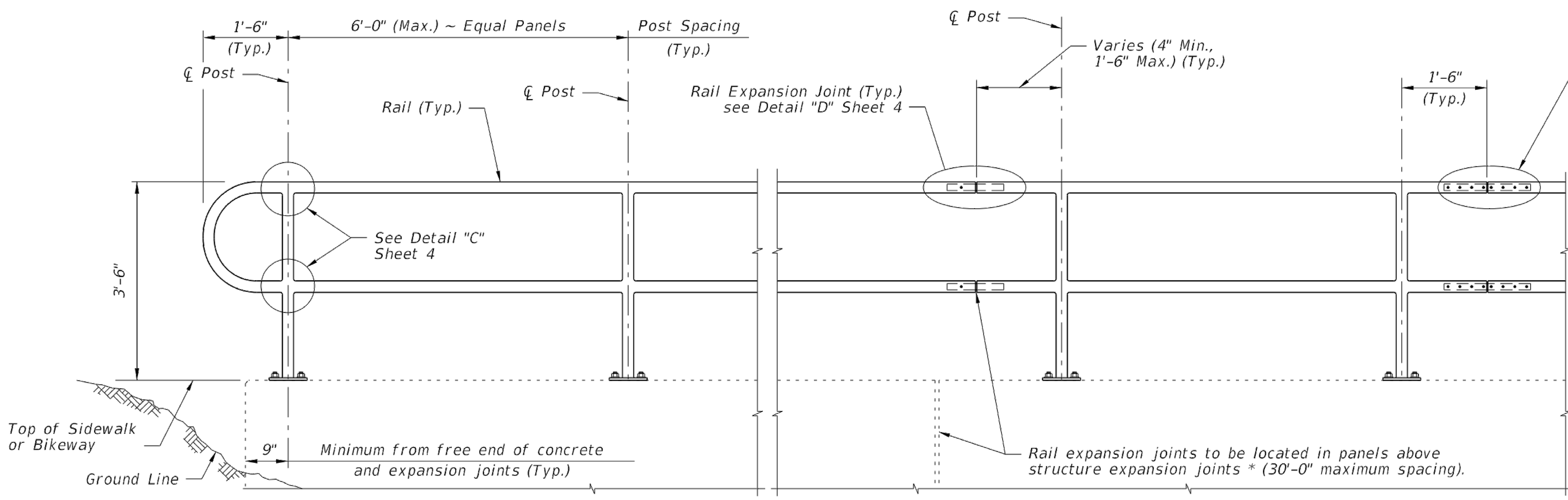
Amelia River Waterfront Stabilization
Parking Lots C & D
Town/City: Fernandina Beach
County: Nassau State: Florida

Project No. 99000047.0095

Drawing No. C4-6

Date May 10, 2021

Drawing name: F:\PASSERO\FHB\99000047.0095 FHB Waterfront\Airport\C4-01_FDOT-RAIL-DETL.dwg C4-5_FDOT-RAIL (2) May 07, 2021 3:39pm by: EBredestege



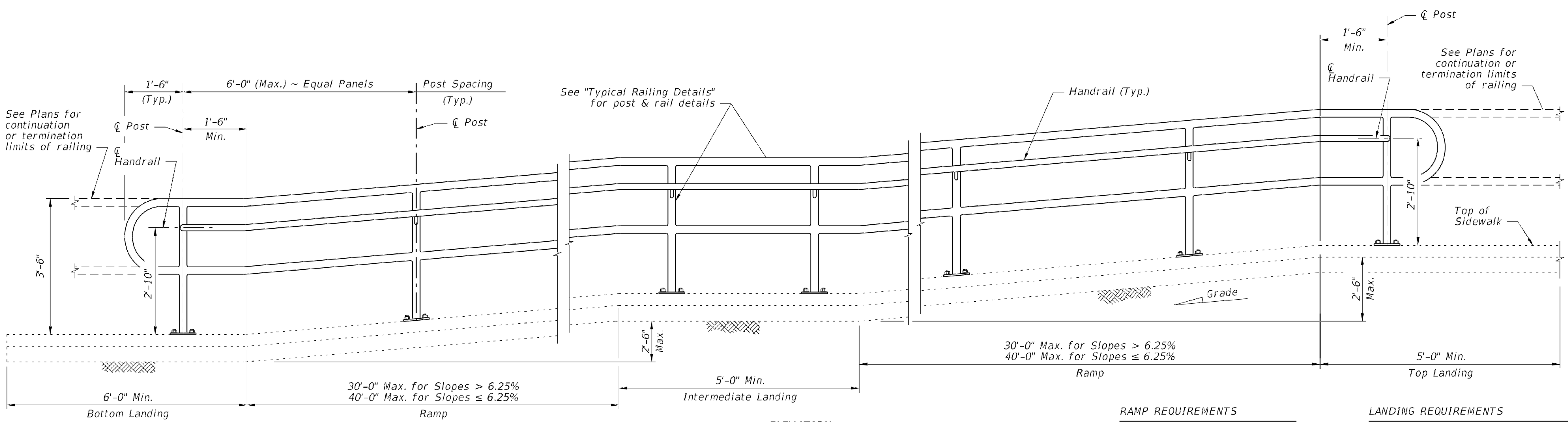
ELEVATION

NOTES:
NPS = Nominal Pipe Size

STRUCTURES EXPANSION JOINTS NOTE:
* Keyed construction joints in Index 400-011 Gravity Wall are not considered to be expansion joints.

CROSS REFERENCE:
For Details "C", "D" and "E", see Sheet 4.

TYPICAL RAILING DETAILS & RAILINGS ON GRADES 0% TO 5%



ELEVATION
(Showing Inside Face of Railing)

RAMP REQUIREMENTS
For slopes greater than 5%:
Max. ramp slope = 8.33%
Max. ramp cross-slope = 2.0%

LANDING REQUIREMENTS
Max. landing slope = 2%
Max. landing cross-slope = 2%

RAILINGS ON GRADES STEEPER THAN 5% TO 8.33%

LAST REVISION 11/01/17	REVISION	DESCRIPTION:	FDOT	FY 2020-21 STANDARD PLANS	PIPE GUIDERAIL (ALUMINUM)	INDEX 515-070	SHEET 2 of 5

10/14/2019 11:04:38 AM

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Revisions

No.	Date	By	Description

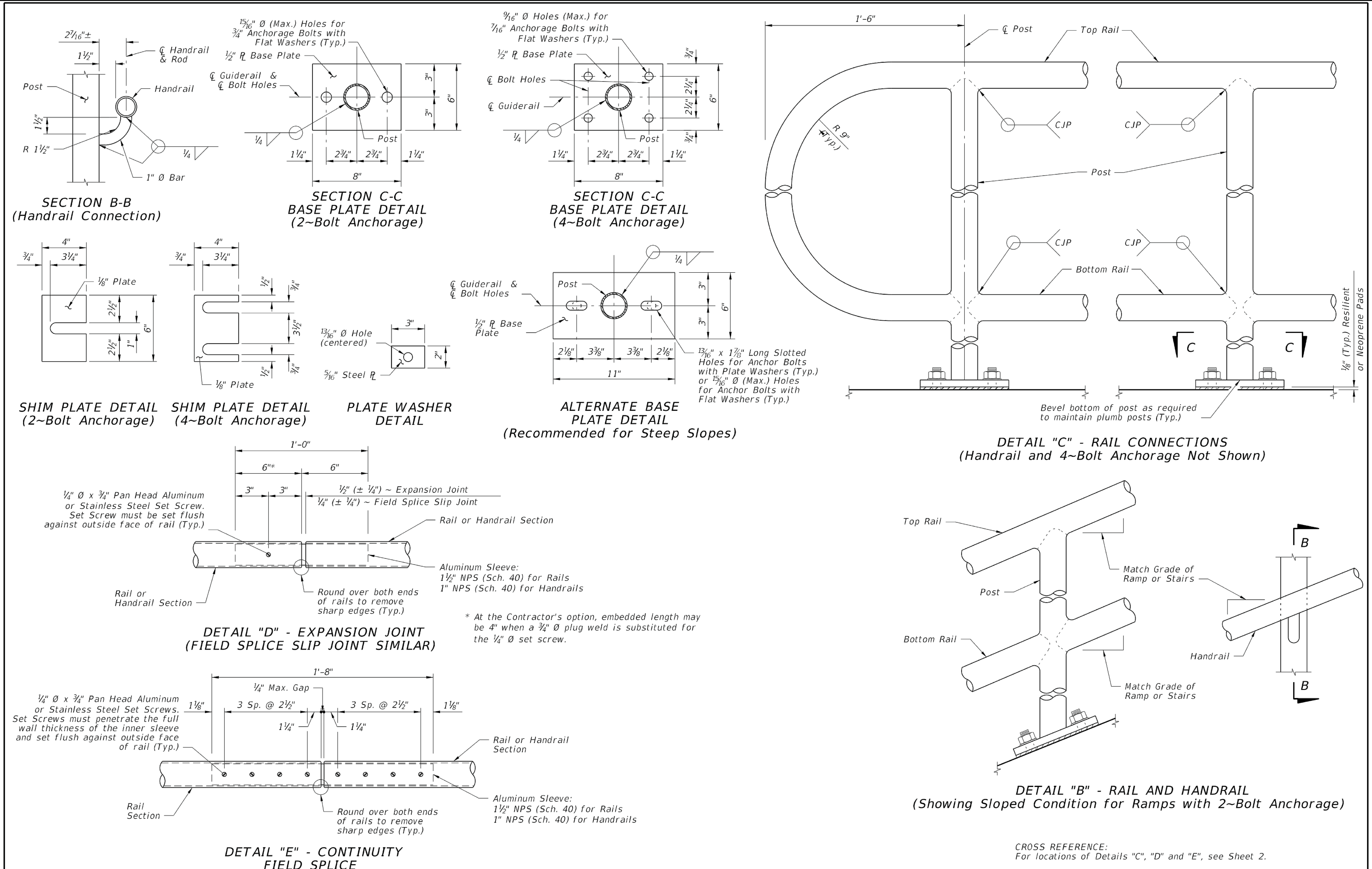
FDOT GUIDERAIL

Amelia River Waterfront Stabilization
Parking Lots C & D
Town/City: Fernandina Beach
County: Nassau State: Florida

Project No.
99000047.0095

Drawing No.
C4-7

Date
May 10, 2021



LAST REVISION	REVISION	DESCRIPTION:	FDOT	FY 2020-21 STANDARD PLANS	PIPE GUIDERAIL (ALUMINUM)	INDEX	SHEET
11/01/17						515-070	4 of 5

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Revisions

No.	Date	By	Description

FDOT GUIDERAIL

Amelia River Waterfront Stabilization
Parking Lots C & D
Town/City: Fernandina Beach
County: Nassau State: Florida

Project No.
99000047.0095

Drawing No.
C4-8

Date
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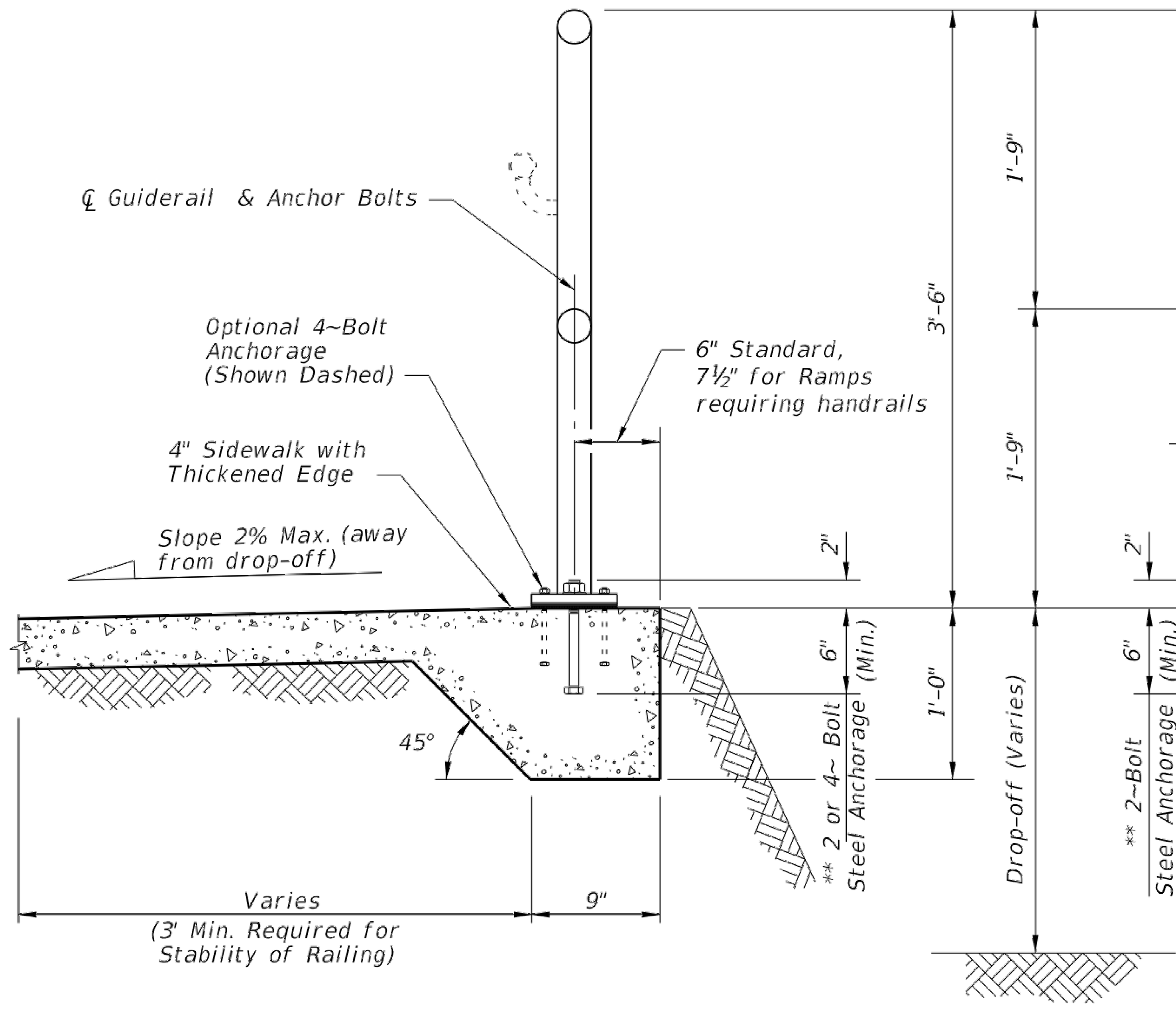
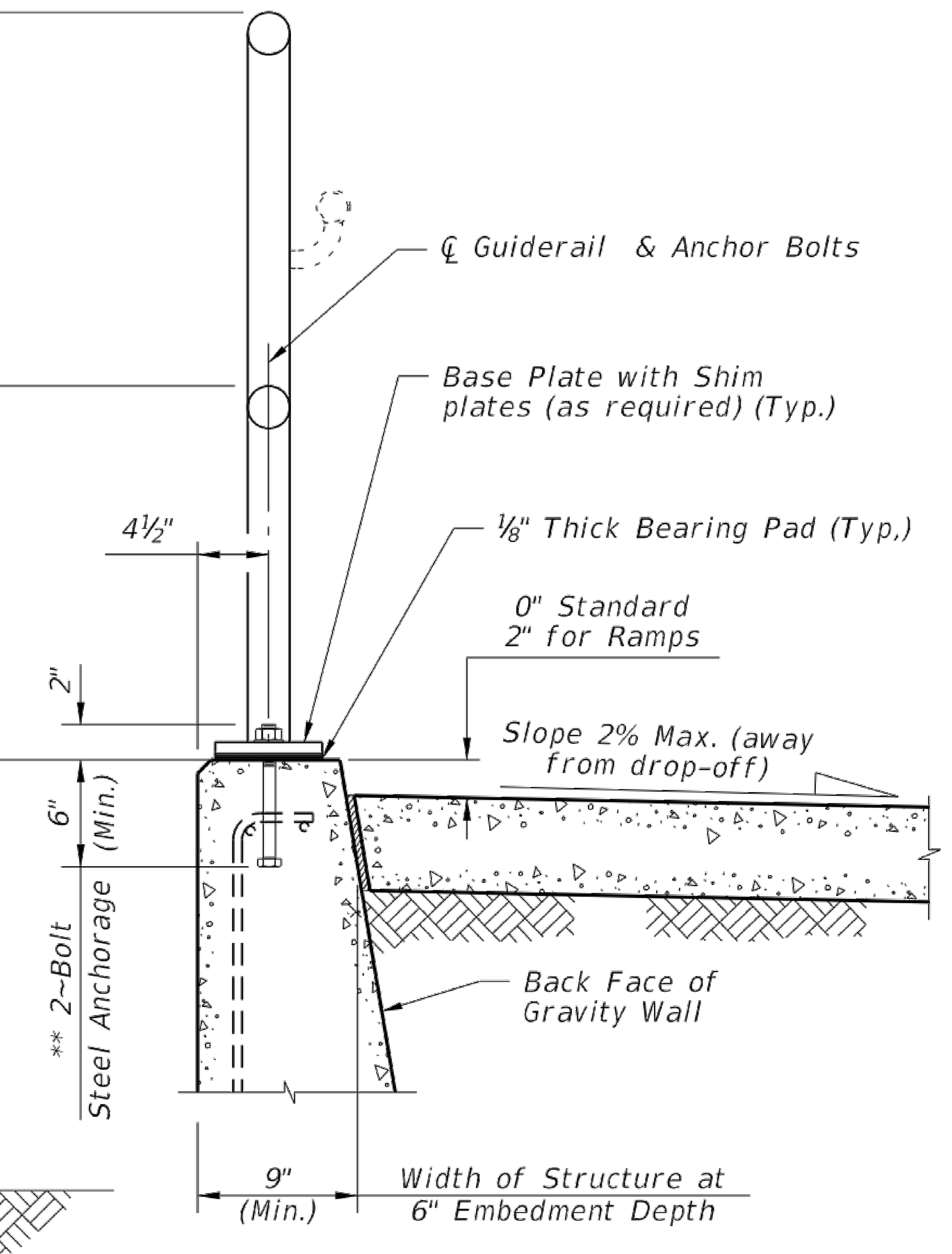
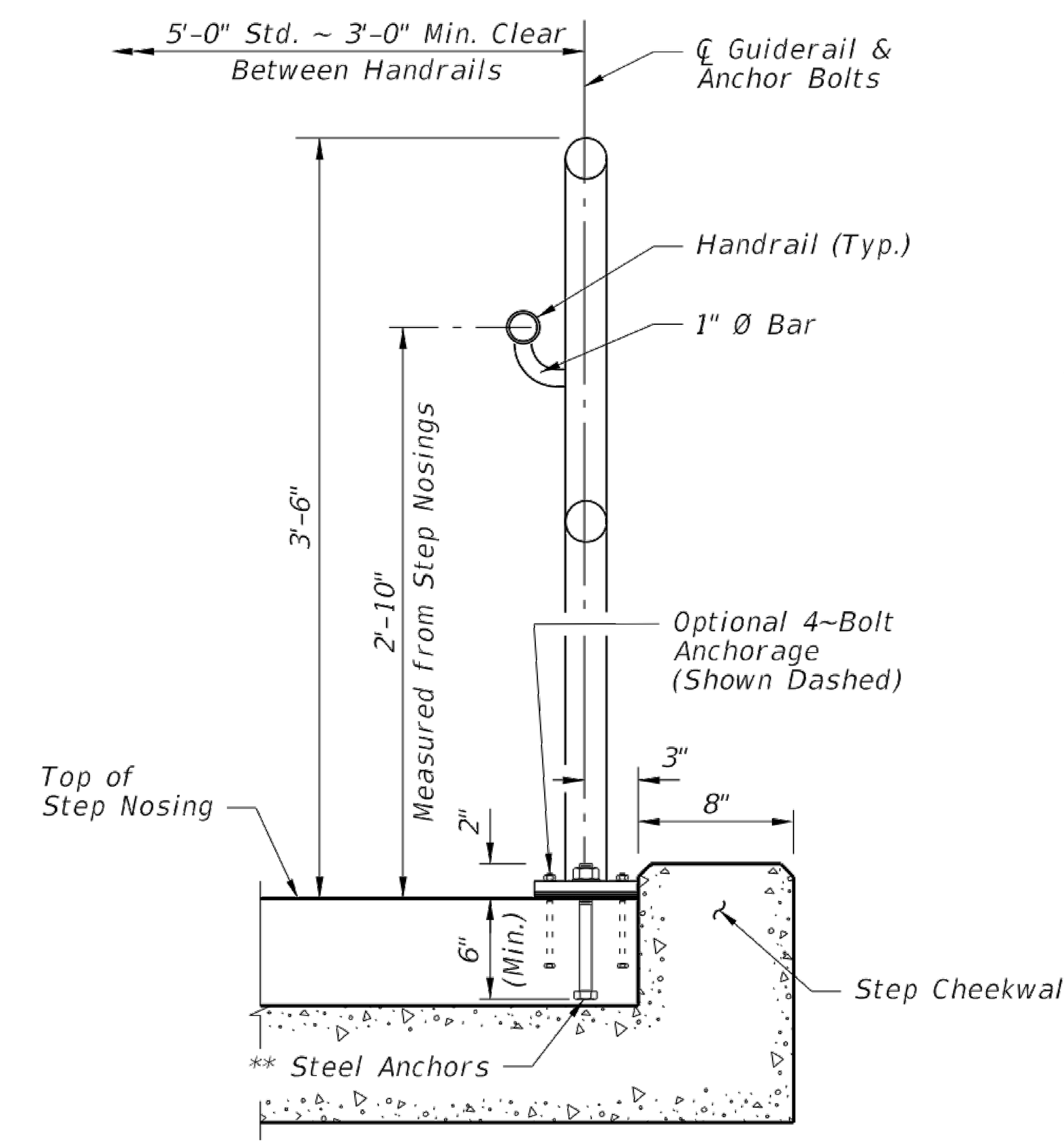


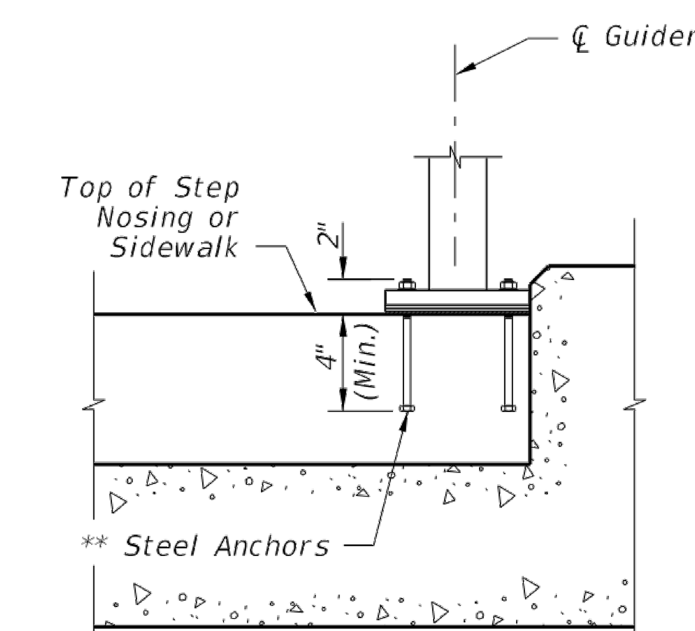
TYPICAL SECTION ON CONCRETE SIDEWALK



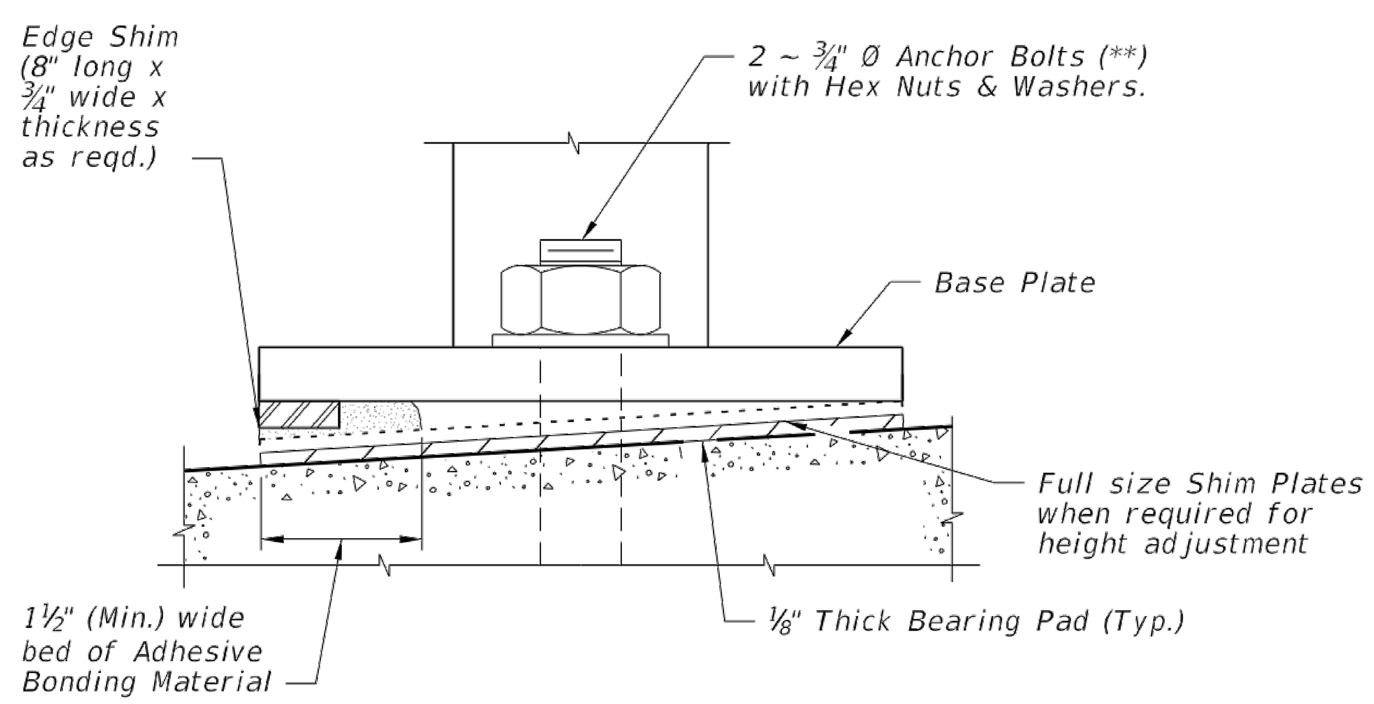
TYPICAL SECTION ON GRAVITY WALL
(Other Retaining Walls Similar)



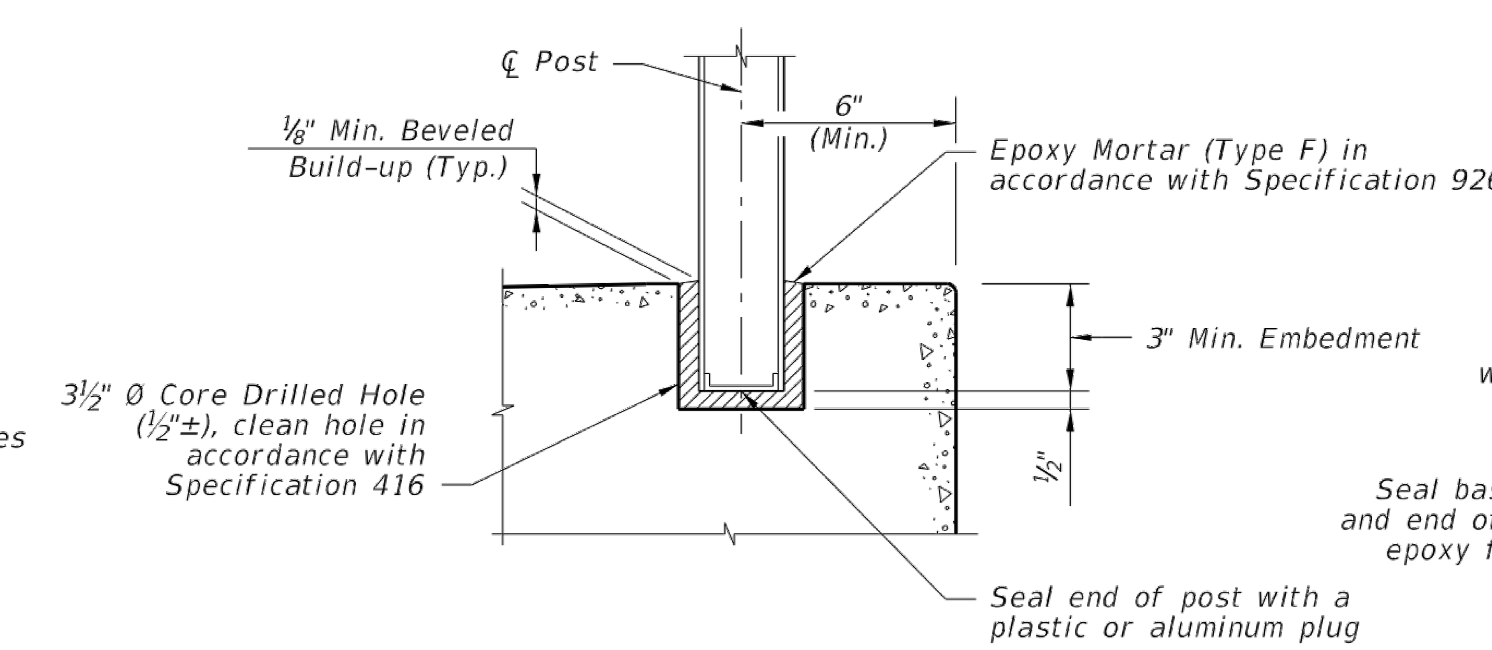
TYPICAL SECTION ON STEPS & STAIRS



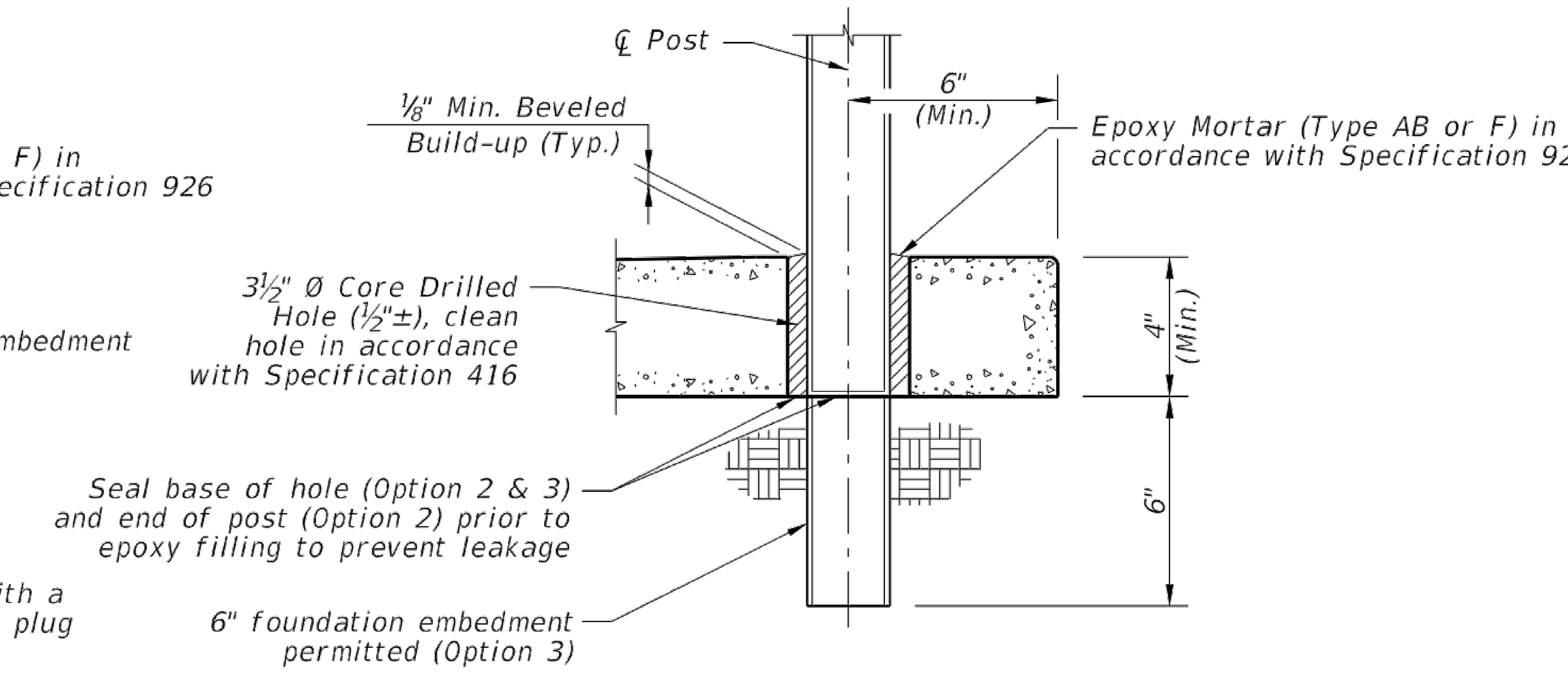
4~BOLT ANCHORAGE DETAIL



DETAIL "F" (OPTIONAL SHIMMING DETAIL FOR CROSS SLOPE CORRECTION)
(Used in lieu of Beveled Shim Plates)



SIDEWALK ANCHORAGE DETAIL
OPTION 1



SIDEWALK ANCHORAGE DETAIL
OPTION 2 & 3

NOTES:
** 2 ~ ¾" Ø x 8" or 4 ~ $\frac{7}{16}$" Ø x 6" Steel Anchors: Galvanized Steel Bolts (As Shown) (C-I-P); Galvanized U-Bolts Permitted (C-I-P); Galvanized Adhesive Anchors Permitted

*** The minimum embedment for Adhesive Anchors is 6" for 2~Bolt Anchorage or 4" for 4~Bolt Anchorage.

10/14/2019 11:04:41 AM

LAST REVISION	REVISION	DESCRIPTION:	FDOT	FY 2020-21 STANDARD PLANS	PIPE GUIDERAIL (ALUMINUM)	INDEX	SHEET
11/01/17						515-070	5 of 5

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Designed by Emily Bredestege

Revisions

No.	Date	By	Description

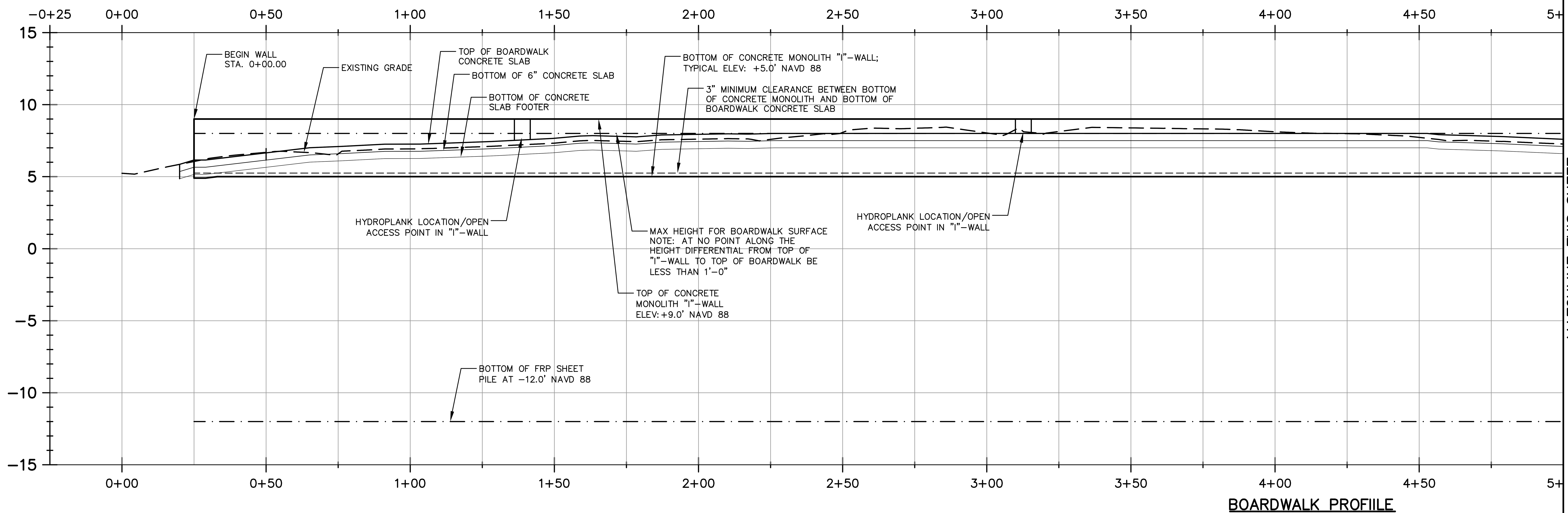
FDOT GUIDERAIL

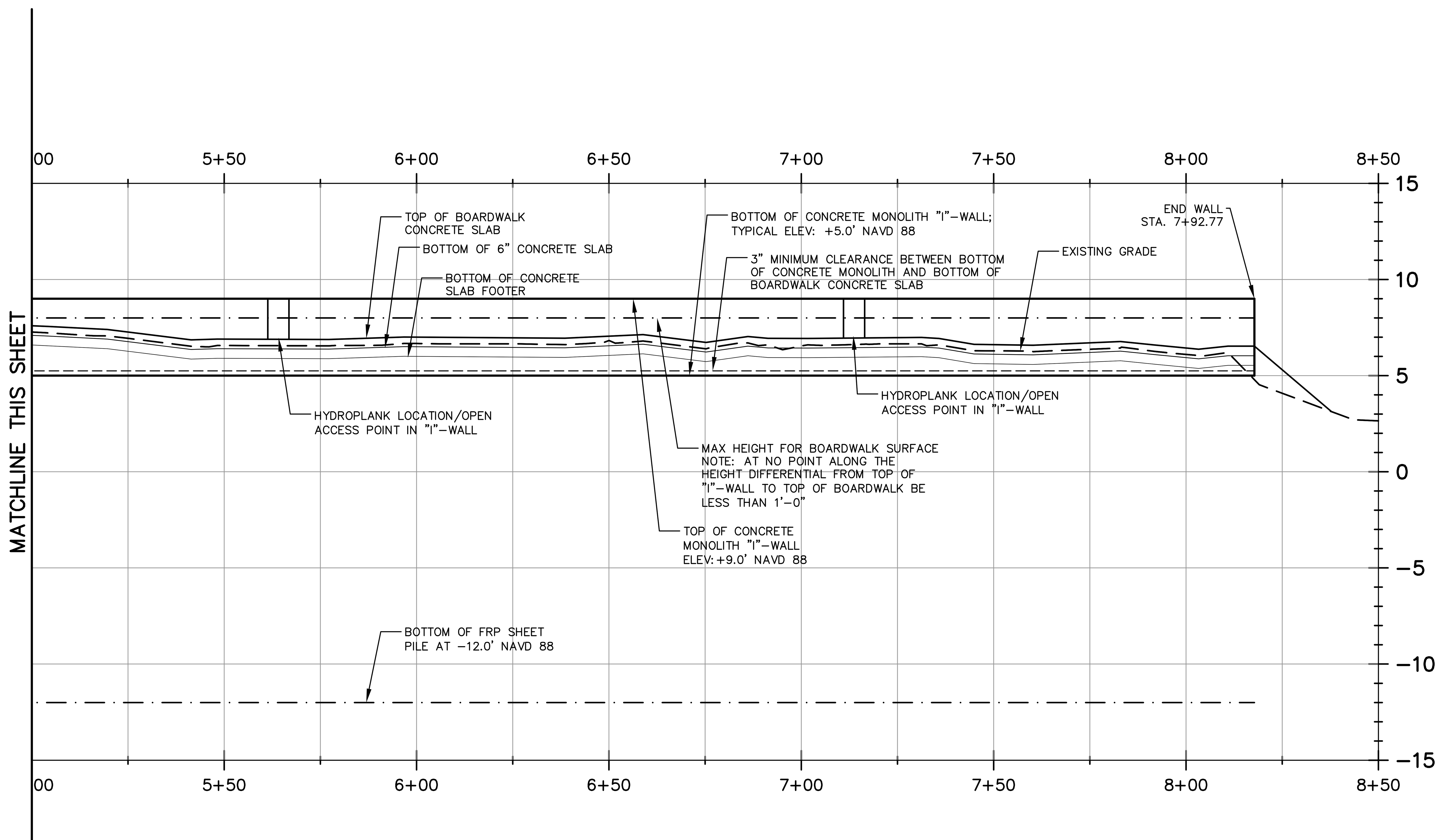
Amelia River Waterfront Stabilization
Parking Lots C & D
Town/City: Fernandina Beach
County: Nassau State: Florida

Project No.
99000047.0095

Drawing No.
C4-9

Date
May 10, 2021





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Revisions

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BOARDWALK AND "I"-WALL PROFILE

Amelia River Waterfront Stabilization
Parking Lots C & D

Town/City: Fernandina Beach
County: Nassau
State: Florida

Project No.
99000047.0095

Drawing No.
C5-1

Date
May 10, 2021

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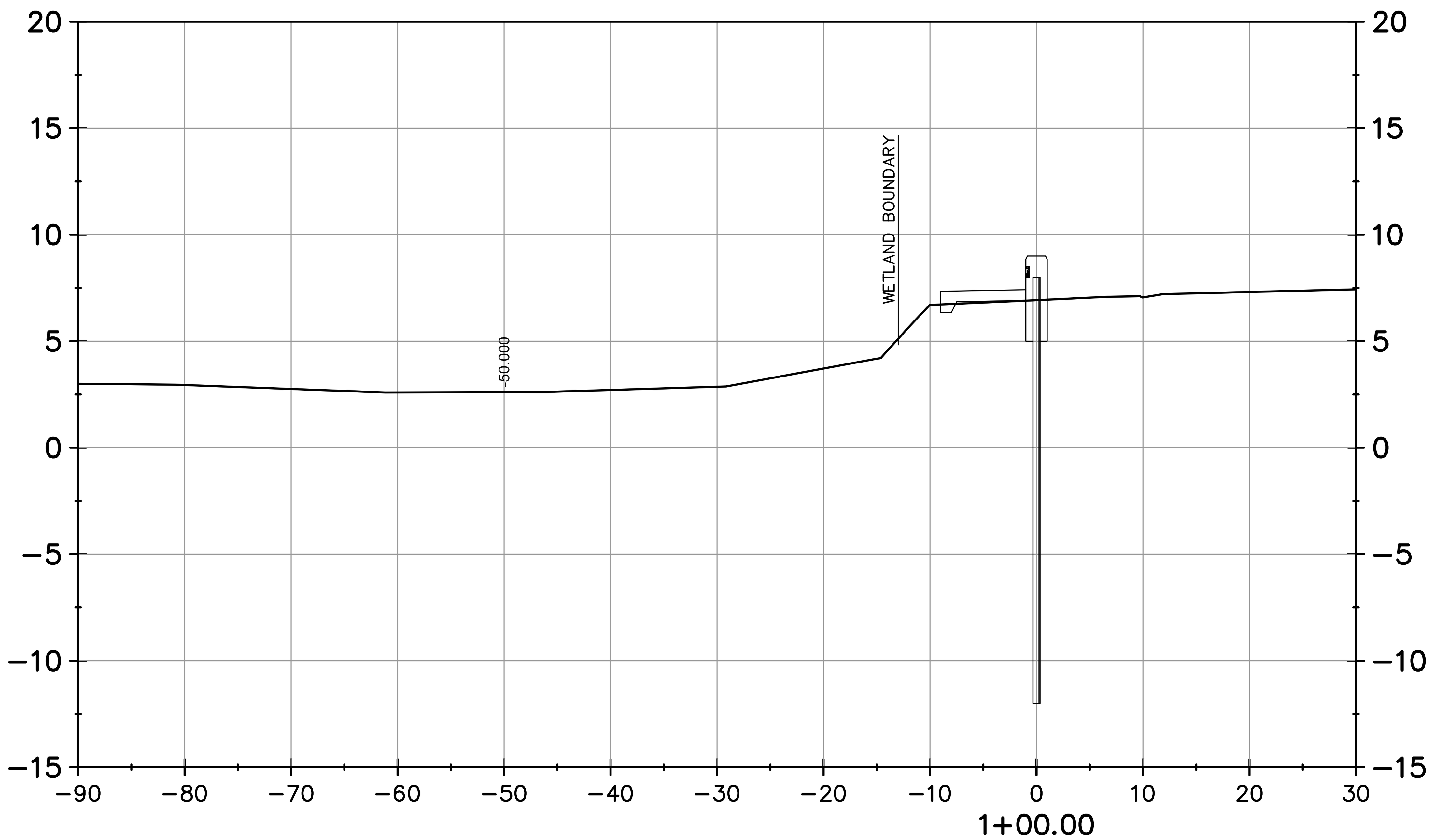

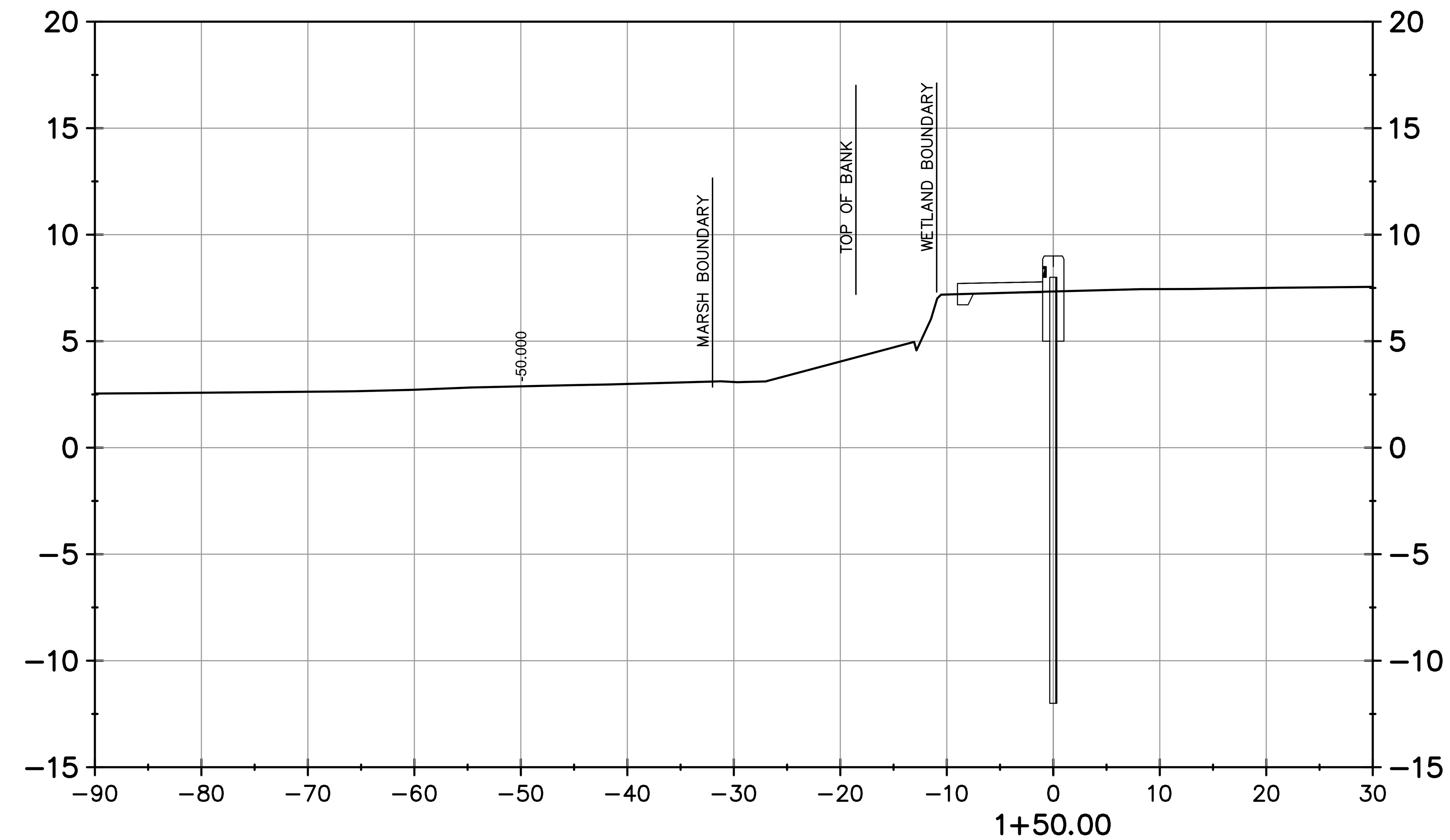

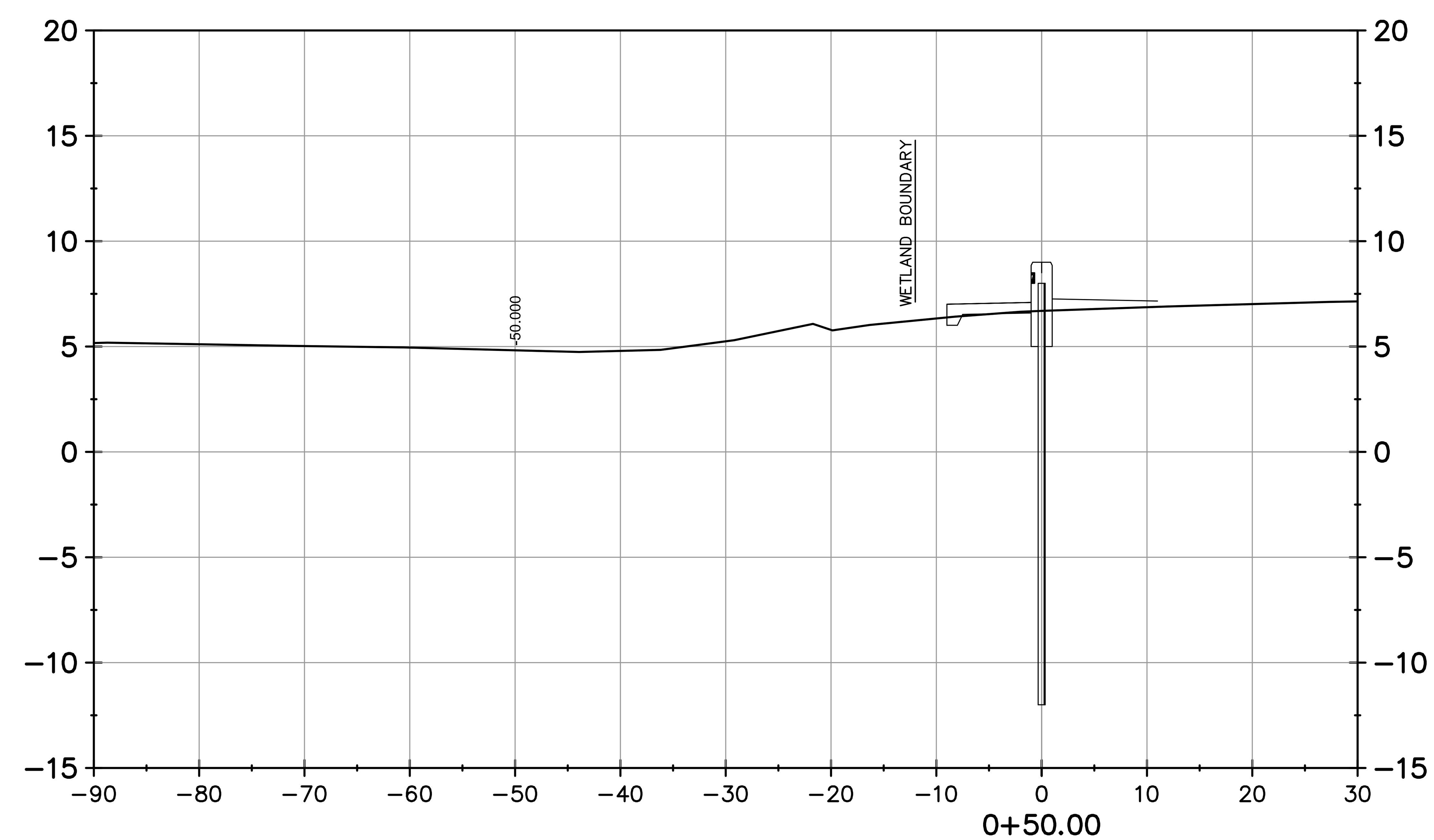

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Project Manager	Christopher Nardone, AIA
Designed by	Emily Bredestege

Revisions

No.	Date	By	Description

CROSS SECTIONS

Amelia River Waterfront Stabilization
Parking Lots C & D

Town/City: Fernandina Beach
County: Nassau State: Florida

Project No.
99000047.0095

Drawing No.
C6-1

Date
May 10, 2021

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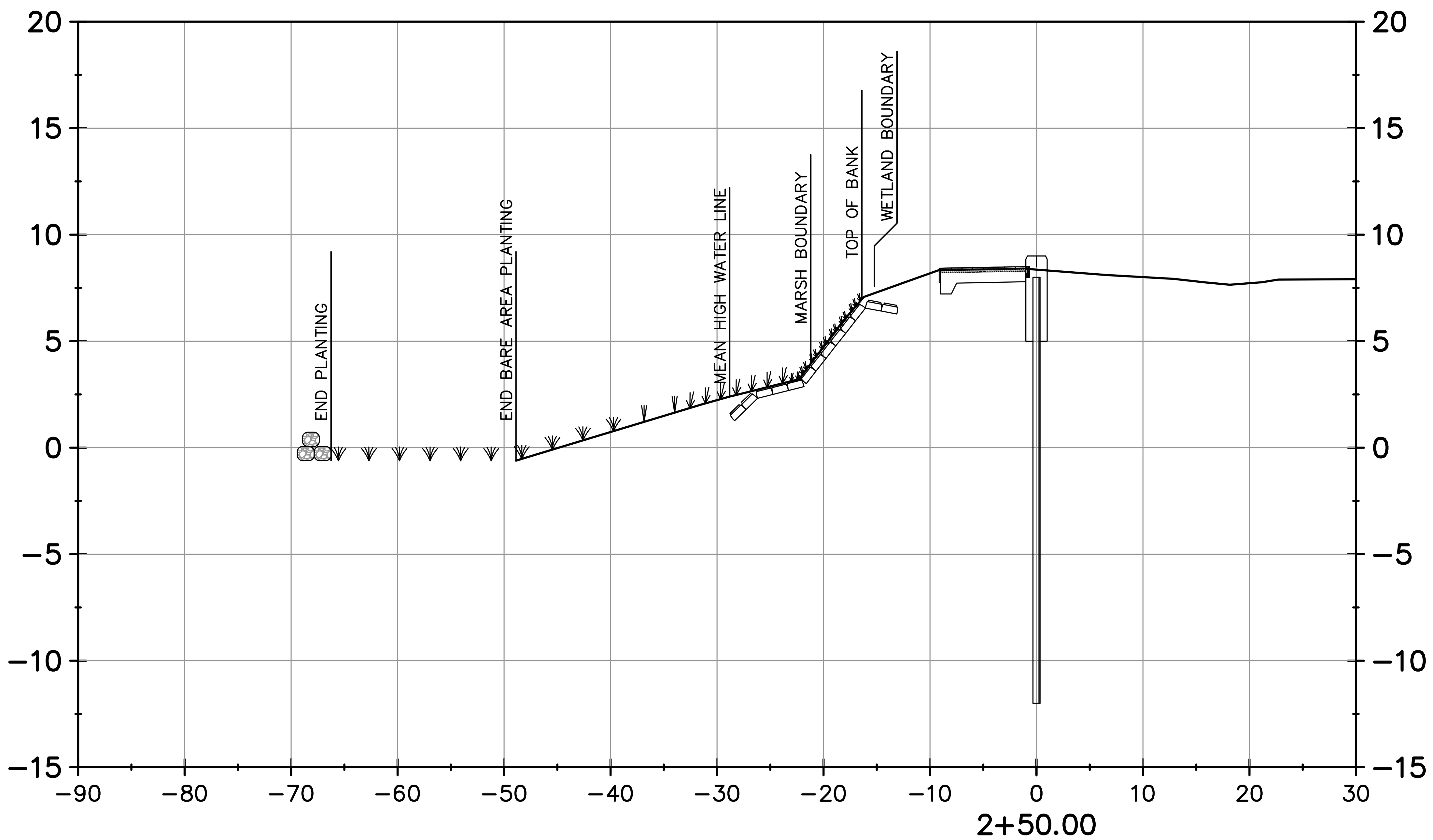

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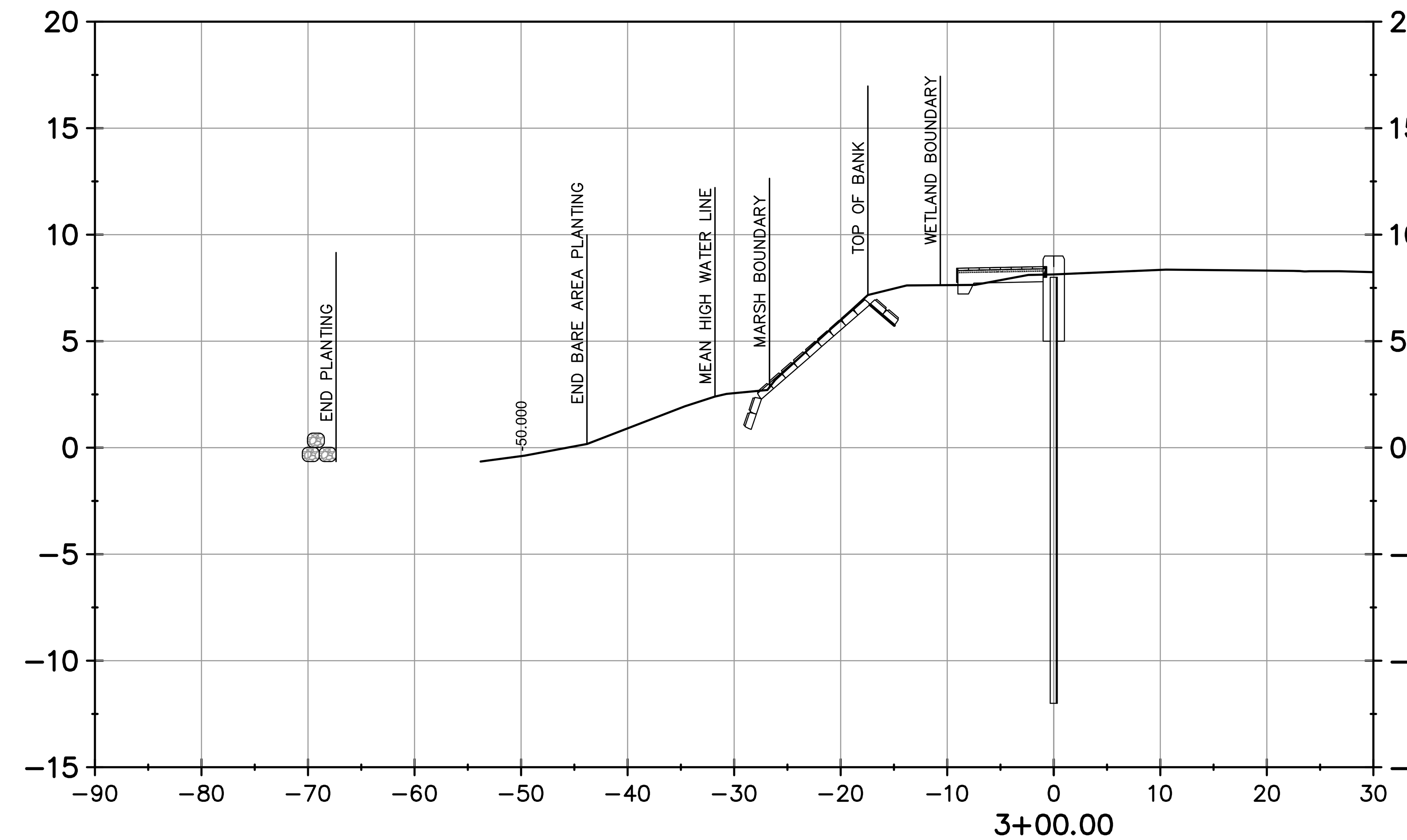

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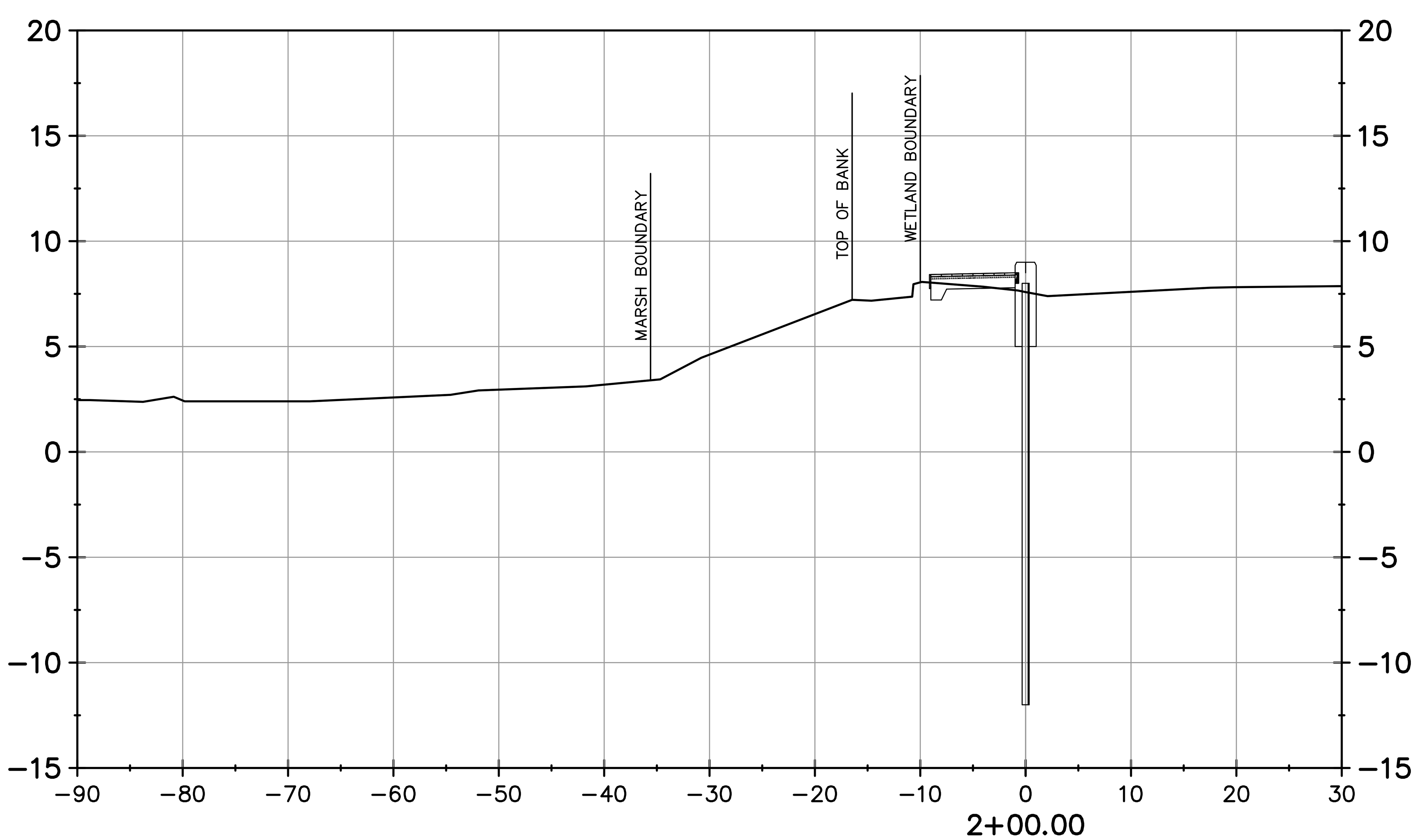

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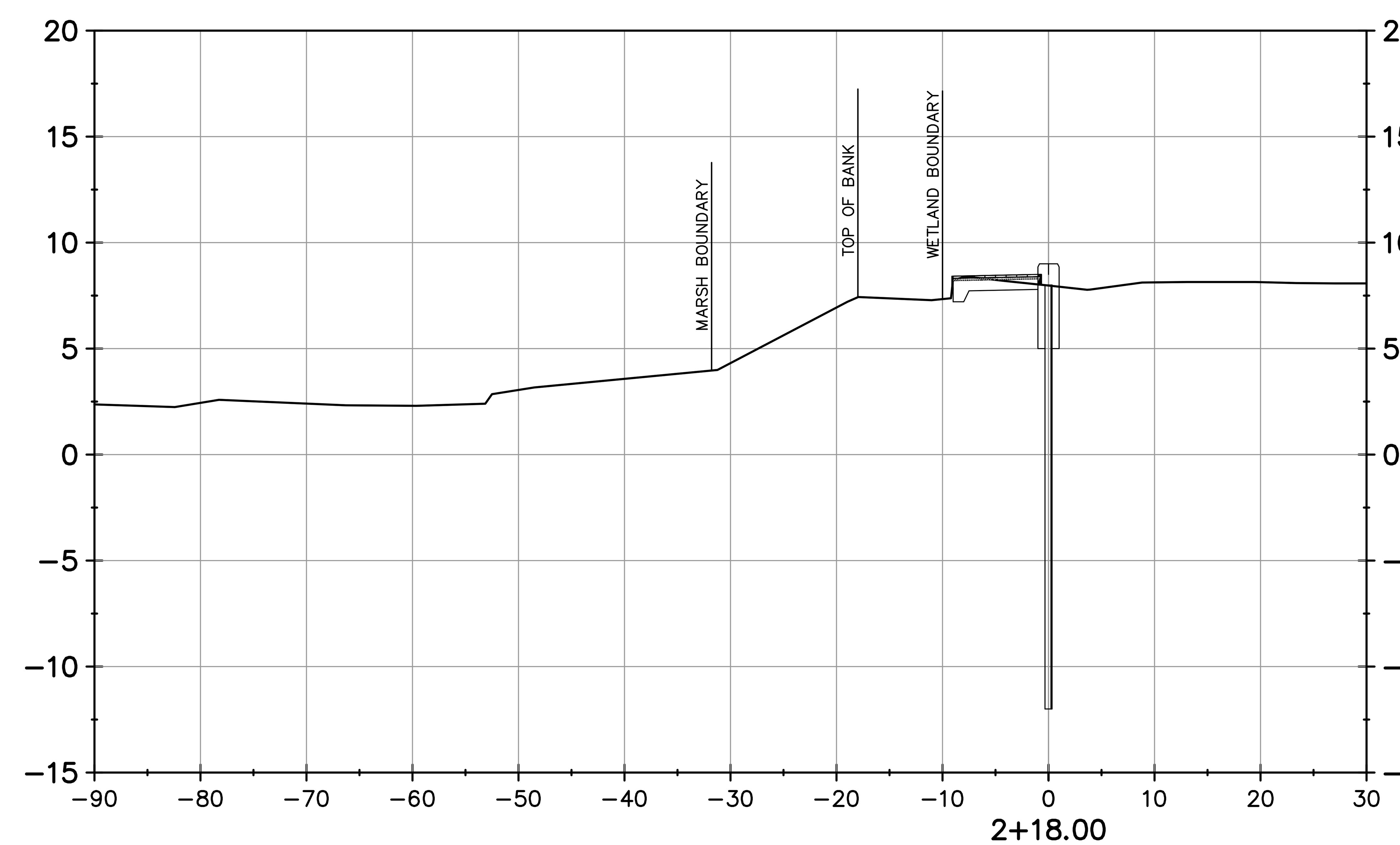

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County: Nassau State: Florida

Project No.
99000047.0095

Drawing No.
C6-2

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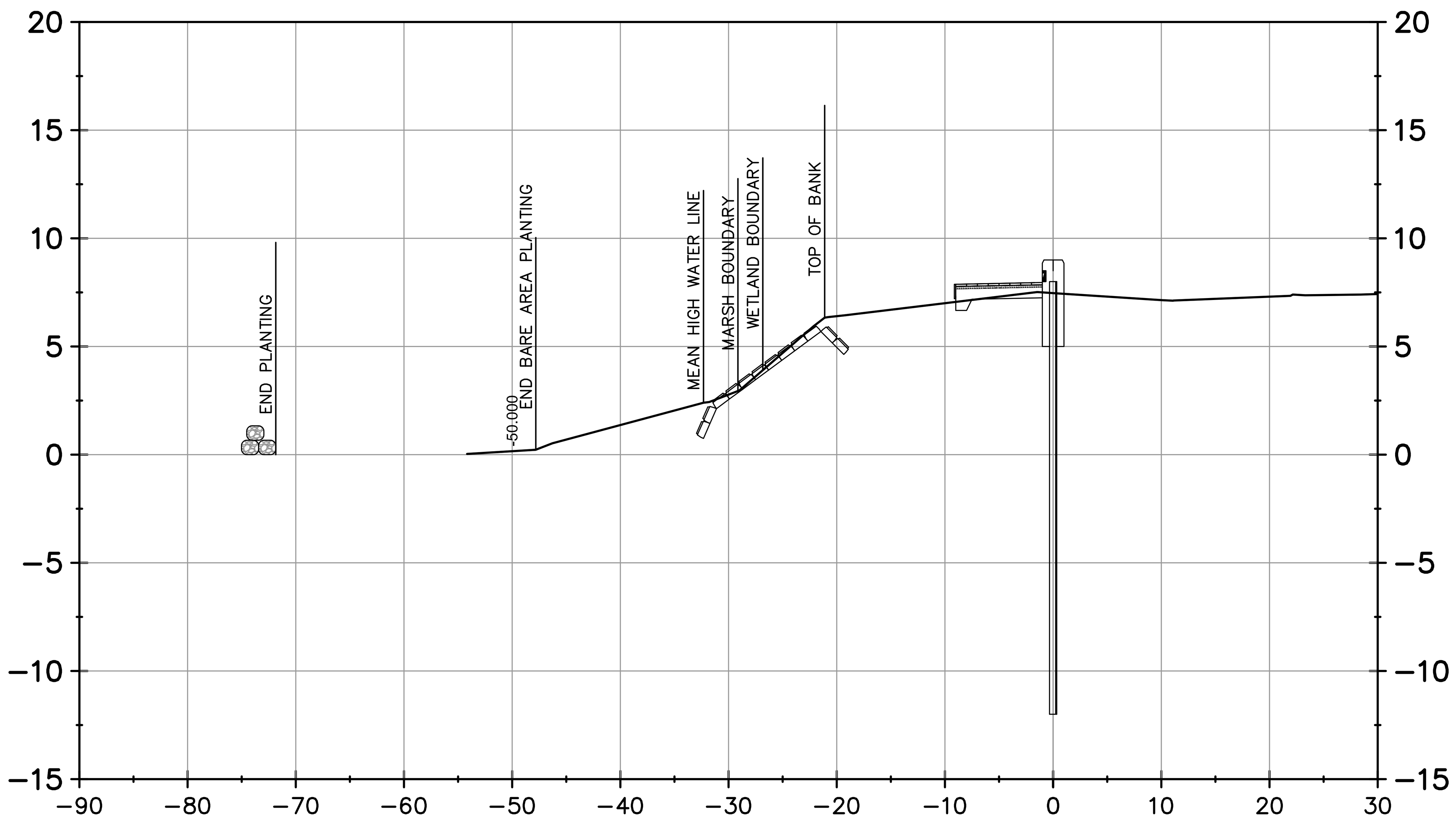
May 10, 2021



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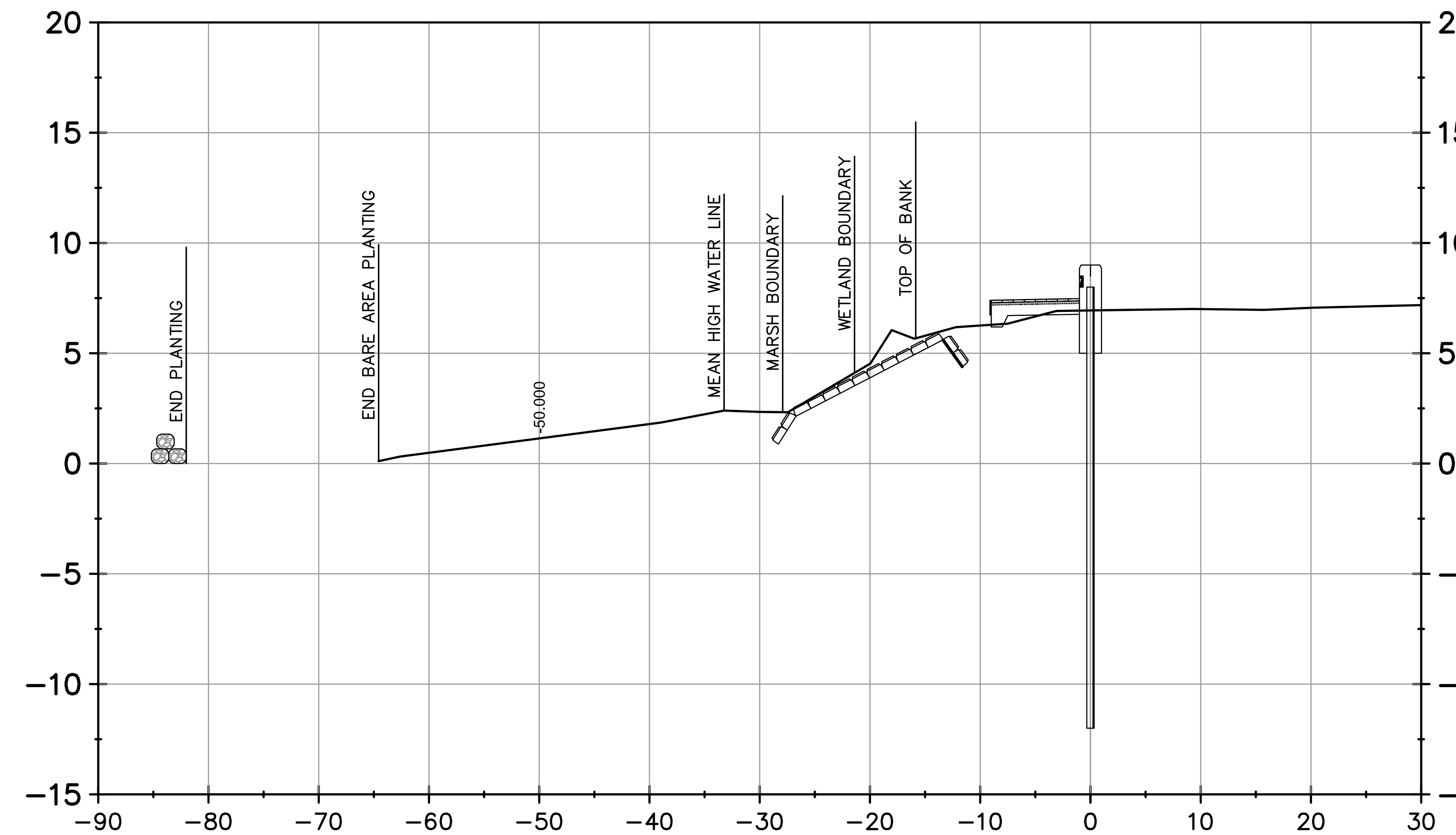

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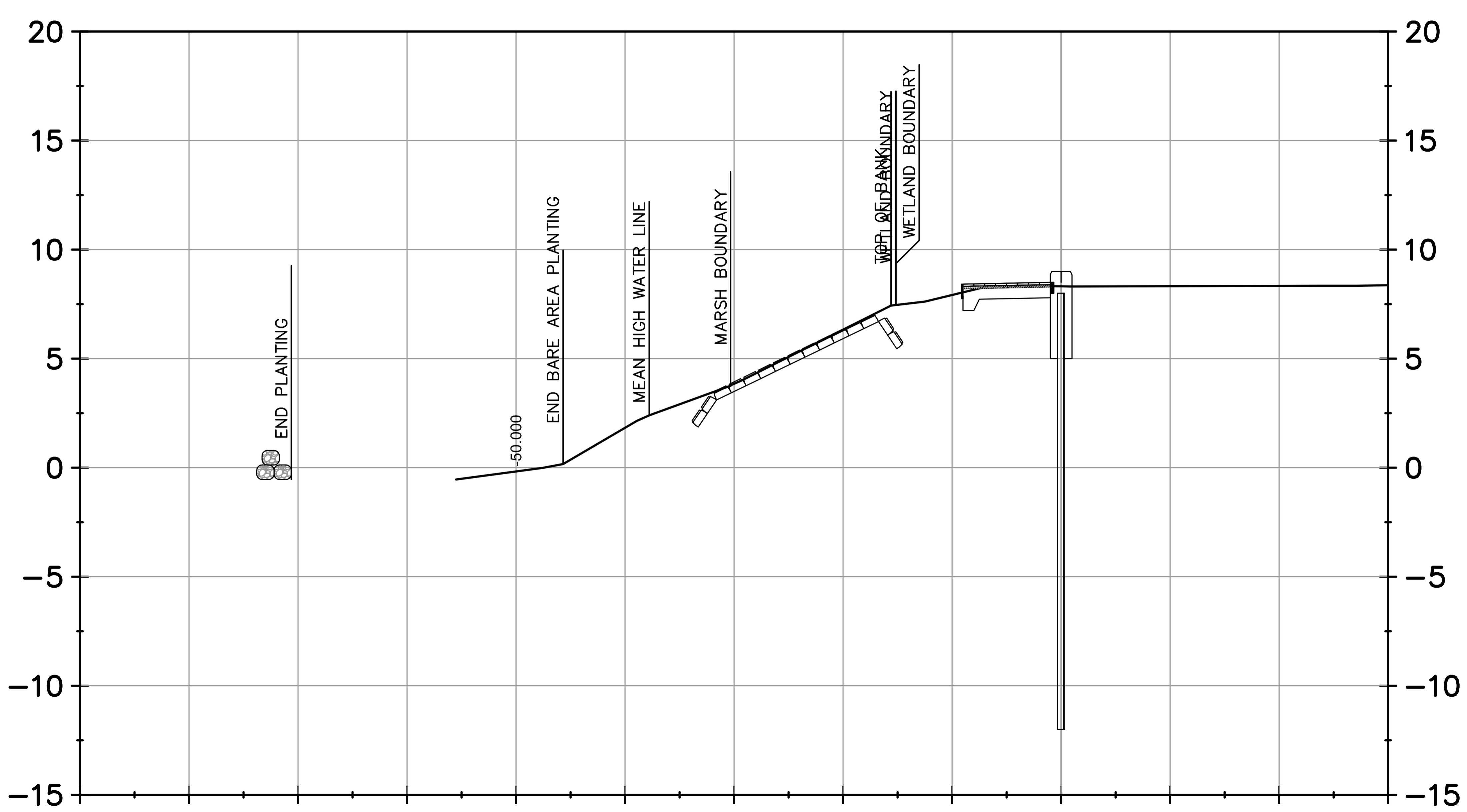

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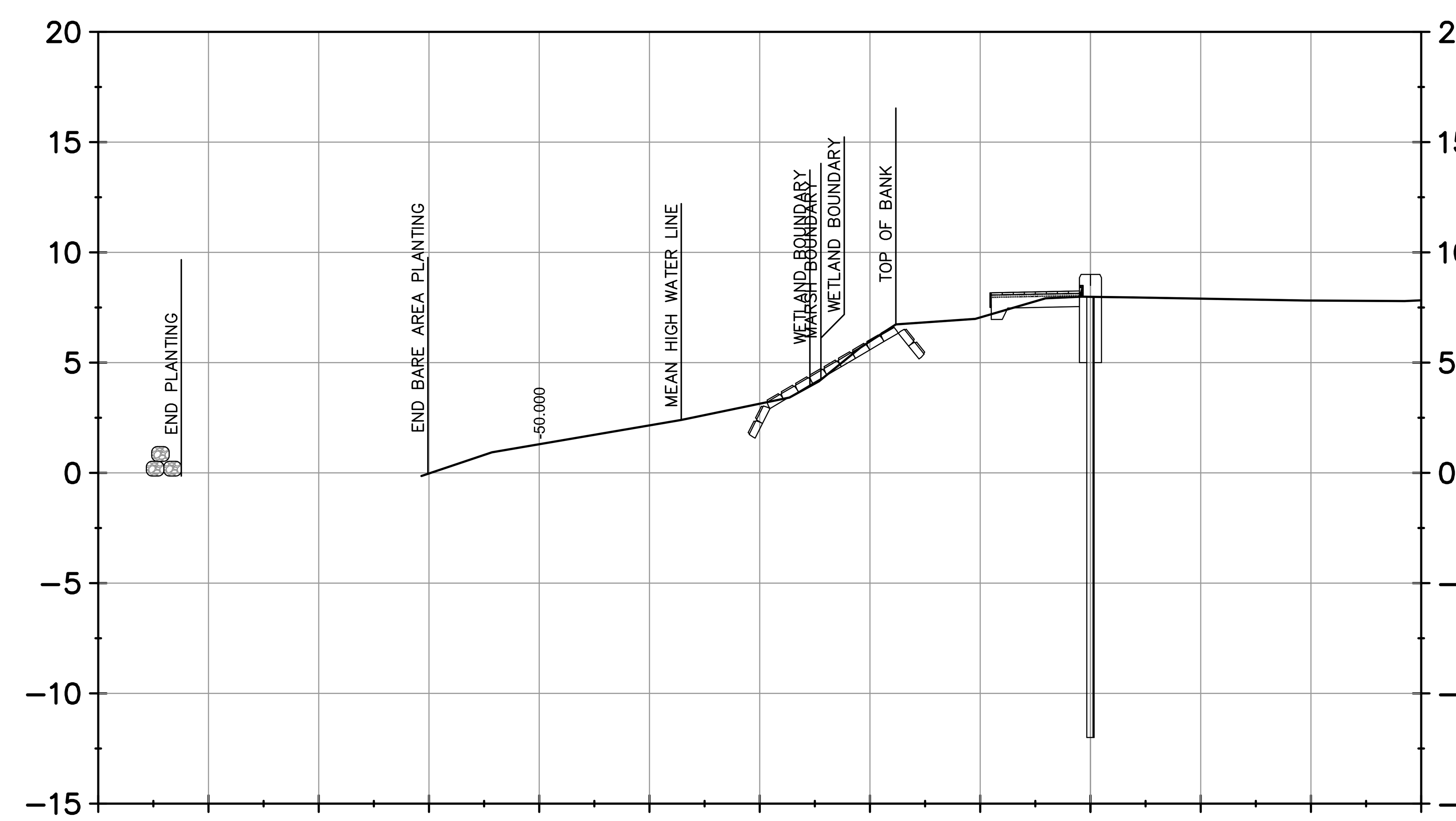

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Amelia River Waterfront
Stabilization
Parking Lots C & D

Town/City: Fernandina Beach
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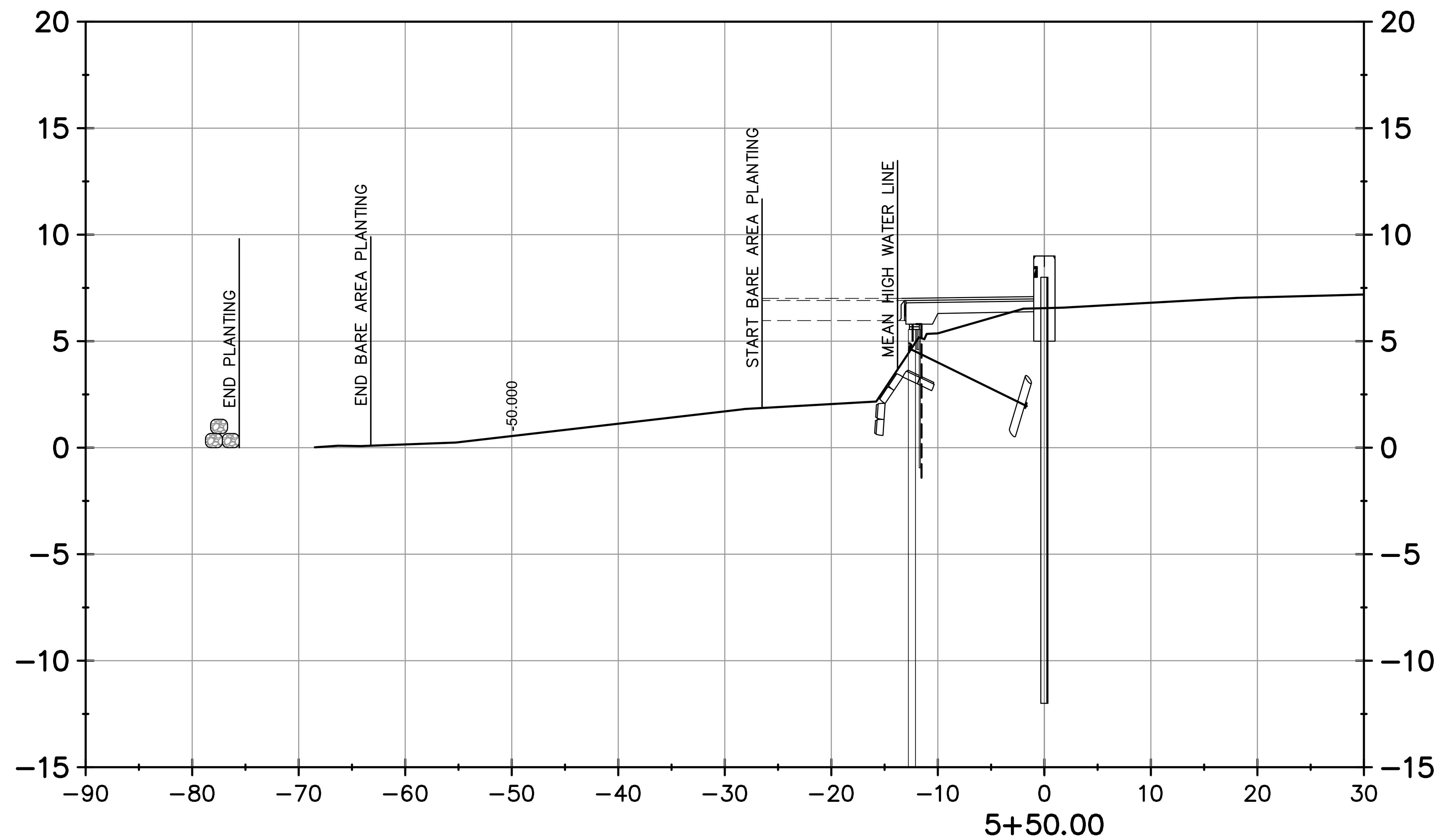

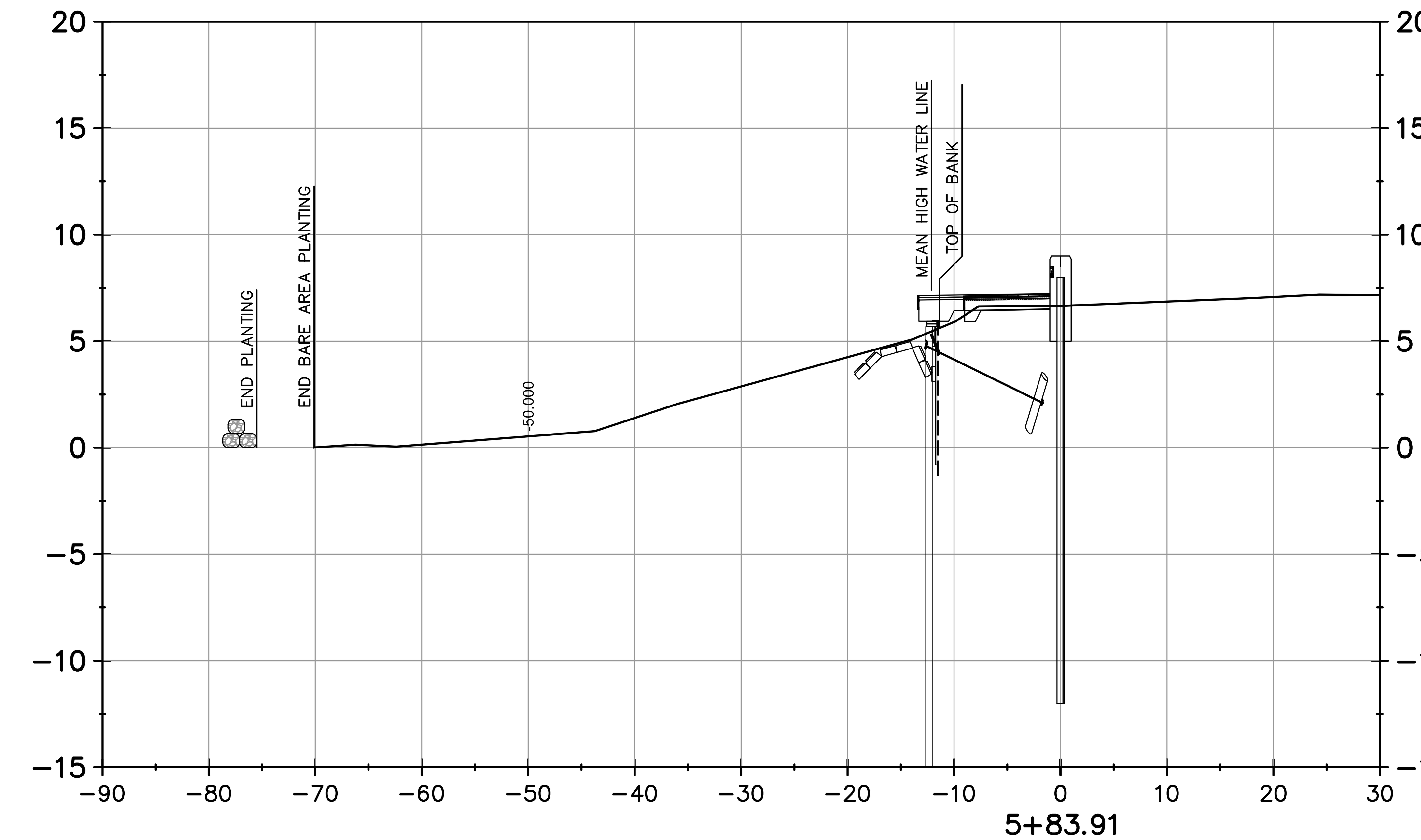

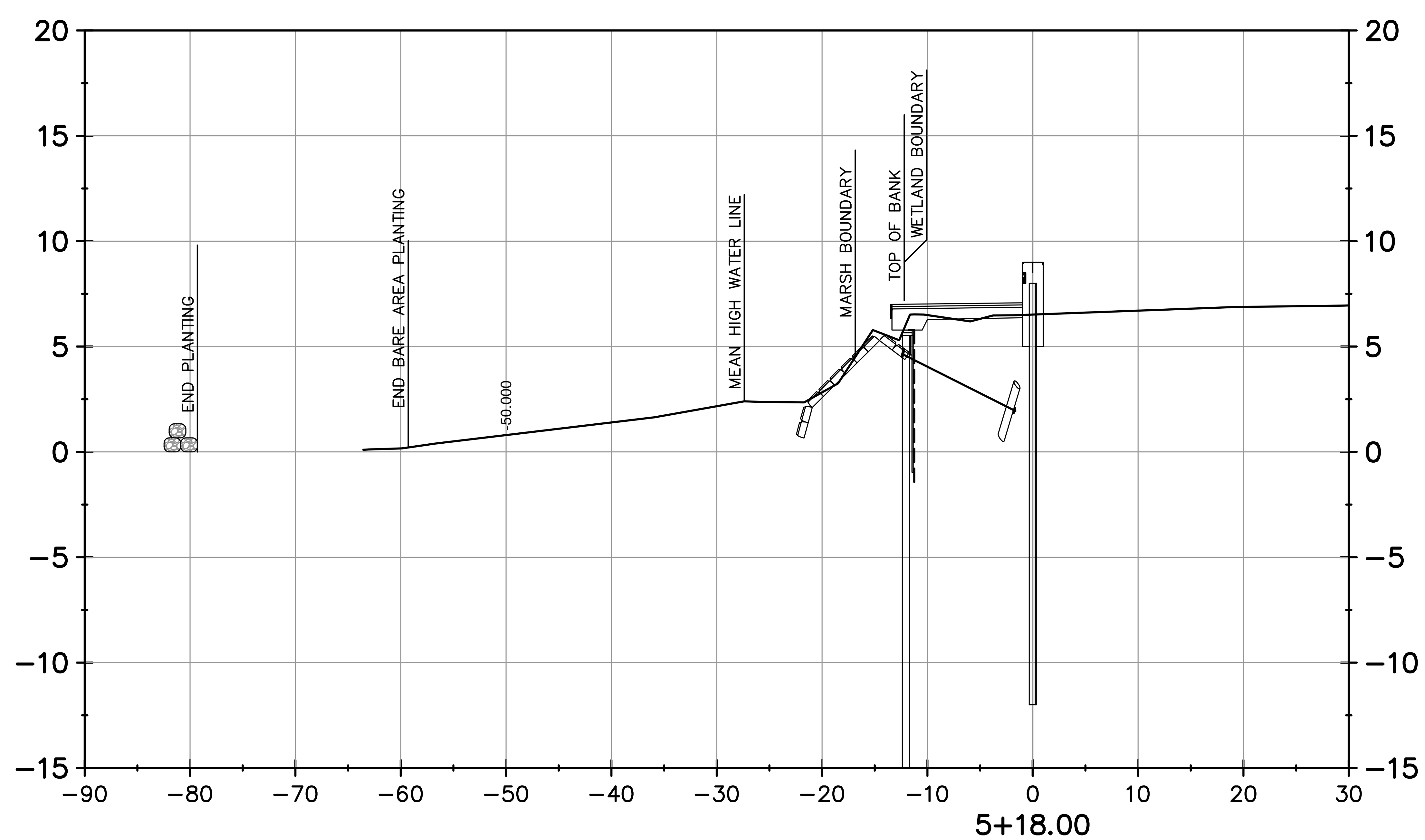

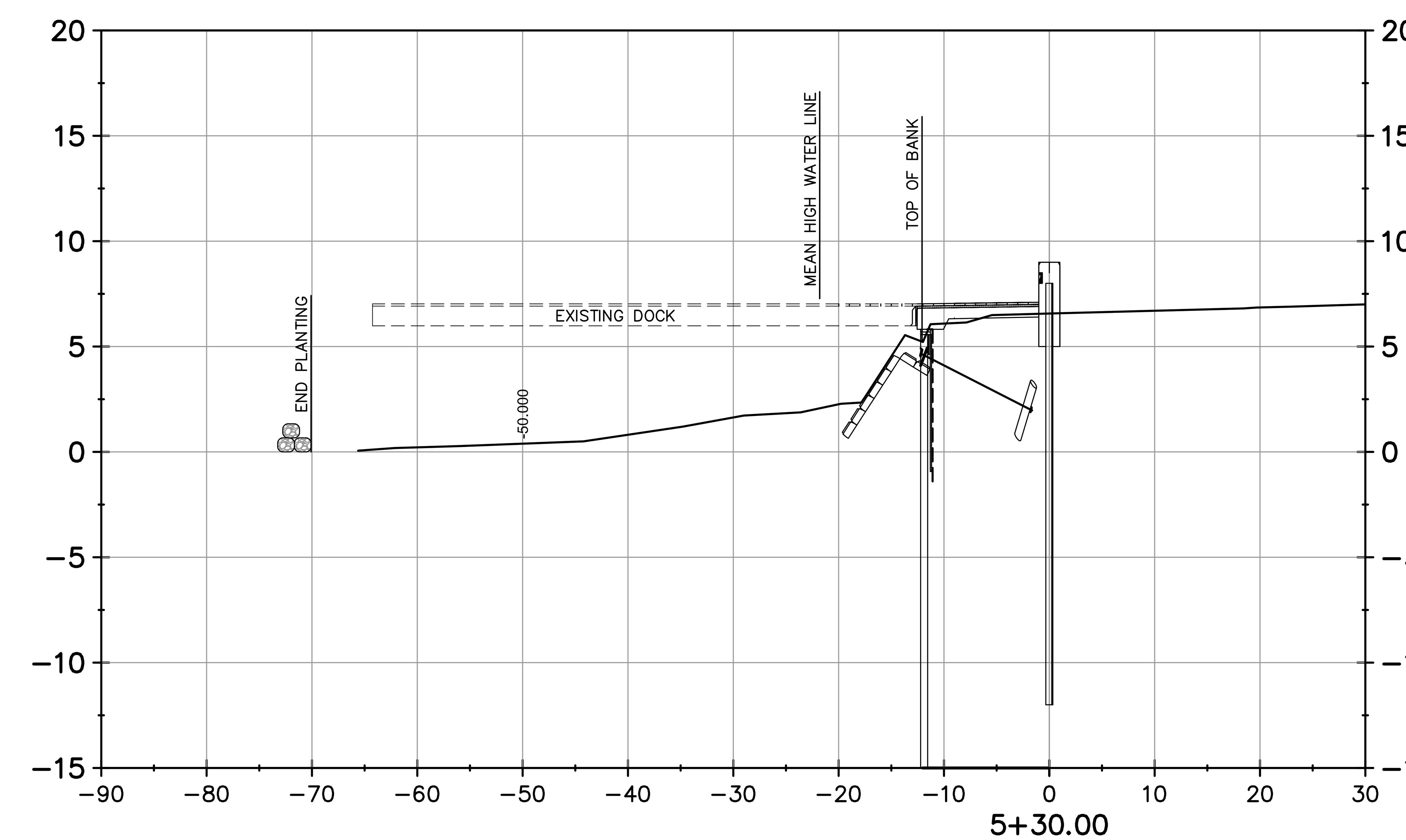

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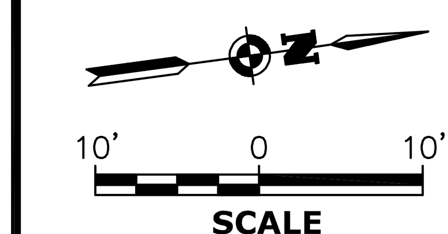

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Amelia River Waterfront Stabilization Parking Lots C & D

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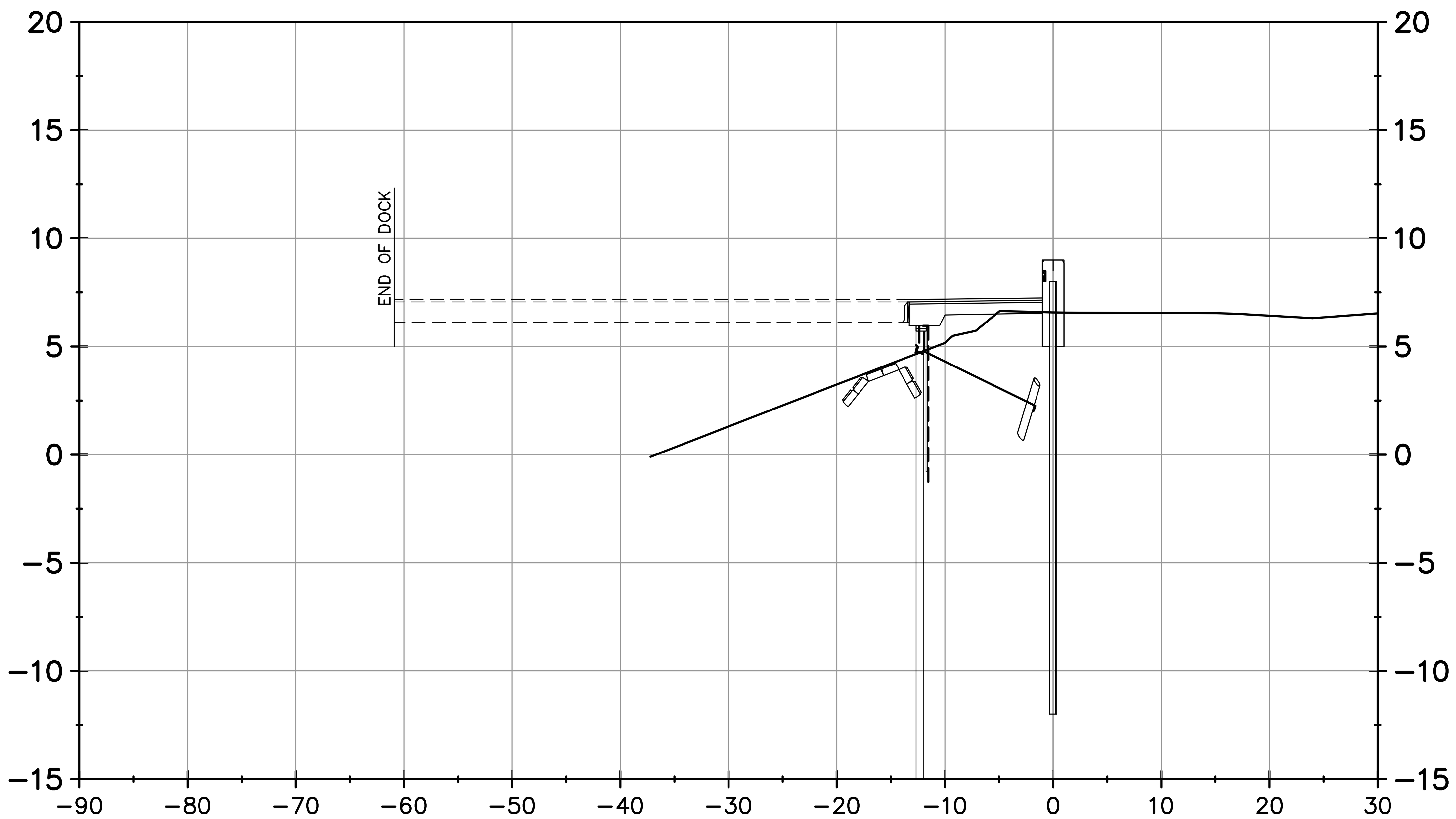

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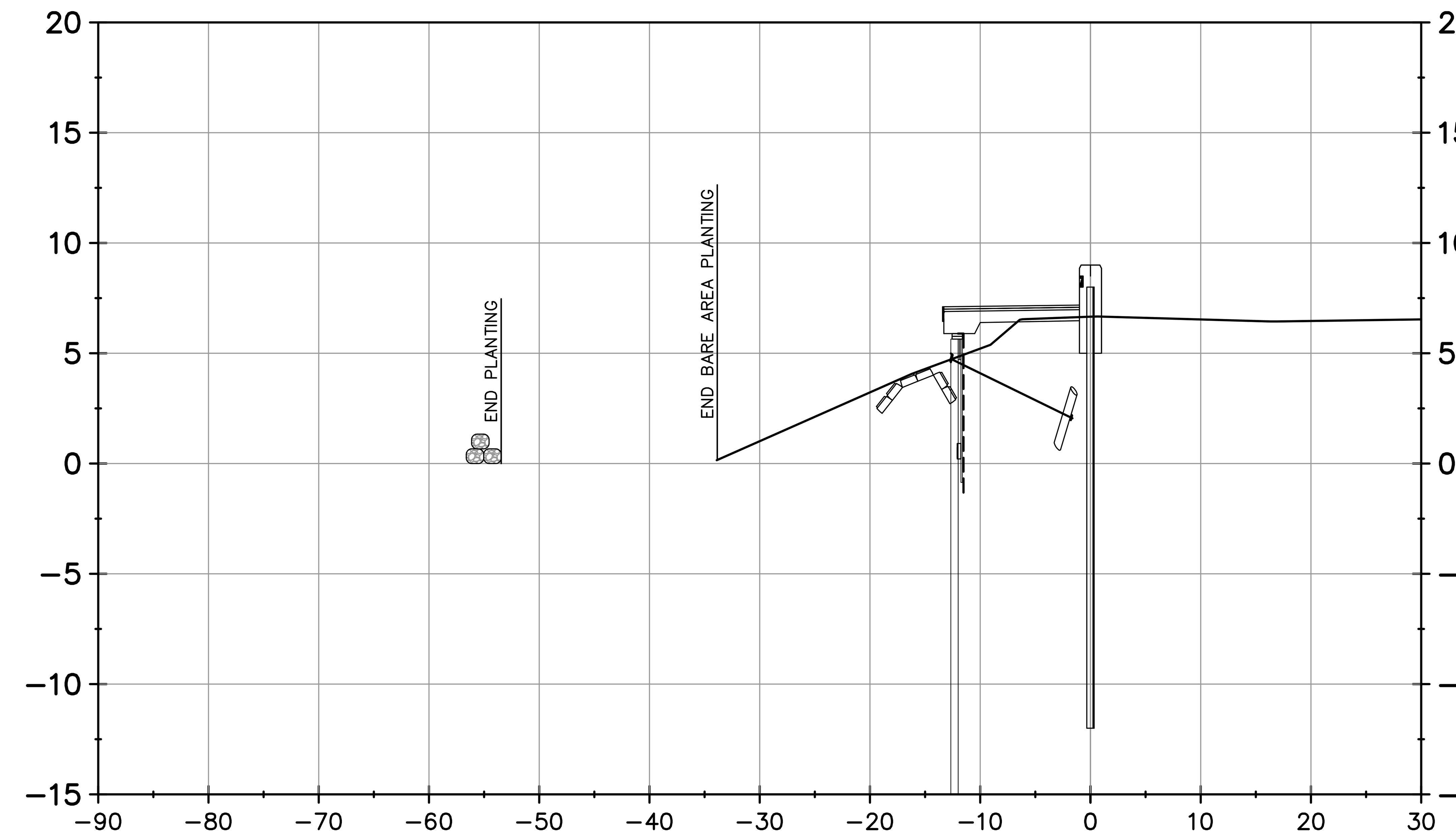

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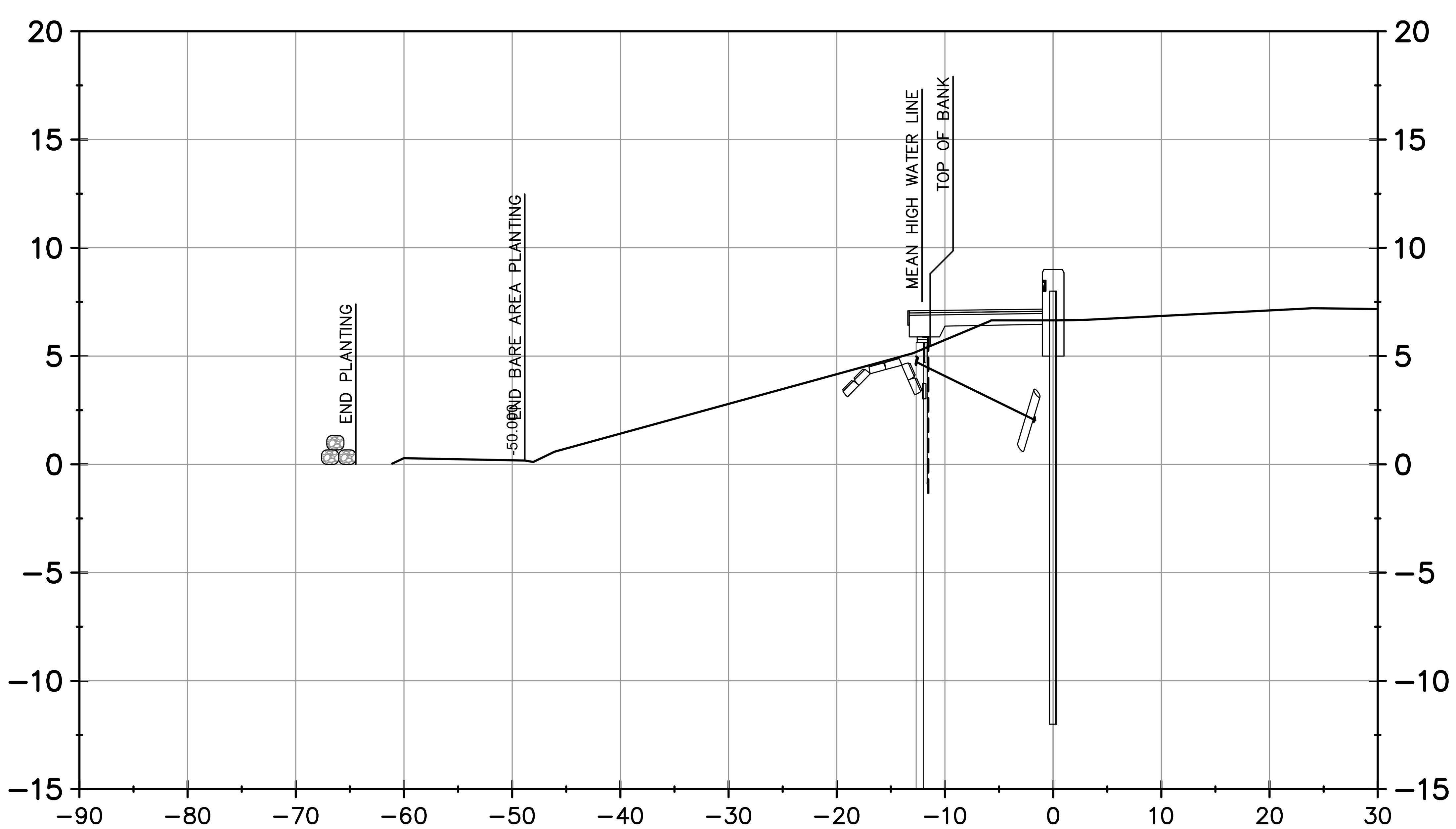

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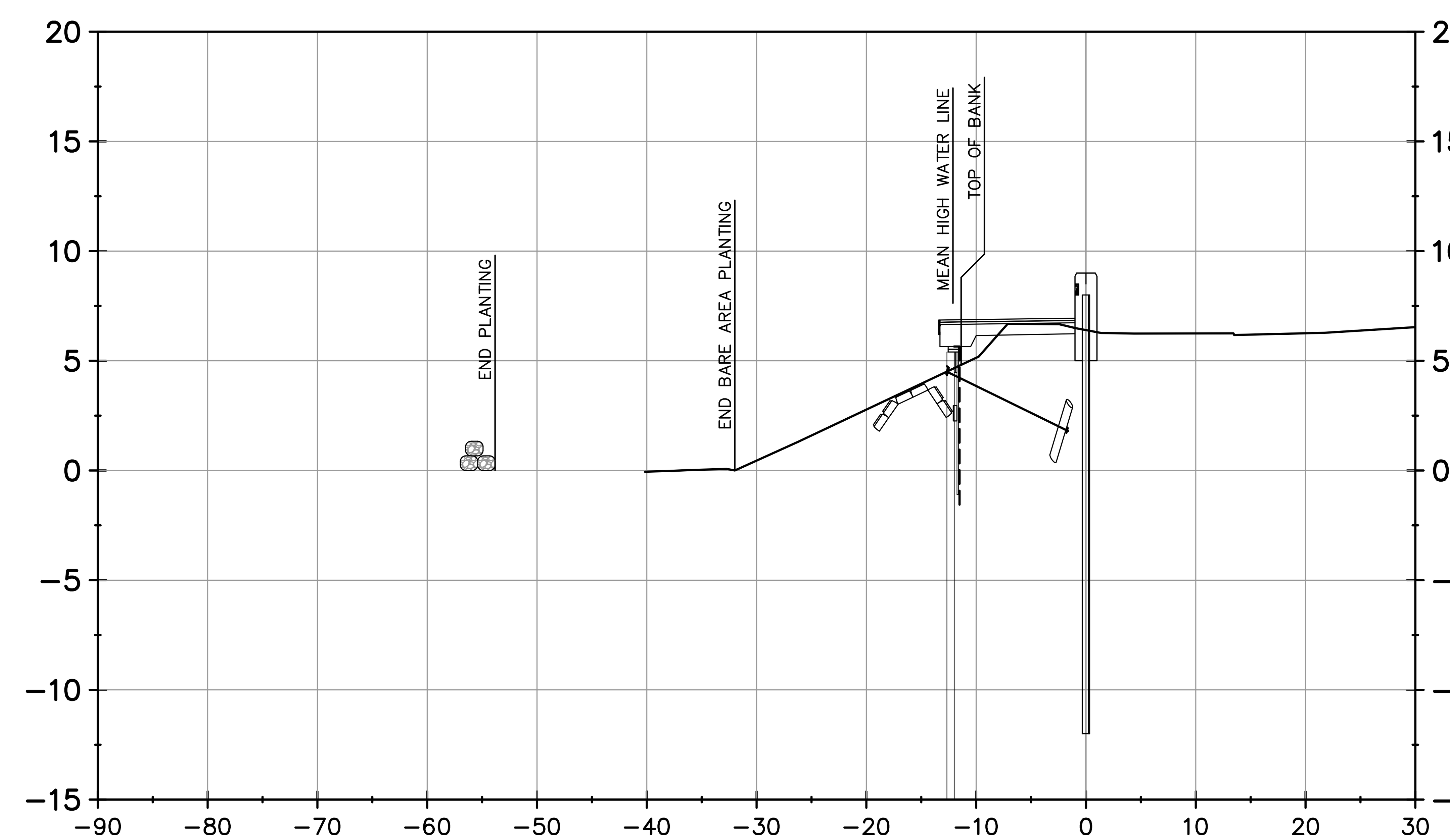

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Stabilization
Parking Lots C & D

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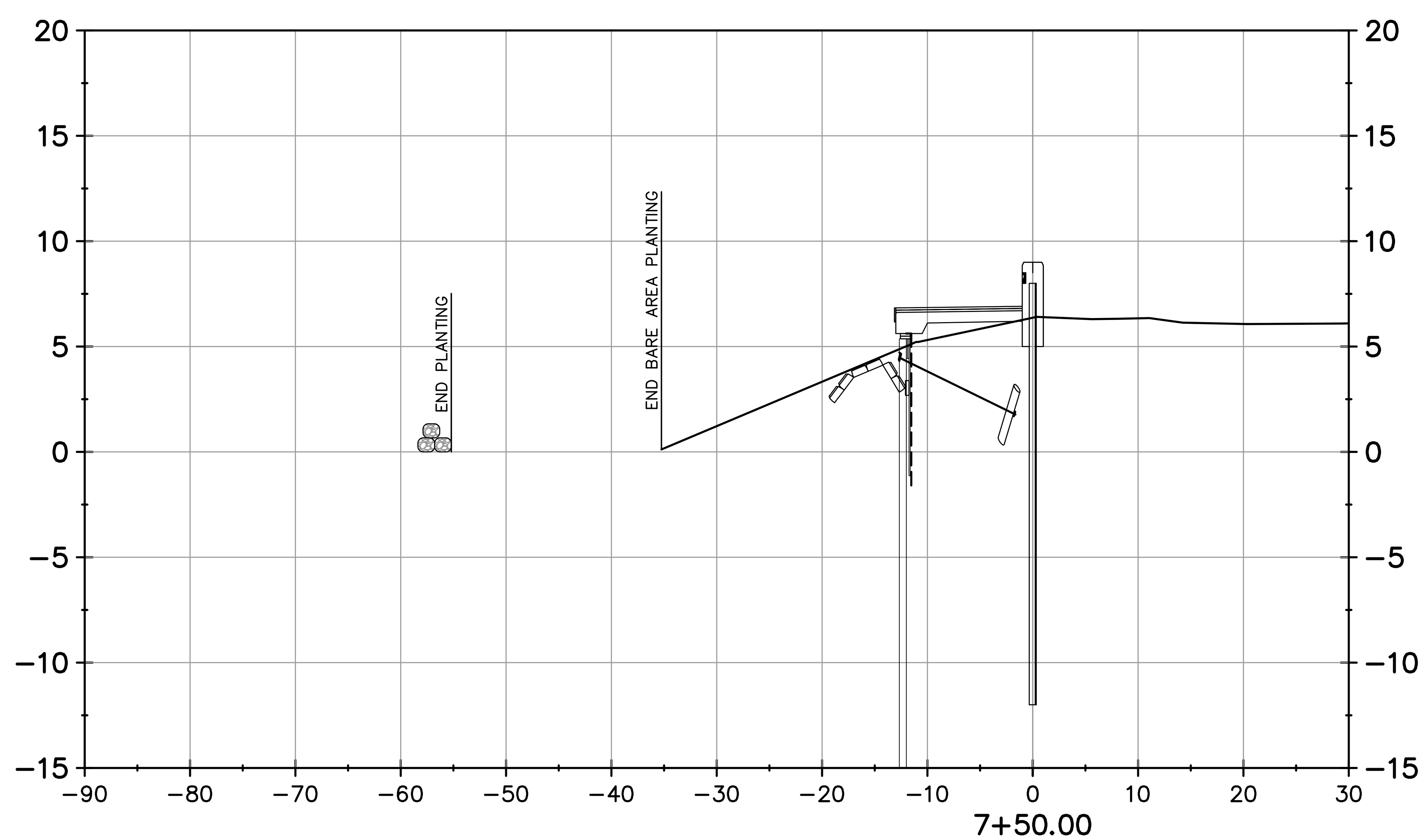

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Stabilization
Parking Lots C & D

Town/City: Fernandina Beach
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Project No.
99000047.0095

Drawing No.
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Date
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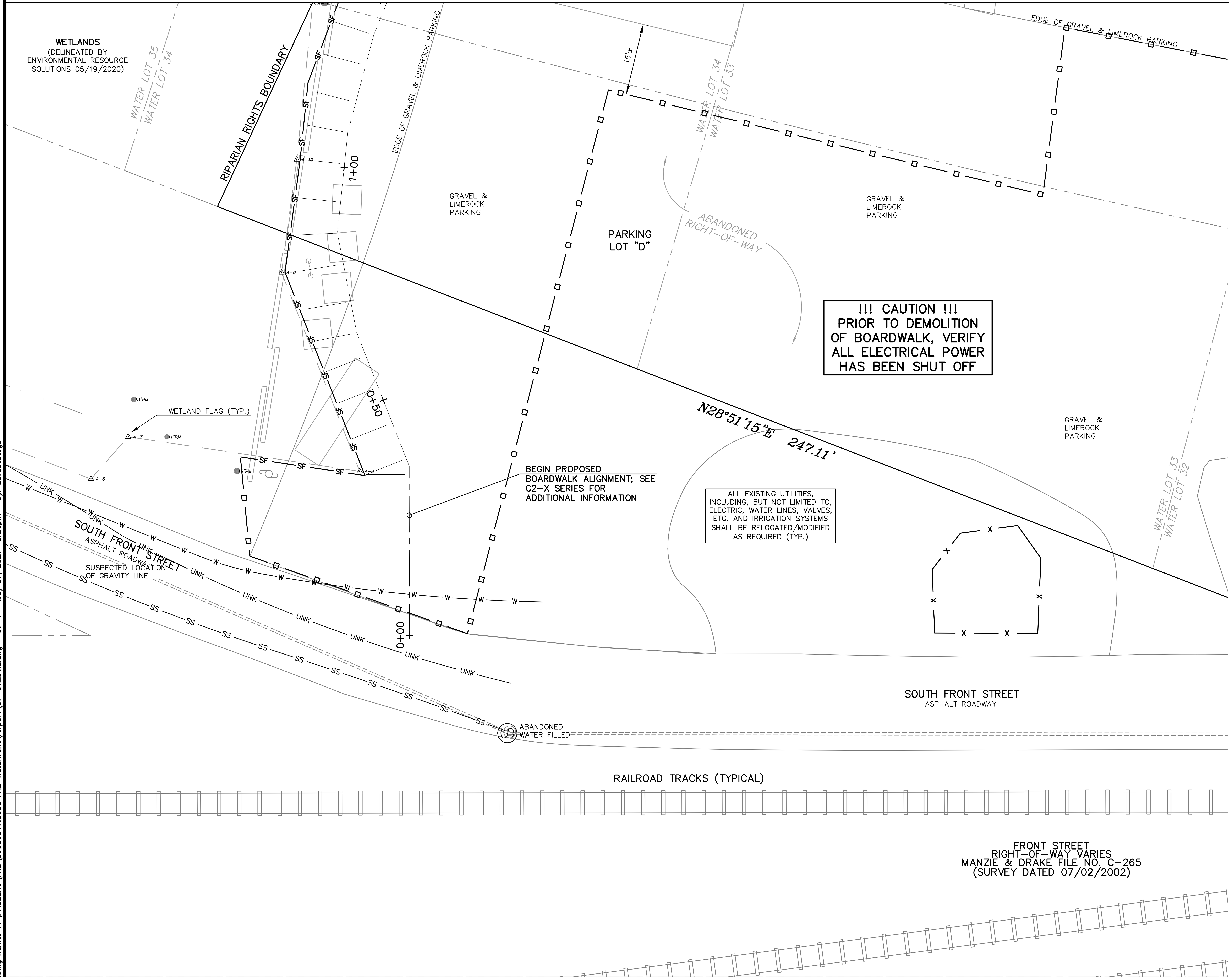

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EXISTING UTILITY PLAN

Amelia River Waterfront
Stabilization
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Town/City: Fernandina Beach
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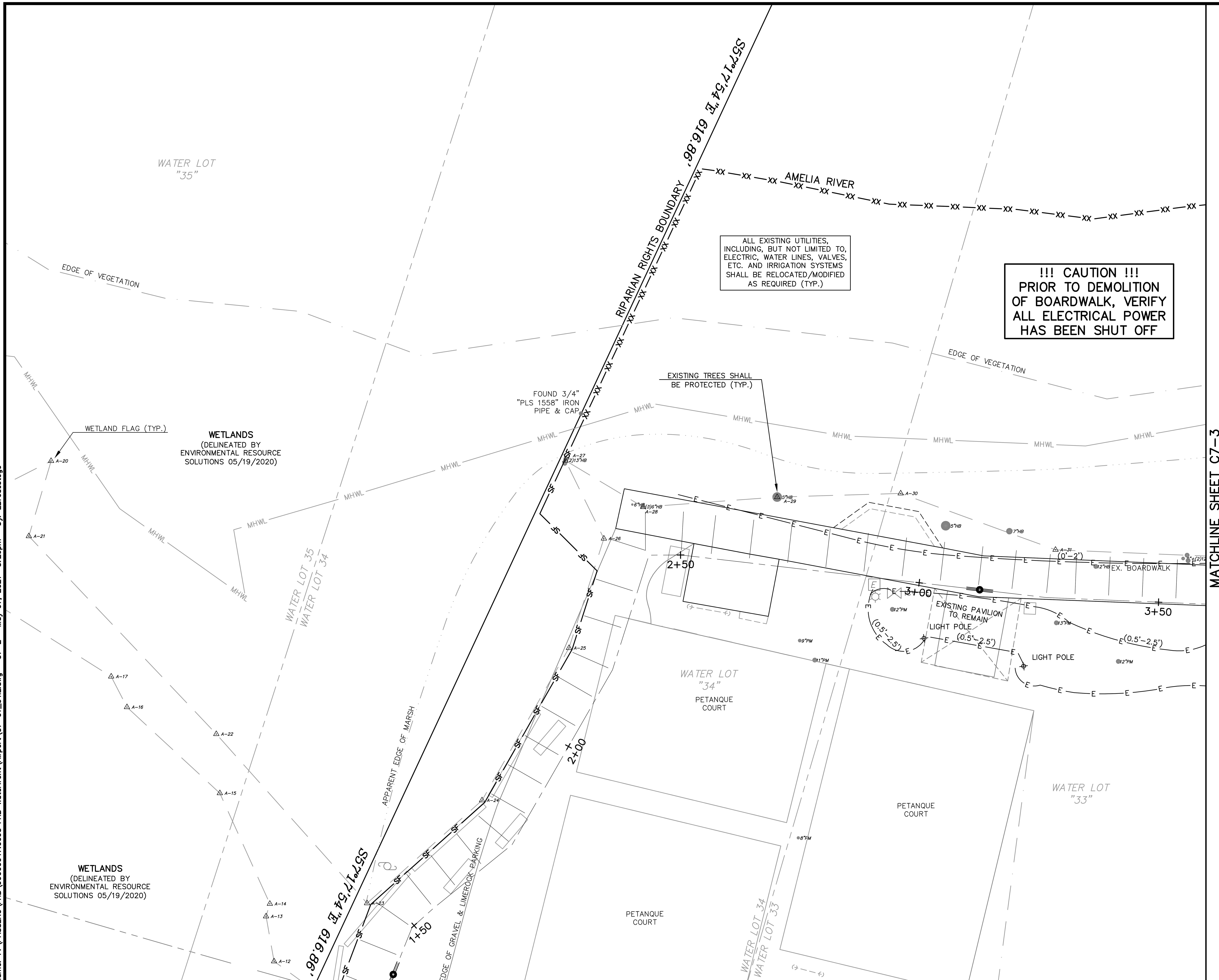

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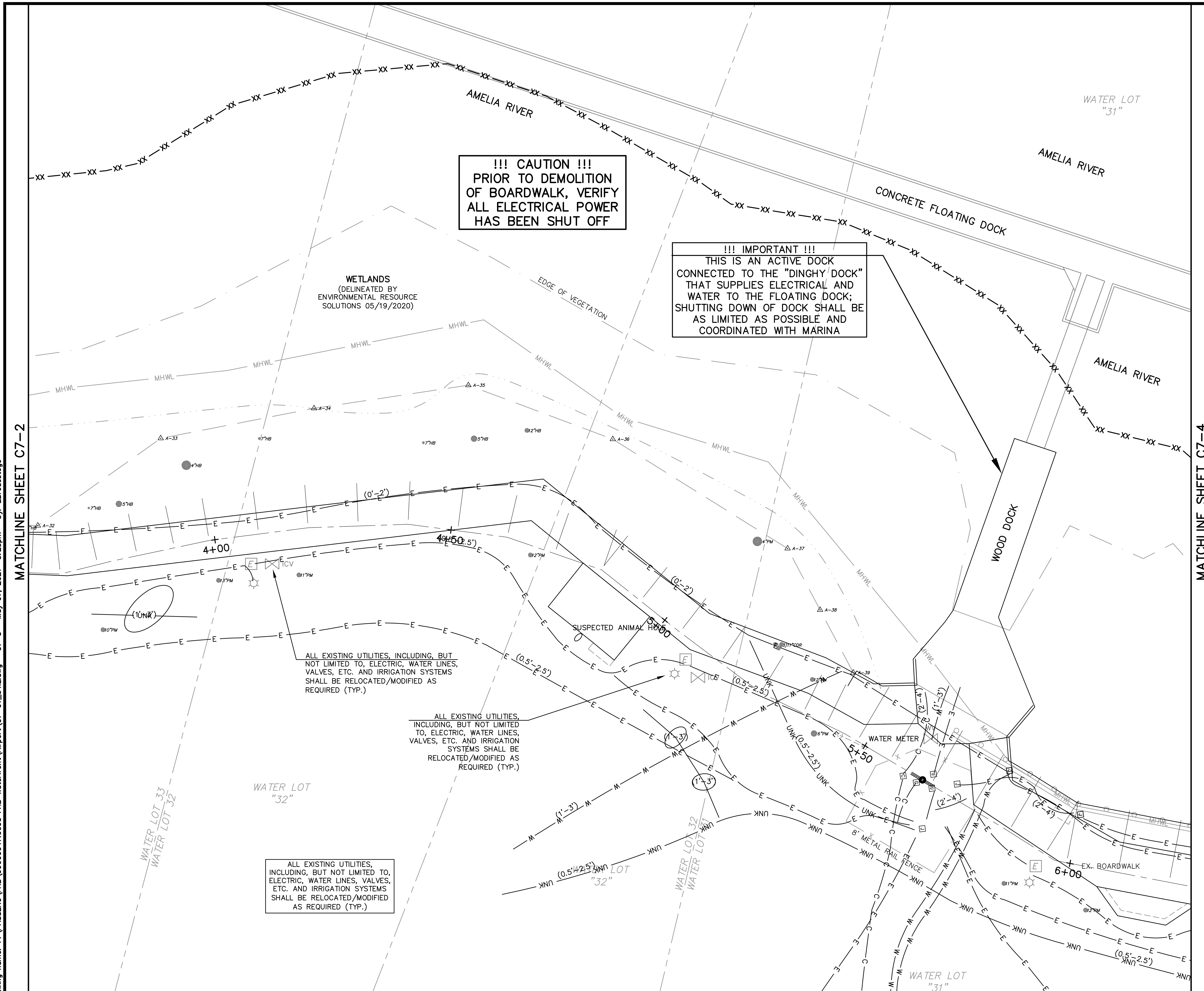

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Parking Lots C & D

Town/City: Fernandina Beach
County: Nassau
State: Florida

Project No.
99000047.0095

Drawing No.
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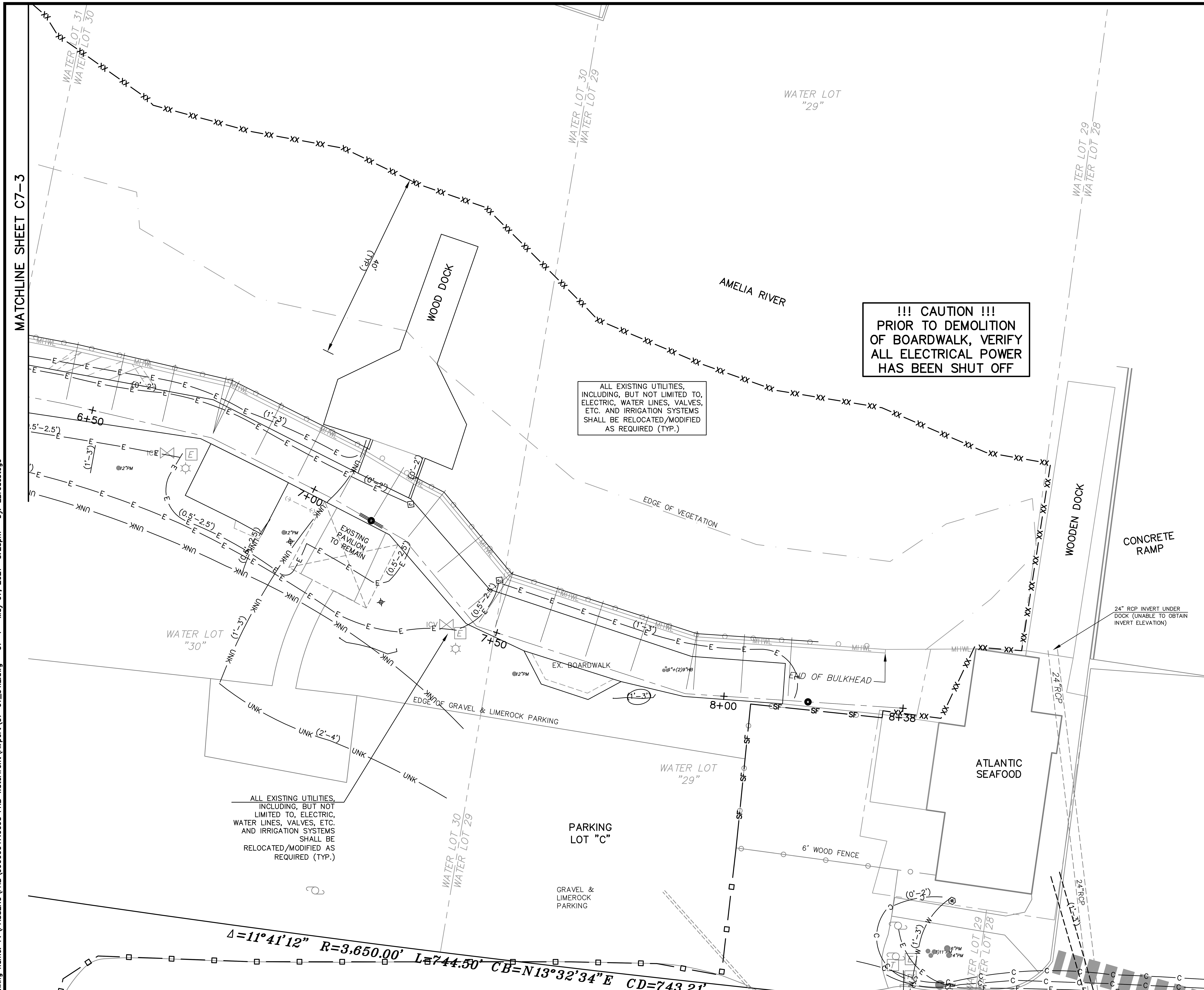

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Parking Lots C & D

Town/City: Fernandina Beach
County: Nassau State: Florida

Project No.
99000047.0095

Drawing No.
C7-4

Date
May 10, 2021

PART 6
APPENDIX

SITE INVESTIGATION REPORTS

ECS Florida, LLC

Geotechnical Engineering Report

FHB Riverfront

Front Street
Fernandina Beach, Florida

ECS Project Number 35:29978

March 31, 2020

ECS FLORIDA, LLC "Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities

March 31, 2020

Mr. Christopher Nardone, AIA
Passero Associates, LLC
4730 Casa Cola Way
Suite 200
St. Augustine, Florida 32095

ECS Project No. 35:29978
Client ID: MK04

Reference: Geotechnical Engineering Report
FHB Riverfront
Front Street
Fernandina Beach, Florida

Dear Mr. Nardone:

ECS Florida, LLC. (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our Proposal No. 35:16306, dated January 24, 2020. This report presents our understanding of the geotechnical aspects of the project, the results of the field exploration and laboratory testing conducted, and our design and construction recommendations.

It has been our pleasure to be of service to Passero Associates, LLC during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify the assumptions of subsurface conditions made for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS Florida, LLC.

Chris M. Egan, P.E.
Senior Project Manager
Registered, Florida No. 79645
CEgan@ecslimited.com

David W. Spangler, P.E.
Principal Engineer
Registered Florida No. 58770
DSpangler@ecslimited.com

Distribution: Mr. Christopher Nardone, AIA – Passero Associates, LLC 1 pdf

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The following summarizes the main findings of the exploration, particularly those that may have a cost impact on the planned development. Further, our principal recommendations are summarized. Information gleaned from the executive summary should not be utilized in lieu of reading the entire geotechnical report.

- The borings generally encountered very loose to medium dense sandy material (SP, SC) and to a lesser extent clay (CH) to depths of approximately 12 feet below existing grades underlain by very loose to loose sand (SP, SP-SC, SC) and very soft to stiff clay (CH) to depths of approximately 40 feet below grade. Below depths of approximately 40 feet, the borings encountered loose to very dense sands (SP, SP-SC, SC) to the boring termination depths of 60 feet.

- The test pits performed behind the existing bulkhead wall exposed the concrete cap and a portion of the back of the double tee. However, due to site constraints and safety concerns the back of the existing bulkhead wall was not exposed.

- A geophysical survey consisting of electromagnetic techniques was utilized to locate the tieback anchors. The anchors were located at an approximate spacing of 15 feet along the wall and were mapped between depths of 6 feet and 15 feet below existing ground surface.

- The planned bulkhead wall may be designed utilizing the design parameters included in the tables in Section 5.2 of the report.

1.0 INTRODUCTION

1.1 GENERAL

The purpose of this study was to provide geotechnical information for the design of a new bulkhead wall along the Amelia River. The recommendations developed for this report are based on project information supplied by Passero Associates, LLC. This report contains the results of our subsurface explorations and laboratory testing programs, site characterization, engineering analyses, and recommendations for the design and construction of the planned bulkhead wall.

1.2 SCOPE OF SERVICES

To obtain the necessary geotechnical information required for design of the new wall, five soil test borings were performed at locations selected by Structures International and approved by Passero Associates, LLC. A laboratory-testing program was also implemented to characterize the physical and engineering properties of the subsurface soils.

This report discusses our exploratory and testing procedures, presents our findings and evaluations and includes the following.

- A brief review and description of our field and laboratory test procedures and the results of testing conducted.
- A review of surface topographical features and site conditions.
- A review of area and site geologic conditions.
- A review of subsurface soil stratigraphy with pertinent available physical properties.
- Final copies of our soil test boring logs.
- Photographs of the test pit excavations.
- Recommendations for landside soil parameters for bulkhead wall design.

1.3 AUTHORIZATION

Our services were provided in accordance with our Proposal No. 16306, dated January 24, 2020, and the Subconsultant Agreement between Passero Associates and ECS Florida, LLC dated January 29, 2020.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION

The project site is located along the west side of Front Street and along the east side of the Amelia River in Fernandina Beach, Florida. The site extends along the bulkhead wall west of Front Street from approximately Beech Street north to Broome Street. The general site location is shown on Figure 1.

2.2 SITE CONDITIONS

At the time of our exploration, the site was developed with an existing bulkhead wall along the Amelia River. The southern portion of the site is a parking area for a boat ramp and surface cover primarily consists of gravel and landscaped areas. The central portion of the site is an at grade asphalt parking lot with a restaurant supported on pile foundations over the River. The northern portion of the site was primarily cleared and appeared like it may have been used as a lay-down yard and surface cover consisted primarily of sands. A site survey was not available to our office at the time of this report preparation. However based on our observations, we understand that the site generally slopes downward to the north. Surface water (outside of the Amelia River) was not observed near planned structural areas at the time of our exploration.

2.3 PROJECT DESCRIPTION

You provided project information via several discussions. We were provided with a copy of an aerial photograph showing the proposed boring locations and depths. We understand the proposed construction includes a new bulkhead wall between approximately Cedar Street and Broome Street. We were not provided with the final wall design but we understand that the wall with either be steel sheetpiles or concrete construction.

If actual project information varies from these conditions, then the recommendations in this report may need to be re-evaluated. We should be contacted if any of the above project information is incorrect so that we may reevaluate our recommendations.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION PROGRAM

We performed a field exploration between February 19, 2020 and February 26, 2020. The approximate boring locations are indicated on the attached Field Exploration Plan (Figure 2). Our personnel determined the boring and test pit locations using our handheld GPS units. The boring and test pit locations on the referenced Field Exploration Plan should be considered accurate only to the degree implied by the method of measurement used.

3.1.1 SPT Borings

We located and performed five Standard Penetration Test (SPT) borings, drilled to depths of approximately 60 feet below the existing ground surface, in general accordance with the methodology outlined in ASTM D 1586 to explore the subsurface conditions adjacent to the bulkhead wall. Split-spoon soil samples recovered during performance of the borings were visually classified in the field and representative portions of the samples were transported to our laboratory for further evaluation. A summary of the field procedures is included in Appendix A.

3.1.2 Test Pits

A test pit exploration was performed on February 25, 2020. The approximate test pit locations are indicated on the attached Test Pit and Geophysical Location Plan (Figure 3). Three test pits were performed in areas adjacent to the existing bulkhead wall to explore the condition of the wall. The test pit locations were determined in the field based on existing site features. The test pit locations on the referenced Field Exploration Plan should be considered accurate only to the degree implied by the method of measurement used.

Test pits, having a width of about 3 feet to 4 feet, were excavated using a rubber tired-excavator. The test pit excavation allowed the field representative to visually observe the subsurface conditions within the depth of excavation. At the completion of our exploration, the test pits were backfilled and tamped with the bucket on the excavator. Sample photographs of our encountered conditions are presented in Appendix C of this report.

3.2 LABORATORY TESTING

The laboratory testing performed by ECS for this project consisted of selected tests performed on samples obtained during our field exploration operations. The following paragraphs briefly discuss the results of the completed laboratory testing program.

An experienced geotechnical engineer visually classified each soil sample from the test borings on the basis of texture and plasticity in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. A Key to the Soil Classification System is included in Appendix A.

Selected samples of the soils encountered during the field exploration were subjected to quantitative laboratory testing to better define the composition of the soils encountered and to provide data for correlation to their anticipated strength and compressibility characteristics. The laboratory testing determined the percent fines, moisture, and organic contents of selected soil samples. The results of the laboratory testing are shown in the Laboratory Testing Summary included in Appendix B. Also, these results are shown on the Subsurface Soil Profiles and on the Log of Boring records at the respective depths from which the tested samples were recovered.

4.0 SUBSURFACE CHARACTERIZATION

A graphical presentation of the generalized subsurface conditions and detailed boring records are included in Appendix A. It should be understood that the soil conditions will vary between the boring locations. The following table summarizes the soil conditions encountered.

4.1 SUBSURFACE STRATIGRAPHY

Table 4.1.1 Subsurface Stratigraphy

Approximate Depth Range (ft)	Stratum	Description	Ranges of SPT(1) N-values (bpf)
0 to 12	I	Very Loose to Medium Dense Sand (SP) and Clayey Sand (SC) or Stiff CLAY with Sand (CH)	2 to 20
12 to 40	II	Very Loose to Loose Sand with Clay (SP-SC) and Clayey Sand (SC) or Very Soft to Soft CLAY (CH)	WOH(2) to 7
40 to 60	III	Medium Dense to Very Dense Sand (SP), Sand with Clay (SP-SC), Clayey Sand (SC) or Very Stiff Clay (CH)	20 to 91/10”(3)

Notes: (1) Standard Penetration Test
(2) Weight of Hammer was used to advance the sampler
(3) 91 blows with 10 inches of sampler penetration

As an exception, Borings B-3 and B-4 encountered varying amounts of concrete, brick, and gravel debris in the Stratum I material.

4.2 MEASURED GROUNDWATER LEVEL

Groundwater was recorded at the time of drilling at depths of approximately 5 feet below the existing ground surface. We note that groundwater levels will fluctuate due to tidal fluctuations, seasonal climatic variations, surface water runoff patterns, construction operations, and other interrelated factors. We note that based on published data, tidal fluctuations on the order of 5 feet to 6 feet occur in the Amelia River in the vicinity of the project site. The groundwater depth at each boring location is noted on the Subsurface Soil Profiles and on the Log of Boring records.

4.3 EXPLORATION BEHIND THE BULKHEAD WALL BY TEST PITS AND GEOPHYSICAL SURVEY

A geophysical survey was performed by GeoView, Inc. to locate the tiebacks of the existing bulkhead wall. The geophysical survey consisted of electromagnetic techniques to determine the location of metallic surfaces behind the bulkhead wall. In general, tiebacks were located approximately spaced 15 feet laterally at depths ranging between approximately 6 feet and 15 feet below existing ground surface. The vertical location of the tiebacks is more difficult to determine with electromagnetic surveying and therefore the actual depths of the tiebacks may vary from the reported depths. The results of the geophysical survey are presented on Figure 3 of this report.

Test pits were also excavated behind the existing bulkhead wall to further evaluate the conditions. Test pits were located in areas of suspected tieback anchors and excavated to depths of approximately 7 feet below existing grades. The test pits performed behind the existing bulkhead wall exposed the concrete cap and a portion of the back of the double tee. The soils encountered during our excavations were generally consistent with the soil borings and encountered sands with varying amounts of debris that consisted of concrete fragments and rebar fragments. However, due to site constraints and safety concerns the back of the existing bulkhead wall and tieback anchors were not exposed during our exploration.

It was noted the test pits were backfilled on a day when it was raining. The following day, we returned to finish filling in the test pits and grading the surface sands, and portions of the backfill nearest the concrete cap had washed through and left voids in the backfilled areas. The direction of these voids appeared to traverse towards the existing wall. Thus, suggesting that the backfilled soils washed through the bulkhead wall.

5.0 DESIGN RECOMMENDATIONS

5.1 GENERAL

Our geotechnical engineering evaluation of the site and subsurface conditions at the property, with respect to the planned construction and our recommendations for site preparation and foundation support, are based on (1) our site observations, (2) the field and laboratory test data obtained, (3) our understanding of the project information and structural conditions as presented in this report, and (4) our experience with similar soil and loading conditions.

If the stated structural or grading conditions are incorrect, or should the location of the structure or pavement areas be changed, please contact us so that we can review our recommendations. Also, the discovery of any site or subsurface conditions during construction that deviate from the data obtained during this geotechnical exploration should also be reported to us for our evaluation.

The recommendations in the subsequent sections of this report present design and construction techniques that are appropriate for the planned construction. We recommend that ECS be provided the opportunity to review the foundation plans and earthwork specifications to verify that our recommendations have been properly interpreted and implemented.

5.2 SHEET PILE DESIGN PARAMETERS

Based on the subsurface information obtained from the soil borings, we recommend the soil parameters listed in the tables following be used in designing the wall. The soil parameters provided in the tables were based on our interpretation of the N-values obtained from the SPT borings. The table includes soil description/classification, strength parameters (cohesion, phi angles and interactive friction angle between soil and wall), and total unit weight.

Table 5.2.1: Soil Parameters for Bulkhead Wall Design (Boring B-1)

Depth	USCS	Total Unit Weight, γ_{SAT} (pcf)*	Internal Friction Angle, ϕ	Cohesion, c (ksf)	Friction Angle between Soil and Steel Sheet Pile	Adhesion (ksf)	K_a	K_p
0-12	SP, SP-SC, SC	110	30	0	17	--	0.33	3.00
12-42	SP-SC, SC	95	26	0	14	--	0.39	2.56
42-47	SP-SC	110	30	0	17	--	0.33	3.00
47-52	CH	120	0	2.5	--	1.0	1.00	1.00
52-57	SP-SC	128	36	0	17	--	0.26	3.85
57-60	SP	120	32	0	17	--	0.49	2.04

*Effective Unit Weight = Total Unit Weight – 62.4pcf (Below the Water Table)

Table 5.2.2: Soil Parameters for Bulkhead Wall Design (Boring B-2)

Depth	USCS	Total Unit Weight, γ_{SAT} (pcf)*	Internal Friction Angle, ϕ	Cohesion, c (ksf)	Friction Angle between Soil and Steel Sheet Pile	Adhesion (ksf)	K_a	K_p
0-4	SP	115	32	0	17	--	0.49	2.04
4-6	CH	110	0	0.8	--	0.6	1.00	1.00
6-17	SP	105	29	0	17	--	0.35	2.88
17-22	SC	95	26	0	14	--	0.39	2.56
22-32	CH	110	0	0.5	--	0.5	1.00	1.00
32-37	SP	100	28	0	14	--	0.36	2.77
37-47	CH	110	0	0.8	--	0.6	1.00	1.00
47-52	SP	125	36	0	17	--	0.26	3.85
52-57	SP	130	38	0	17	--	0.24	4.20
57-60	SC	127	36	0	17	--	0.26	3.85

*Effective Unit Weight = Total Unit Weight – 62.4pcf (Below the Water Table)

Table 5.2.3: Soil Parameters for Bulkhead Wall Design (Borings B-3 and B-4)

Depth	USCS	Total Unit Weight, γ_{SAT} (pcf)*	Internal Friction Angle, ϕ	Cohesion, c (ksf)	Friction Angle between Soil and Steel Sheet Pile	Adhesion (ksf)	K_a	K_p
0-17	SP, SC	100	28	0	17	--	0.36	2.77
17-37	SC, CH	95	0	0.1	--	0.1	1.00	1.00
37-42	SP-SC, SC	100	29	0	17	--	0.35	2.88
42-60	SP, SP-SC	125	36	0	17	--	0.26	3.85

*Effective Unit Weight = Total Unit Weight – 62.4pcf (Below the Water Table)

Table 5.2.4: Soil Parameters for Bulkhead Wall Design (Boring B-5)

Depth	USCS	Total Unit Weight, γ_{SAT} (pcf)*	Internal Friction Angle, ϕ	Cohesion, c (ksf)	Friction Angle between Soil and Steel Sheet Pile	Adhesion (ksf)	K_a	K_p
0-12	SP	105	30	0	17	--	0.33	3.00
12-47	SC, CH	95	0	0.1	--	0.1	1.00	1.00
47-57	SP	135	38	0	17	--	0.24	4.20
57-60	SP	125	34	0	17	--	0.28	3.54

*Effective Unit Weight = Total Unit Weight – 62.4pcf (Below the Water Table)

6.0 CLOSING

Our geotechnical exploration has been performed, our findings obtained, and our recommendations prepared, in accordance with generally accepted geotechnical engineering principles and practices. ECS is not responsible for any independent conclusions, interpretation, opinions, or recommendations made by others based on the data contained in this report.

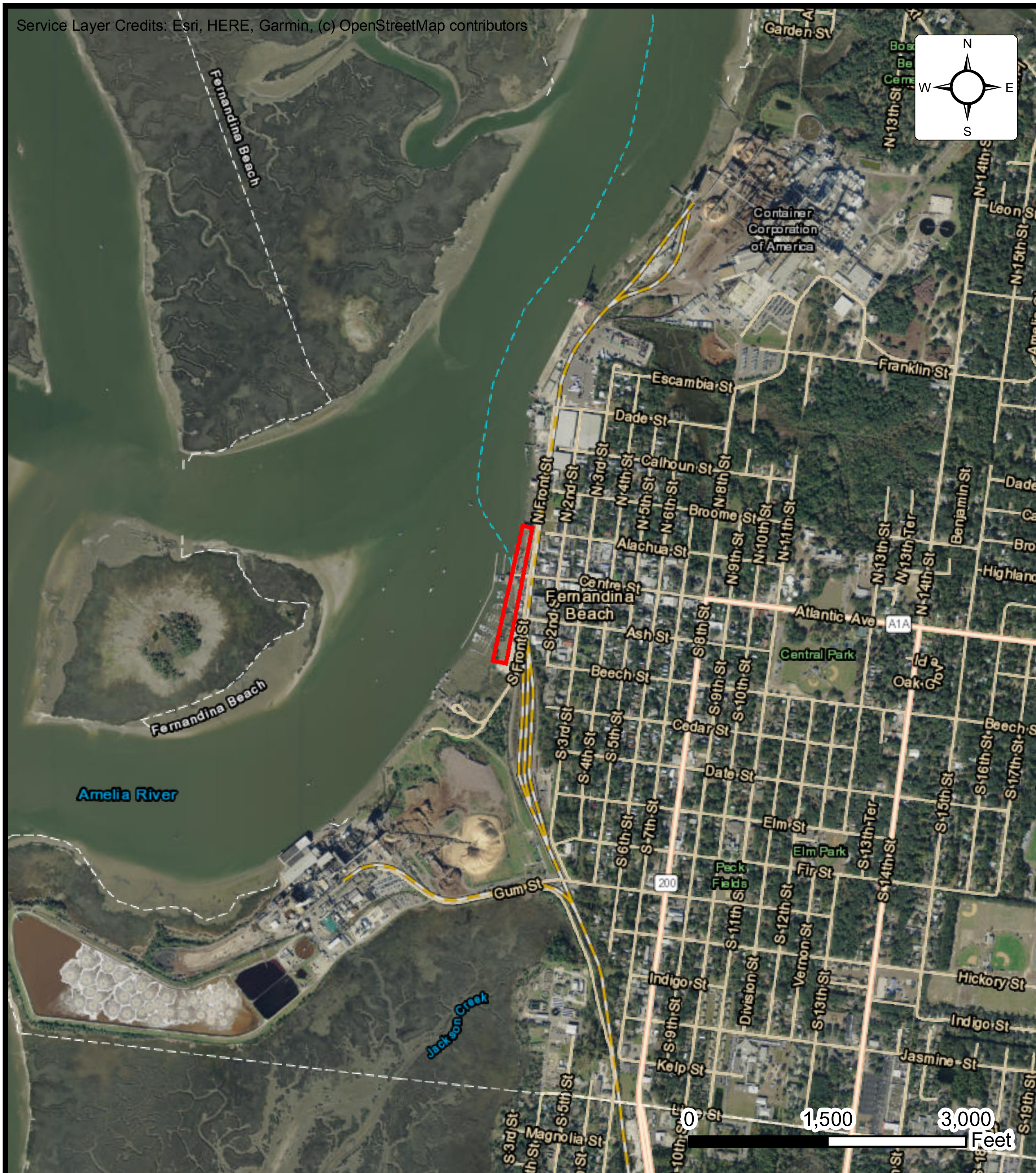
Our scope of services was intended to evaluate the soil conditions within the zone of soil influenced by the wall system. Our scope of services does not address geologic conditions, such as sinkholes or soil conditions existing below the depth of the soil borings.

If any of the project description information discussed in this report is inaccurate, either due to our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted immediately in order that we can review the report in light of the changes and provide additional or alternate recommendations as may be required to reflect the proposed construction.

We recommend that ECS be allowed to review the project's plans and specifications pertaining to our work so that we may ascertain consistency of those plans/specifications with the intent of the geotechnical report.

Field observations, monitoring, and quality assurance testing during earthwork and foundation installation are an extension of and integral to the geotechnical design recommendation. We recommend that the owner retain these quality assurance services and that ECS be allowed to continue our involvement throughout these critical phases of construction to provide general consultation as issues arise. ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

FIGURES



Site Location Plan
FHB RIVERFRONT

178 FRONT STREET, FERNANDINA BEACH, FLORIDA

PASSERO ASSOCIATES

ENGINEER	DS05
SCALE	1 " = 1500 '
PROJECT NO.	35:29978
SHEET	FIGURE 1
DATE	3/24/2020