Preliminary Design Report

SOUTH COAST ENGINEERS
Engineering for the Coast

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Date: March 11, 2024

To: Town of Dauphin Island

From: Scott L. Douglass, PE
South Coast Engineers, LLC

Subject: Preliminary Design Phase Report
NFWF Dauphin Island Beach Nourishment Engineering and Design (West End)

This is the Preliminary Design Phase Report submittal to the Town of Dauphin Island for the National Fish and Wildlife Foundation's (NFWF) Gulf Environmental Benefit Fund (GEBF) project #NFWF Project ID #73501: Dauphin Island Beach Nourishment Engineering and Design (West End). This describes the Basis of Design for the 30% level Project design.

Project Overview and Goal

The Project is beach nourishment and dune restoration along 3½ miles of the West End's Gulf of Mexico shoreline. The Project design is consistent with the NFWF GEBF goals to restore and maintain the ecological functions of the coastal barrier island beach and dune habitats as well as protect the ecological integrity of Mississippi Sound and its extensive marsh habitats. The Project will also provide significant protection for the built infrastructure in this area.

Design Plan Sheets

Attachment #1 is the design plan sheet set in an 8½ x 11-inch format. It includes 12 sheets:

1. 'Project Vicinity + Location Map' (M)
2. 'Plan Overview' (P)
3. 'Conceptual Plan View 1' (P1)
4. 'Conceptual Plan View 2' (P2)
5. 'Conceptual Plan View 3' (P3)
6. 'Conceptual Plan View 4' (P4)
7. 'Typical Dune Cross-Section' (XD)
8. 'Cross-Section DI-2_-1' (X1)
9. 'Cross-Section DI-2' (X2)
10. 'Cross-Section DI-8' (X3)
11. 'Cross-Section DI-10' (X4)
12. 'Cross-Section DI-14' (X5)

The basis for the selected values in these plans is explained in the remainder of this report.

Design Concept

The proposed design addresses several of the critical erosion issues facing the West End beaches with the construction of a large sand dune and wide beach south of the toe of the dune. A high, vegetated uniform sand dune will be built generally south of the existing shoreline. This dune will reduce barrier island overwashing during hurricanes. The majority of the beach sand volume losses south of Bienville Boulevard, in the past 5 decades, have been due to overwash (to the north) in major hurricanes and subsequent high-water overwashing events before the barrier island is able to naturally rebuild its elevations.[1] This repeated barrier island overwash is also extremely problematic for the built infrastructure on the West End. The joint USGS-USACE Alabama Barrier Island Restoration Assessment concluded that beach nourishment with dunes on the West End, like this design, can be effective in mitigating the effects of storms and sea level rise. A wide, healthy beach needs to be built and maintained south of the toe of the sand dune so that the dune is fully functional when the major events occur.

Beach Design

The new sandy beach, the flat beach berm, will be constructed at an elevation of +5.5 feet NAVD. This is generally consistent with the elevation of the native West End beach berms during recent decades. At the seaward end, the construction template slopes down at 12:1 (H:V) from the berm elevation to the existing water bottom.

The design, constructed beach widths vary due to variations in the beach profile and differences in expected performance. The increased beach widths immediately after construction are shown in this Table.

Cross-Section Sheet (Location)	Constructed Increase in Beach Width (ft)
Sheet X1; DI-2_-1 (west side of West Beach Park)	590
Sheet X2; DI-2 (near western end of Bienville Blvd)	400
Sheet X3; DI-8 (near Seneca Ct.)	350
Sheet X4; DI-10 (near 2417 Bienville Blvd.)	220
Sheet X5; DI-10-1 (450 feet east of St. Stephens St.)	170

The design, constructed beach width at each location includes 3 components:

- the distance required for the footprint of the sand dune. This can be considered as the baseline fill (see next section for sand dune dimensions),
- the initial profile adjustment expected immediately after construction, plus

[1] SCE (2023) "Coastal Processes and Geomorphology of the West End of Dauphin Island," report from South Coast Engineers to Town of Dauphin Island, October 20, 2023

- an additional “design” width to account for uncertainties and future erosion losses including longshore sand transport gradients.

Initial beach profile adjustment has been estimated by translating the existing beach profile. This common method has the inherent assumptions that the new fill sands will match the native sands and that the existing profile has fully adjusted to the wave climate at each location. This initial beach profile adjustment, or narrowing of the beach width immediately after construction, also referred to as profile equilibration, is expected to occur within a few good storms or a year or so after construction. The adjustment distance varies by location based on the surveyed 2023 beach profile data.

The additional design width varies across two primary reaches, a “West Reach” and an “East Reach” within the Project as shown in Attachment 2. In the “West Reach”, where the beaches have been largely erosional for the last 14 years, enough sand is included in the design template to place the new (equilibrated) shoreline approximately 150 feet seaward of the new dune toe. In the “East Reach,” where the beaches have been stable or slightly accretional over the last 14 years, the design template will place the new shoreline approximately 100 feet seaward of the new dune toe. There is a 600-foot transition reach between the two main reaches and a linear taper to zero beach fill at the east and west ends. The “East Taper” section will linearly taper down to meet the native beach near Ryan Ct. along the 2,000 easternmost feet of the Project area. The “West Taper” tapers down to meet the native beach near the east end of the rocks at Katrina Cut along the 3,500 westernmost feet of the Project area. Shoreline change rates since 2010 are shown in Attachment #3. A more extensive analysis including longer-term shoreline change rates is in SCE (2023).

Sand Dune

A uniform sand dune will be constructed along the length of the Project (see Sheet XD, sheet 7 of 12). The constructed dune will extend a few blocks farther to the east than the constructed beach at the east end of the project. This is where the shoreline is accretional in recent years but a natural dune has not built up substantially yet (Quebec Ct. to Ryan Ct.). In order to minimize the seaward extent of the project, the dune would be constructed at the landward-most location, immediately south of most of the existing built houses. The dune cross-section will be minimized in the cross-shore direction to be constructible and stable with 2:1 (H:V) side slopes. The crest elevation of the dune is set at +16 feet NAVD, the crest width is 15 feet, and the base width, the footprint, is about 60 feet in the cross-shore direction. The cross-sectional area of the dune is about 378 ft^2 or 14 yd^3/foot of shoreline.

The Hallermeier and Rhodes method suggests that the proposed dune volume could withstand up to a 10-year return period event (SWL for a 10-year storm is +5.1 feet NAVD, see SCE 2023). Numerical modeling to evaluate the beach and dune construction template’s potential cross-shore performance under storm conditions suggests that the design dune could survive storm surge and waves consistent with those observed during and estimated for Hurricane Nate (2017). Both offshore wave height and still water level for Hurricane Nate were estimated to be 10-year return period conditions.

The dune is designed to be uniform down the beach with slight modifications (details to be determined) at several locations for emergency access points through the dune feature at existing rights-of-way.

Vegetation

The sand dune will be planted with native dune vegetation, primarily sea oats, with seeds sourced from the island.

Sand Fencing

Sand fencing will be constructed along the majority of the project length along the landward limit of the project.

Sand Source

The expected sand source for this project is on the southern end of the ebb-tidal shoal of Mobile Pass (see "Offshore Geotechnical Investigation Areas" marked on Sheet 1 of 12) where previous studies have indicated the presence of beach-compatible sands in sufficient quantities. The required offshore borrow area investigations are not a part of this Report as they will be completed under a separate, subsequent contract between South Coast Engineers and the Town. The native beach sand characteristics have been quantified. It is assumed, based on the investigations to date, that the borrow areas sands match the native beach sands. This match is includes median grain size, grain size distribution, composition (quartz sands), and fines/shell content (less than 2%).

Material Quantities

The estimated total volume of sand required for the project is about 2.4 million cubic yards. Vegetation plantings on approximately one-foot centers on the dunes south of the houses will require about 1,000,000 plants. Sand fencing quantity is estimated at 20,000 ft.

Construction Method and Timing

It is expected that the construction method for this project will be a cutterhead dredge with submerged pipelines pumping sand, with a booster pump(s), to the beach with bulldozers constructing the beach berm and dune. This is similar to the construction technique used by the marine contractor for the construction of the 2016 and 2024 East End Beach and Dune Restoration Projects. The relatively shallow depths of the likely borrow area will make the alternative of hopper dredging challenging. It is estimated that the project will take 3- 6 months to construct.

Specifications

The design specifications will be similar to those for the 2023-2024 East End beach nourishment project. Standard General specifications will be included with Supplemental specifications 32 92 26 Vegetation Plantings, 35 20 00 Beach Fill, 35 20 10 Sand Dunes, and 35 24 00 Dredging. The plans and specifications will be developed for construction with a cutterhead dredge and pipeline with booster pumps.

Opinion of Probable Cost

The opinion of probable cost (OPC) for construction of this design is in the table below. The average estimated cost is about $46.0 M with a range from $39.2 to $52.6 M.

				UNIT COSTS			SUBTOTAL COSTS		
Item No.	Qty.	Unit	Description	MIN	AVG	MAX	MIN	AVG	MAX
1	1	LS	Mob/demob	$ 7,043,750.00	$ 8,548,458.33	$ 10,933,125.00	$ 7,043,750	$ 8,548,458	$ 10,933,125
2	2400000	CYIP	Beach fill	$ 12.00	$ 13.65	$ 14.70	$ 28,800,000	$ 32,760,000	$ 35,280,000
3	1000000	EA	Vegetative plantings	$ 1.15	$ 1.30	$ 1.60	$ 1,150,000	$ 1,300,000	$ 1,600,000
4	20000	LF	Sand fencing	$ 17.50	$ 20.00	$ 22.00	$ 350,000	$ 400,000	$ 440,000
						OPC	$ 37,343,750	$ 43,008,458	$ 48,253,125
5	1	-	CE&I Services	5%	7%	9%	$ 1,867,188	$ 3,010,592	$ 4,342,781
						TOTAL OPC	**$ 39,210,938**	**$ 46,019,050**	**$ 52,595,906**

This estimate is based on the unit costs of the 2024 East End Project adjusted upward 22.5% for increased pump distance and inflation. This OPC is made on the basis of our experience, qualifications, and general familiarity with the construction industry. However, we have no control over the cost of labor, materials, equipment, or services furnished by others, or over contractors' methods of determining prices, or over competitive bidding or market conditions, and cannot and do not guarantee that proposals, bids, or actual Construction Cost will not vary from these opinions.

Other Issues

Permits: The Project will require a joint USACE-ADEM coastal construction permit and an ADCNR State Lands permit. The joint coastal permit encompasses all the local, state, agencies and tribal entities with jurisdiction. The required preparation and submittal of the permits are not a part of this Report as they will be completed under a separate, subsequent contract between South Coast Engineers and the Town.

Cultural Resources (Beach and Dune Location): A Phase I Cultural Resource Survey of the Project Beach and Dune Restoration Area has been conducted under a subcontract, on behalf of the Town, by Pre-Columbian Archeological Research Group, Inc (PCARG). The results of this survey/investigation indicated no presence of cultural resources along the south shoreline of the Island earmarked for beach renourishment and dune restoration. Consequently, PCARG recommends no further testing be performed.

Coastal Structures: The Project design does not include any new or modified coastal structures (groins, breakwaters, etc.), but they can be considered in the future if the performance of the Project warrants structures to extend the life of the beach and dune restoration sands.

Monitoring: Post-construction monitoring of the performance of this Project will be needed. That will likely be a condition of the environmental permits and will provide critically important information for the future management of these beaches by the Town. Additionally, annual and post-event monitoring of beach performance (i.e., beach profile surveys) is a required component of establishing a formal beach management plan for the Town. Establishing such a plan can be vital should the Town wish to apply for FEMA Category G funding following a federal disaster declaration.

Phasing: The Project could be constructed in phases if required. Some options for phasing, by reaches, of the Project are:

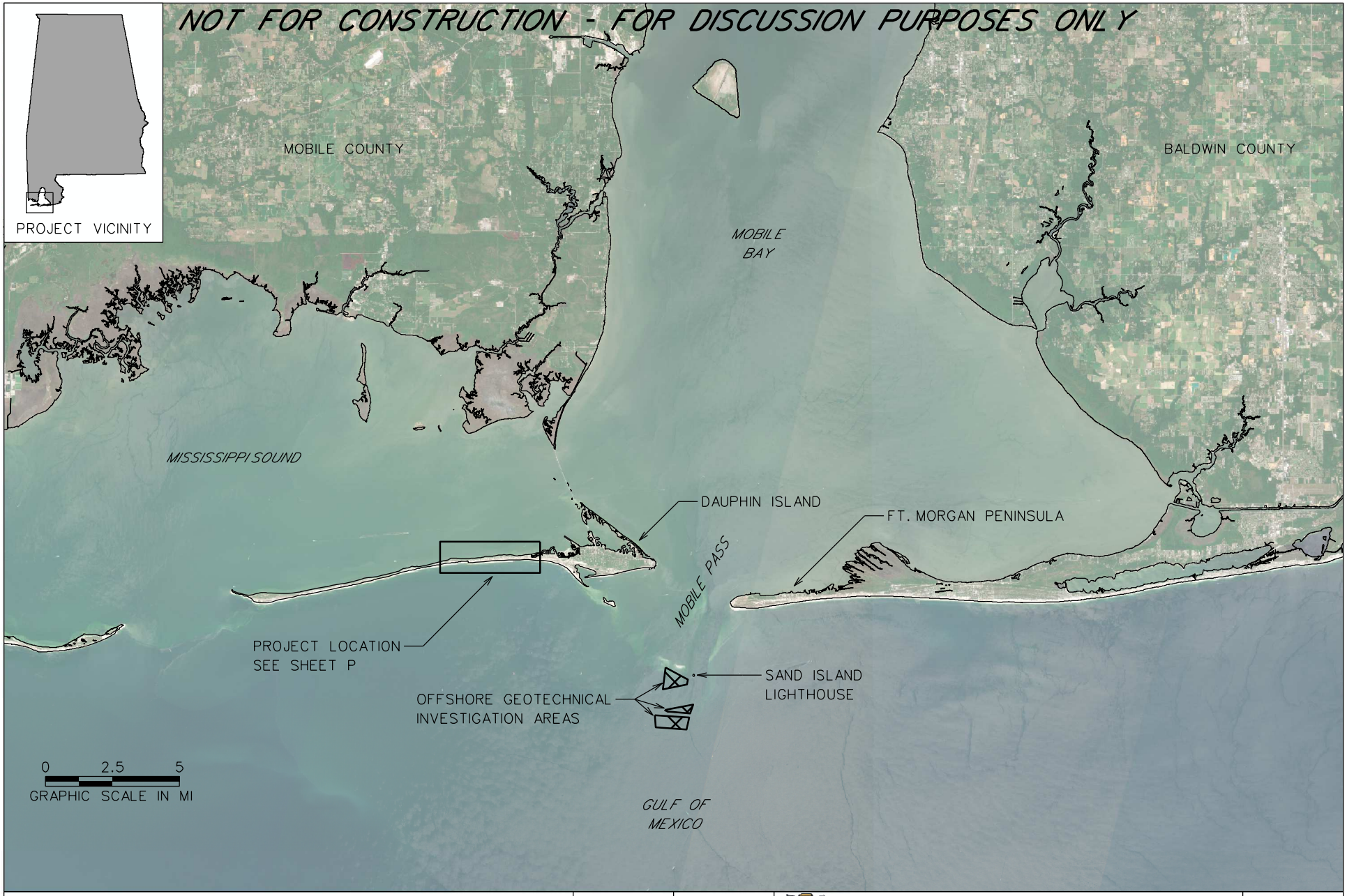
1. The beaches east of Seneca Ct.: This portion of the Project is about 9,100 ft (1.7 mi) long and contains about 25% of the total Project sand volume. Using the unit costs of the OPC above, the construction costs for only this reach is estimated at about $19M.

2. The beaches between Seneca Ct. and the west end of Bienville Boulevard: This portion of the Project is about 5,100 ft (0.97 mi) long and contains about 40% of the total Project sand volume. Using the unit costs of the OPC above, the construction costs for only this reach is estimated at about $24M.
3. The beaches west of the end of Bienville Boulevard (including the Town's West Beach Park): This portion of the Project is about 3,100 ft (0.6 mi) long and contains about 35% of the total Project sand volume. Using the unit costs of the OPC above, the construction costs for only this reach is estimated at about $21M.
4. The beaches east of Seneca Ct. and the beaches west of the end of Bienville Boulevard: These two portions of the Project, separated by about a mile, are about 12,200 ft (2.3 mi) long and contain about 60% of the total Project sand volume. Using the unit costs of the OPC above, the construction costs for only these two reaches is estimated at about $31M.

A rather large mobilization expense will be incurred for each construction effort. Further evaluation of costs and performance of phasing portions of the Project will be done under a separate, subsequent contract between South Coast Engineers and the Town.

List of Attachments

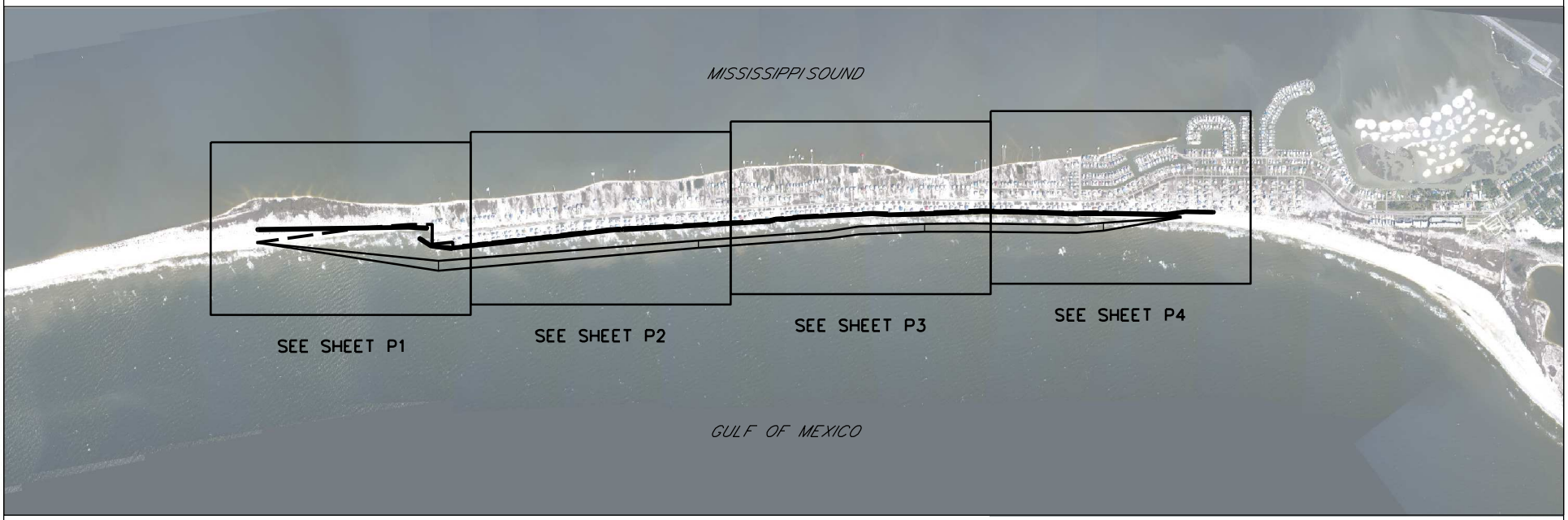
1. West End Beach & Dune Restoration, Dauphin Island 8½ x11 design drawings by South Coast Engineers dated 1/30/24 (12 sheets)
2. Design Beach Width South of Dune
3. Shoreline Change Rates Since 2010



Project Vicinity + Location Map West End Beach & Dune Restoration Dauphin Island, AL	DESIGN: SD	CHECK:	Town of Dauphin Island	DRAWING NO. M
	DRAWING: BB	REVIEW:		
	DATE: 1/30/24	SUBMITTED:	SOUTH COAST ENGINEERS Engineering for the Coast	SH. 01/12

Attachment 1

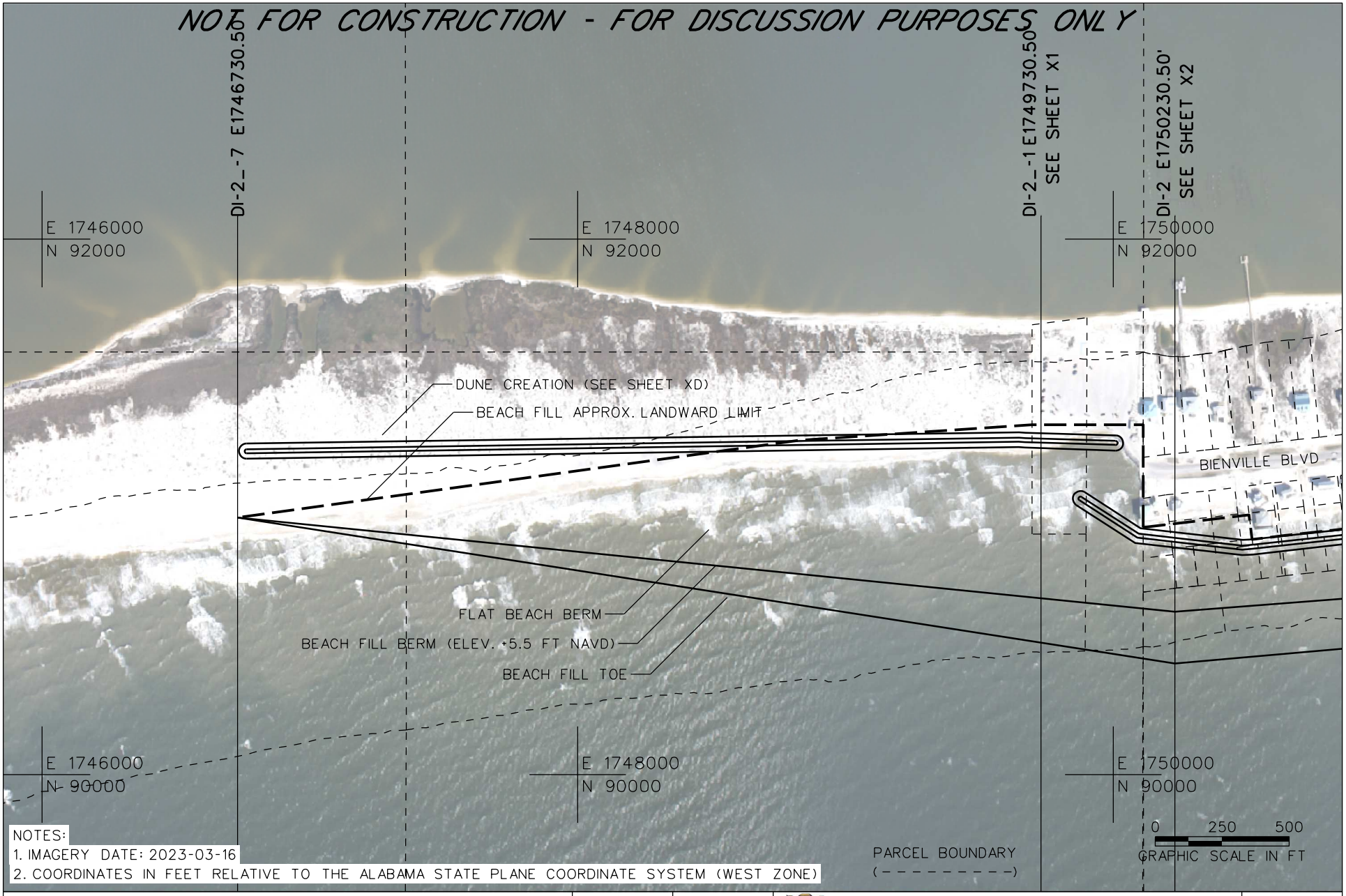
NOT FOR CONSTRUCTION - FOR DISCUSSION PURPOSES ONLY



0 1500 3000
GRAPHIC SCALE IN FT

Plan Overview West End Beach & Dune Restoration Dauphin Island, AL	DESIGN: SD DRAWING: BB DATE: 1/30/24	CHECK: REVIEW: SUBMITTED:	Town of Dauphin Island SOUTH COAST ENGINEERS Engineering for the Coast	DRAWING NO. P SH. 02/12

Attachment 1 (cont)



Conceptual Plan View 1
West End Beach & Dune Restoration
Dauphin Island, AL

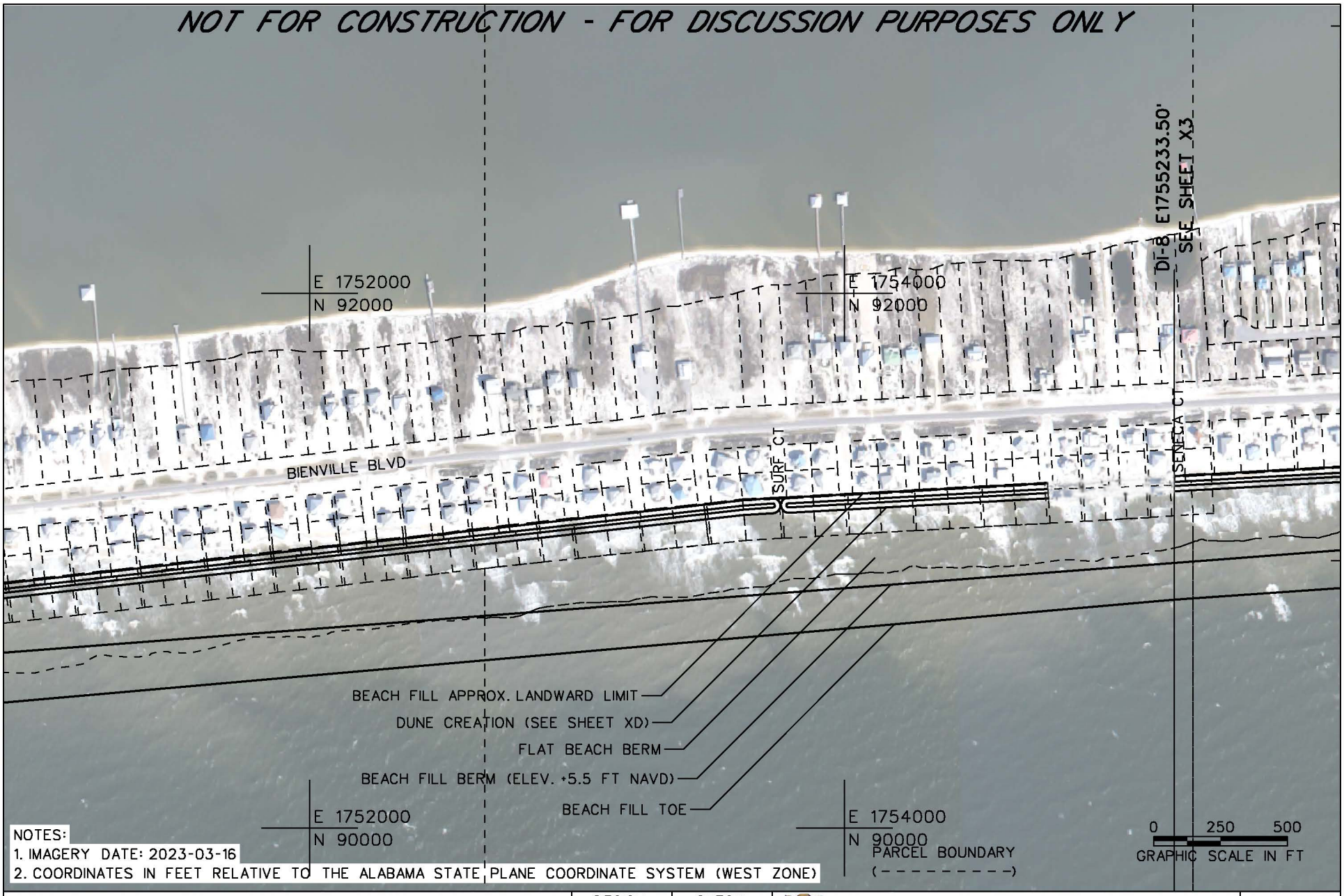
DESIGN: SD	CHECK:
DRAWING: BB	REVIEW:
DATE: 1/30/24	SUBMITTED:

Town of Dauphin Island

SOUTH COAST ENGINEERS
Engineering for the Coast

DRAWING NO. P1
SH. 03/12

Attachment 1 (cont)



Conceptual Plan View 2
West End Beach & Dune Restoration
Dauphin Island, AL

DESIGN: SD	CHECK:
DRAWING: BB	REVIEW:
DATE: 1/30/24	SUBMITTED:

Town of Dauphin Island

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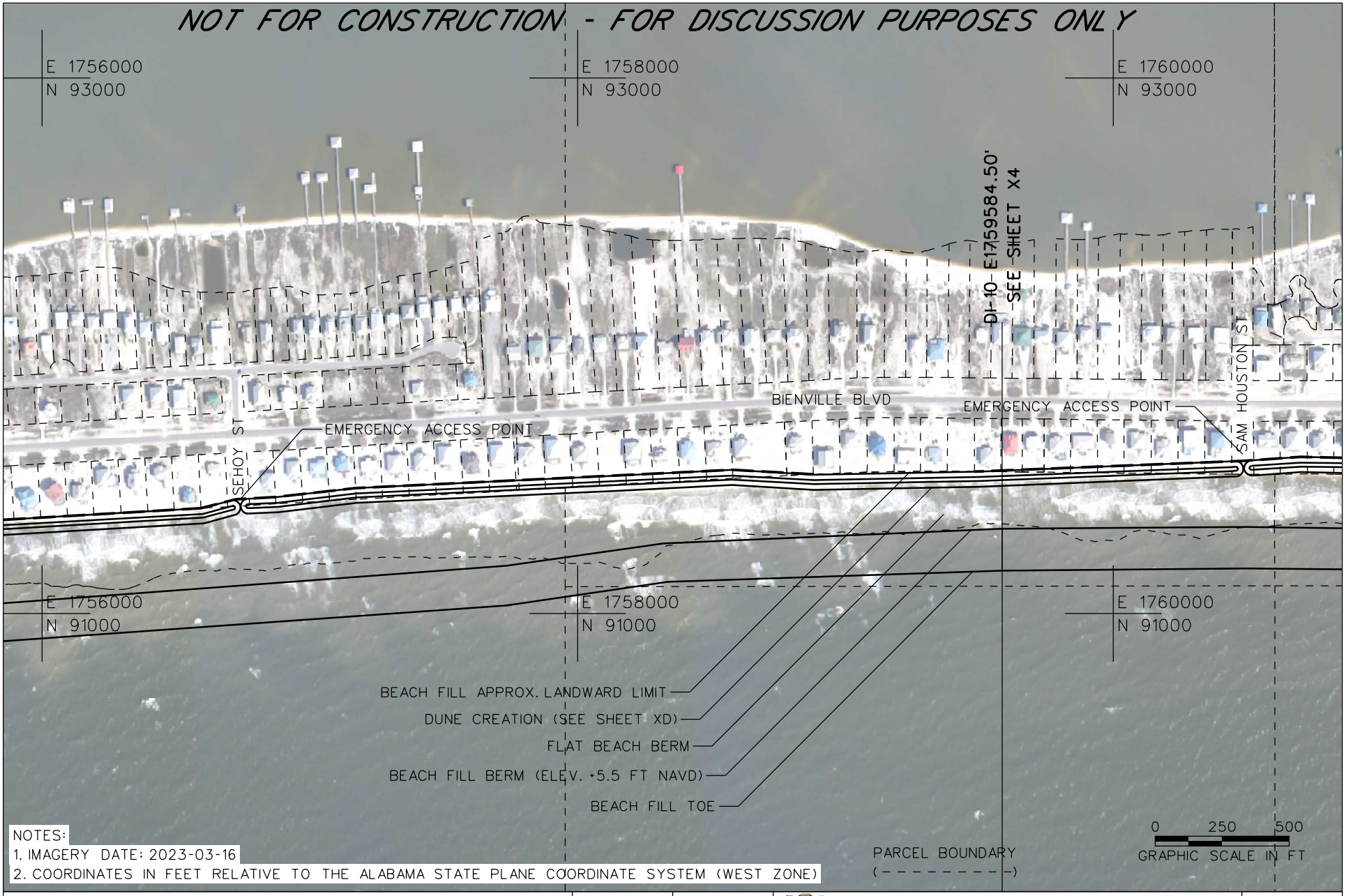
DRAWING NO.
P2
SH. 04/12

Attachment 1 (cont)



Conceptual Plan View 3
West End Beach & Dune Restoration
Dauphin Island, AL

DESIGN: SD	CHECK:
DRAWING: BB	REVIEW:
DATE: 1/30/24	SUBMITTED:

Town of Dauphin Island

SOUTH COAST ENGINEERS
Engineering for the Coast

DRAWING NO. P3
SH. 05/12

Attachment 1 (cont)

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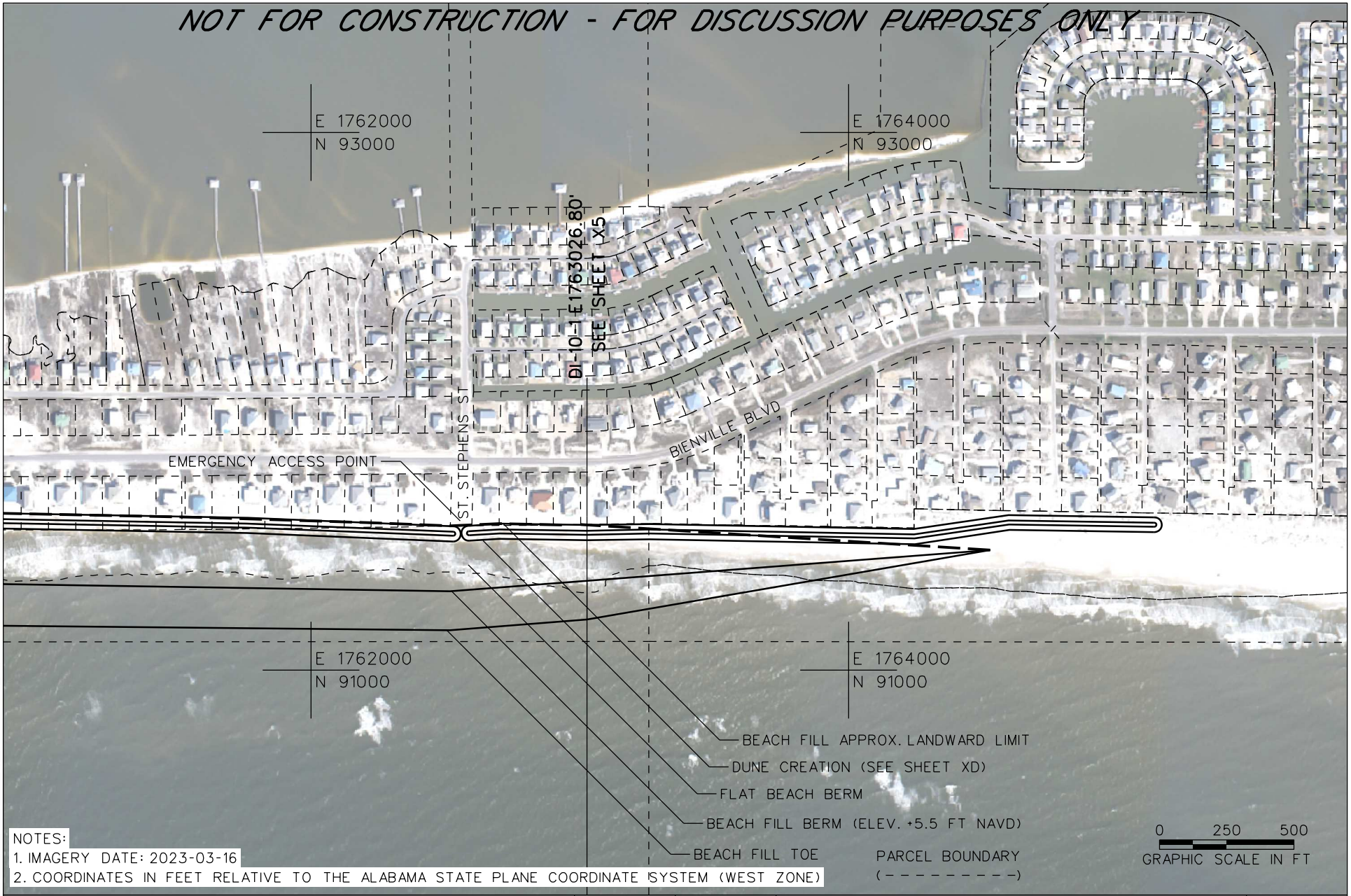

NOTES:
1. IMAGERY DATE: 2023-03-16
2. COORDINATES IN FEET RELATIVE TO THE ALABAMA STATE PLANE COORDINATE SYSTEM (WEST ZONE)

Conceptual Plan View 4
West End Beach & Dune Restoration
Dauphin Island, AL

DESIGN: SD	CHECK:
DRAWING: BB	REVIEW:
DATE: 1/30/24	SUBMITTED:

Town of Dauphin Island

SOUTH COAST ENGINEERS
Engineering for the Coast

DRAWING NO. P4
SH. 06/12

Attachment 1 (cont)

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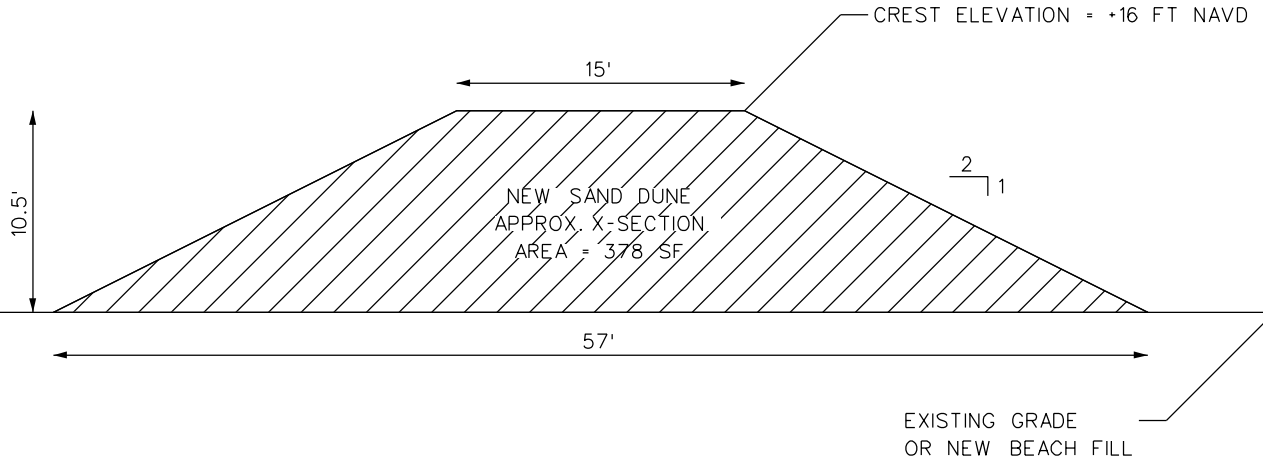
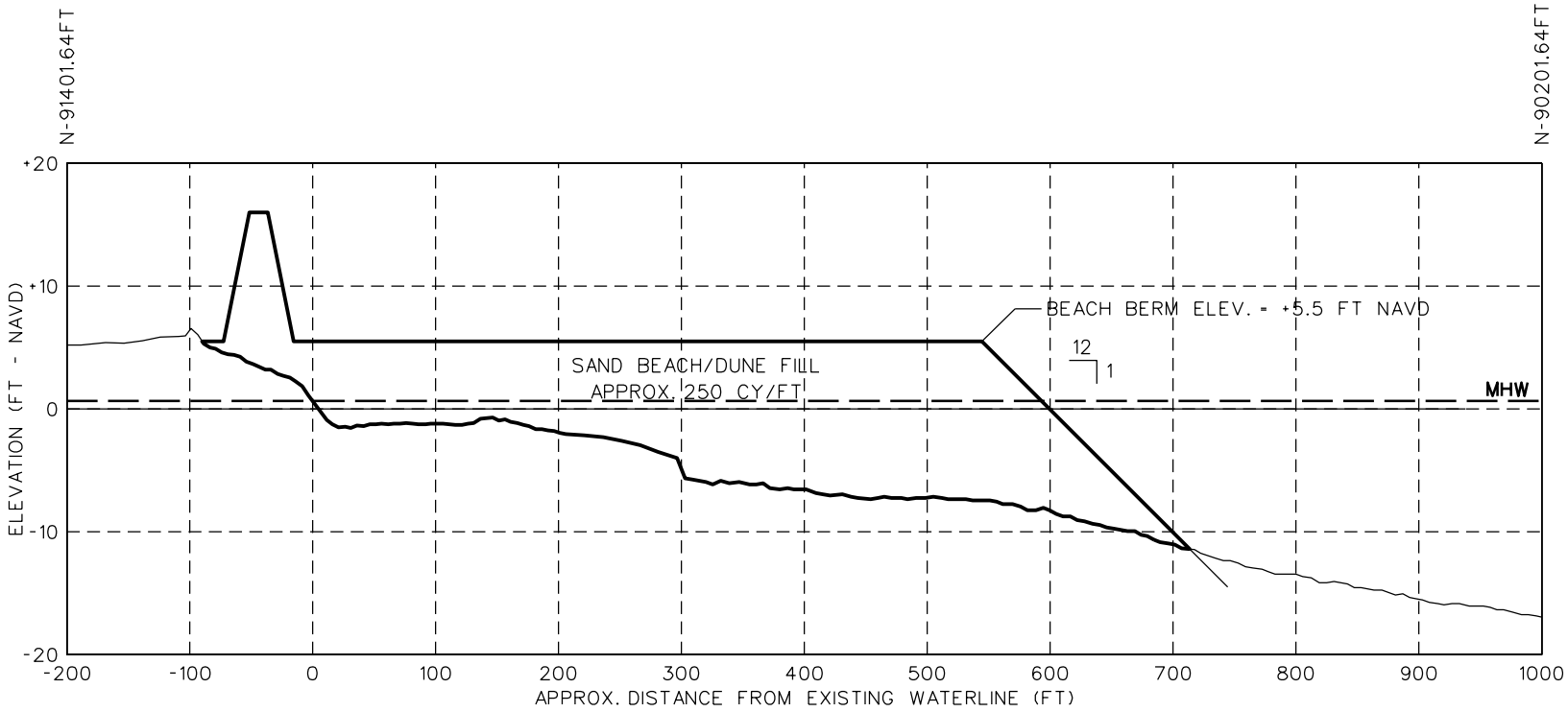


Typical Dune Cross-Section West End Beach & Dune Restoration Dauphin Island, AL	DESIGN: SD DRAWING: BB DATE: 1/30/24	CHECK: REVIEW: SUBMITTED:	Town of Dauphin Island SOUTH COAST ENGINEERS Engineering for the Coast	DRAWING NO. XD SH. 07/12

Attachment 1 (cont)

NOT FOR CONSTRUCTION - FOR DISCUSSION PURPOSES ONLY

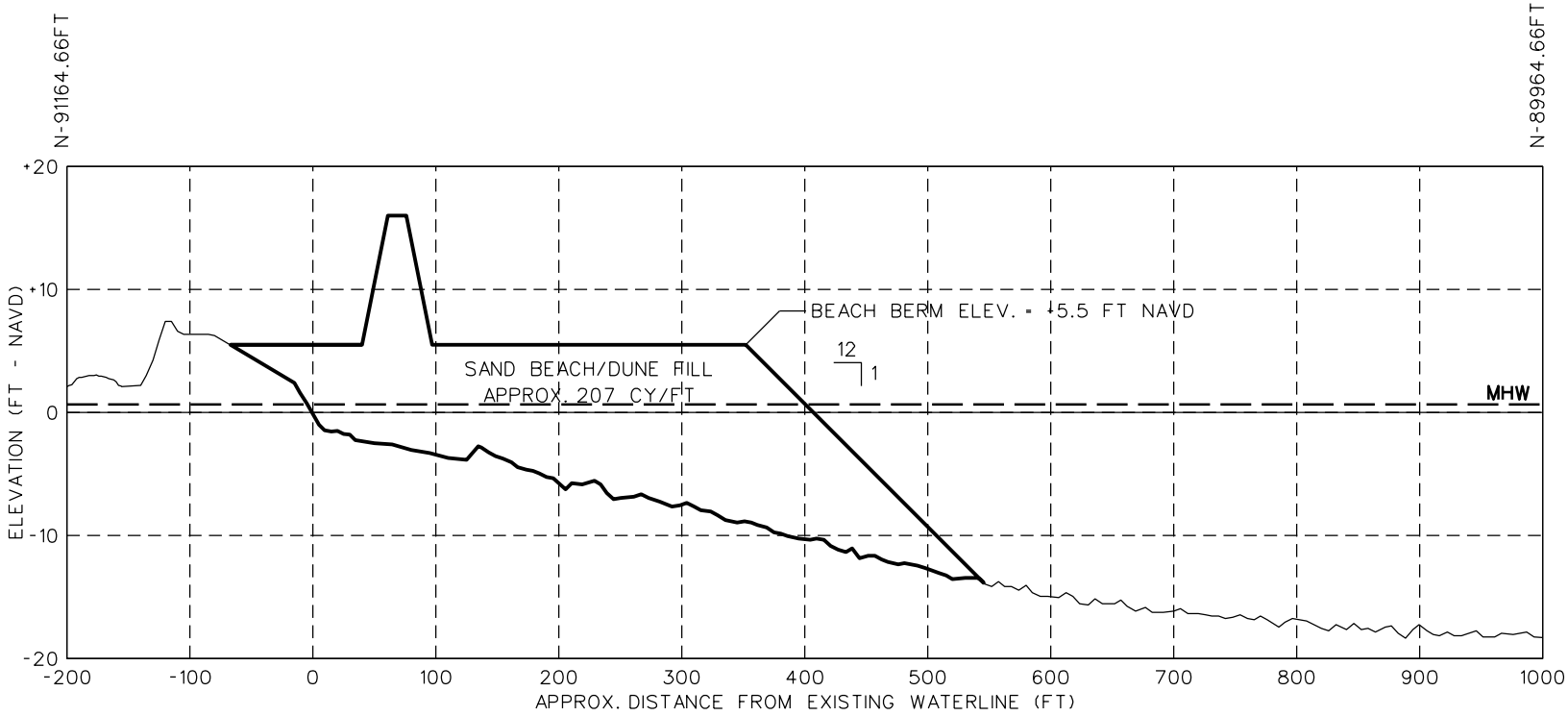


NOTES:
1. EXISTING GRADE SURVEYED BY GOODWYN MILLS & CAWOOD APRIL 2023
2. COORDINATES IN FEET RELATIVE TO THE ALABAMA STATE PLANE COORDINATE SYSTEM (WEST ZONE)
3. CROSS-SECTION DI-2_-1 LOCATED NEAR THE WESTERN BOUNDARY OF WEST BEACH PARK (SEE SHEET P1)

Cross-Section DI-2_-1 West End Beach & Dune Restoration Dauphin Island, AL	DESIGN: SD	CHECK:	Town of Dauphin Island	DRAWING NO. X1
	DRAWING: BB	REVIEW:		
	DATE: 1/30/24	SUBMITTED:	SOUTH COAST ENGINEERS Engineering for the Coast	SH. 08/12

Attachment 1 (cont)

NOT FOR CONSTRUCTION - FOR DISCUSSION PURPOSES ONLY

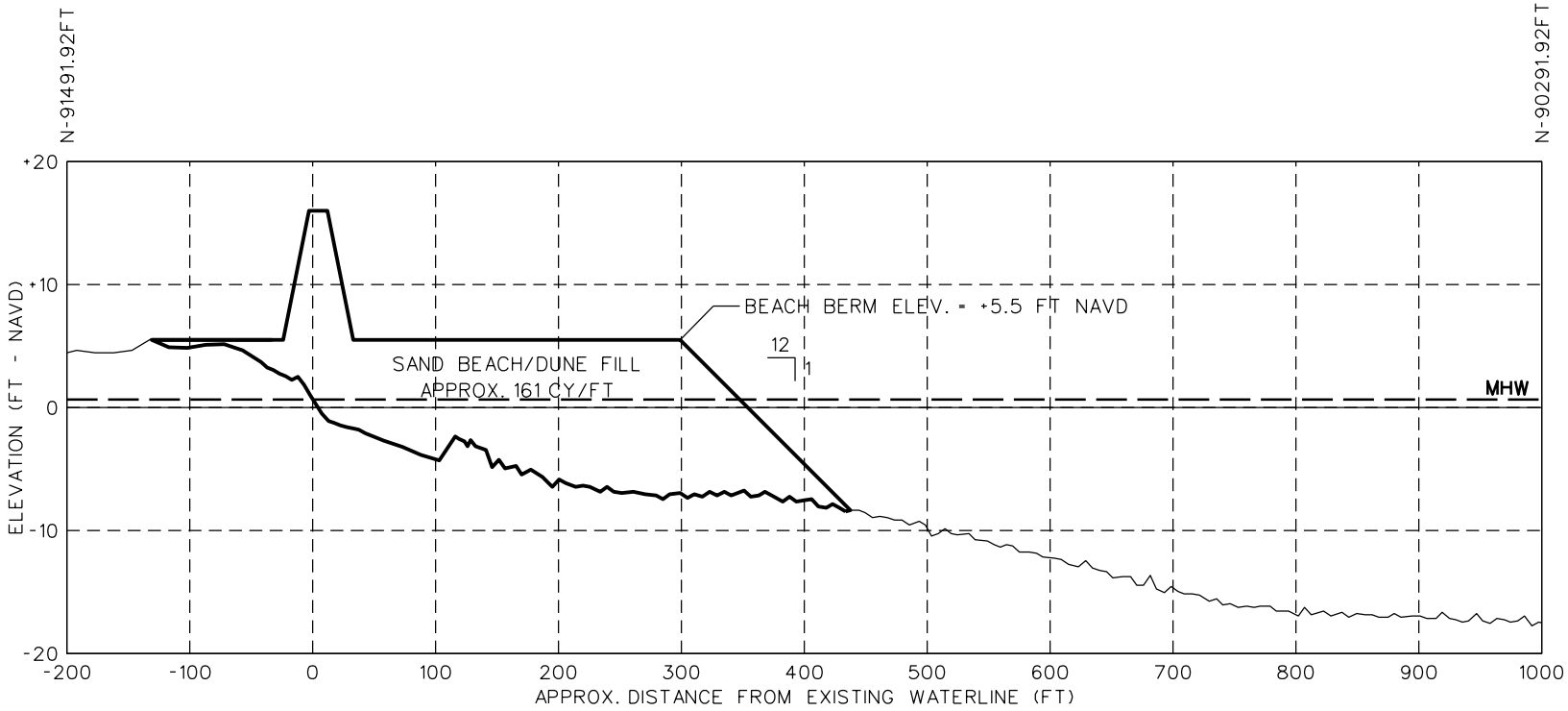


NOTES:
1. EXISTING GRADE SURVEYED BY GOODWYN MILLS & CAWOOD APRIL 2023
2. COORDINATES IN FEET RELATIVE TO THE ALABAMA STATE PLANE COORDINATE SYSTEM (WEST ZONE)
3. CROSS-SECTION DI-2 LOCATED NEAR THE WESTERN END OF BIENVILLE BLVD. AT WINDWARD CT. (SEE SHEET P1)

Cross-Section DI-2 West End Beach & Dune Restoration Dauphin Island, AL	DESIGN: SD DRAWING: BB DATE: 1/30/24	CHECK: REVIEW: SUBMITTED:	Town of Dauphin Island SOUTH COAST ENGINEERS Engineering for the Coast	DRAWING NO. X2 SH. 09/12

Attachment 1 (cont)

NOT FOR CONSTRUCTION - FOR DISCUSSION PURPOSES ONLY

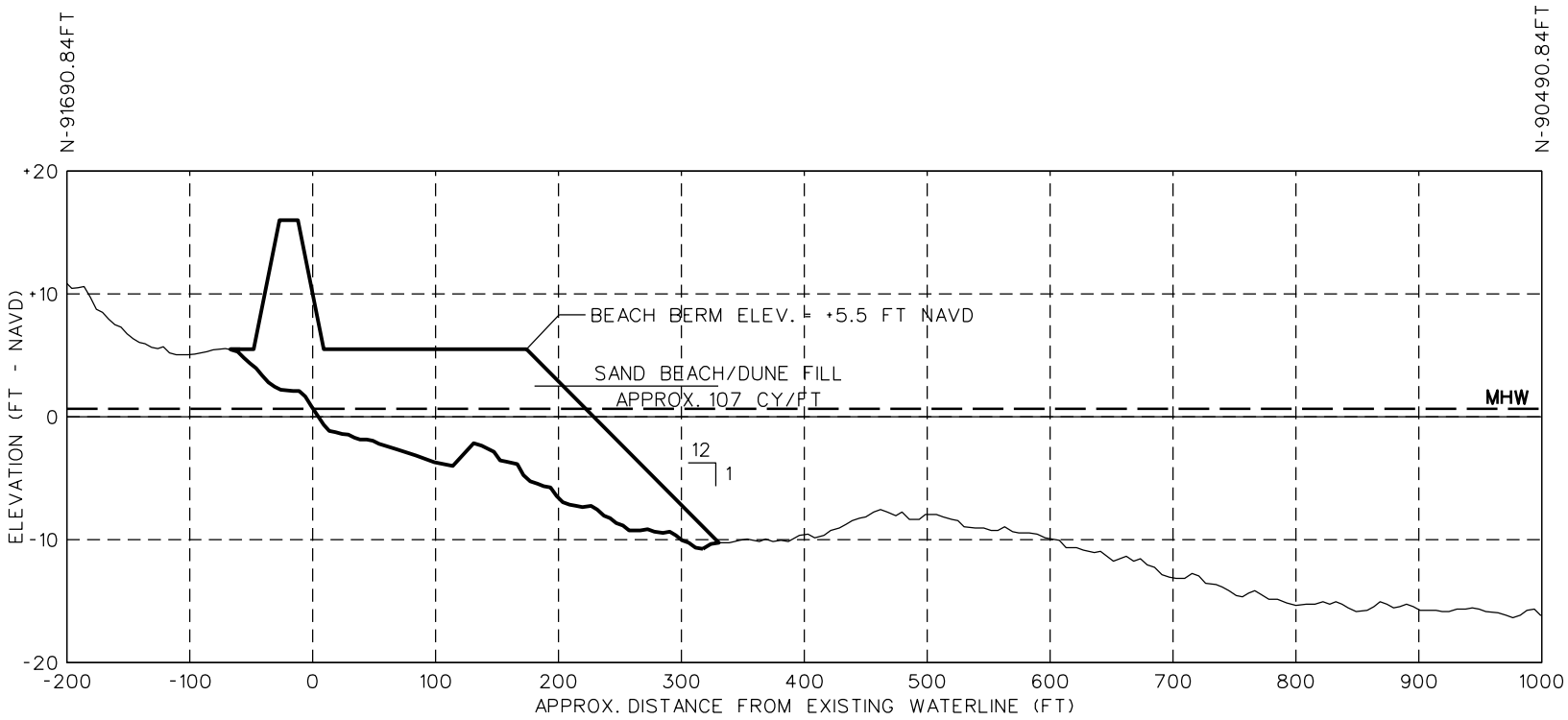


NOTES:
1. EXISTING GRADE SURVEYED BY GOODWYN MILLS & CAWOOD APRIL 2023
2. COORDINATES IN FEET RELATIVE TO THE ALABAMA STATE PLANE COORDINATE SYSTEM (WEST ZONE)
3. CROSS-SECTION DI-8 LOCATED NEAR SENECA CT. (SEE SHEET P2)

Cross-Section DI-8 West End Beach & Dune Restoration Dauphin Island, AL	DESIGN: SD DRAWING: BB DATE: 1/30/24	CHECK: REVIEW: SUBMITTED:	Town of Dauphin Island SOUTH COAST ENGINEERS Engineering for the Coast	DRAWING NO. X3 SH. 10/12

Attachment 1 (cont)

NOT FOR CONSTRUCTION - FOR DISCUSSION PURPOSES ONLY



NOTES:
1. EXISTING GRADE SURVEYED BY GOODWYN MILLS & CAWOOD APRIL 2023
2. COORDINATES IN FEET RELATIVE TO THE ALABAMA STATE PLANE COORDINATE SYSTEM (WEST ZONE)
3. CROSS-SECTION DI-10 LOCATED NEAR 2417 BIENVILLE BLVD. (SEE SHEET P3)

Cross-Section DI-10 West End Beach & Dune Restoration Dauphin Island, AL	DESIGN: SD DRAWING: BB DATE: 1/30/24	CHECK: REVIEW: SUBMITTED:	Town of Dauphin Island SOUTH COAST ENGINEERS Engineering for the Coast	DRAWING NO. X4 SH. 11/12

Attachment 1 (cont)

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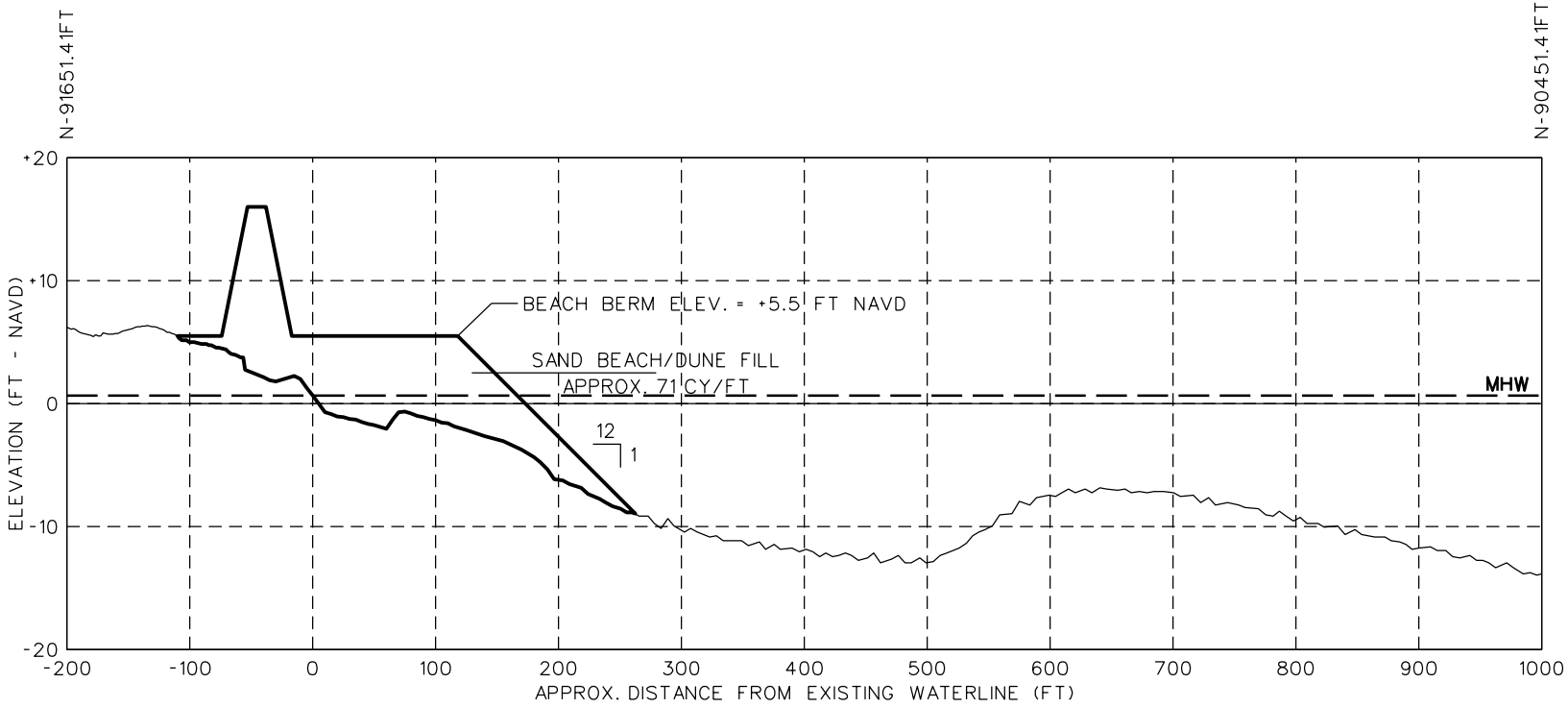
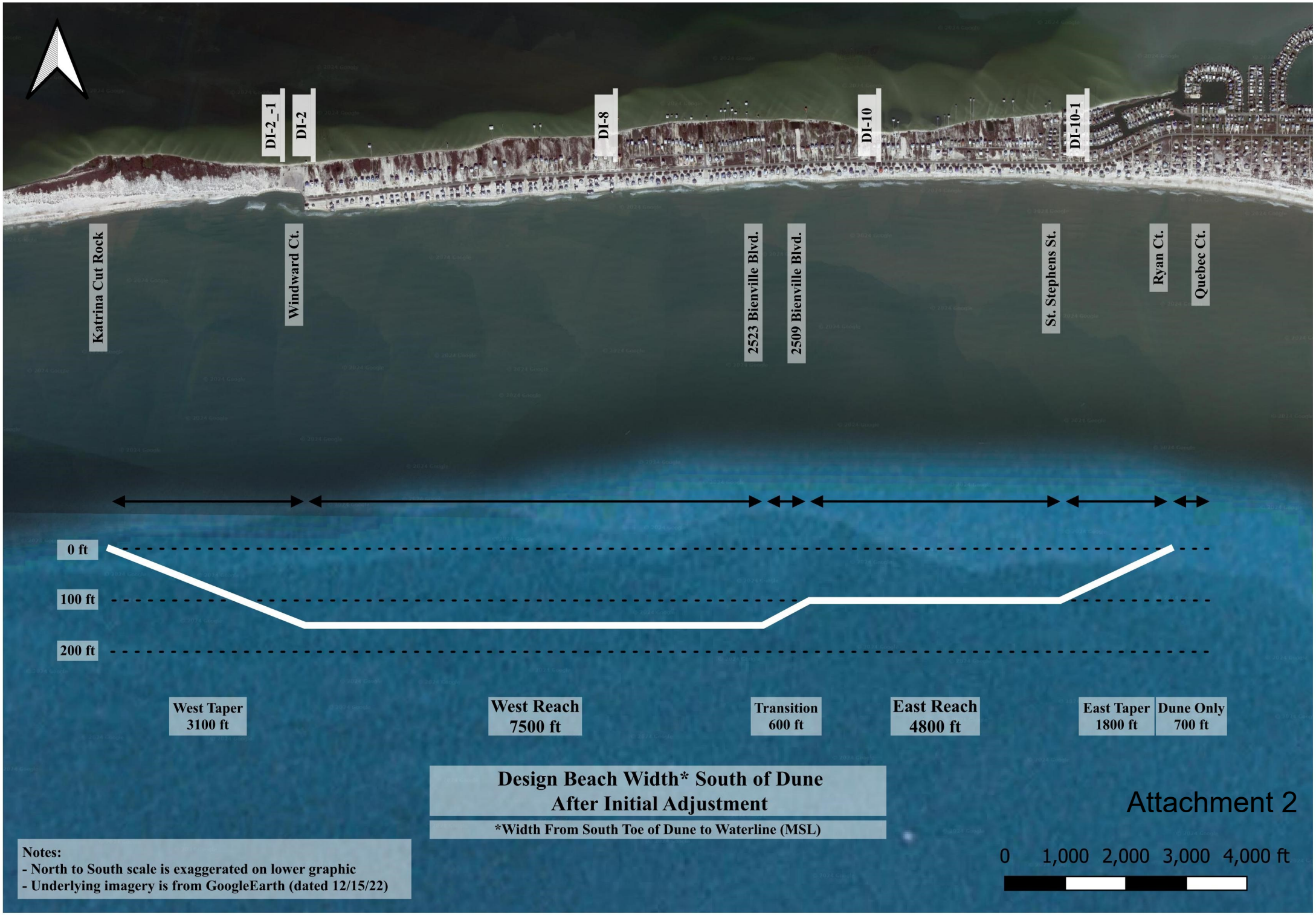
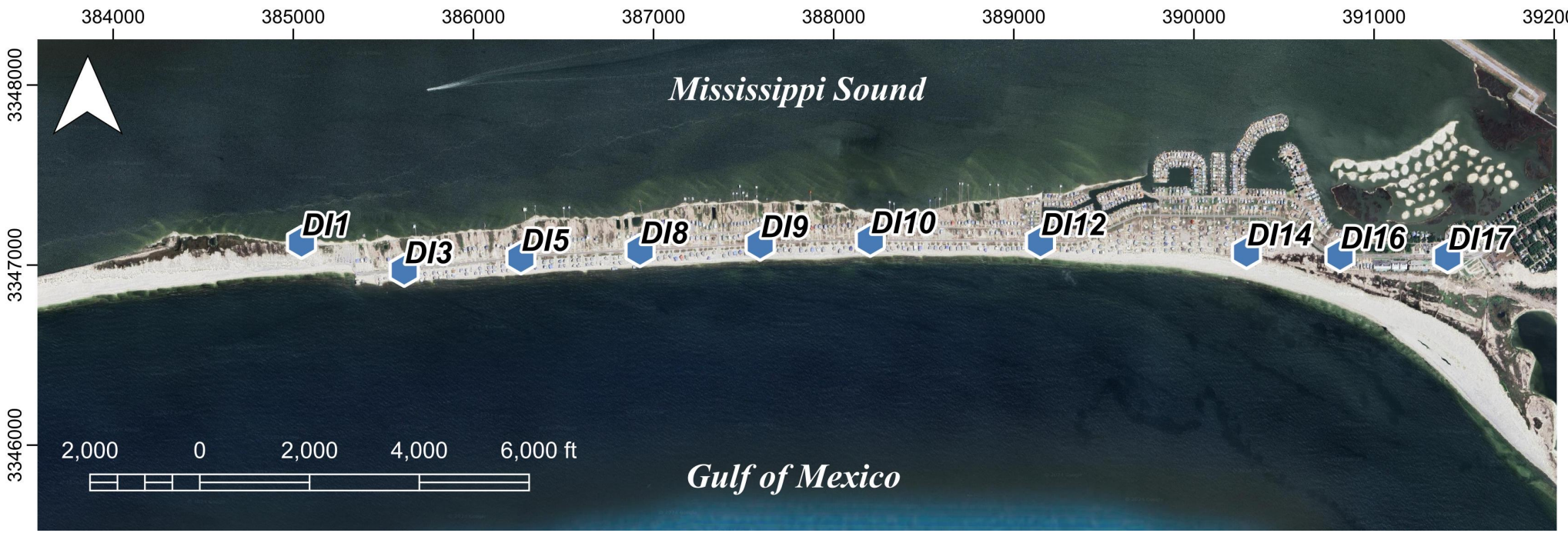


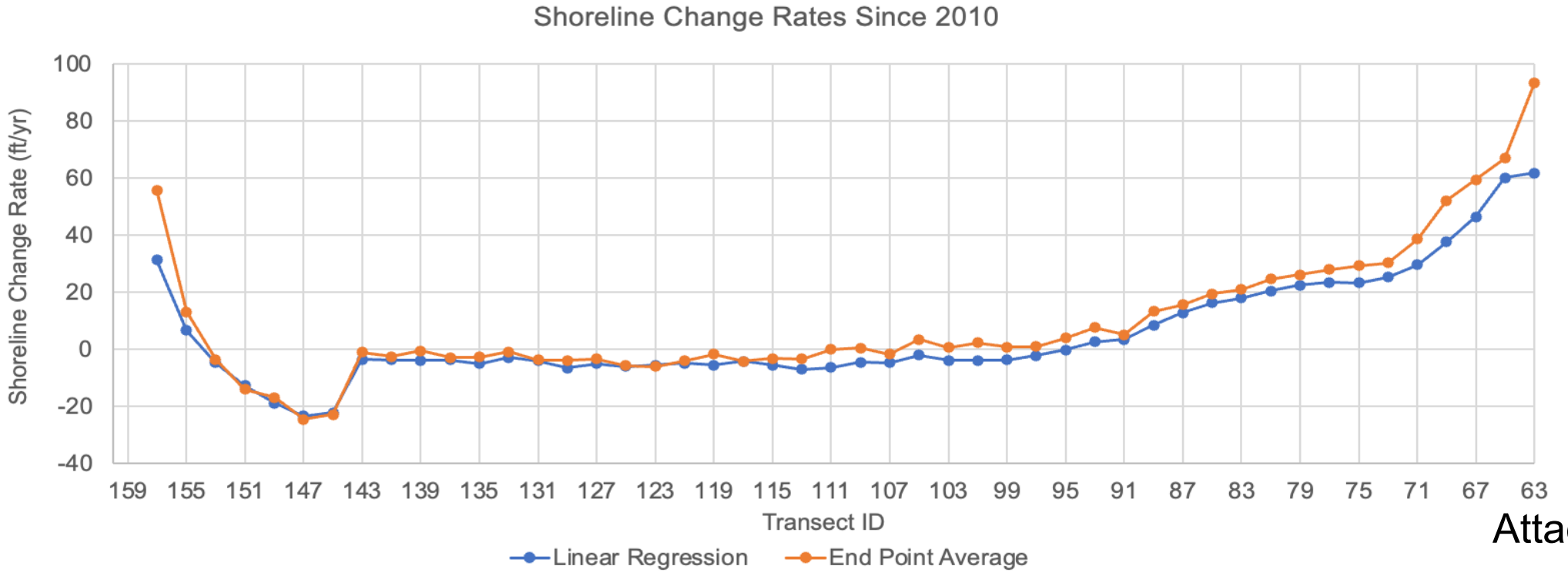
NOTES:
1. EXISTING GRADE SURVEYED BY GOODWYN MILLS & CAWOOD APRIL 2023
2. COORDINATES IN FEET RELATIVE TO THE ALABAMA STATE PLANE COORDINATE SYSTEM (WEST ZONE)
3. CROSS-SECTION DI-10-1 LOCATED 450 FT EAST OF ST. STEPHENS ST (SEE SHEET P4)

Cross-Section DI-10-1 West End Beach & Dune Restoration Dauphin Island, AL	DESIGN: SD	CHECK:	Town of Dauphin Island	DRAWING NO. X5
	DRAWING: BB	REVIEW:	SOUTH COAST ENGINEERS Engineering for the Coast	SH. 12/12
	DATE: 1/30/24	SUBMITTED:		

Attachment 1 (cont)


DI-2_-1
DI-2
DI-8
DI-10
DI-10-1
Katrina Cut Rock
Windward Ct.
2523 Bienville Blvd.
2509 Bienville Blvd.
St. Stephens St.
Ryan Ct.
Quebec Ct.
0 ft
100 ft
200 ft
West Taper
3100 ft
West Reach
7500 ft
Transition
600 ft
East Reach
4800 ft
East Taper
1800 ft
Dune Only
700 ft
Design Beach Width* South of Dune
After Initial Adjustment
*Width From South Toe of Dune to Waterline (MSL)
Attachment 2
Notes:
- North to South scale is exaggerated on lower graphic
- Underlying imagery is from GoogleEarth (dated 12/15/22)
0 1,000 2,000 3,000 4,000 ft





Attachment 3