Report

Bald Head Island, NC
Beach Monitoring Program

Monitoring Report No. 23
April 2024 to May 2025

Village of Bald Head Island
November 2025

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Bald Head Island, NC

Beach Monitoring Program

Monitoring Report No. 23

April 2024 to May 2025

Prepared for
Village of Bald Head Island, NC

Prepared by
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Executive Summary

This report summarizes the Year 24 monitoring data and initial performance of the 2024/25 Bald Head Island Beach Renourishment project. The Year 24 monitoring period (April 2024 to May 2025) represents the twenty-fourth year of island-wide monitoring following completion of the initial 2001 Federal +1.849 Mcy beach disposal at Bald Head Island.

A 2024/25 beach fill project was constructed between December 12, 2024 and March 4, 2025 and was the third Village sponsored nourishment of project shoreline (2009/10 & 2019). The fill limits of the 2024/25 project span roughly 2.6 miles of the Atlantic Ocean shoreline of Bald Head Island. The project resulted in the placement of a pay volume of 1,000,000 cubic yards (cy) of sand at a total cost of $16,125,000.00. The project was financed and managed by the Village of Bald Head Island. In addition to the renourishment project, the Village contracted with McPherson Marine Services, LLC. to concurrently replace the 13-structure sand-tube groin field. The sand-tube construction began on January 5, 2025 and was completed on February 17, 2025. The engineer and permit agent for both projects was Foth | Olsen of Jacksonville, FL.

In compliance with project permits and the physical monitoring plan, survey data and aerial photography were collected during Year 24. These data include island-wide beach profile surveys in April 2024, October 2024, & May 2025; bathymetric surveys in April 2024 & October 2024 of the original Jaybird Shoals (JBS) borrow area limits, bathymetric surveys in November 2024 & March 2025 of the expanded JBS borrow area utilized in the 2024/25 project, island-wide orthorectified aerial photography in April 2024, October 2024 & May 2025, and oblique aerial drone photography flown at various dates during the monitoring year.

West Beach, "the Point", South Beach Changes. During the 6-month monitoring period prior to the 2024/25 beach fill placement (April 2024 to October 2024), the combined West Beach, "the Point", and South Beach shorelines lost -246,400 cy above -16 ft-NGVD (i.e. presumed depth of survey closure). On weighted average the berm and Mean High Water Line (MHWL) receded by -1 ft and -9 ft, respectively.

The 2024/25 South Beach fill placement area lost -160,100 cy above closure during this period. Additionally, the contractor's pre-construction survey (November 2024) indicated an additional -93,600 cy of sand loss prior to construction, necessitating a slight adjustment to the final construction template.

During the 7-month period that includes the 2024/25 beach fill placement (October 2024 to May 2025), the combined shoreline gained +658,600 cy above closure. On weighted average the berm and MHWL advanced by about +54 ft and 61 ft, respectively.

The 2024/25 South Beach fill placement area gained +731,400 cy above closure during this period. Measured above -5 ft-NGVD, (roughly the offshore limit of fill placement), the beach fill area gained +761,200 cy. On weighted average, the berm and MHWL advanced by 106 ft and 104 ft, respectively. This shoreline advance created roughly 32.3 acres of additional "dry beach" area as measured between the October 2024 and May 2025 MHWLs.

Over the entire Year 24 (October 2024 to May 2025), the combined shoreline gained +412,200 cy above closure. This is inclusive of the 1.0 Mcy (pay) placed along portions of South Beach. On weighted average, the berm and MHWL advanced by +53 ft and +52 ft, respectively.

The 2024/25 South Beach fill placement area gained +571,300 cy above closure during Year 24 and +637,300 cy above -5 ft-NGVD (roughly the offshore limit of fill placement). On weighted average, the berm and MHWL advanced by 106 ft and 104 ft, respectively. This shoreline advance created roughly 32.3 acres of additional "dry beach" area as measured between the October 2024 and May 2025 MHWLs.

2024/25 Borrow Area Changes. Based upon the Contractor's pre- and post-construction surveys of the JBS expansion area used for the 2024/25 beach placement, roughly 1,122,800 cy of material was excavated from within the borrow area limits. This is within about 6 percent of the Contractor's measured BD/AD total beach placement volume of 1,052,400 cy. Some of these differences may be attributable to natural changes within the expansion borrow area. The next survey of the borrow area is scheduled for the Year 25 monitoring period in event in the spring of 2026.

List of Abbreviations, Acronyms, and Symbols

AIWW	Atlantic Intracoastal Waterway
CAMA	Coastal Area Management Act (North Carolina)
DEQ	Department of Environmental Quality (North Carolina)
FEMA	Federal Emergency Management Agency
FDEM	Federal Division of Emergency Management
Foth | Olsen	Foth Infrastructure & Environment, LLC | Olsen Associates, Inc.
MHW	Mean Higher Water
MLLW	Mean Lower Low Water
NAVD88	North American Vertical Datum of 1988
NGVD29	National Geodetic Vertical Datum of 1929
USACE	United States Army Corps of Engineers

1. Introduction

1.1 Overview & Scope

This engineering report presents the measured physical changes along the Row-Boat-Row, West Beach, "the Point", South Beach, and East Beach shorelines of Bald Head Island (BHI) based principally upon historical and updated monitoring surveys performed annually on behalf of the Village of Bald Head Island (Village). The report specifically addresses:

- A description of the project location and physical setting,
- A comparison of the monitoring period wave climate with historical periods,
- A discussion of the Federal Navigation Channel and the status of the implementation of the Wilmington Harbor Sand Management Plan (WHSMP),
- A brief history of historical erosion control activities along the Bald Head Island shoreline,
- A discussion of the 2024/25 Village Beach Renourishment project (1.0 Mcy) constructed between December 2024 and March 2025.
- Recent volume and shoreline position changes measured along Bald Head Island between April 2024 and May 2025. This period includes construction of the 2024/25 Village Beach Renourishment project.

1.2 Location & Physical Setting

Bald Head Island is located in Brunswick County, North Carolina at approximately 33°51' N, 78°00' W (**Figure 1.1**). The island is roughly 25 miles south of the City of Wilmington and 32 miles east of the South Carolina/North Carolina state line. It is the southernmost of the coastal barrier islands which form the Smith Island complex at the mouth of the Cape Fear River. The southeastern tip of the island is Cape Fear (also referred to as Cape Fear Point) from which Frying Pan Shoals extend seaward over 20 miles to the southeast.

The island's east and south shorelines, "East Beach" and "South Beach", front the Atlantic shoreline. The west shoreline, or "West Beach", fronts the Cape Fear River. The north side of the island is bounded by the Bald Head Creek estuary, Middle Island and Bluff Island. The Cape Fear River entrance, over one mile in width, separates Bald Head Island from Oak Island (or Caswell Beach).

The astronomical tides in the vicinity of Bald Head Island are semi-diurnal and have average mean and spring ranges of approximately 4.3 ft and 5.0 ft, respectively. Tidal datums for Bald Head Island are listed in **Table 1.1**. The predicted astronomical tides during the April 2024 to May 2025 monitoring period are plotted as **Figure 1.2**.

Figure 1.1: Location of Bald Head Island, NC and Federal Navigation Channel.

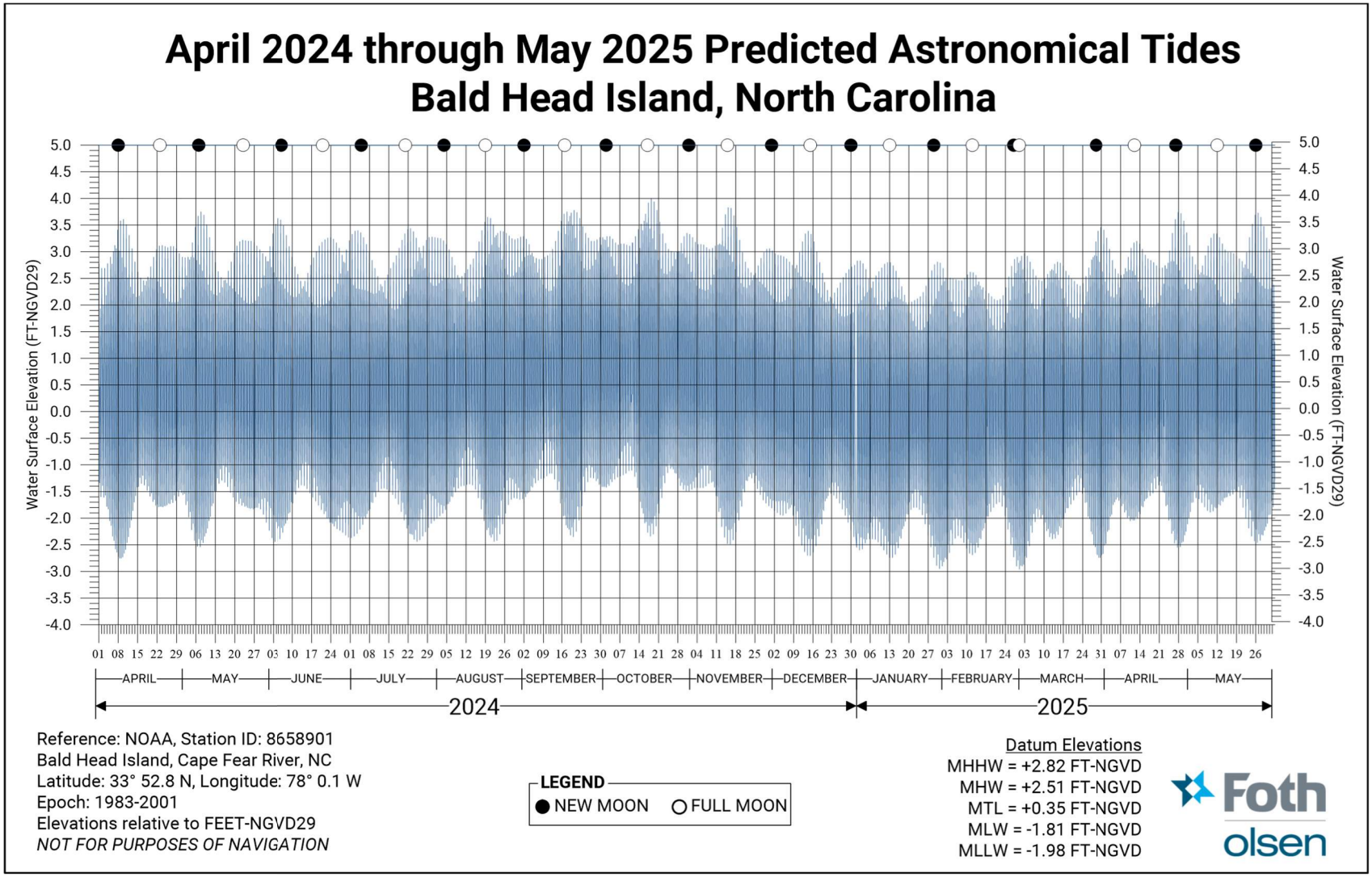

Figure 1.2: Monitoring period predicted astronomical tides, Bald Head Island, NC.

Table 1.1: Tidal datums for Bald Head Island, North Carolina[1].

Datum	Elevation (ft-NGVD29[2])
Mean Higher High Water (MHHW)	+2.82
Mean High Water (MHW)	+2.51
NAVD 1988	+1.10
Mean Tide Level (MTL)	+0.35
NGVD 1929	0.00
Mean Low Water (MLW)	-1.81
Mean Lower Low Water (MLLW)	-1.98

1.3 Monitoring Period Wave Climate (April 2024 to May 2025)

Figure 1.3 displays a time series of significant wave heights measured at National Data Buoy Center (NDBC) Station 41108 from April 2024 through May 2025. NDBC Station 41108 is located roughly 9 miles south of Bald Head Island in approximately 42 feet of water. The buoy was deployed in March 1988 and has been collecting data nearly continuously for 37+ years except for an approximate five-year period between April 1992 and May 1997 and several other periods lasting a few weeks or less in duration. The data collected by the buoy includes significant wave height (average of the highest one-third of all waves in a 20-minute sampling period), wave period, wave direction, wind speed and other standard meteorological data.

The average significant wave height[3] (H_s) at NDBC Station 41108 during the Year 24 monitoring period (April 1, 2024 through May 31, 2025) was 3.3 feet with a maximum wave height of 12.8 ft measured on April 11, 2024 during a nor'easter. The Year 24 average is slightly higher than the full record average significant wave height of 3.2 feet (March 1988 through May 2025) and about the same as the Year 23 average (3.3 feet). During the Year 24 monitoring period, roughly 5.1 percent of the recorded wave heights were above 6 feet, compared to 5.5 percent for the full record average. The occurrence of waves above 10 feet during Year 24 was slightly higher than the full record average (0.3 vs 0.2 percent, respectively).

[1] Approximations based upon extrapolation from Southport, N.C.

[2] NGVD 1929: National Geodetic Vertical Datum of 1929 (1929 Mean Seas Level). Horizontal coordinates are referenced to the North Carolina State Plane Coordinate System, North American Datum of 1983.

[3] These measurements reflect the significant wave height, or the average of the highest 1/3rd of waves passing the buoy during a 20 minute sampling period.

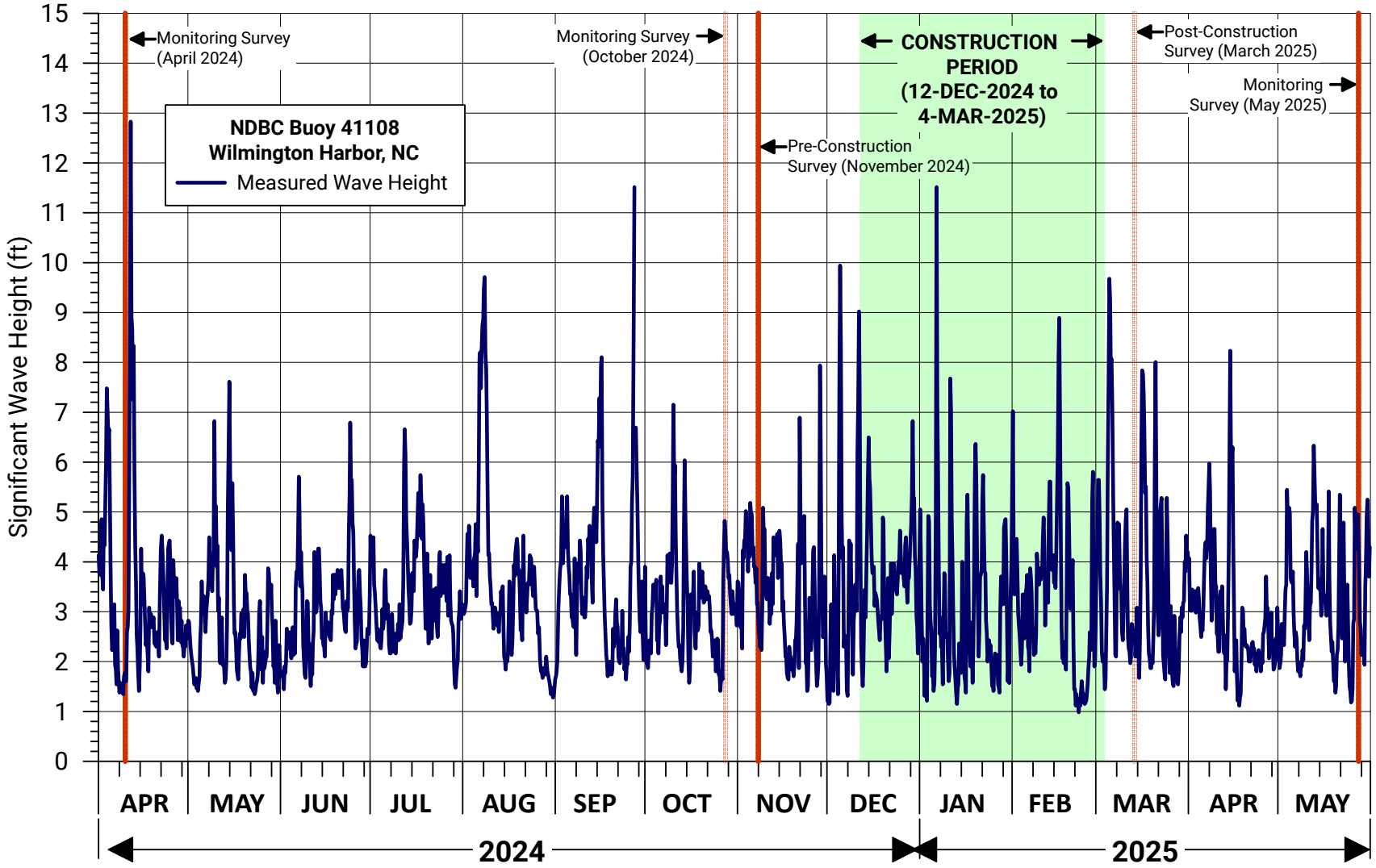

Figure 1.3: Significant wave heights recorded by NOAA Buoy 41108 during the 2024-2025 monitoring period (Wilmington Harbor, NC).

1.4 Wilmington Harbor Federal Navigation Channel & Sand Management Plan

A detailed discussion of the history of the navigation channel and the Wilmington Harbor Sand Management Plan (WHSMP) is provided in Monitoring Report No. 15 (Olsen 2017).

The Wilmington Harbor Federal Navigation Project extends up the Cape Fear River from a point seven statute miles seaward of the Bald Head Island Marina, upstream 30.4 miles to a location just north of the City of Wilmington, N.C. The Wilmington District, U.S. Army Corps of Engineers (USACE) is responsible for maintaining the project at its congressionally authorized depths and widths.

The Wilmington Harbor Sand Management Plan (USACOE 2000) was formulated as a specific action element of the deepening project for Wilmington Harbor. For the most part, the Plan was in direct response to the stated concerns of the Village of Bald Head Island regarding the historical harbor maintenance impacts and potential new impacts of the deepening project to both the regional sediment budget and Bald Head Island. The Plan's stated purpose was to reverse the practice of placing beach quality sand in the off-shore disposal area by calling for placement of this sand onto adjacent beaches. Over a theoretical six-year biennial maintenance cycle, the initial Wilmington Harbor Sand Management Plan (WHSMP) stipulated that approximately 1.0 Mcy of sand was to be placed on the beaches of Bald Head Island in years two and four (*after* initial construction) and on Oak Island/Caswell Beach during year six. The six-year disposal cycle was proposed for the life of the project but, accordingly to its terms, could be altered based upon documentation of impacts to adjacent beaches, changes in conditions and other relevant factors. The first six-year (3 maintenance event) cycle was completed in April 2009. In early 2011, the Wilmington District issued a draft report-of-findings both summarizing approximately 10-years of monitoring and readdressing the tenets of the original (2000) Sand Management Plan based upon their interpretation of monitoring results, related analyses and other salient factors or considerations. Subsequently the District solicited public comments from the two (2) principal stakeholders – the Village of Bald Head Island and Caswell Beach.

It has been OAI's continuing opinion that an equitable division of sand between the two (2) abutting shorefronts of Oak Island and Bald Head Island should be based upon the cumulative quantities of sediment *lost* from each shoreline over the prior dredging cycle(s) as documented by survey, as well as identifiable impacts which exceed the November 2000 (pre-project) benchmark survey. Pursuant to the WHSMP, it should be based upon the ratio of documented littoral transport rates for each island *toward* the Cape Fear River. Pursuant to the existing Federal Disposal Plan, the most recent disposal operation at South Beach occurred in the winter/spring months of 2022/2023. The subsequent scheduled disposal event will address the eastern end of Oak Island at Caswell Beach between November 2025 and April 2026. In conflict with the terms of the WHSMP, the latter disposal project will likewise extend beyond Caswell Beach into the Town of Oak Island – where net littoral transport is westward and not eastward toward the inlet.

1.5 Historical Erosion Control Activities

1.5.1 Beach Fill and Disposal Projects

Beach fill placement activities constructed at Bald Head Island since 1991 are summarized in **Table 1.2.**

The three small-scale beach placement projects constructed between 1991 and 1997 were either cost-shared or paid for by the Village. Although strategic in nature, they were not comprehensive in scope. Simplistically, they resulted in limited sand placement along the west end of South Beach near the federal channel.

Not until 2001 did South Beach in its entirety become the recipient of a designed comprehensive beach restoration project. The source of beach compatible sand was the federally authorized navigation project widening/deepening project. The sand was placed as a designed berm along approximately 15,500 feet of shoreline. The limits of work and design templates were provided to the Wilmington District by Olsen Associates, Inc. on behalf of the Village. All work was performed in general conformance with the requirements of the Wilmington Harbor Sand Management Plan.

The 2005 project was the initial beach disposal event (intended for Year 2, but occurring in Year 3) of the scheduled disposal cycle and was constructed between November 2004 and January 2005. The 2006, non-federal West Beach limited sand placement project was constructed by the Village in January 2006. The 2007 disposal project was the second declared "maintenance" event (intended for Year 4, but occurring in Year 5) and was constructed between February and April 2007. Approximately 0.98 Mcy of beach quality material was placed along the South Beach shoreline between Sta. 46+00 and 174+00.

Between February and April 2009, approximately 1.064 Mcy of beach quality sand was excavated from three navigation channel segments (Smith Island Channel thru Bald Head Shoal Reach 1 and 2). All 2009 channel maintenance material was placed on Oak Island/Caswell Beach and none was placed on Bald Head Island. Analyses performed for prior Monitoring Reports prepared on behalf of the Village had predicted a looming net sediment deficit along portions of South Beach concurrent with the third biennial channel maintenance event whereby beach disposal would *not* be scheduled to occur at Bald Head Island but rather at Oak Island (pursuant to the WHSMP). As a result, the Village had strategically designed and permitted a locally sponsored renourishment project with groin field rehabilitation – as warranted. The first such locally sponsored renourishment occurred in 2009/10.

The maximum volume of sand placement permitted for the 2009/10 renourishment project was 2 Mcy or less. Approximately 5% of the total dredge contract pay volume was to be placed on West Beach. The remainder was to be directed toward South Beach with the highest fill density scheduled for placement on the westernmost end closest the navigation project. The final "pay" volume (in-place) by Contract was 1,594,533 cy. The actual volume of sand excavated and pumped to the two Bald Head Island shoreline segments was estimated at approximately

1.85 Mcy ±. The project borrow area was located at the seaward end of Jay Bird Shoals, a highly dynamic linear shoal feature bordering the western perimeter of the original navigation project entrance channel. The project was constructed by Norfolk Dredging at a cost of approximately $14.9 M. A Post-Construction Report detailed the project elements (Olsen 2010a).

Table 1.2: Beach disposal or sand placement activities at Bald Head Island since 1991.

Year	Volume	Sponsor	Location
1991	0.35 ± Mcy	VBHI	(Sta. 24+00 to 138+00)
1996	0.65 ± Mcy	VBHI	(Sta. 24+00 to 142+00)
1997	0.45 ± Mcy	VBHI	(Sta. 24+00 to 128+00)
2001	1.849 ± Mcy	USACE*	South Beach (Sta. 41+60 to 205+50)
2005	1.217 ± Mcy	USACE*	South Beach (Sta. 46+00 to 126+00)
2006	47,800 cy	VBHI	West Beach (Sta. 16+00 to 34+00)
2007	0.9785 ± Mcy	USACE*	South Beach (Sta. 46+00 to 174+00)
2009/10	1.850 ± Mcy	VBHI	West Beach (Sta. 8+00 to 32+00) South Beach (Sta. 40+00 to 190+00)
2012	137,990 cy	FEMA/VBHI	West Beach & Western South Beach
2013	1.566 ± Mcy	USACE*	South Beach (Sta. 44+00 to 150+00)
	92,500 cy		West Beach (Sta. 8+00 to 27+00)
2015	1.33 ± Mcy	USACE*	South Beach (Sta. 41+50 to 154+00)
2016/17	50,000 cy	VBHI	West Beach and Row Boat Row
2019	1.1 Mcy	VBHI	South Beach (Sta. 49+00 to Sta. 146+00)
2021	1.61 Mcy	USACE	South Beach (Sta. 60+00 to Sta. 212+00)
2023	1.3 Mcy	USACE	South Beach (Sta. 60+00 to Sta. 165+00)
2024/25	1.0 Mcy	VBHI	South Beach (Sta. 53+00 to Sta. 130+00 & Sta. 162+00 to 222+00)

* Disposal pursuant to the WHSMP. Dredge volume estimate (pre-losses).

In late August 2011, Hurricane Irene impacted portions of the coastline of North Carolina. During the incident period, storm surge and high waves associated with the declared event, resulted in erosion of varying severity along the engineered shorefront of Bald Head Island. In a predictable fashion, the erosion was most severe for the shoreline nearest the mouth of the Cape Fear River. As a result of an on-site inspection by FEMA representatives, three (3) Project Worksheets (PW's) were issued allowing for the following actions by the Village:

- Mechanical pushing of sand from the lower beach to the duneline along a section of East Beach facing Onslow Bay.
- The reconstruction of the westernmost 5 sand-tube groins, partially damaged or displaced during the event, and
- The placement of 10,000 cy of sand along West Beach and 95,000 cy along the westernmost segment of South Beach.

The Village's strategic permitting of a Bald Head Creek "emergency" dredging project allowed the FEMA project to be expeditiously bid and constructed within the non-turtle nesting window addressed by State and Federal permits. The 140,000 cy project was initiated by Cottrell Contracting Corporation on 19 January and completed on 25 February 2012. Of the total 137,990 cy of sand placed, 105,000 cy were reimbursable by FEMA under P.W.BHGJS03.

In 2013, almost 1.7 Mcy of channel disposal material was placed on Bald Head Island. This included a 92,500 cy fill placement on West Beach which was the first occasion of channel material disposal at that location since the initial construction of the 2000 Wilmington Harbor Deepening Project.

In the spring of 2015, the Wilmington District awarded a maintenance contract in accordance with the Wilmington Harbor Sand Management Plan (WHSMP). Accordingly, all material was placed on the South Beach portion of Bald Head Island between STA 41+50 and 154+00. The estimated placed volume was 1.33 ± Mcy. To allow for sand placement extending to STA 41+50 for purposes of benefiting a proposed terminal groin (to be constructed the same year), the Village was required to pay approximately $945,000 to the USACE.

A small-scale sand placement project totaling approximately 50,000 cy was constructed by Marcol Dredging in late December 2016 and finished the first week of March 2017. The specified borrow area was the southernmost permitted section of the Bald Head Creek ebb tidal platform – previously utilized for two prior small-scale beach fill projects. Approximately 26,000 cy were placed along 1,500 ft. of Row Boat Row shorefront beginning at the north jetty. Subsequently 24,000 cy were placed at West Beach between Sta. 8+00 and 22+00.

The typical 3-Year spring of 2018 channel maintenance contract (for some reason) was not "scheduled" by the Wilmington District, USACOE. However, problematic shoaling reported by the Port Pilots necessitated that the District issue an emergency contract for summer of 2018 maintenance dredging. Accordingly, the Corps was granted permits to perform beach placement in the sea turtle nesting season of 2018. Pursuant to the WHSMP, the beach quality material was

placed on Oak Island throughout the limits of Caswell Beach – and not at Bald Head Island. Hence, the requirement for the Village sponsored 2019 renourishment project.

Between January and April 2019, the Village completed construction of a 1.1 Mcy beach renourishment project along some 8,900 ft of South Beach shoreline located eastward of the 2015 terminal groin. The project borrow area was Jay Bird Shoals. The firm contracted to perform the work was S.J. Hamill Construction Co., LLC. The actual dredge and fill operations were performed by Marinex Construction, Inc. (their Sister Firm) at a cost of approximately $11.8 million. As an adjunct to the renourishment project, the Village likewise contracted for the replacement of the 13-structure sand-tube groin field. A Post-Construction Report detailed the project elements (Olsen 2019).

In early 2021, the Wilmington District, USACE performed routine navigation channel maintenance for the Smith Island Channel Range and Bald Head Reaches 1 & 2. All excavated beach compatible material was placed on South Beach, Bald Head Island. The measured placed volume was about 1.61 Mcy. At the time of disposal, the sand-tube groin field was buried in its entirety below the beach disposal project berm.

Between December 2022 and March 2023, USACE performed the most recent Wilming Harbor Inner Ocean Bar maintenance dredging of the Smith Island Channel Range and Bald Head Reaches 1 & 2. The measured placed volume was about 1.3 Mcy with all sand placement along South Beach, pursuant to the WHSMP.

Between December 2024 and March 2025, the Village completed construction of a 1.0 Mcy beach renourishment project along roughly 13,700 ft of South Beach shoreline located eastward of the 2015 terminal groin (see **Section 1.6**). The project borrow area was expansion area of Jay Bird Shoals. The firm contracted to perform the work was Marinex Construction, Inc. at a cost of approximately $16.1 million. In addition to the renourishment project, the Village likewise contracted with McPherson Marine Services, LLC to concurrently replace the 13-structure sand-tube groin field. A Post-Construction Report detailed the project elements (Foth 2025).

1.5.2 Erosion Control Structures (Pre-2024/25 Project)

Erosion control structures constructed at Bald Head Island since 1996 are summarized in **Table 1.3**.

A temporary sand-filled tube groin field was installed by the Village along western South Beach in March 1996, immediately following completion of a small-scale sand placement project. Sixteen (16) soft groins (geotube-type structures) were constructed of geotextile material and sand fill (i.e. LONGARD tubes).

In 2003/2004 a pre-existing sandbag revetment located in the back beach berm and dune was greatly expanded by the Village along western South Beach as an emergency erosion control "back-up" measure to protect residences as well as a road and adjacent sub-grade public utilities. The original revetment was constructed in 1994 along 645 ft. of shoreline. The 2003/2004 improvements included the lengthening of the structure by approximately 200 ft. Additionally, the structure width was increased to 40 ft. and the crest elevation to +12 ft.-NGVD – in order to better address wave overtopping.

A sand-filled tube groin field (sixteen tubes) *replacement* project was constructed between January and March 2005, immediately following a 1.217 Mcy federal disposal project. Minor changes in groin location were made to improve performance. Similarly, experimental "tapered" spiral seam (coated) tubes were deployed to better address tube longevity.

The westernmost sand-tube groins had historically been subject to quickened destabilization due to accentuated navigation project related downdrift sand losses at "the Point", as well as sand starvation when the updrift portion of the groin field became "activated" to the point that net alongshore transport (toward the west) was diminished. The Village obtained a renewal of the groinfield permit(s) so as to be able to reconstruct all *or* portions of the structures after the locally funded and constructed winter 2009/10 beach renourishment project. Some adjustment of groin lengths, and the western relocation of groin no. 16 to a location at the Point were made to continue to refine the project performance.

In the spring of 2013, the westernmost five (5) sand-tube groins were replaced in their entirety. This work was co-funded by FEMA as part of a post-Irene damage mitigation effort. The project P.W. was BHGJS04 in accordance with FEMA declaration 4019 DR NC. The work was initiated during the federal beach disposal event.

Table 1.3: History of erosion control structures at Bald Head Island since 1994.

Year	Location	Description
1994	Western South Beach	Sand bag revetment located along 645 feet of the back-beach berm
1996 (March)	Western South Beach	Sixteen (16) soft groins (geotube-type structures) were constructed of geotextile material and sand fill
2003/2004	Western South Beach	Rehabilitation of 1994 constructed sand bag revetment. Revetment lengthened by approximately 200 feet and base width increased to 40 ft and crest elevation raised to +12 ft-NGVD).
2005 (January to March)	Western South Beach	Replacement of 1996 constructed sand-tube groin field. Minor changes in groin location were made in an effort to improve performance. Similarly, experimental "tapered" tubes were deployed in an attempt to better accommodate beach profile recession over time.
2009	Western South Beach	Complete rehabilitation of the sand-tube groin field. Some adjustment of groin lengths, and the westward relocation of groin no. 16 were made in an attempt to refine the project design.
2011	Western South Beach	300 ft sand bag revetment was constructed on the downdrift (western side) of the last sand-tube groin in order to protect several endangered residential structures.
2013	Western South Beach	In the spring of 2013, the westernmost five (5) sand-tube groins were replaced in their entirety. This work was co-funded by FEMA as part of a post-Irene damage mitigation effort. The project P.W. was BHGJS04 in accordance with FEMA declaration 4019 DR NC.
2015	Western South Beach	In the spring of 2015, construction was initiated on a single 1,300 ft. long rock terminal groin designed to complement future placement of beach fill at South Beach. At that time, the westernmost three (3) geotube groins were removed in their entirety. A detailed description of the project is provided in Monitoring Report No. 15 (Olsen 2017).
2015	Bald Head Marina	The two marina entrance channel structures seaward of Row-Boat-Row originally constructed by Bald Head Island, Ltd., were modified through the addition of rock extensions.
2017	Row Boat Row	Two (2) detached breakwaters were constructed just north of the Marina Entrance. Construction details are provided in Monitoring Report No. 16 (Olsen, 2018).
2019	Western South Beach	All remaining 13 sand-tube groins were removed and replaced coincident with the 2019 beach fill.
2022	Eastern South Beach	A major sand-tube revetment was constructed seaward of the Shoals Club property.
2024/25	Western South Beach	All remaining 13 sand-tube groins were removed and replaced coincident with the 2024/25 beach fill.

Comprehensive beach monitoring since 2000 by the Village of Bald Head Island had resulted in the conclusion that sand placement alone would *not* offset the net negative impacts to the west end of South Beach and the resulting chronic rates of sediment loss and concurrent northerly recession of the Point. The net result of these phenomena had been shoreline realignment and associated threat to public infrastructure, homes, roads, beaches, protective dunes and wildlife habitat, as well as the requirement for supplementary sand placement by the Village. As a result, the Village permitted a unique 1,900 ft. long terminal groin designed to complement future placement of beach fill at South Beach. The rock structure is intended to serve as a "template" for fill material placed eastward thereof on South Beach. The terminal groin was designed as a "leaky" structure (i.e. semi-permeable) so as to provide for some level of sand transport to West Beach and portions of the Point (located northward of the structure). It was the Village's position that the construction of the groin stem should be constructed in 2 phases. Phase I, constructed in 2015 was approximately 1,300 ft. in length. Phase II will only be initiated after some period of monitoring of the groin's post-construction performance and the determination that some level of additive structure is warranted. The Phase I project cost was approximately $6.8 M (construction, design, permitting, EIS, etc.).

In 2015, the Village likewise funded the redesign and construction of two (2) small rock jetties located at the entrance to BHI marina. The express purpose of that project was to reduce maintenance dredging of the channel so as to provide reliable and safe pedestrian ferry and barge access between the island and the mainland. The structures were designed so as to beneficially affect sand bypass activities from West Beach to Row Boat Row.

In early July 2017, two small detached breakwaters were constructed northward of the marina channel – seaward of Row Boat Row. The express purpose of the structures was to reduce high frequency barge and ferry wake impacts responsible for accentuated sand losses at that location. Both the marina channel structures and the detached breakwaters are components of the Village's comprehensive Beach Management Plan for both South and West Beach.

As part of the assessment for the 2019 beach renourishment project to be constructed at South Beach by the Village, it was determined that numerous sand tube groins were approaching the end of their effective life and that replacement was warranted. In the spring of 2019, the remaining thirteen (13) sand tube groins were removed and replaced.

In spring 2022, the Shoals Club constructed a sandbag revetment along the existing scarp line seaward of the club facility to preclude future losses of land and infrastructure. In 2025 modifications were made to the revetment configuration.

In the winter of 2024/25, the Village contracted with McPherson Marine Services, LLC to concurrently replace the 13-structure sand-tube groin field (see **Section 1.6**). A Post-Construction Report detailed the project elements (Foth 2025).

1.6 2024/25 Beach Fill & Sand-Tube Groin Field Projects

A comprehensive summary of the construction of both the 2024/25 Beach Fill and Sand-Tube Groin Field projects is available in both project's post-construction report (Foth 2025).

The 2024/25 Village of Bald Head Island Beach Renourishment Project was constructed between December 12, 2024 and March 4, 2025. The project components, including the fill limits and the Jay Bird Shoals borrow area are depicted in **Figure 1.4**. **Photograph 1.1** presents pre- (August 2024) and post-beach fill placement (January 2025) photography at the western limit of the project, just east of the terminal groin. Additional pre- and post-construction drone imagery is available in **Appendix F** as well as the post-construction report.

The fill limits of the project spanned roughly 2.6 miles (13,700 ft) of the Atlantic Ocean shoreline of Bald Head Island. The project resulted in the placement of a pay volume of 1,000,000 cubic yards (cy) of sand at a total cost of $16,125,000.00. The project was financed and managed by the Village of Bald Head Island. The engineer and permit agent for the project was Foth | Olsen of Jacksonville, FL.

The project was constructed by Marinex Construction, Inc. of Charleston, SC. Marinex supplied all personnel and equipment necessary to construct the project, including the dredge, pipeline, and earth moving equipment. The cutterhead/pipeline dredge *Savannah* was used for all dredging operations. Gahagan & Bryant Associates, Inc. (GBA), of Wilmington, NC, provided topographic and hydrographic surveys before, during, and after construction. Foth | Olsen designed and permitted the project and provided bidding and construction contract management assistance for the Village.

In addition to the renourishment project, the Village contracted with McPherson Marine Services, LLC. to concurrently replace the 13-structure sand-tube groin field. The sand-tube construction began on January 5, 2025 and was completed on February 17, 2025.

For the renourishment project, the contractor "before dredge" and "after dredge" surveys (BD/AD) of the placement area indicated a total placement sand volume of 1,052,400 cy. The small additional volume of sand placed in addition to the pay volume, (52,400 cy, 5.2% of the pay volume), occurred at no additional cost to the Village.

The estimated average daily production volume for the 82 days of beach fill placement was 12,600 cy/day, including 23 full "down days" for weather, holidays, and mechanical delays. Excluding those down days, the average daily dredge volume was approximately 17,800 cy/day. The peak daily dredge production was 40,333 cy on February 23, 2025.

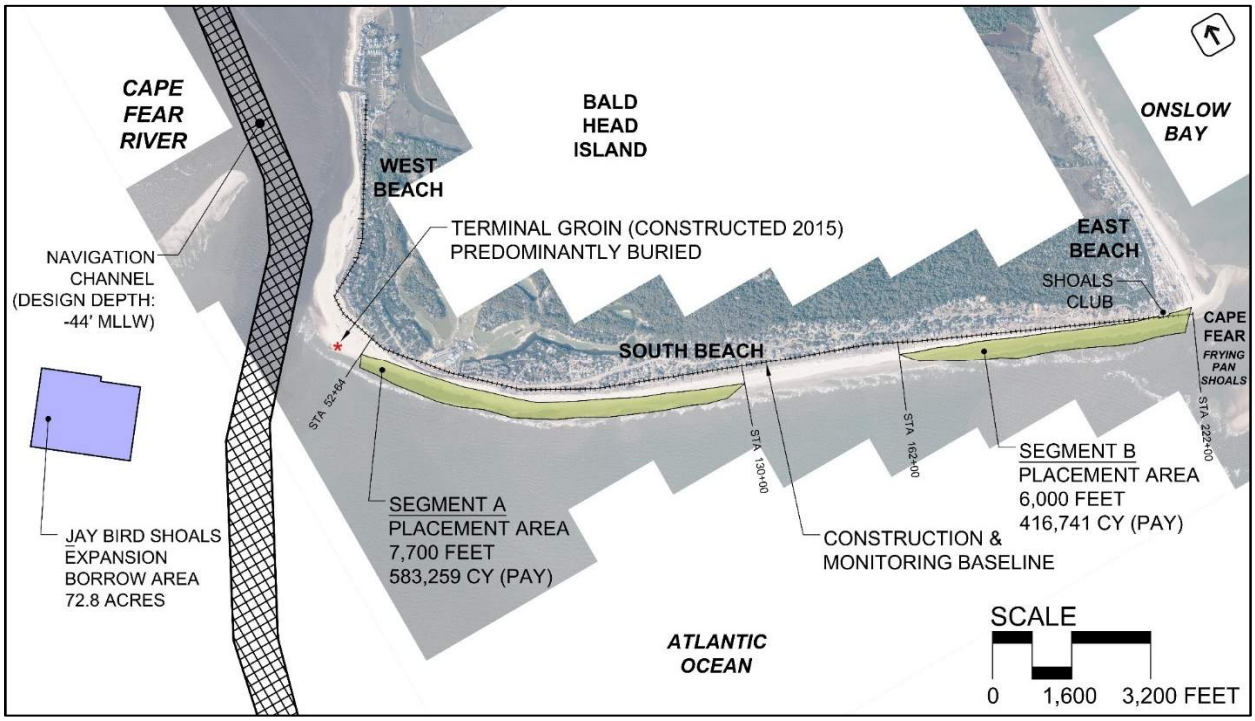

Figure 1.4: Project components for 2024/25 Village of Bald Head Island Beach Renourishment Project.

Photograph 1.1: Pre-(August 2024) and post-beach fill placement (January 2025) at the western limit of the project, just east of the terminal groin. Note that the sand-tube groins are buried in the post placement photograph.

2. Physical Monitoring Program

2.1 Monitoring Baseline & Beach Profiles

Monitoring Baseline. The present-day Bald Head Island monitoring baseline extends roughly 31,400 ft from the northern end of Row Boat Row (Sta. -014+72) southward along West Beach, around "the Point", then eastward along South Beach to Cape Fear and finally northward along East Beach (Sta. 284+00). The individual profile station and coordinates are listed in **Table 2.1** and graphically depicted in **Figure 2.1**.

Beach Profiles. To document and assess any potential adverse effects of the Wilmington Harbor Navigation Channel Navigation project to Bald Head Island, the Village Council initiated a comprehensive beach monitoring program which commenced in 1999. As part of the present-day program, onshore and offshore profiles are measured annually at seventy-nine (79) stations spaced approximately 400 ft apart along the roughly 31,400 ft of Bald Head Island's shorefront. Since October 2003 profiles have been surveyed at 6-month intervals (i.e. fall and spring). The primary focus of this monitoring report (No. 23) is beach profile and shoreline changes occurring over the latest set of monitoring surveys (April 2024 to October 2024 to May 2025). In addition to the bi-annual monitoring surveys, pre- and post-construction surveys (November 2024 & March 2025, respectively) were conducted as part of the 2024/25 Beach Fill project. These construction period surveys did not include the Row Boat Row and East Beach shorelines. The five (5) surveys examined in this report are summarized in **Table 2.2**.

Typically, survey transects extend across the upland berm or from the dune line seaward a distance of up to 3,000 ft. Depending upon the location of the survey profile, this distance corresponds to offshore water depths of at least -40 ft relative to NGVD within the Cape Fear River Channel and -16 ft-NGVD along the Atlantic Ocean shorefront. In **Chapter 3.0**, these surveys are intra-compared in order to determine trends in the condition of the beaches of Bald Head Island. Plots of the beach profile data (since April 2024) are provided in **Appendix G**.

Prior to October 2003, fifty-five (55) stations were surveyed as part of the monitoring program. Five (5) additional intermediate stations were added at the Point, commencing with the October 2003 survey. These profile stations were added to more accurately capture the extreme changes that occur at the Point. Seven (7) profiles were added along East Beach (EB-01 to EB-07) beginning with the November 2008 survey. Beginning with the November 2015 survey five (5) profiles were added along Row Boat Row and four (4) were added at the Point, as part of the terminal groin monitoring requirement. Finally, in November 2016, three (3) additional profiles were added along West Beach.

Table 2.1: Bald Head Island baseline stationing and beach monitoring profile locations.

Station (Monument)	Station Location Easting (FT-NAD83)	Station Location Northing (FT-NAD83)	Grid Azi. (Deg.)
Row Boat Row			
-018+72 (RB-01)	2,304,277.9	49,117.4	302
-014+72 (RB-02)	2,304,068.6	48,776.5	302
-012+00 (RB-03)	2,303,937.2	48,538.1	302
-008+00 (RB-04)	2,303,728.0	48,197.2	302
-004+00 (RB-05)	2,303,518.7	47,856.3	302
West Beach			
000+00 (B-01)	2,303,309.3	47,515.5	302
004+00 (B-02)	2,303,100.4	47,174.4	301
008+00 (B-03)	2,302,891.5	46,833.3	301
010+00 (I-03)	2,302,788.1	46,662.0	301
012+00 (B-04)	2,302,682.5	46,492.2	301
014+00 (I-04)	2,302,578.8	46,321.1	301
016+00 (B-05)	2,302,473.6	46,151.1	301
018+00 (I-05)	2,302,369.5	45,980.3	301
020+00 (B-06)	2,302,264.7	45,810.0	301
024+00 (B-07)	2,302,055.2	45,468.8	302
"the Point"			
028+00 (B-08)	2,301,845.1	45,126.6	303
032+00 (B-09)	2,301,566.1	44,843.7	301
034+00 (I-09)	2,301,394.4	44,742.0	301
036+00 (B-10)	2,301,220.2	44,647.1	299
038+00 (I-10)	2,301,043.1	44,550.6	296
039+60 (B-11)	2,300,902.6	44,473.9	291
041+50 (I-11)	2,300,765.0	44,365.0	287
043+47 (B-12)	2,300,757.5	44,167.6	284
044+25 (I-12)	2,300,754.6	44,090.2	276
045+07 (B-13)	2,300,751.4	44,007.0	268
046+00 (I-13)	2,300,784.9	43,920.7	260
046+89 (B-14)	2,300,813.7	43,836.0	251
049+00 (H-14)	2,300,881.5	43,636.5	247
050+50 (I-14)	2,300,913.5	43,541.9	247
051+00 (J-14)	2,300,945.8	43,447.1	247
052+64 (B-15)	2,300,998.3	43,292.1	243
054+00 (I-15)	2,301,042.2	43,163.0	243
South Beach			
056+56 (B-16)	2,301,148.7	42,933.8	233
060+51 (B-17)	2,301,399.6	42,628.3	230
065+50 (B-18)	2,301,716.0	42,243.2	229
069+46 (B-19)	2,301,967.6	41,937.0	227
073+39 (B-20)	2,302,246.1	41,660.5	223
076+37 (B-21)	2,302,609.2	41,320.5	222
084+16 (B-22)	2,303,032.1	40,924.5	219
088+23 (B-23)	2,303,372.1	40,705.0	214
092+15 (B-24)	2,303,714.1	40,513.9	209
097+10 (B-25)	2,304,146.1	40,272.5	206
102+08 (B-26)	2,304,592.1	40,057.6	204
106+00 (B-27)	2,304,960.4	39,915.3	201
110+00 (B-28)	2,305,333.5	39,771.1	201
114+00 (B-29)	2,305,708.5	39,626.3	202
118+00 (B-30)	2,306,080.6	39,482.5	202
122+00 (B-31)	2,306,451.7	39,339.2	201
126+00 (B-32)	2,306,824.0	39,195.3	200
130+00 (B-33)	2,307,196.5	39,051.4	200
134+00 (B-34)	2,307,569.6	38,907.3	200
138+00 (B-35)	2,307,943.9	38,767.8	200
142+00 (B-36)	2,308,320.5	38,633.0	200
146+00 (B-37)	2,308,697.1	38,498.2	200
150+00 (B-38)	2,309,073.8	38,363.4	200
154+00 (B-39)	2,309,452.4	38,228.0	201
158+00 (B-40)	2,309,818.8	38,074.6	202
162+00 (B-41)	2,310,179.1	37,895.6	203
166+00 (B-42)	2,310,539.0	37,716.9	204
170+00 (B-43)	2,310,903.5	37,552.0	204
174+00 (B-44)	2,311,267.9	37,387.2	204
178+00 (B-45)	2,311,632.4	37,222.3	204
182+00 (B-46)	2,311,996.9	37,057.4	204
186+00 (B-47)	2,312,361.3	36,892.6	204
190+00 (B-48)	2,312,725.8	36,727.8	204
194+00 (B-49)	2,313,090.2	36,562.9	204
198+00 (B-50)	2,313,454.7	36,398.1	204
202+00 (B-51)	2,313,819.2	36,233.2	204
206+00 (B-52)	2,314,183.6	36,068.4	204
210+00 (B-53)	2,314,548.1	35,903.5	204
214+00 (B-54)	2,314,912.5	35,738.7	204
218+00 (B-55)	2,315,277.0	35,573.8	204
220+00 (B-56)*	2,315,459.7	35,492.5	204
222+00 (B-57)*	2,315,642.4	35,411.1	204
East Beach			
224+80 (EB-01)	2,315,748.8	36,063.3	90
234+80 (EB-02)	2,315,748.8	37,063.3	90
244+80 (EB-03)	2,315,748.8	38,063.3	90
254+80 (EB-04)	2,315,748.8	39,063.3	90
264+80 (EB-05)	2,315,748.8	40,063.3	90
274+80 (EB-06)	2,315,748.8	41,063.3	90
284+80 (EB-07)	2,315,748.8	42,063.3	90

* Stations 220+00 and 222+00 were added just for the 2024/25 project construction and are not surveyed as part of the monitoring program.

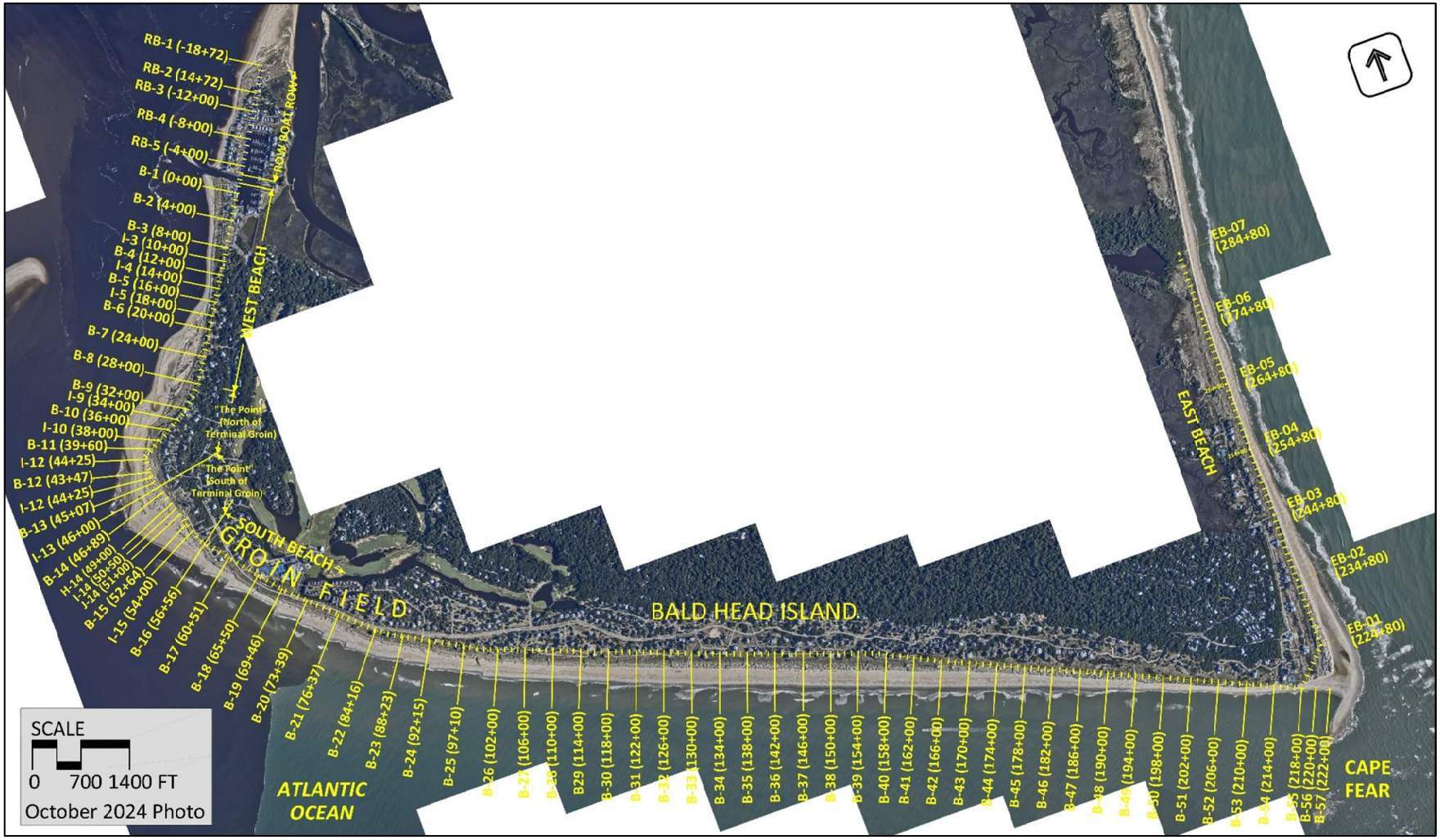

Figure 2.1: Island-wide beach monitoring baseline, Bald Head Island, NC.

Table 2.2: Bald Head Island recent beach profile surveys.

Survey	Surveyor	Notes
April 2024 (Monitoring)	M&C	Conducted between April 1 & 10, 2024, approximately 8 months before construction began for the 2024/25 Beach Fill Project.
October 2024 (Monitoring)	M&C	Conducted between October 7 to 28, 2024, approximately 2 months before construction began for the 2024/25 Beach Fill Project.
November 2024 (Pre-Construction)	GBA	Conducted between November 4 & 8, 2024, approximately 1 month before construction began on the 2024/25 Beach Fill Project. Does not include Row-Boat-Row or East Beach and limited profiles along West Beach, "the Point" and areas of South Beach not receiving fill.
March 2024 (Post-Construction)	GBA	Conducted between March 8 & 14, 2025, immediately after completion of the 2024/25 Beach Fill Project. Does not include Row-Boat-Row or East Beach and limited profiles along West Beach, "the Point" and areas of South Beach not receiving fill.
May 2025 (Monitoring)	M&C	Conducted between April 24 & May 28, 2025, approximately 3 months after completion of the 2024/25 Beach Fill Project.

2.2 Mean High Water Line (MHWL) Surveys

As part of the permit required monitoring for the terminal groin project completed in late 2015, post-construction MHWL surveys were initiated in November 2015. Each survey was specified to begin at the Marina entrance (Sta. 0+00) and extend to St. 75+00, about 3,000 ft eastward of the terminal groin head. On an annual basis, surveys are to be intercompared to assess both updrift fillet conditions and the location of the downdrift shoreline fronting the Cape Fear River. The most recent survey was performed in May 2025 and is discussed in **Section 3.3.5**.

2.3 Jay Bird Shoals Borrow Area Surveys

As part of the annual island-wide monitoring program, the Jay Bird Shoals expansion borrow area is regularly surveyed. Specifically, borrow area surveys are required both pre- and post-excavation, as well as at 12-, 24, -36-months and biennially thereafter. Since the post-construction survey (March 2025), was performed only 2 months prior to the present annual monitoring effort, no additional survey of the borrow area was conducted during the Spring 2025 monitoring effort. The next scheduled borrow area survey will be conducted with the Fall 2025 monitoring effort (i.e. a "6-month" survey).

For the present report, the pre-and post-construction borrow area surveys were analyzed. Both the pre- and post-construction bathymetric surveys were performed by the contractor's surveyor, Gahagan & Bryant Associates, Inc (GBA):

- The pre-construction 2024/25 project borrow area bathymetric survey was conducted on November 7, 2024. The survey was completed approximately 35 days before the start of construction and 118 days before the end of construction. The survey drawings are available in the Post-Construction Report (Foth 2025).
- The post-construction 2024/25 project borrow area bathymetric survey was completed on March 7, 2025. The survey was completed approximately 3 days after the end of construction and 86 days after the start of construction. The survey drawings are available in the Post-Construction Report (Foth 2025).

The pre- and post-construction surveys listed above only included the expansion area utilized in the 2024/25 project. On October 15, 2024, the previously utilized borrow area (2009/10 & 2019 projects) in addition to the expansion area was surveyed by McKim & Creed. This is the most recent survey of the previously utilized area and is discussed in **Section 4.2** of this report. Both areas with be surveyed with the fall 2025 monitoring effort.

2.4 Orthorectified Aerial Photography

As part of the annual monitoring program, digital color orthorectified aerial photography is by Green -Pederson, Inc. (GPI) [4.] A complete listing of the flights is provided as **Table 2.3**. Reproductions of the three most recent aerial photograph sets (April 2024, October 2024, & May 2025) are presented in **Appendices B**, **C**, and **D**.

2.5 Oblique Aerial Drone Photograpy

To document project performance, low-altitude aerial drone photography was acquired during the monitoring year by the Village, the sand-tube groin contractor (Fish-Tec), and Davey Resource Group, Inc. (Davey)[5]. Selected examples of this photography are provided throughout this report and in **Appendix F.**

[4] GPI Geopatial Inc., 3909 Wrightsville Ave STE 100, Wilmington, NC 28403

[5] 3805 Wrightsville Avenue, Suite 15, Wilmington, NC 28403

Table 2.3: Bald Head Island monitoring aerial photography collected as of May 2025.

Photo Date	Comment	Photo Date	Comment
2001 (September)	2-months post-construction (2001 disposal)	2015 (March)	Post-construction (2015 Disposal)
2002 (November)	16-months post-construction (2001 disposal)	2015 (August)	5 months post-construction (2015 Disposal)
2003 (April)	21-months post-construction (2001 disposal)	2015 (November)	Post-terminal groin construction
2004 (January)	30-months post-construction (2001 disposal)	2016 (April)	4-months post-construction (Terminal Groin)
2004 (May)	34-months post-construction (2001 disposal)	2016 (October)	Post-Hurricane Matthew
2004 (October)	39-months post-construction (2001 disposal)	2017 (April)	5-months Post-Hurricane Matthew
2005 (May)	4-months post-construction (2004/05 disposal)	2017 (November)	24-months post-construction (Terminal Groin.)
2005 (November)	10-months post-construction (2004/05 disposal)	2018 (April)	29-months post-construction (Terminal Groin.)
2006 (April)	15-months post-construction (2004/05 disposal)	2018 (October)	Post-Hurricane Florence
2006 (October)	21-months post-construction (2004/05 disposal)	2019 (April)	1-month post-construction (2018/19 renourishment)
2007 (May)	1-month post-construction (2007 disposal)	2019 (November)	8-months post-construction (2018/19 renourishment)
2008 (May)	13-months post-construction (2007 disposal)	2020 (May)	13-months post-construction (2018/19 renourishment)
2009 (January)	21-months post-construction (2007 disposal)	2020 (November)	20-month post-construction (2018/19 renourishment)
2009 (May)	25-months post-construction (2007 disposal)	2021 (May)	25-months post-construction (2018/19 renourishment)
2009 (August)	3-months pre-construction (2009/10 nourishment)	2021 (November)	31-months post-construction (2018/19 renourishment)
2010 (April)	1-month post-construction (2009/10 nourishment)	2022 (May)	37-months post-construction (2018/19 renourishment)
2011 (April)	13-months post-construction (2009/10 nourishment)	2022 (October)	43-months post-construction (2018/19 renourishment)
2012 (May)	26-months post-construction (2009/10 nourishment)	2023 (May)	49-months post-construction (2018/19 renourishment)
2012 (December)	33-months post-construction (2009/10 nourishment)	2023 (November)	55-months post-construction (2018/19 renourishment)
2013 (May)	38-months post-construction (2009/10 nourishment)	2024 (April)	60-months post-construction (2018/19 renourishment)
2013 (November)	44-months post-construction (2009/10 nourishment)	2024 (October)	2-months pre-construction (2024/25 renourishment)
2014 (May)	50-months post-construction (2009/10 nourishment)	2025 (May)	2-months post-construction (2024/25 renourishment)

3. Monitoring (Survey Results)

3.1 Methodology

For purposes of analysis and discussion, the Bald Head Island monitoring baseline is qualitatively broken into seven (7) shoreline segments, or zones of interest, with significantly varying physiographic characteristics as follows:

- Row Boat Row: Marina RB-1 to Marina Jetty (Sta. -018+72 to -003+00)
- West Beach: Jetty to B-8 (Sta. -001+60 to 028+00)
- The Point - North of Terminal Groin: B-8 to I-13 (Sta. 028+00 to 046+00)
- The Point - South of Terminal Groin: I-13 to B-16 (Sta. 046+00 to 056+56)
- South Beach[6]: B-16 to B-54 (Sta. 056+56 to 214+00)
- Cape Fear Point[7]: B-54 to EB-1 (Sta.214+00 to 224+80)
- East Beach: EB-1 to EB-7 (Sta. 224+80 to 284+80)

Additionally, the limits of the 2024/25 beach fill were also examined separately. The fill was constructed in two segments. Segment A spanned approximately 7,736 feet from monument B-15 to B-33 (Sta. 52+64 to 130+00). Segment B spanned approximately 6,000 feet from B-41 to B-57 (Sta. 162+00 to 222+00).

Alongshore **volume changes** were calculated using an average end-area method, where the cross-sectional areas are determined by comparing beach profiles at each beach monitoring station above several different vertical datums. This approach allows evaluation of beach changes at different elevations along the project in addition to the total profile. For this analysis, volume changes were calculated in 0.5 ft vertical increments from +20.0 to -30 ft-NGVD. Volume changes above the MHWL (+2.51 ft-NGVD) and the presumed depth of survey closure (-16.0 ft-NGVD) are principally discussed in this report. **Tables 3.1** through **3.3** list the computed changes along the West Beach, "the Point", and South Beach shorelines for the April 2024 – October 2024 – May 2025 survey intervals. **Figures 3.1, 3.2** and **3.3** depict the cumulative and local volume changes for the same intervals and shorelines. Row Boat Row, Cape Fear Point, and East Beach changes are discussed separately in this report.

[6] In this monitoring report, as in previous monitoring reports, the eastern limit of South Beach nominally extends to B-54 (STA 214+00). The changes at the easternmost monument on the Atlantic Ocean facing shoreline (B-55, STA 218+00) are typically included in discussions of Cape Fear Point due to the monument's proximity to the cape (see **Section 3.4**). However, during the 2024/25 beach fill project, sand was placed to approximately STA 222+00, roughly 800 feet east of B-54 and 400 feet east of B-55. For the volume totals listed for the beach fill placement areas (only) in **Sections 3.3.1, 3.3.2,** & **3.3.3**, the volume changes between B-54 and B-55 were included.

[7] The general condition of the Cape Fear spit is qualitatively monitored primarily through controlled aerial photography as well as quarterly drone flights. This depositional feature is routinely subject to episodic periods of accretion and erosion resulting from eventual detachment via tidal channel breakthrough during storms. It is likewise influenced by beach fill activities and sediment added to the littoral system of South Beach as well as storm waves originating from the east or southeast.

Shoreline position changes were computed at the nominal berm (+6.0 ft-NGVD) and MHWL (+2.51 ft-NGVD). The nominal berm elevation is approximately 2.5 feet below the seaward edge of the 2024/25 constructed berm template elevation (+8.5 ft-NGVD). Average shoreline position changes were spatially weighted based upon the distance between stations due to the non-uniform alongshore spacing of survey monuments. The results are summarized in **Tables 3.4** and **3.5** and graphically depicted in **Figure 3.4** (relative to the *November 2000* pre-disposal locations). Row Boat Row, Cape Fear Point, and East Beach changes are discussed separately in this report.

Table 3.1: Bald Head Island shoreline volume change (April 2024 to October 2024).
(2024/25 fill placement areas are shaded orange)

	Start Profile	End Profile	Reach (FT)	Volume Change Above +2.51 (FT)	Volume Change Above -16 (FT)
West Beach	Jetty	B-1	160	-100	-100
	B-1	B-2	400	+100	0
	B-2	B-3	400	+400	+100
	B-3	I-3	200	+100	-200
	I-3	B-4	200	-100	-500
	B-4	I-4	200	-100	-700
	I-4	B-5	200	0	-400
	B-5	I-5	200	-300	-700
	I-5	B-6	200	-500	-1,600
	B-6	B-7	400	+1000	+6,100
	B-7	B-8	400	+400	+2,600
		Subtotal	**2,960**	**+900**	**+4,600**
Point (North of Groin)	B-8	B-9	395	-3,100	-8,700
	B-9	I-9	200	-400	+2,000
	I-9	B-10	210	+1,500	+7,800
	B-10	I-10	230	+700	+3,700
	I-10	B-11	230	-1,400	-4,100
	B-11	I-11	220	-2,900	-10,400
	I-11	B-12	220	-3,100	-15,400
	B-12	I-12	190	-2,000	-16,500
	I-12	B-13	190	-1,400	-15,300
	B-13	I-13	200	-900	+800
		Subtotal	**2,285**	**-13,000**	**-56,100**
Point (South of Groin)	I-13	B-14	200	-800	+4,500
	B-14	H-14	250	+100	-4,300
	H-14	I-14	100	-100	-1,000
	I-14	J-14	100	-300	-700
	J-14	B-15	240	-900	-5,300
	B-15	I-15	135	-1,200	-5,100
	I-15	B-16	380	-3,300	-16,900
		Subtotal	**1,405**	**-6,500**	**-28,800**
South Beach	B-16	B-17	423	-3,100	-16,100
	B-17	B-18	510	-3,500	-12,300
	B-18	B-19	423	-3,600	-12,600
	B-19	B-20	442	-4,000	-10,900
	B-20	B-21	516	-2,700	-3,300
	B-21	B-22	611	-200	-3,700
	B-22	B-23	471	-1,800	-5,900
	B-23	B-24	455	-2,900	-6,800
	B-24	B-25	536	-1,500	-12,700
	B-25	B-26	525	+100	-10,700
	B-26	B-27	436	+500	-6,300
	B-27	B-28	400	0	-6,900
	B-28	B-29	388	-600	-5,600
	B-29	B-30	407	-900	-7,200
	B-30	B-31	413	-700	-9,600
	B-31	B-32	405	-1,000	-8,400
	B-32	B-33	405	+100	-5,700
	B-33	B-34	398	+500	-3,100
	B-34	B-35	401	-1,200	-6,100
	B-35	B-36	400	-1,900	-8,500
	B-36	B-37	400	-500	-4,000
	B-37	B-38	399	+100	-900
	B-38	B-39	385	-500	-2,500
	B-39	B-40	383	+400	-900
	B-40	B-41	386	+700	-1,100
	B-41	B-42	393	+300	-2,500
	B-42	B-43	394	+1,500	+200
	B-43	B-44	400	+1,700	-4,300
	B-44	B-45	400	+1,400	-5,600
	B-45	B-46	400	+1,300	+4,100
	B-46	B-47	400	900	+3,600
	B-47	B-48	400	+2,200	+2,800
	B-48	B-49	400	+3,100	+7,500
	B-49	B-50	400	+1,900	+2,900
	B-50	B-51	400	+1,000	+2,500
	B-51	B-52	400	+400	+2,100
	B-52	B-53	400	+300	-3,400
	B-53	B-54	400	+1,100	-4,200
		Subtotal	**16,105**	**-11,100**	**-166,100**
		Bald Head Total	**22,755**	**-29,700**	**-246,400**

Note: Elevations are referenced to NGVD 1929.

Table 3.2: Bald Head Island shoreline volume change (October 2024 to May 2025).
(2024/25 fill placement areas are shaded orange)

	Start Profile	End Profile	Reach (FT)	Volume Change Above +2.51 (FT)	Volume Change Above -16 (FT)
West Beach	Jetty	B-1	160	-100	-100
	B-1	B-2	400	-200	-500
	B-2	B-3	400	-200	-1,100
	B-3	I-3	200	-100	-600
	I-3	B-4	200	-100	-500
	B-4	I-4	200	-100	-500
	I-4	B-5	200	-100	-700
	B-5	I-5	200	100	-200
	I-5	B-6	200	500	+1,700
	B-6	B-7	400	600	+100
	B-7	B-8	400	-500	-5,700
		Subtotal	**2,960**	**-200**	**-8,100**
Point (North of Groin)	B-8	B-9	395	1,400	+4,400
	B-9	I-9	200	1,200	+3,900
	I-9	B-10	210	-600	-3,100
	B-10	I-10	230	-2,900	-9,500
	I-10	B-11	230	-3,600	-10,000
	B-11	I-11	220	-1,300	0
	I-11	B-12	220	1,300	+13,800
	B-12	I-12	190	1,200	+17,400
	I-12	B-13	190	700	+7,900
	B-13	I-13	200	600	-12,200
		Subtotal	**2,285**	**-2,000**	**+12,600**
Point (South of Groin)	I-13	B-14	200	+700	-11,600
	B-14	H-14	250	+600	-400
	H-14	I-14	100	+500	+400
	I-14	J-14	100	+600	+900
	J-14	B-15	240	+1,800	+7,200
	B-15	I-15	135	+2,100	+6,300
	I-15	B-16	380	+7,300	+17,500
		Subtotal	**1,405**	**+13,600**	**+20,300**
South Beach	B-16	B-17	423	+10,800	+23,400
	B-17	B-18	510	+14,700	+36,300
	B-18	B-19	423	+14,500	+38,700
	B-19	B-20	442	+16,000	+36,400
	B-20	B-21	516	+14,700	+28,200
	B-21	B-22	611	+11,900	+22,000
	B-22	B-23	471	+9,600	+20,400
	B-23	B-24	455	+14,400	+29,400
	B-24	B-25	536	+17,700	+38,100
	B-25	B-26	525	+14,000	+29,000
	B-26	B-27	436	+9,900	+17,000
	B-27	B-28	400	+9,200	+14,900
	B-28	B-29	388	+9,100	+14,400
	B-29	B-30	407	+8,900	+14,100
	B-30	B-31	413	+7,400	+11,900
	B-31	B-32	405	+6,600	+9,600
	B-32	B-33	405	+3,000	+3,200
	B-33	B-34	398	+200	-400
	B-34	B-35	401	+800	0
	B-35	B-36	400	+800	-1,900
	B-36	B-37	400	-100	-4,900
	B-37	B-38	399	-900	-7,300
	B-38	B-39	385	-1,100	-6,400
	B-39	B-40	383	-1,700	-8,000
	B-40	B-41	386	-1,600	-7,200
	B-41	B-42	393	+500	-3,800
	B-42	B-43	394	+2,500	-5,000
	B-43	B-44	400	+5,300	+2,000
	B-44	B-45	400	+8,000	+7,000
	B-45	B-46	400	+9,300	+7,000
	B-46	B-47	400	+10,900	+14,900
	B-47	B-48	400	+11,800	+24,300
	B-48	B-49	400	+12,700	+28,100
	B-49	B-50	400	+15,500	+35,900
	B-50	B-51	400	+18,500	+41,500
	B-51	B-52	400	+20,900	+43,800
	B-52	B-53	400	+22,500	+45,600
	B-53	B-54	400	+21,000	+41,600
		Subtotal	**16,105**	**+348,200**	**+633,800**
		Bald Head Total	**22,755**	**+359,600**	**+658,600**

Note: Elevations are referenced to NGVD 1929.

Table 3.3: Year 24 Bald Head Island shoreline volume change (April 2024 to May 2025).
(2024/25 fill placement areas are shaded orange)

	Start Profile	End Profile	Reach (FT)	Volume Change Above +2.51 (FT)	Volume Change Above -16 (FT)
West Beach	Jetty	B-1	160	-200	-200
	B-1	B-2	400	-100	-500
	B-2	B-3	400	+200	-1,000
	B-3	I-3	200	0	-800
	I-3	B-4	200	-200	-1,000
	B-4	I-4	200	-200	-1,200
	I-4	B-5	200	-100	-1,100
	B-5	I-5	200	-200	-900
	I-5	B-6	200	0	+100
	B-6	B-7	400	+1,600	+6,200
	B-7	B-8	400	-100	-3,100
		Subtotal	**2,960**	**+700**	**-3,500**
Point (North of Groin)	B-8	B-9	395	-1,700	-4,300
	B-9	I-9	200	+800	+5,900
	I-9	B-10	210	+900	+4,700
	B-10	I-10	230	-2,200	-5,800
	I-10	B-11	230	-5,000	-14,100
	B-11	I-11	220	-4,200	-10,400
	I-11	B-12	220	-1,800	-1,600
	B-12	I-12	190	-800	+900
	I-12	B-13	190	-700	-7,400
	B-13	I-13	200	-300	-11,400
		Subtotal	**2,285**	**-15,000**	**-43,500**
Point (South of Groin)	I-13	B-14	200	-100	-7,100
	B-14	H-14	250	+700	-4,700
	H-14	I-14	100	+400	-600
	I-14	J-14	100	+300	+200
	J-14	B-15	240	+900	+1,900
	B-15	I-15	135	+900	+1,200
	I-15	B-16	380	+4,000	+600
		Subtotal	**1,405**	**+7,100**	**-8,500**
South Beach	B-16	B-17	423	+7,700	+7,300
	B-17	B-18	510	+11,200	+24,000
	B-18	B-19	423	+10,900	+26,100
	B-19	B-20	442	+12,000	+25,500
	B-20	B-21	516	+12,000	+24,900
	B-21	B-22	611	+11,700	+18,300
	B-22	B-23	471	+7,800	+14,500
	B-23	B-24	455	+11,500	+22,600
	B-24	B-25	536	+16,200	+25,400
	B-25	B-26	525	+14,100	+18,300
	B-26	B-27	436	+10,400	+10,700
	B-27	B-28	400	+9,200	+8,000
	B-28	B-29	388	+8,500	+8,800
	B-29	B-30	407	+8,000	+6,900
	B-30	B-31	413	+6,700	+2,300
	B-31	B-32	405	+5,600	+1,200
	B-32	B-33	405	+3,100	-2,500
	B-33	B-34	398	+700	-3,500
	B-34	B-35	401	-400	-6,100
	B-35	B-36	400	-1,100	-10,400
	B-36	B-37	400	-600	-8,900
	B-37	B-38	399	-800	-8,200
	B-38	B-39	385	-1,600	-8,900
	B-39	B-40	383	-1,300	-8,900
	B-40	B-41	386	-900	-8,300
	B-41	B-42	393	+800	-6,300
	B-42	B-43	394	+4,000	-4,800
	B-43	B-44	400	+7,000	-2,300
	B-44	B-45	400	+9,400	+1,400
	B-45	B-46	400	+10,600	+11,100
	B-46	B-47	400	+11,800	+18,500
	B-47	B-48	400	+14,000	+27,100
	B-48	B-49	400	+15,800	+35,600
	B-49	B-50	400	+17,400	+38,800
	B-50	B-51	400	+19,500	+44,000
	B-51	B-52	400	+21,300	+45,900
	B-52	B-53	400	+22,800	+42,200
	B-53	B-54	400	+22,100	+37,400
		Subtotal	**16,105**	**+337,100**	**+467,700**
		Bald Head Total	**22,755**	**+329,900**	**+412,200**

Note: Elevations are referenced to NGVD 1929.

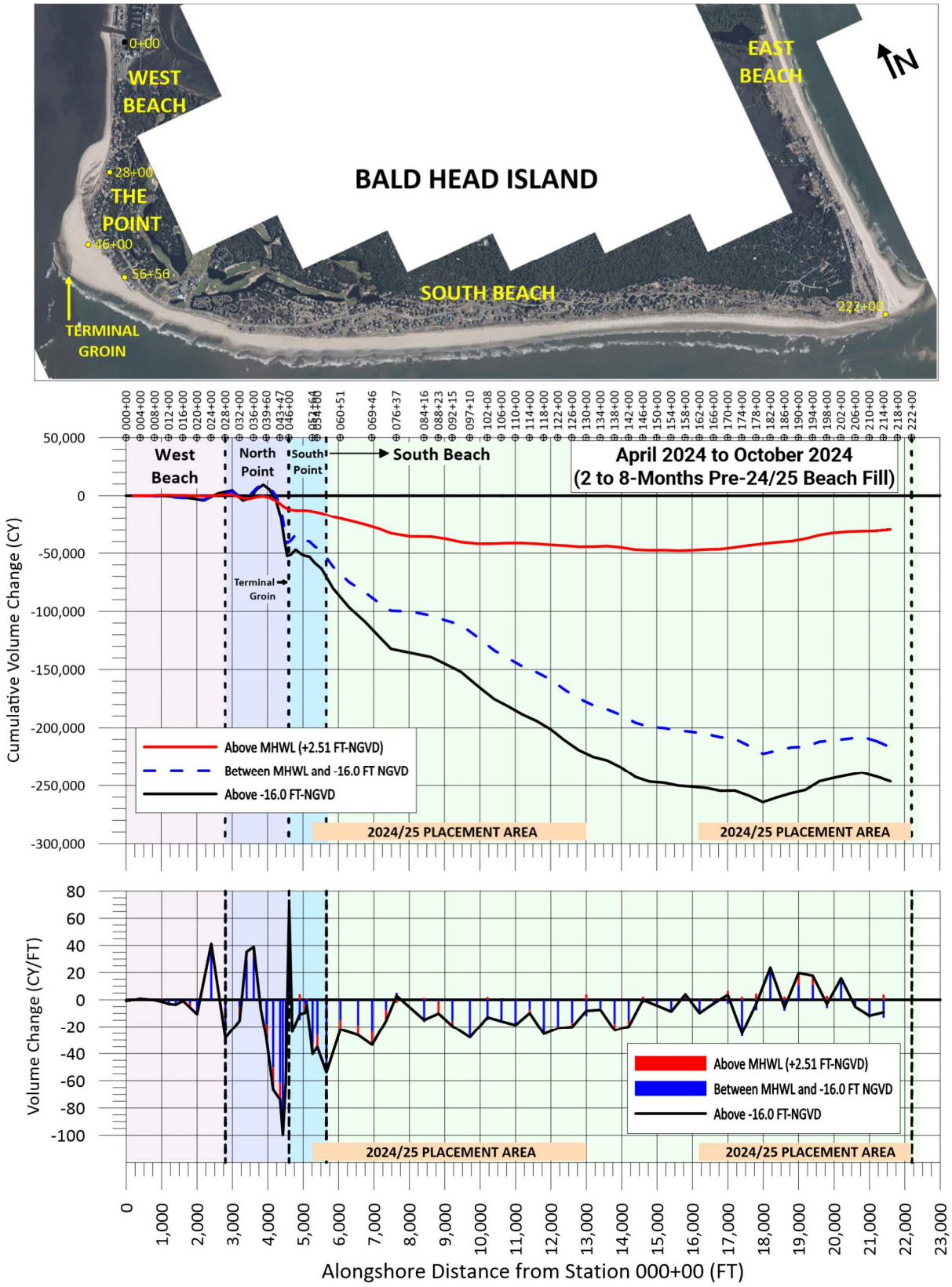

Figure 3.1: Volume change along the Bald Head Island shoreline between April 2024 & October 2024.

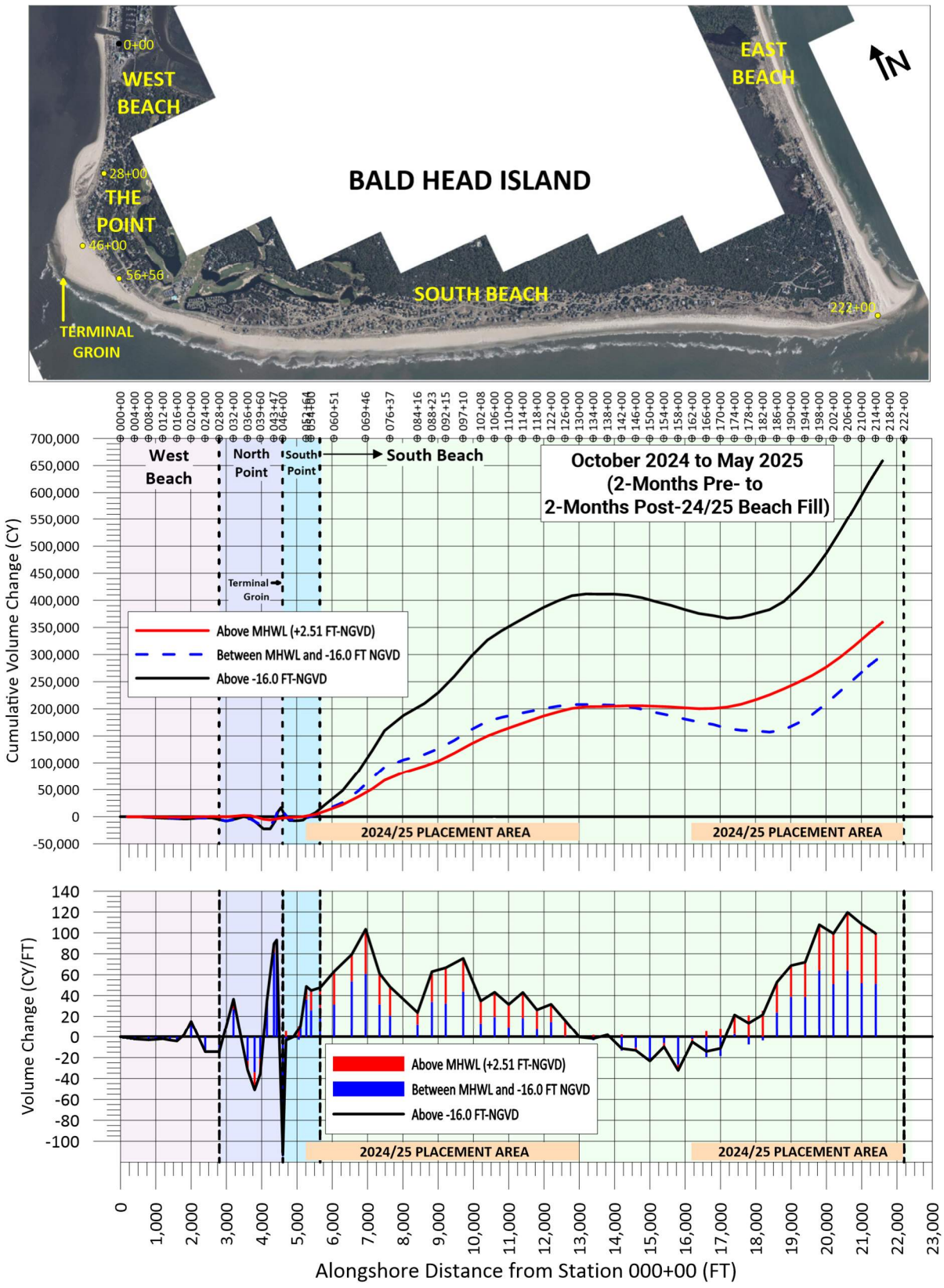

Figure 3.2: Volume change along the Bald Head Island shoreline between October 2024 & May 2025.

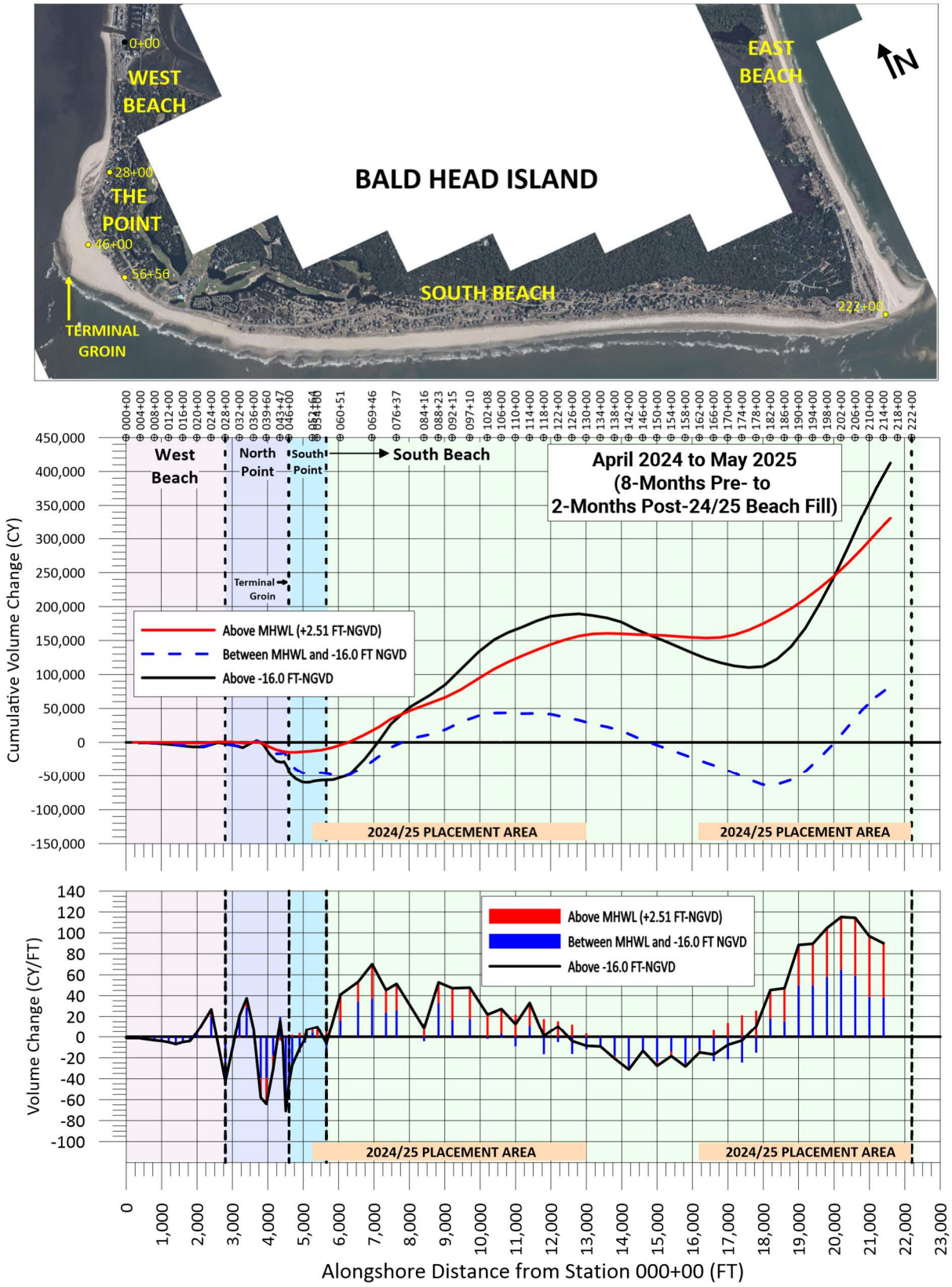

Figure 3.3: Volume change along the Bald Head Island shoreline between April 2024 and May 2025 (Year 24).

Table 3.4: Location of the **BERM** (+6.0 ft-NGVD) relative to the November 2000 (pre-2001 fill) location for selected monitoring surveys.

	Station	Location Relative to Nov. 2000				Station	Location Relative to Nov. 2000		
		April 2024	October 2024	May 2025			April 2024	October 2024	May 2025
West Beach	B-1	102.0	112.7	80.3	South Beach	B-17	28.6	-1.1	143.3
	B-2	-2.3	10.8	7.2		B-18	32.5	6.8	125.2
	B-3	-14.9	-4.4	-14.2		B-19	65.2	34.2	203.5
	I-3	No November 2000 profile				B-20	123.3	93.8	217.4
	B-4	9.4	14.4	9.3		B-21	187.8	177.6	284.9
	I-4	No November 2000 profile				B-22	187.7	218.3	246.6
	B-5	24.0	29.8	26.2		B-23	247.0	188.9	296.7
	I-5	No November 2000 profile				B-24	165.2	161.7	288.1
	B-6	184.2	188.8	187.9		B-25	117.8	126.0	251.3
	B-7	304.2	426.4	396.7		B-26	123.2	150.2	223.3
	B-8	381.7	360.0	162.9		B-27	140.3	167.3	251.9
Point (North of Groin)	B-9	315.9	42.1	49.6		B-28	155.5	171.8	246.8
	I-9	No November 2000 profile				B-29	174.8	182.0	266.9
	B-10	183.2	287.4	181.1		B-30	198.9	207.7	273.7
	I-10	No November 2000 profile				B-31	236.2	245.7	311.8
	B-11	203.1	116.9	15.4		B-32	265.7	264.9	311.2
	I-11	No November 2000 profile				B-33	276.9	285.3	304.5
	B-12	33.5	-54.1	12.8		B-34	295.4	292.7	293.2
	I-12	No November 2000 profile				B-35	313.4	295.9	295.6
	B-13	15.7	-1.2	-5.7		B-36	309.0	294.6	298.6
	I-13	No November 2000 profile				B-37	290.5	304.9	286.8
Point (South of Groin)	B-14	248.3	256.5	248.8		B-38	296.4	298.2	272.7
	H-14	No November 2000 profile				B-39	297.4	301.5	248.6
	I-14	No November 2000 profile				B-40	275.1	289.8	256.2
	J-14	No November 2000 profile				B-41	270.7	284.7	244.4
	B-15	245.8	210.2	267.3		B-42	280.7	290.1	289.0
	I-15	No November 2000 profile				B-43	247.5	280.2	295.8
	B-16	129.0	84.5	161.6		B-44	208.6	227.7	285.1
						B-45	199.6	226.7	301.2
						B-46	181.1	193.8	283.8
						B-47	136.5	156.7	269.9
						B-48	97.0	142.0	253.1
						B-49	63.1	96.3	232.0
						B-50	-3.2	16.8	192.7
						B-51	-41.7	-30.2	181.7
						B-52	-138.5	-137.1	103.4
						B-53	-216.4	-209.2	35.2
						B-54	-338.7	-324.9	-127.2

Positive values indicate shoreline advance relative to the pre-construction location. Negative values indicate shoreline erosion and are highlighted in red.

2024/25 fill placement areas are shaded orange.

Table 3.5: Location of the **MHWL** (+2.51 ft-NGVD) relative to the November 2000 (pre-2001 fill) location for selected monitoring surveys.

	Station	Location Relative to Nov. 2000				Station	Location Relative to Nov. 2000		
		April 2024	October 2024	May 2025			April 2024	October 2024	May 2025
West Beach	B-1	109.8	99.3	100.2	South Beach	B-17	18.3	-11.6	135.3
	B-2	1.9	3.6	-0.3		B-18	20.6	-2.0	112.6
	B-3	-11.8	-11.9	-15.0		B-19	54.5	30.8	223.4
	I-3	No November 2000 profile				B-20	139.5	108.7	210.0
	B-4	-24.4	-32.8	-35.4		B-21	199.3	185.5	294.4
	I-4	No November 2000 profile				B-22	217.9	219.8	230.5
	B-5	18.7	12.0	2.6		B-23	243.6	207.0	347.9
	I-5	No November 2000 profile				B-24	180.8	157.5	284.2
	B-6	223.7	183.7	230.6		B-25	133.2	132.7	259.6
	B-7	367.5	412.2	386.5		B-26	144.4	157.1	234.9
	B-8	333.8	266.4	238.2		B-27	163.3	172.2	247.1
Point (North of Groin)	B-9	245.4	226.1	304.4		B-28	179.8	170.0	235.2
	I-9	No November 2000 profile				B-29	181.5	182.4	251.6
	B-10	188.4	227.5	167.7		B-30	206.9	214.9	264.9
	I-10	No November 2000 profile				B-31	232.9	237.2	305.3
	B-11	161.4	62.1	45.6		B-32	263.5	249.9	303.0
	I-11	No November 2000 profile				B-33	275.5	280.7	300.4
	B-12	-68.3	-154.5	-82.0		B-34	297.2	290.5	290.7
	I-12	No November 2000 profile				B-35	307.6	280.9	285.2
	B-13	-6.7	-28.3	-34.8		B-36	318.8	291.9	292.5
	I-13	No November 2000 profile				B-37	290.6	299.1	279.8
Point (South of Groin)	B-14	272.2	275.1	247.1		B-38	292.7	292.3	265.4
	H-14	No November 2000 profile				B-39	294.2	291.1	282.4
	I-14	No November 2000 profile				B-40	294.5	283.8	259.0
	J-14	No November 2000 profile				B-41	262.8	276.2	274.7
	B-15	232.4	200.8	247.7		B-42	275.1	278.5	279.8
	I-15	No November 2000 profile				B-43	236.2	253.5	269.5
	B-16	113.5	72.7	137.1		B-44	225.3	220.0	286.6
						B-45	220.2	224.0	311.3
						B-46	184.4	187.2	285.3
						B-47	139.9	143.1	249.4
						B-48	83.1	118.7	229.3
						B-49	47.2	67.5	207.1
						B-50	-5.6	2.8	181.5
						B-51	-57.6	-48.1	154.5
						B-52	-152.8	-159.7	67.8
						B-53	-239.8	-226.9	1.2
						B-54	-342.3	-335.1	-147.7

Positive values indicate shoreline advance relative to the pre-construction location. Negative values indicate shoreline erosion and are highlighted in red.

2024/25 fill placement areas are shaded orange.

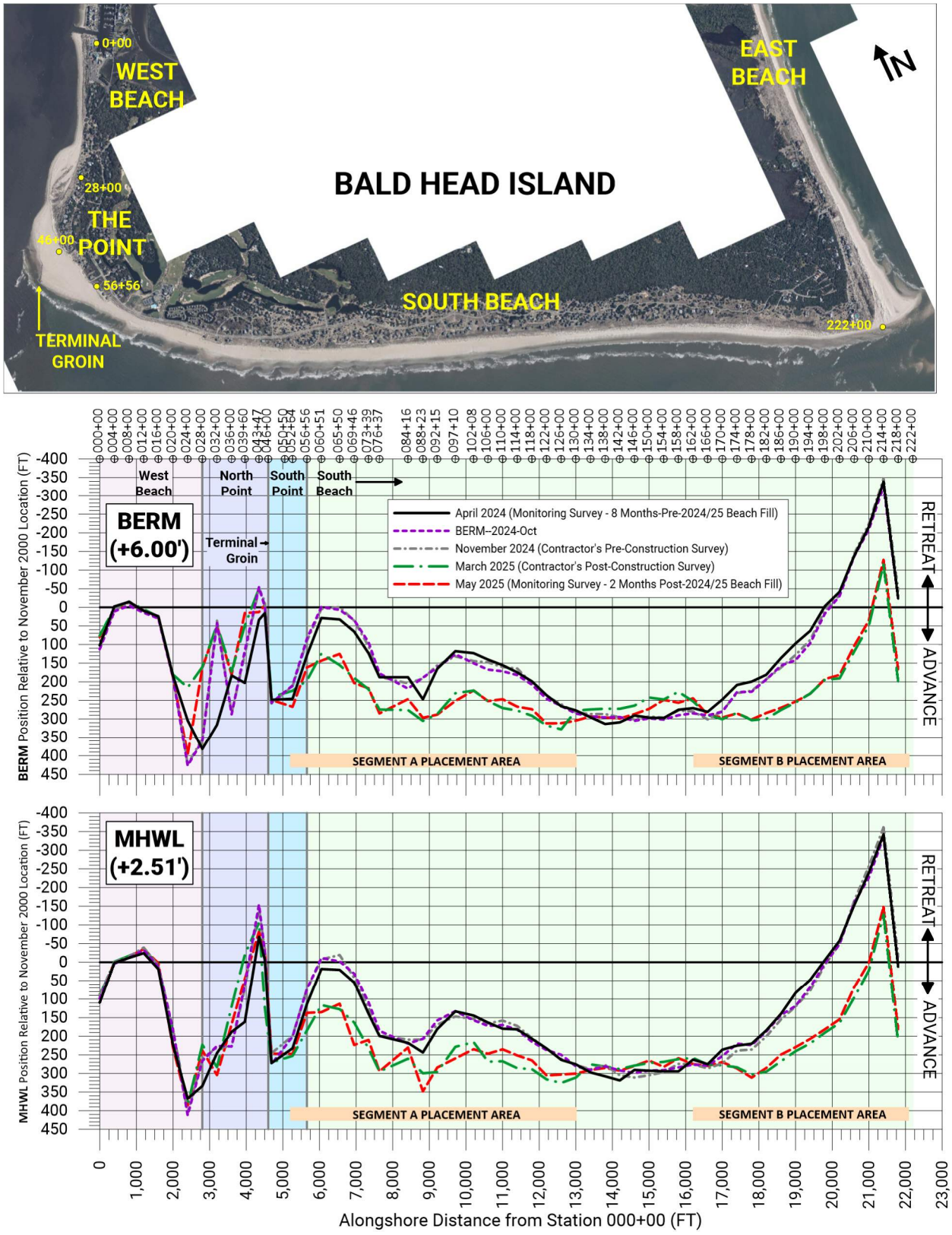

Figure 3.4: Location of the Berm & MHWL relative to the November 2000 (pre-2001 fill) location.

3.2 Year 24: Monitoring Program (April 2024 – October 2024 – May 2025)

The April 2024 to October 2024 to May 2025 monitoring period represents the 24th year of monitoring following completion of the initial 2001 Federal +1.849 Mcy beach disposal at Bald Head Island. The May 2025 survey was conducted approximately 2 months following completion of the +1.0 Mcy (pay) beach fill constructed by the Village of Bald Head Island along South Beach in the winter of 2024/2025. The May 2025 survey was also conducted approximately two years following the March 2023 completion of an approximate 1.3 Mcy Federal beach disposal project along South Beach.

In addition to the three monitoring surveys, the contractor's pre- and post-construction surveys (November 2024 and March 2025) for the 2024/25 beach nourishment project were also analyzed. Since the contractor's pre- and post-construction surveys were not as comprehensive as the annual monitoring surveys and limited to only those areas related to beach fill construction, with only 62 of the typical 79 monitoring profile locations surveyed, the volume and shoreline changes analyses using these surveys are discussed separately, where applicable, within the monitoring survey period discussions below.

3.3 West Beach, "The Point", and South Beach Discussion

3.3.1 Survey Period: April 2024 to October 2024 (Pre-2024/25 Beach Fill)

This April to October 2024 time span represents the 6-month monitoring period immediately *prior* to the 2024/25 beach fill placement along South Beach. **Photograph 3.1** depicts the conditions along the western South Beach shoreline in August 2024. As shown in **Figure 3.1** and **Table 3.1**, the *net* volume change for this period along the combined West Beach, "The Point", and South Beach shorelines was a loss -246,400 cy (-10.8 cy/ft) above -16 ft-NGVD. Similarly, above the MHWL, the shoreline lost -29,700 cy (-1.3 cy/ft). On weighted average, the berm and MHWL receded by -1 and -9 ft, respectively.

Photograph 3.1: Eastward looking drone image of the Bald Head Island shoreline taken near the terminal groin in August 2024 (pre-2024/25 beach fill).

In the net, West Beach was accretional during this period gaining +900 cy above the MHWL and +3,700 cy between the MHWL and the -16 ft-NGVD contour. Overall West Beach gained roughly +4,600 cy above the -16 ft contour. On weighted average, the berm advanced by about +23 ft and MHWL receded by -7 ft. However, the average advancement of the berm was heavily influenced by the measured advancement at monument B-7, which advanced by +122 ft (see **Appendix G**, **Figure G-15**). The weighted average berm advancement along West Beach after removing B-7 was about +5 ft.

The entire 3,690 ft of "the Point" shoreline (Sta. 28+00 to 56+56) was net erosional during this monitoring period, losing -84,900 cy above -16 ft-NGVD. For purposes of evaluating the impacts of the terminal groin completed in November 2015, "the Point" shoreline is subdivided into two reaches with Sta. 46+00, the approximate location of the terminal groin, as the dividing station.

North of the terminal groin (Sta. 28+00 to 46+00), the shoreline lost -13,000 cy (-5.7 cy/ft) above the MHWL and -56,100 cy (-24.6 cy/ft) above the -16 ft-NGVD contour. On weighted average, the berm receded by about -56 ft and the MHWL receded by -40 ft.

South of the terminal groin (Sta. 46+00 to 56+56), the shoreline lost -6,500 cy (-4.6 cy/ft) above the MHWL and -28,800 cy (-20.5 cy/ft) above the -16 ft-NGVD. On weighted average, the both the berm and MHWL receded by about -24 ft.

South Beach was net erosional during the period, losing roughly -11,100 cy above the MHWL and -166,100 cy above -16 ft-NGVD. On weighted average, the berm advanced by about +4 ft and MHWL receded by -4 ft.

The 2024/25 Beach Fill Area[8] was net erosional during the April 2024 to October 2024 pre-construction period, losing -12,400 cy above the MHWL and -160,100 cy above -16 ft-NGVD. Additionally, the contractor's pre-construction survey (November 2024) indicated an additional -85,600 cy of loss between October and November 2024 above -16 ft-NGVD. The October to November 2024 measured loss was unbalanced between the two fill segments with Segment A losing -26,400 cy (-3.4 cy/ft), while Segment B lost -59,200 cy (-9.9 cy/ft), necessitating a slight adjustment to the final construction template.

3.3.2 Survey Period: October 2024 to May 2025 (Beach Fill Construction)

Photograph 3.2: Eastward looking drone image of the Bald Head Island south beach shoreline taken near B-43 in April 2025 (post-2024/25 beach fill).

This October 2024 to May 2025 time span represents the 7-month monitoring period that includes the construction of the 2024/25 beach fill along portions South Beach. **Photograph 3.2** depicts the conditions along the eastern South Beach shoreline in April 2025, approximately 1 month after completion of the beach fill. A discussion of the contractor's pre- and post-beach fill construction surveys (November 2024 & March 2025) within the project area is included at the end of this section.

[8] Volume totals include approximately +800 cy (above MHWL) and +900 cy (above -16 ft-NGVD), measured between B-54 & B-55 (STA 218+00 to 222+00). These values are not included in **Table 3.1**.

As depicted in **Figure 3.2** and **Table 3.2**, the *net* volume change during this monitoring period (October 2024 to March 2025) along the combined West Beach, "The Point", and South Beach shorelines was a gain of +359,600 cy (+15.8 cy/ft) above the MHWL and +658,600 cy (+28.9 cy/ft) above -16 ft-NGVD. On weighted average, the berm and MHWL advance by about +54 and +61 ft, respectively.

In the net, West Beach was erosional during this period losing -200 cy above the MHWL and -7,900 cy between the MHWL and the -16 ft-NGVD contour. Overall West Beach gained lost roughly -8,100 cy above the -16 ft contour. On weighted average, the berm receded by about -24 ft and MHWL receded by -2 ft.

The entire 3,690 ft of "the Point" shoreline (Sta. 28+00 to 56+56) was net accretional during this monitoring period, gaining +32,900 cy above -16 ft-NGVD. North of the terminal groin (Sta. 28+00 to 46+00), the shoreline lost -2,000 cy above the MHWL and gained +12,600 cy above the -16 ft-NGVD contour. On weighted average, the berm receded by about -29 ft and the MHWL advanced by +10 ft. South of the terminal groin (Sta. 46+00 to 56+56), the shoreline gained +13,600 cy above the MHWL and +20,300 cy above the -16 ft-NGVD. On weighted average, the berm and MHWL advanced by 40 ft and 30 ft, respectively.

South Beach was net accretional during the period, gaining roughly +348,200 cy above the MHWL and +633,800 cy above -16 ft-NGVD as approximately 1.0 Mcy of sand (pay) was placed along portions of South Beach during this period. On weighted average, the berm and MHWL advanced by 81 ft and 82 ft, respectively.

The 2024/25 Beach Fill Area[9] was net accretional during the October 2024 to May 2025 period that included the direct placement of approximately 1.0 Mcy of sand. The fill area gained roughly +379,500 cy above the MHWL and +731,400 cy above -16 ft-NGVD. Measured above -5 ft-NGVD (roughly the offshore limit of fill placement), the beach fill area gained +761,200 cy. The balance between the two fill segments was Segment A gaining +410,800 cy (+53.1 cy/ft) above -16 ft-NGVD and Segment B gaining +320,600 cy (+53.4 cy/ft). On weighted average, the berm and MHWL advanced by 106 ft and 104 ft, respectively. This shoreline advance created roughly 32.3 acres of additional "dry beach" area within the fill limits as measured between the October 2024 and May 2025 MHWLs.

Beach Fill Construction (Pre- & Post-Construction Contractor Surveys). This period includes the placement of approximately 1.0 Mcy (pay) of sand during the 2024/25 beach renourishment project between December 2024 and March 2025 along portions of South Beach. While the Contractor's pre- to post-construction surveys (November 2024 & March 2025, respectively) served to document the construction changes resulting from the direct placement of 1.0 Mcy of sand placed during the 2024/25 beach fill, the beach placement occurred over 83 days. As such, the pre-construction survey was conducted up to 117 days prior to and the post-construction survey up to 93 days after the placement of sand at a given location along the beach.

[9] Volume totals include approximately +18,300 cy (above MHWL), +39,700 cy (above -5 ft-NGVD), and +37,700 cy (above -16 ft-NGVD), measured between B-54 & B-55 (STA 218+00 to 222+00). These values are not included in **Table 3.2**.

Based upon the Contractor's pre- and post-construction surveys (November 2024 to March 2025), the entire surveyed area gained +659,800 cy above -16 ft-NGVD. However, measured above -5 ft-NGVD, roughly the offshore limit of fill placement, the beach gained +836,000 cy. This value is approximately 21 percent less than the Contractor's BD/AD surveys that were utilized for construction review and payment (+1,052,400 cy). The difference is attributed to a.) ongoing erosion during the December to March construction period, b.) difference in survey profile spacing used to calculate each value, and c.) potential difference in surveys (survey error).

3.3.3 Year 24 Monitoring Results: April 2024 to May 2025

During Year 24 in its entirety (April 2024 to May 2025), the monitored portion of Bald Head Island (excluding East Beach & Row Boat Row) experienced a net gain of +412,200 cy above -16 ft-NGVD (see **Table 3.3** and **Figure 3.3**). This is inclusive of the approximate 1.0 Mcy (pay) placed along portions of South Beach between December 2024 and March 2025. Above the MHWL, the island gained +329,900 cy. On weighted average, the berm and MHWL advanced by 53 ft and 52 ft, respectively.

In the net, West Beach gained +700 cy above the MHWL and lost -3,500 cy above the -16 ft-NGVD contour. On weighted average, the berm and MHWL receded by about -1 ft and -9ft, respectively.

The entire 3,690 ft of "the Point" shoreline (Sta. 28+00 to 56+56) was net erosional during this monitoring year, losing -52,000 cy above -16 ft-NGVD. North of the terminal groin (Sta. 28+00 to 46+00), the shoreline lost -15,000 cy above the MHWL and -43,500 cy above the -16 ft-NGVD contour. On weighted average, the berm and MHWL receded by about -85 ft and -30 ft, respectively. South of the terminal groin (Sta. 46+00 to 56+56), the shoreline gained +7,100 cy above the MHWL and lost -8,500 cy above the -16 ft-NGVD. On weighted average, the berm and MHWL advanced by +16 ft and +6 ft, respectively.

South Beach was net accretional during the period, gaining roughly +337,100 cy above the MHWL and +467,700 cy above -16 ft-NGVD as approximately 1.0 Mcy of sand (pay) was placed along portions of south beach during this period. On weighted average, the berm and MHWL advanced by +85 ft and +78 ft, respectively.

The 2024/25 Beach Fill Area[10] was net accretional during the Year 24 (April 2024 to May 2025) that included the direct placement of approximately 1.0 Mcy of sand. The monitored fill area gained roughly +367,100 cy above the MHWL and +571,300 cy above -16 ft-NGVD. Measured above -5 ft-NGVD (roughly the offshore limit of fill placement), the beach gained +637,300 cy. The balance between the two fill segments was Segment A gaining +244,100 cy (+31.6 cy/ft) above -16 ft-NGVD and Segment B gaining +327,200 cy (+54.5 cy/ft). On weighted average, the berm and MHWL advanced along the entire fill area by 109 ft and 100 ft, respectively.

[10] Volume totals include approximately +19,100 cy (above MHWL), +35,800 cy (above -5 ft-NGVD) and +38,600 cy (above -16 ft-NGVD), measured between B-54 & B-55 (STA 218+00 to 222+00). These values are not included in **Table 3.3**.

3.3.4 Long-Term Beach Changes: November 2000 to May 2025

For purposes of tracking gross sand placement performance, **Figure 3.5** plots a time history of cumulative volume change relative to November 2000 conditions. **Figure 3.6** presents net volumetric change (alongshore above -16 ft NGVD) for the maximum period of comparison to date (*i.e.* November 2000 to May 2025). In both figures the effects of approximately 14.1 Mcy of direct placement since 2000 are included. As with other similar analyses over the last decade, East Beach, Cape Fear and Row Boat Row are *excluded* from this analysis.

The classic "saw-tooth" effects of episodic sand placement (and subsequent sand losses over time), as reflected in **Figure 3.5**, are indicative of the periodic infusion of sand along South Beach at Bald Head Island associated with the placement of sand during initial construction of the channel deepening project, six (6) subsequent beach disposal operations pursuant to the WHSMP, the proactive beach renourishment project constructed by the Village in 2009/10 and to a smaller degree the emergency fill of 2012. The Village 2009/10, 1.85 Mcy fill was constructed with the knowledge gained through monitoring that certain irreparable large-scale impacts to Bald Head Island would predictably occur as a direct result of the proposed diversion of channel maintenance material in 2009 to Oak Island. *Note – a similar diversion of Federal maintenance sand occurred in the summer of 2018 and will again in 2025/26.* As a result of the 2018 federal sand disposal at Oak Island, the Village constructed a 1.1 Mcy interim beach fill at South Beach in the fall/winter of 2018/19. The most recent federal beach disposal project was completed in March 2023 along South Beach on Bald Head Island. Over the following 2 months, mol the fill berm had just begun to equilibrate. Similarly, a portion of that sand placed can be found as an accretional spit located immediately westward of the terminal groin. The episodic formation of that depositional feature was intended "by design" to maintain a sand supply to West Beach – after terminal groin construction.

Table 3.6 presents a chronology of sediment volumes (measured in-place) for the three (3) segments of shoreline noted between the benchmark survey of November 2000 and present (May 2025). Currently, within the approximate 22,755 ft of shoreline considered, there is a net gain of +4,129,300 cy. However, after removing the effects of the gross volume of sand artificially placed along the Bald Head Island shoreline since the 2000 deepening project, the net change in Island-wide volume (exclusive of East Beach and the Cape Fear Point) is a measured sediment *loss* of -9,963,500 cy. It is important to note that the chronology of sand volumes presented by this table reflects the *actual volumes* of sand *measured in-place* by survey and therefore is not related to projections based upon *estimated* volumes dredged from the channel or borrow area, *estimated* sand volumes placed, contractual "net pay" volumes, etc.

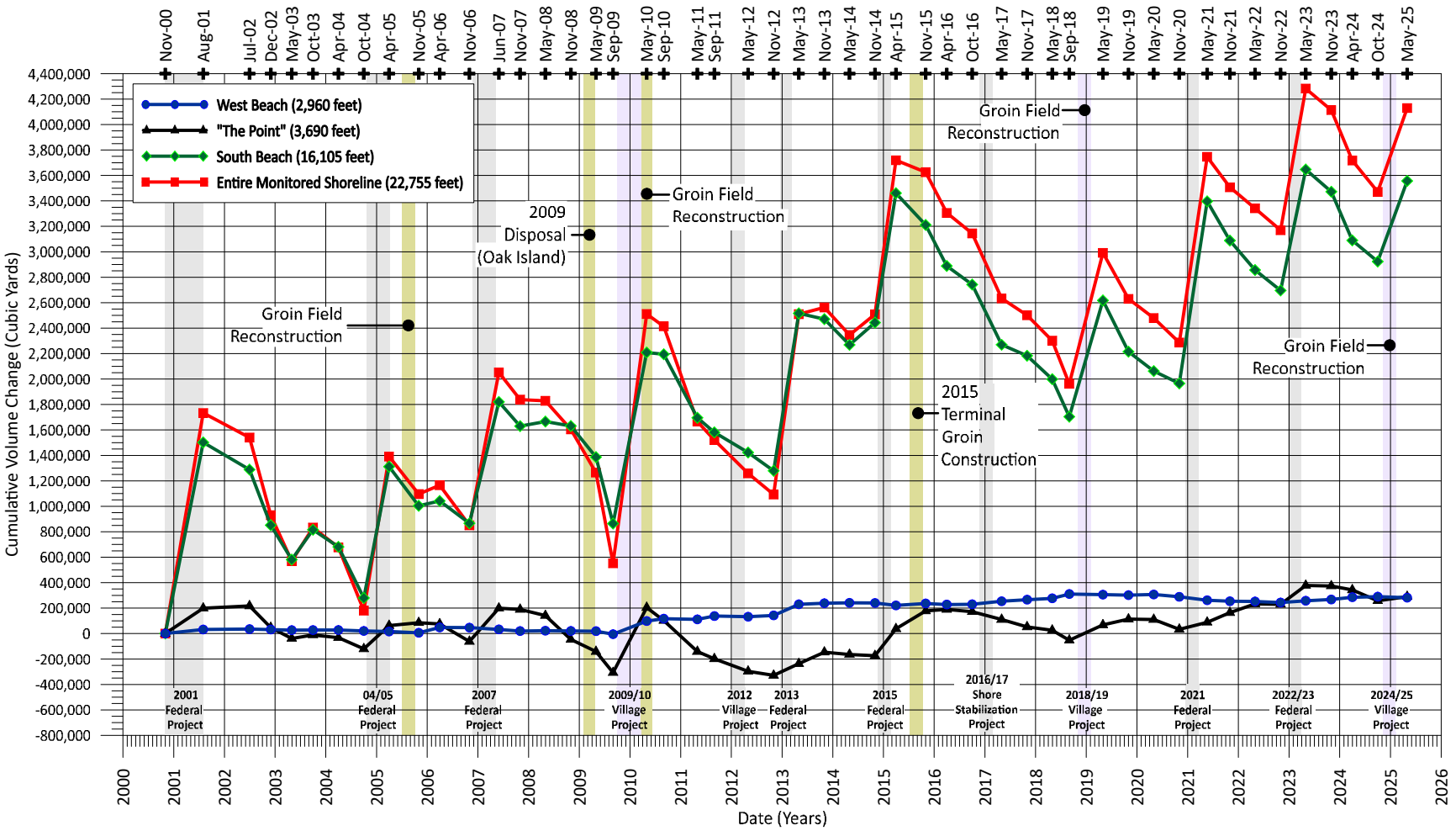

Figure 3.5: Cumulative volume change (above -16 ft-NGVD) relative to November 2000 conditions.

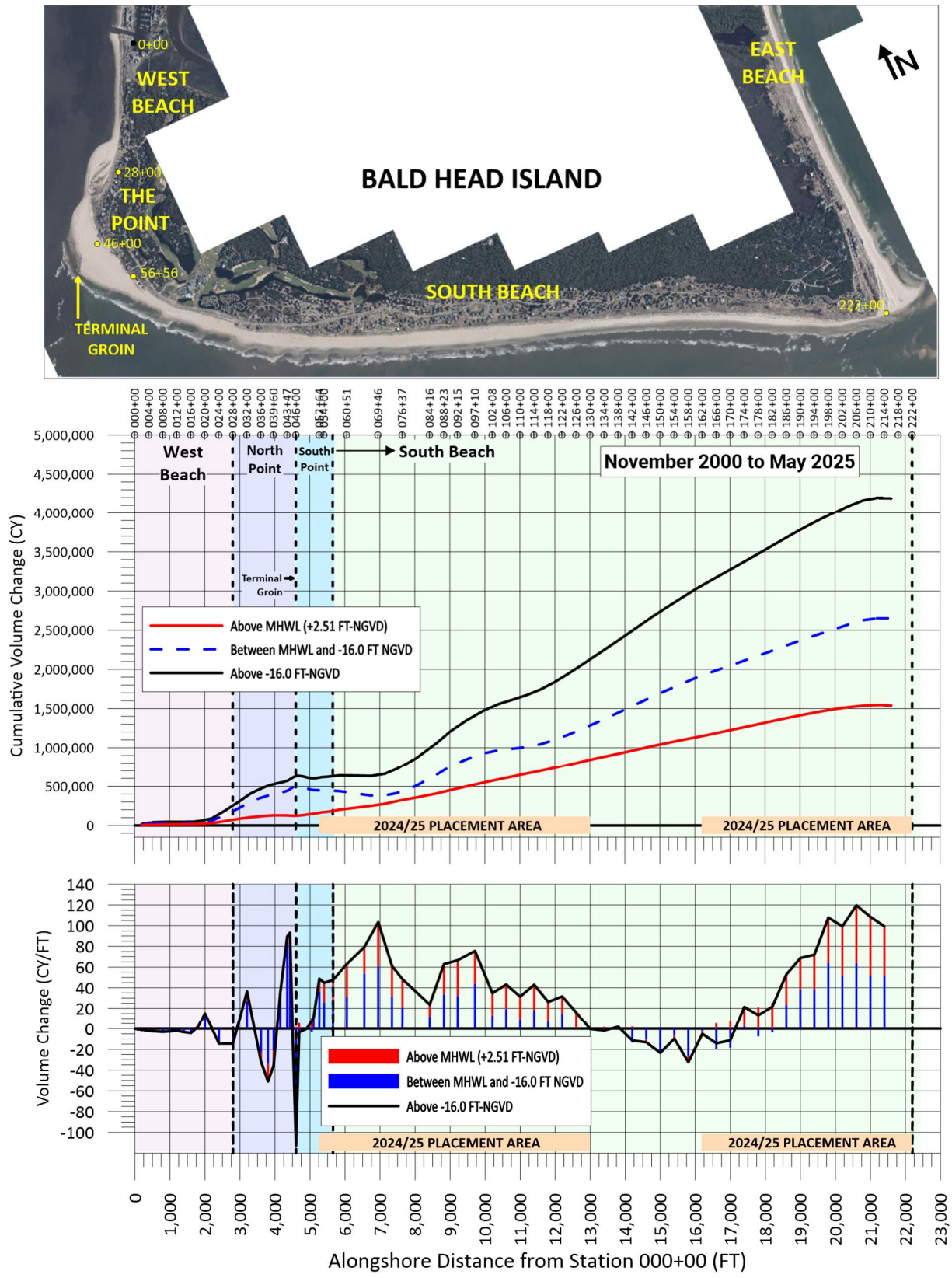

Figure 3.6: Volume change along the Bald Head Island shoreline between November 2000 and May 2025.

Table 3.6: Bald Head Island historic net volume change above -16 ft-NGVD (presumed closure depth).

Period	Start Date	End Date	Span (Months)	Volume Change Above -16 ft-NGVD (CY)			
				West Beach	The Point	South Beach	Total
Year 0 (Const.)[1]	Nov. 2000	Aug. 2001	9	+31,900	+199,500	+1,501,800	+1,733,200
Year 1	Aug. 2001	Jul. 2002	11	+2,900	+17,400	-213,300	-193,000
Year 2	Jul. 2002	May 2003	10	-8,000	-255,500	-707,400	-970,900
Year 3	May 2003	Apr. 2004	11	+1,000	+6,500	+99,900	+107,400
Year 4 (Project)[2]	Apr. 2004	Apr. 2005	12	-11,800	+94,700	+631,200	+714,100
Year 5 (Project)[3]	Apr. 2005	Apr. 2006	12	+32,000	+13,300	-270,200	-224,900
Year 6 (Project)[4]	Apr. 2006	Jun. 2007	14	-15,400	+123,500	+778,100	+886,200
Year 7	Jun. 2007	May 2008	11	-10,300	-58,200	-154,600	-223,100
Year 8	May 2008	May 2009	12	-3,400	-282,800	-278,200	-564,400
Year 9 (Project)[5]	May 2009	May 2010	12	+79,300	+346,000	+821,300	+1,246,600
Year 10	May 2010	May 2011	12	+13,200	-346,100	-512,700	-845,600
Year 11 (Fill)[6]	May 2011	May 2012	12	+20,800	-154,600	-273,300	-407,100
Year 12 (Disposal)[7]	May 2012	May 2013	12	+97,600	+59,800	+1,093,900	+1,251,300
Year 13	May 2013	May 2014	12	+11,600	+72,100	-247,500	-163,800
Year 14 (Disposal)[8]	May 2014	Apr. 2015	11	-20,400	+201,800	+1,191,800	+1,373,200
Year 15	Apr. 2015	Apr. 2016	12	+7,200	+151,800	-572,500	-413,500
Year 16	Apr. 2016	May 2017	13	+25,500	-79,000	-619,000	-672,500
Year 17	May 2017	May 2018	12	+23,200	-84,600	-270,500	-331,900
Year 18 (Fill)[10]	May 2018	May 2019	12	+29,000	+42,200	+619,500	+690,700
Year 19	May 2019	May 2020	12	+1,200	+42,200	-555,900	-512,500
Year 20 (Disposal)[11]	May 2020	May 2021	12	-45,300	-21,600	+1,334,400	+1,267,500
Year 21	May 2021	May 2022	12	-9,400	+144,500	-540,800	-405,700
Year 22 (Disposal)[12]	May 2022	May 2023	12	+5,800	+145,400	+790,000	+941,200
Year 23	May 2023	Apr. 2024	11	+27,600	-35,700	-557,400	-565,500
Year 24[13]	April 2024	May 2025	13	-3,500	-52,000	+467,700	+412,200
Year 0 to Year 24	Nov. 2000	May 2025	294	+281,900	+290,700	+3,556,700	+4,129,300
Year 0 to Year 24 (14,092,800 cy of Fill Removed)	Nov. 2000	May 2025	294	NA	NA	NA	-9,963,500

[1] 2001 Initial Disposal (1,849,500± cy); [2] 2005 Beach Disposal (1,217,000± cy); [3] 2006 West Beach Fill (47,800± cy)
[4] 2007 Beach Disposal (978,500± cy); [5] 2009/10 Beach Fill (1,850,000± cy); [6] 2012 Beach Fill (138,000± cy)
[7] 2013 Beach Disposal Fill (1,658,000± cy); [8] 2015 Beach Disposal (1,320,000± cy);
[9] 2016/17 Beach Disposal (24,000± cy); [10] 2018/19 Beach Fill (1,100,000± cy); [11] 2021 Beach Disposal (1,610,000± cy)
[12] 2022/23 Beach Disposal (1,300,000± cy); [13] 2024/25 Beach Fill (1,000,000± cy)

Figure 3.7 depicts the long-term volume changes along the monitored shoreline of Bald Head Island with the approximate 14.1 Mcy of sand placed during beach fill and disposal projects removed since 2000. As of May 2025, the estimated *average* annual loss of sand from the monitored section of the Bald Head Island shorefront (excluding East Beach and Row Boat Row) since November 2000, is approximately -402,200 cy per year including the impacts of numerous major storm events. Along just western south beach (terminal groin to STA 118+00) the measured loss with sand placement effects removed is approximately -280,700 cy per year.

The assignment of an "average" annual long-term rate of sand loss at Bald Head Island however, is *not* necessarily a meaningful indicator of navigation project impact. Such an "average rate" is temporally biased by periods of beach fill placement and equilibration, groin field effectiveness, the occurrence of episodic destabilizing dredging events in close proximity to the island, as well as other physiographic phenomena temporally affecting annualized quantities of alongshore sediment transport – from Bald Head Island – to the navigation channel, -- including meteorological effects – such has Hurricanes Florence, Dorian and Isaias.

3.3.5 MHWL Shoreline Position

As part of the permit required monitoring for the terminal groin project completed in late 2015, the MHWL was surveyed in December 2015 (post-construction), April 2016 (5 months post-construction), June 2017 (19 months post-construction), May 2018 (30 months post-construction), September 2018 (post-Florence), May 2019 (post-fill), November 2019 (post-Dorian), May 2020, May 2021, May 2022, May 2023, April 2024 and May 2025. Various selected surveys are plotted in **Figure 3.8**. The purpose of the surveys is to be able to intercompare and assess both updrift fillet conditions and the location of the downdrift shoreline immediately fronting the Cape Fear River. Through May 2025, terminal groin project performance – based upon monitoring – has been both as intended and as predicted.

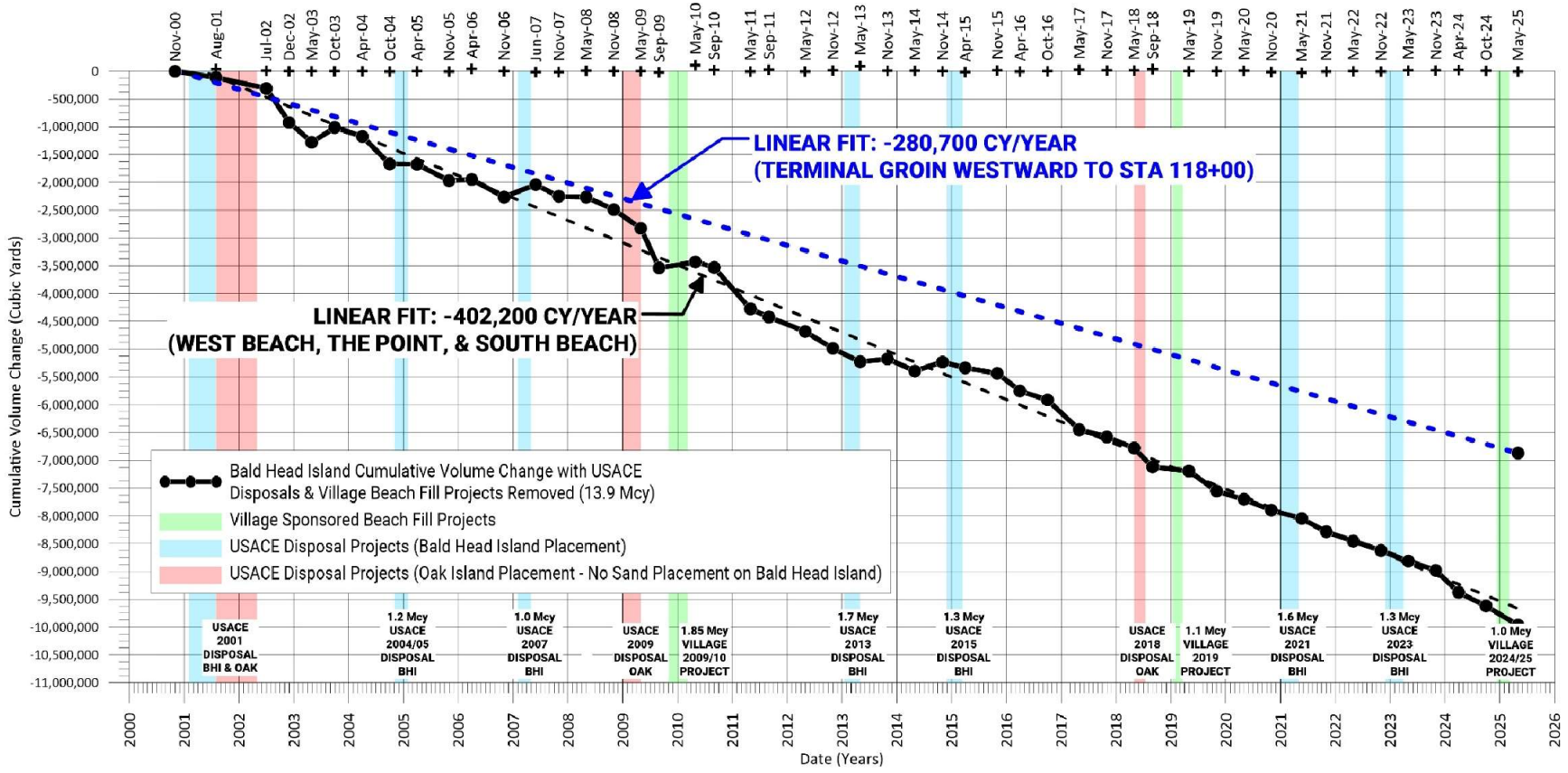

Figure 3.7: Cumulative volume change (above -16 ft-NAVD) along Bald Head Island shoreline through time relative to November 2000 conditions, excluding nourishment events.

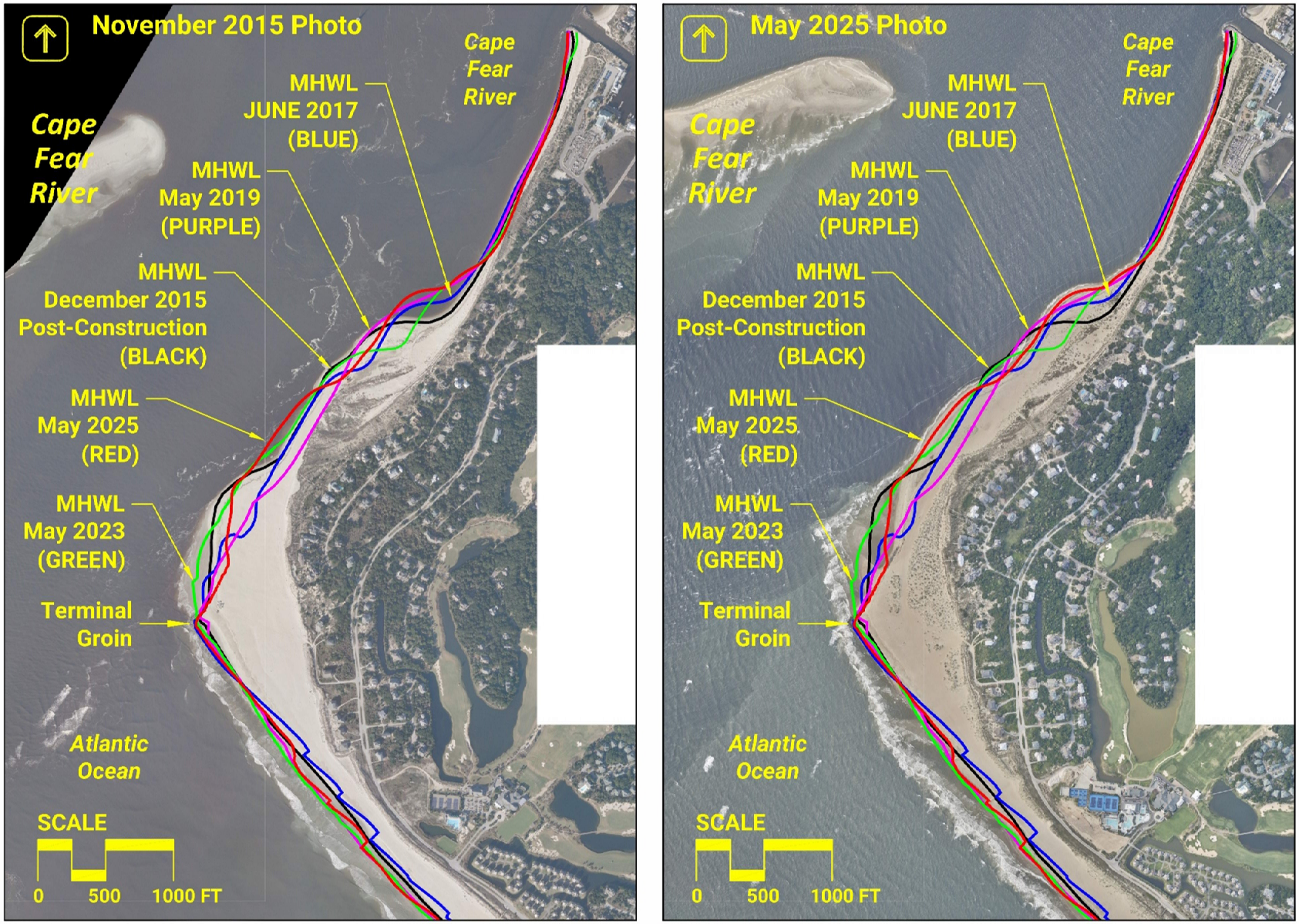

Figure 3.8: Surveyed MHWL positions in the vicinity of the terminal groin, Bald Head Island, NC.

3.3.6 Chronology of the Point

Since the initiation of the last Wilmington Harbor Channel Deepening Project – in about 2001, the spatial configuration of the spit feature (known as the "Point") located at the juncture of South Beach and the entrance channel, has been a focal point of the Village's monitoring program. Accordingly, the chronology of the Point's condition and evolution over time is indicative of the dynamic interaction between the ever-increasing rate of sand transport westward along South Beach and the man-altered inlet hydrodynamics, as well as episodic dredging operations which result in sand removal from the island's littoral system. In its simplest sense, the Point has historically been to a large degree, a visual indictor of the processes involved and a potential "bellwether" as to direct and indirect impacts associated with the Navigation Project – irrespective of proactive or remedial actions specified within the Wilmington Harbor Sand Management Plan. The latter take the form of alongshore sand placement events intended to mitigate adverse impacts associated with both project construction in 2000 and episodic channel maintenance required to ensure navigability.

Appendix E includes a high resolution visual chronology of the Point from 1998 to April 2024. Demarcated on each photo panel are the approximate September 2001 (blue line) and April 2024 (red line) apparent vegetation lines. Also placed on each photo are two reference marks (green dots). The variation in spit configuration from the before navigation improvement project photos (1998 and 1999) throughout the last approximate twenty-one years for pre- and post-fill timeframes can be easily visualized. Similarly, the advance and recession of the Point, as well as its consistent *net northerly migration* are self-evident. An additional perspective can be gained by an assessment of the locations of the pre-project and present day "vegetation lines" over the 1998 through 2025 timeframe. As had been concluded throughout the numerous years of comprehensive beach monitoring funded by the Village of Bald Head Island – improved conditions along the westernmost segment of South Beach and the Point were documented to last only about 2 years after each federal disposal event – *prior* to terminal groin construction in 2015.

Both long term monitoring, as well as numerical modeling of the Cape Fear River Entrance by Olsen Associates, Inc. (Olsen 2013a), and the abutting Bald Head Island shoreline, indicated that additional structural measures were warranted. As the westernmost segment of South Beach shoreline had "rolled back," the annualized rate of littoral transport at that location had correspondingly increased. Hence, in 2012 the Village initiated the permitting for a 1,300 ft terminal structure intended to both reorient the effective updrift shoreline alignment (so as to reduce annual sediment losses) and to allow for the reconstruction of a protective beach where one now could not be reliably established through sand placement alone. That project was constructed during the summer of 2015. Subsequently, monitoring reports now document a "new dynamic" predicted to result from the implementation of the terminal groin structure. Analytical predictions of shoreline change to both the updrift and downdrift shorelines abutting the structure – via DELFT 3D modeling – were discussed in a detailed report formulated for purposes of both design and permitting of the terminal groin (Olsen 2013a). Additional monitoring data required by Permit are intended to assist in the quantification of the terminal groin effects on littoral

processes and resultant shoreline reconfiguration. These include additional transects in the vicinity of the structure as well as an approximate MHWL delineation performed by survey every 6-months.

Since construction of the terminal groin, the adjacent inlet facing shoreline has realigned (as predicted) and adjusted to a new equilibrium condition. In accordance with its design intent, intertidal spit formation continues to form on the inlet side of the structure as a result of sediment transported from South Beach through or across the structure. The footprint of the spit varies throughout the year depending on the seasonal wave climate. Updrift thereof, portions of the historical Point continue to migrate northward as they did prior to terminal groin construction. This is best represented by the surveyed MHWL locations depicted in **Figure 3.8**. The configuration of the sand fillet updrift of the terminal groin continues to be influenced by the sand tube groin field as fill berms recede and the formerly buried groins become “activated”.

3.4 East Beach & Cape Fear Shoreline Conditions

East Beach was added to the island-wide beach monitoring program in November 2008[11]. Profiles along the East Beach shoreline are collected at seven (7) monitoring stations starting just north of Cape Fear and extending approximately 6,000 feet northward along the Onslow Bay facing shoreline (see **Figure 2.1**). Plots of these profiles are provided at the end of **Appendix G** (**Figures G-73** to **G-79**). This reach of shoreline did not receive direct beach fill placement during the 2024/25 Village of Bald Head Island beach fill project.

Tables 3.7 and **3.8** summarize the shoreline and volume changes measured during the April 2024 to October 2024 to May 2025 monitoring periods. **Photograph 3.3** depicts a northward looking view from Cape Fear of the East Beach shoreline taken in April 2025. **Figure 3.9** depicts the April 2024, October 2024 and May 2025 aerial photographs along East Beach.

During the April 2024 to October 2024 period, the East Beach shoreline gained approximately +39,400 cy above the MHWL and +37,400 cy below the MHWL for a net gain above -16 ft-NGVD of +76,800 cy. During this same period the backshore berm (at elevation +6 ft-NGVD) advanced by an average of +22.7 ft and the MHWL advanced by an average of +32.3 ft. These averages are skewed by the relatively large advancement at STA 224+80, the southernmost station along East Beach. At this station, the berm and MHWL advanced by +136.7 ft and +164.2 ft, respectively. After removing STA 224+80, the average shoreline advancement along East Beach was +3.7 ft at the berm and +10.2 ft at the MHWL.

During the October 2024 to May 2025 winter period, the East Beach shoreline lost approximately -51,600 cy above the MHWL and -26,400 cy below the MHWL for a net loss above -16 ft-NGVD of -78,000 cy. During this same period the berm receded by an average of -24.2 ft while the MHWL receded by an average of -4.8 ft. After removing STA 224+80, the average shoreline recession along East Beach was -2.5 ft at the berm and -0l9 ft at the MHWL.

Photograph 3.3:
Northward looking view from Cape Fear of the East Beach shoreline (April 2025 Photo).

[11] Profiles were not acquired at East Beach in the fall of 2009

Table 3.7: East Beach shoreline and volume changes between April 2024 and October 2024.

Station	Reach (FT)	Volume Change (CY) Above MHWL (+2.51 FT)	Above -16 FT		Shoreline Change (FT) Berm (+6 FT)	MHWL (+2.51 FT)
EB-1 (STA 224+80)					+136.7	+164.2
	1,000	+15,500	+24,700			
EB-2 (STA 234+80)					+13.1	+42.4
	1,000	+5,600	+14,100			
EB-3 (STA 244+80)					-15.8	-4.5
	1,000	+1,200	+8,500			
EB-4 (STA 254+80)					-15.7	-3.0
	1,000	+4,800	+14,400			
EB-5 (STA 264+80)					+14.3	+23.4
	1,000	+7,400	+13,100			
EB-6 (STA 274+80)					+14.7	+1.3
	1,000	+4,900	+2,000			
EB-7 (STA 284+80)					+11.3	+1.9
Total	**6,000**	**+39,400**	**+76,800**		**+22.7(AVG)**	**+32.3 (AVG)**

Table 3.8: East Beach shoreline and volume changes between October 2024 and May 2025.

Station	Reach (FT)	Volume Change Above MHWL (+2.51 FT)	Above -16 FT		Shoreline Change (FT) Berm (+6 FT)	MHWL (+2.51 FT)
EB-1 (STA 224+80)					-154.4	-28.1
	1,000	-13,700	-22,700			
EB-2 (STA 234+80)					-18.2	-26.2
	1,000	-13,800	-13,300			
EB-3 (STA 244+80)					+12.7	+10.3
	1,000	-3,800	-5,400			
EB-4 (STA 254+80)					+25.7	+14.9
	1,000	-5,500	-10,100			
EB-5 (STA 264+80)					-31.0	-31.8
	1,000	-10,800	-19,300			
EB-6 (STA 274+80)					+1.2	-0.6
	1,000	-4,000	-7,200			
EB-7 (STA 284+80)					-5.3	+27.9
Total	**6,000**	**-51,600**	**-78,000**		**-24.2 (AVG)**	**-4.8 (AVG)**

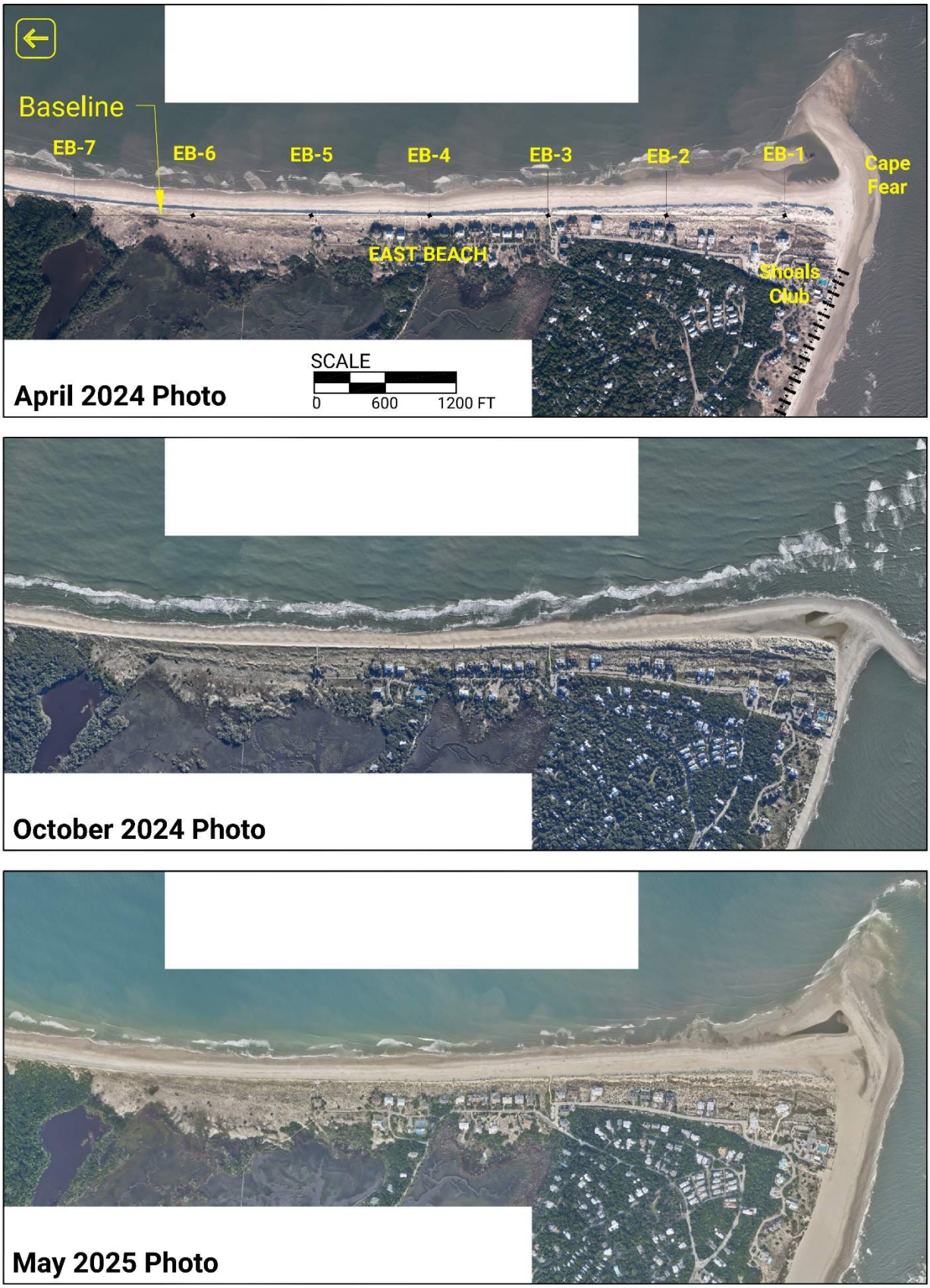

Figure 3.9: East Beach and Cape Fear aerial photography (April 2024/October 2024/May 2025).

Table 3.9 summarizes the volume changes measured over the entire period of survey record (November 2008 – May 2025). Over the 198-month period, the East Beach shoreline gained approximately +60,900 cy above the MHWL and +292,600 cy above the -16 ft-NGVD contour. During this same period the berm advanced by an average of +30.6 ft while the MHWL advanced by an average of +65.7 ft. After removing STA 224+80, the average shoreline advancement along East Beach was +26.5 ft at the berm and +44.2 ft at the MHWL.

As demonstrated by the survey and photographic data (**Figure 3.9**), the condition of East Beach has been and will continue to be not only seasonal but highly influenced by the configuration of the depositional spit and shoals associated with "Cape Fear Point". Variations in spit size and orientation over the 17 years (2008-2025) which are depicted by **Figure 3.10**. In its simplest sense, the Cape Fear spit is a highly dynamic feature which is influenced by sand supply originating from both the west (along South Beach) and the north (along East Beach). The Point is also highly susceptible to storm waves originating from *both* the west (Atlantic Ocean) and the east (Onslow Bay) and resultant tidal channels which episodically break through and subsequently influence localized patterns of sand deposition (or erosion).

Although the near-term locations of the Cape Fear spit have been beneficial to East Beach properties lying northward thereof, it has typically caused significant shoreline and dune recession seaward of the South Beach Shoals Club facility (see **Photograph 3.4ab**). That section of shorefront is monitored via beach profiles B-54 and B-55 (Sta. 214+00 and 218+00). Beach profile plots of these stations are available in **Appendix G** (**Figures G-71** & **G-72**). The Shoals Club lies approximately mid-way between these two survey stations. In the spring of 2022, the Shoals Club was required to construct a sandbag revetment along the existing scarp line seaward of the Club facility to preclude future losses of land and infrastructure. In 2025, modifications were made to the sandbag revetment configuration.

As a result of the 2024/25 Village of Bald Head Island beach fill project, the berm and MHWL were advanced by averages of +237.8 and +232.5 feet, respectively. As of the May 2025 monitoring survey, the berm and MHWL remains +215.7 and +204.4 feet seaward of the pre-construction location.

Photographs 3.4ab:
Shoreline conditions at the Shoals Club, pre- & post-construction of the 2024/25 Village of Bald Head Island Beach Fill Project.

Table 3.9: Volume changes along East Beach (Sta. 224+80 to 284+80).

Survey Period	Volume Change Above Datum (CY)		
	Above MHWL (+2.51 ft-NGVD)	Below MHWL to -16 ft-NGVD	Total Change Above -16 ft-NGVD
November 2008 to May 2009	+700	-65,600	-64,900
May 2009 to May 2010	-23,300	-8,600	-31,900
May 2010 to May 2011	+10,600	+18,000	+28,600
May 2011 to May 2012	+5,700	+87,700	+93,400
May 2012 to May 2013	+20,000	-41,600	-21,600
May 2013 to May 2014	+17,700	+105,200	+122,900
May 2014 to April 2015	-900	+44,100	+43,200
April 2015 to April 2016	+20,800	-400	+20,400
April 2016 to May 2017	+4,500	+38,200	+42,700
May 2017 to May 2018	+31,400	+25,000	+56,400
May 2018 to May 2019	+9,600	+140,300	+149,900
May 2019 to May 2020	-12,500	-76,100	-88,600
May 2020 to May 2021	-7,800	+7,400	-400
May 2021 to May 2022	-1,700	+14,300	+12,600
May 2022 to May 2023	-2,000	+20,400	+18,400
May 2023 to April 2024	+300	-87,600	-87,300
April 2025 to May 2025	-12,200	+11,000	-1,200
November 2008 to May 2025	**+60,900**	**+231,700**	**+292,600**

Figure 3.10: Cape Fear aerial photography (May 2008 to May 2025).

3.5 Row Boat Row Shoreline Conditions

The "Row Boat Row" shoreline was added to the island-wide beach monitoring program in November 2015. Survey data are collected at five (5) monitoring stations starting just north of the marina entrance and extending approximately 1,500 feet northward along the Cape Fear River facing shoreline (see **Figure 2.1**). Plots of these profiles are provided at the beginning of **Appendix G** (Figures G-1 to G-5). This reach of shoreline did not receive direct beach fill placement during the 2024/25 Village of Bald Head Island beach fill project.

In early 2017, after completion of a 26,000 cy beach fill by Marcol Dredging along the Row Boat Row shoreline, two detached rock breakwaters were constructed by Intra Coastal Marine Construction. Final acceptance of the project occurred in July 2017. Subsequently, the shorefront within the influence of the two shore parallel structures has equilibrated into a series fof discrete crenulate features between tombolos which extend from the center of each breakwater in a landward direction. **Photograph 3.5** depicts a northward looking view of this shoreline taken in April 2025.

Tables 3.10 and **3.11** summarize the shoreline and volume changes during the April 2024 – October 2024 – May 2025 monitoring period (13 months). During the April 2024 to May 2025, the shoreline experienced a net gain of roughly +500 cy (+0.3 cy/ft) above the MHWL and a loss -300 cy (-0.2 cy/ft) above -16 ft-NGVD. During the same period, the berm receded by an average of -9.3 ft while the MHWL advanced by an average of +4.4 ft.

Photograph 3.5:
Northward looking view of the Row Boat Row shoreline and detached breakwaters (April 2025 Photo).

Table 3.12 summarizes the volume changes measured over the entire survey period of record (November 2015 to May 2025). Over the 114-month period, the Row Boat Row shoreline lost roughly -12,600 cy (-8.0 cy/ft) above the MHWL and -23,800 cy (-15.1 cy/ft) above the -16 ft-NGVD contour. This includes the direct placement of approximately +26,000 cy in 2016/17. During the same period, the berm receded by an average of -27.9 ft while the MHWL receded by an average of -33.0 ft.

Table 3.10: Row Boat Row shoreline and volume changes between April 2024 and October 2024.

Station	Reach (FT)	Volume Change (CY)			Shoreline Change (FT)	
		Above MHWL (+2.51 FT)	Above -16 FT		Berm (+6 FT)	MHWL (+2.51 FT)
RB-01 (STA -018+72)					+0.7	+6.2
	400	+300	+200			
RB-02 (STA -014+72)					-6.0	-3.0
	272	-200	-600			
RB-03 (STA -012+00)					-12.4	-8.4
	400	-300	-1,300			
RB-04 (STA -008+00)					-8.7	+5.2
	400	+400	+1,100			
RB-05 (STA -004+00)					+9.9	+18.8
	100	+200	+600			
Marina						
Total	**1,572**	**+400**	**0**		**-3.3 (AVG)**	**+3.7 (AVG)**

Table 3.11: Row Boat Row shoreline and volume changes between October 2024 and May 2025.

Station	Reach (FT)	Volume Change (CY)			Shoreline Change (FT)	
		Above MHWL (+2.51 FT)	Above -16 FT		Berm (+6 FT)	MHWL (+2.51 FT)
RB-01 (STA -018+72)					-24.3	-29.3
	400	-1,200	-3,000			
RB-02 (STA -014+72)					-3.6	+1.0
	272	-200	-800			
RB-03 (STA -012+00)					+0.8	-2.0
	400	+800	+2,100			
RB-04 (STA -008+00)					-2.6	+34.1
	400	+700	+1,700			
RB-05 (STA -004+00)					-0.3	-0.7
	100	0	-300			
Marina						
Total	**1,572**	**+100**	**-300**		**-6.0 (AVG)**	**+0.6 (AVG)**

Table 3.12: Row Boat Volume Change since November 2015.

Survey Period	Months	Volume Change (CY)		
		Above MHWL (+2.51 FT)	Below MHWL to -16 f-NGVD	Total Change Above -16 ft-NGVD
November 2015 to April 2016	5	-3,200	-3,300	-6,500
April 2016 to May 2017	13	+8,400	+8,000	+16,400
May 2017 to May 2018	12	-14,500	+2,000	-12,500
May 2018 to May 2019	12	-1,400	-4,800	-6,200
May 2019 to May 2020	12	-1,700	-1,200	-2,900
May 2020 to May 2021	12	+6,800	-1,400	+5,400
May 2021 to May 2022	12	-5,700	-3,100	-8,800
May 2022 to May 2023	12	-100	-1,800	+1,700
May 2023 to April 2024	11	-1,700	-8,400	-10,100
April 2024 to May 2025	13	+500	-800	-300
Total	**114**	**-12,600**	**-11,200**	**-23,800**

4. Jay Bird Shoals Borrow Area Monitoring (Survey) Results

4.1 2024/25 Borrow Area

Pre- and post-construction bathymetric surveys of the borrow area were conducted concurrent with the beach profile surveys. The pre-construction borrow area survey was performed on November 7, 2024, approximately 35 days prior to initiation of dredging activities within the borrow area. The post-construction survey was conducted on March 7, 2025, approximately 3 days following the cessation of dredging activities. Both surveys were performed by Gahagan & Bryant Associates, Inc.

Figures 4.1 and **4.2** present the seabed elevation contours for the pre- and post-construction surveys, respectively. Based upon the post-construction survey, the Contractor did *not* exceed the design depth (-22 ft-NGVD) plus 2 ft tolerance (-24 ft-NGVD). The pre-construction seabed elevations ranged from –4.8 ft-NGVD to -18.4 ft-NGVD, with an average seabed elevation of -9.9 ft-NGVD. The post-construction seabed elevations ranged from -7.1 ft-NGVD to -24.0 ft-NGVD, with an average seabed elevation of -19.5 ft-NGVD.

Figure 4.3 depicts the pre- to post-construction seabed elevation change. Based upon these surveys, roughly 1,122,800 cy of material was excavated from within the borrow area limits. This is within about 6 percent of the Contractor's measured BD/AD total beach placement volume of 1,052,400 cy. Some of these differences may be attributable to natural changes within the expansion borrow area. The next survey of the borrow area is scheduled for the Year 1 monitoring in event in the spring of 2026.

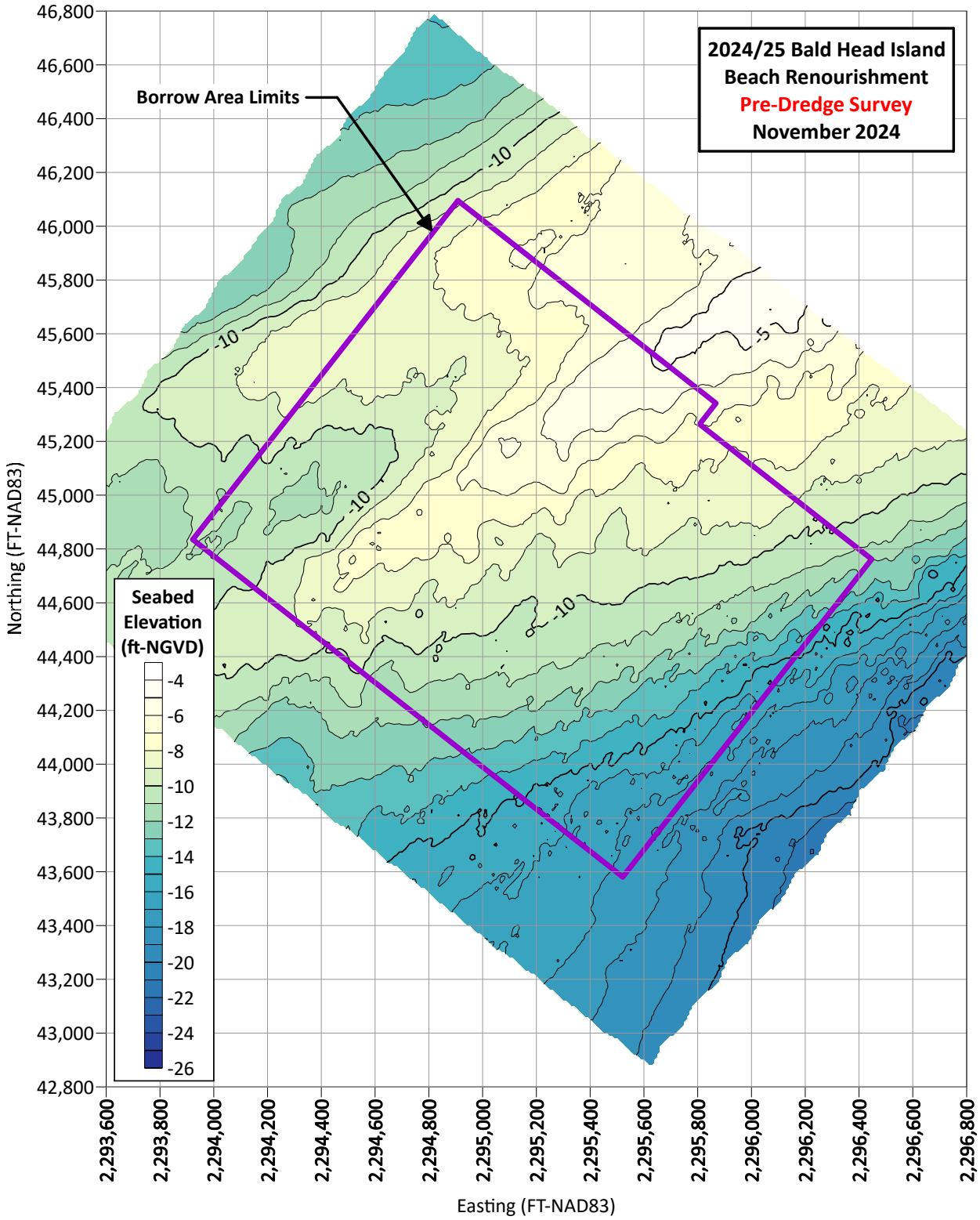

Figure 4.1: Pre-dredge borrow area bathymetry (November 2024), 2024/25 Bald Head Island Beach Renourishment Project.

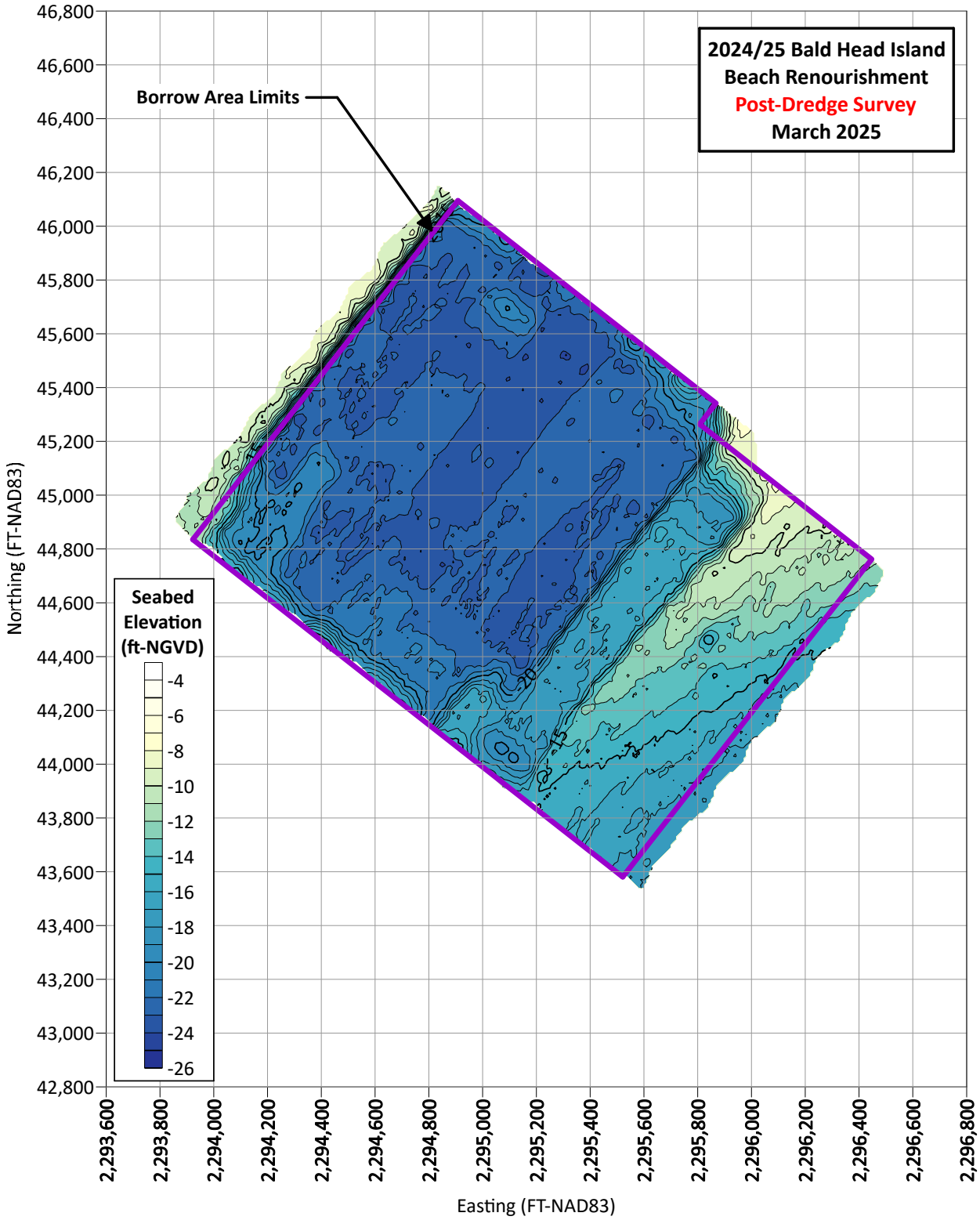

Figure 4.2: Post-dredge borrow area bathymetry (March 2025), 2024/25 Bald Head Island Beach Renourishment Project.

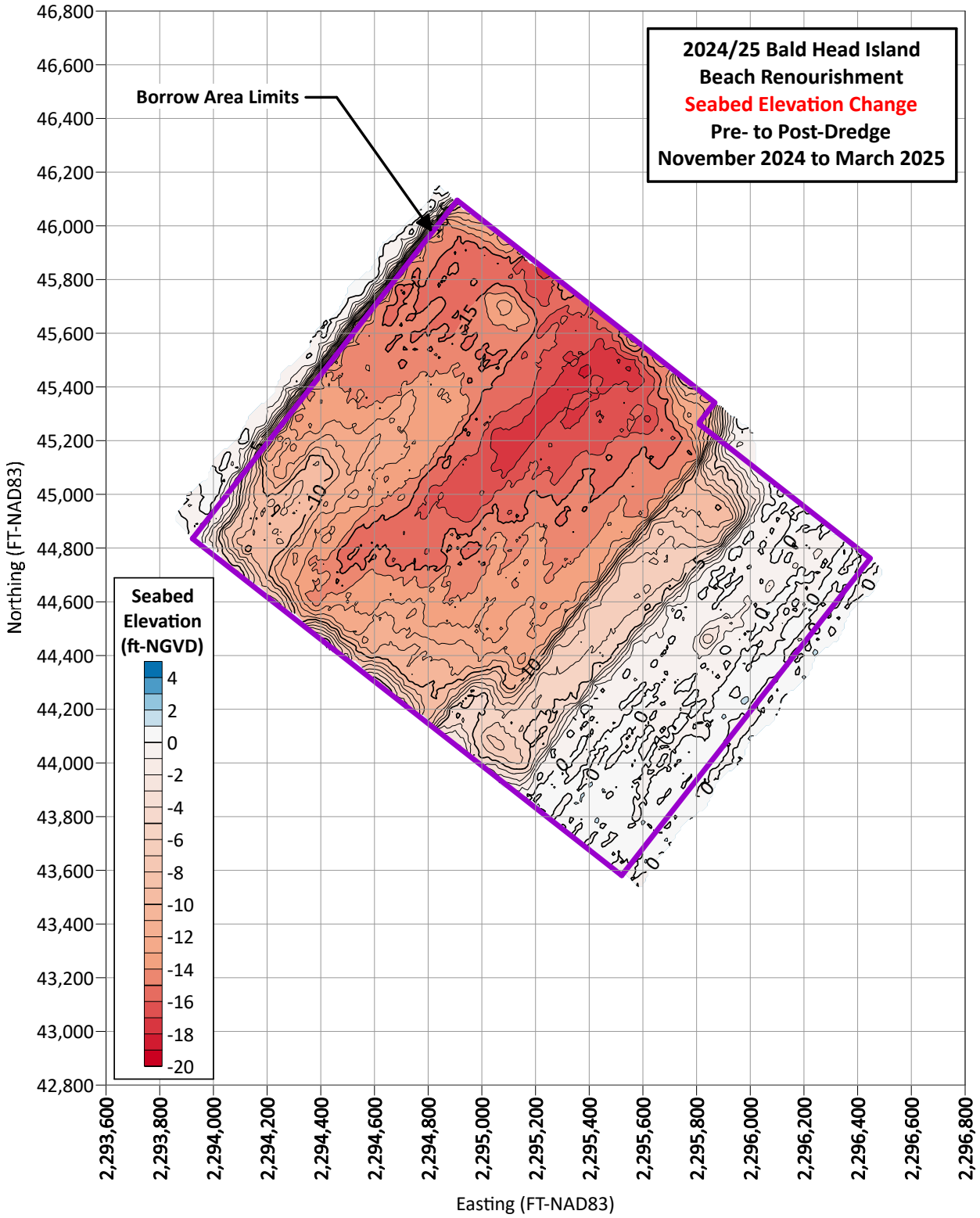

Figure 4.3: Pre- to post-dredge borrow area seabed elevation changes, 2024/25 Bald Head Island Beach Renourishment Project.

4.2 2009/10 & 2019 Borrow Area

Pursuant to permit requirements for the 2009/10 project, the original Jay Bird Shoal borrow area has been surveyed for purposes of monitoring its recovery. Approximately 1.8 Mcy of material was excavated during the 2009/10 project and 1.1 Mcy during the 2019 project.

Figure 4.4 depicts the most recent borrow area (October 2024) seabed elevations of the previously used borrow area. This plot represents conditions approximately 5.5 years post-2019 project and 14.5 years post-2009/10 project conditions. In the plot, the full permitted borrow area limits are shown. The permitted limits are further subdivided into three sub-areas. For the 2009/10 project, only portions of Area 1 and Area 3 were excavated. For the 2019 project, only portions of Area 2 and Area 3 were excavated. Also plotted in the figure are the locations of two dredging exclusion zones[12] (both located in Area 3) and a 200 ft tide gage buffer zone (Area 1 & 2). No excavation was conducted within either the exclusion or buffer zones during the 2009/10 and 2019 projects.

Figure 4.5 depicts the seabed elevation change during the most recent survey period (left plot, April 2024 to October 2024) and the 14.5 years (177 months) since 09/10 project construction to the most recent survey (right plot, March 2010 to October 2024).

Table 4.1 summarizes the volume changes within the permitted borrow area limits between the monitoring surveys conducted since constriction of the 2009/10 project. During the most recent survey period (April 2024 to October 2024), the entire permitted borrow area gained +125,300 cy (including the exclusion and buffer zones). Within just the 2019 project excavated areas (Areas 2 & 3), the borrow area gained +117,500 cy. Within just these areas, the average seabed elevation decreased from -18.5 ft-NGVD to -18.1 ft-NGVD over this period.

Table 4.2 summarizes the volume of material theoretically remaining above the permitted cut elevation (-22 ft-NGVD) by survey date and sub-area. These volumes are exclusive of the exclusion and buffer zones shown in **Figure 4.4**. As of October 2024, there are approximately +1,479,800 cy of material theoretically available within the permitted borrow area limits above -22 ft-NGVD. A portion of this is undredged. Another portion is depositional. However, none of it is suitable in depth for purposes of excavation by an ocean certified dredge.

[12] By permit, no work was allowed within 150 feet and 100 feet of two potential shipwreck sites located within the Jay Bird Shoals borrow area.

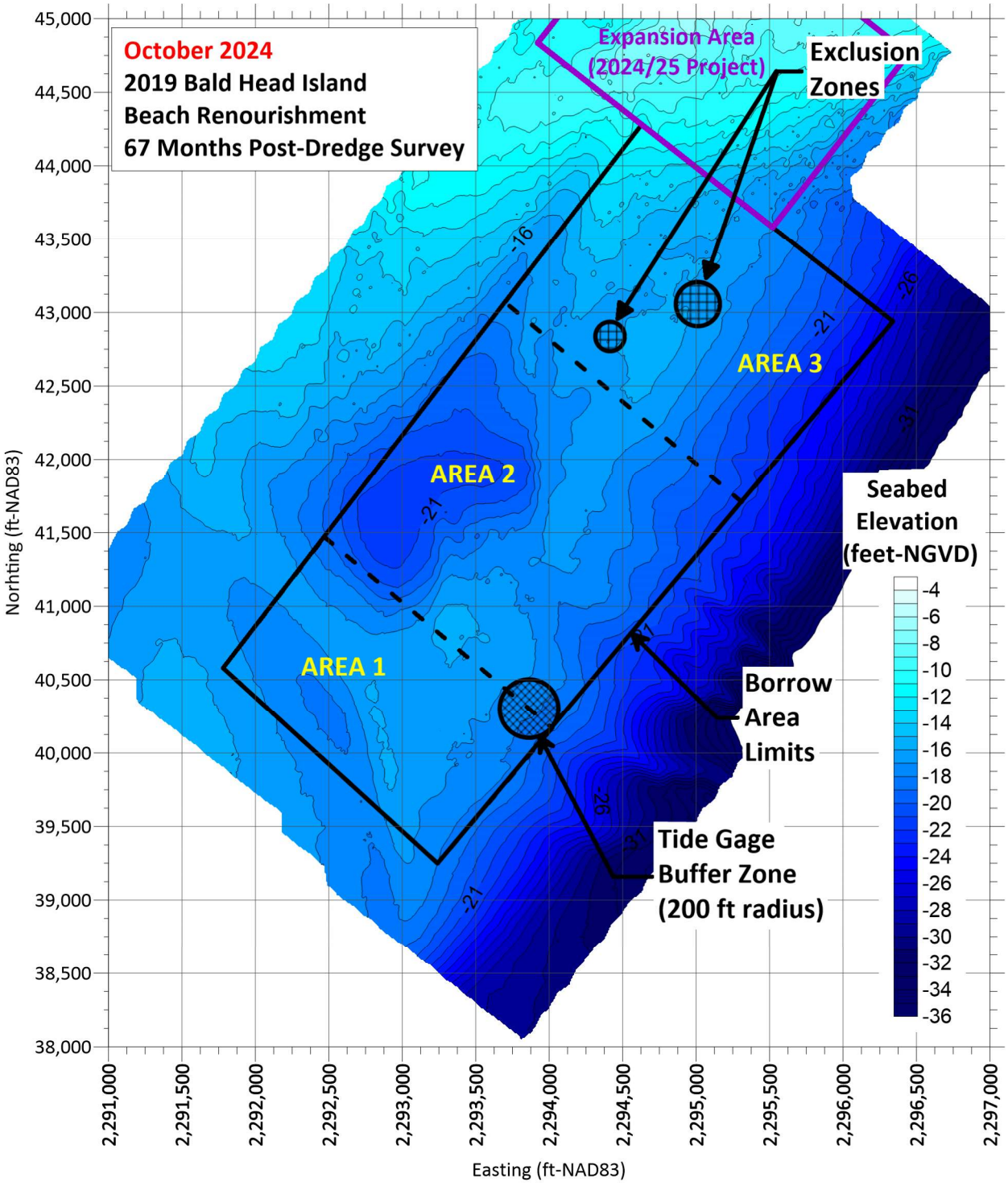

Figure 4.4: October 2024 conditions of the Jay Bird Shoals borrow area used for the 2009/10 and 2019 renourishment projects.

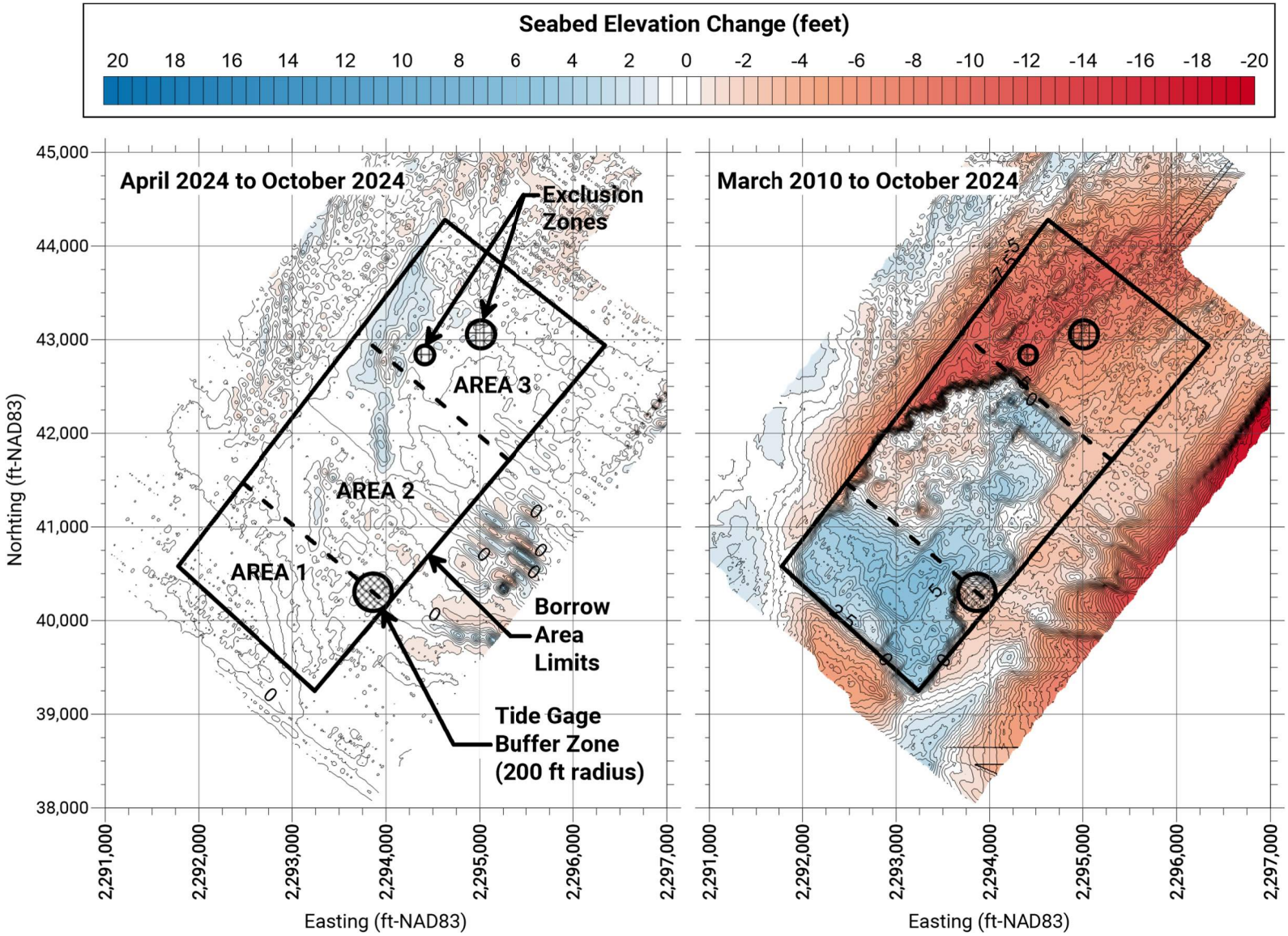

Figure 4.5: Seabed elevation changes within borrow area used for the 2009/10 and 2019 renourishment projects.

Table 4.1: Jay Bird Shoals borrow area volume changes *(PERMITTED LIMITS)*.
(The 2009/10 and 2019 periods of excavation are highlighted in green)

Survey Period	Duration	Volume Change (CY)		
		Gross Gain	Gross Loss	Net Change
October 2009 to March 2010 (Construction)	5 months	+52,700	-1,888,400	-1,835,700
March 2010 to May 2011 (Year 1 Post-Construction)	14 months	+307,200	-104,800	+202,400
May 2011 to May 2012 (Year 2 Post-Construction)	12 months	+112,700	-107,200	+5,500
May 2012 to May 2013 (Year 3 Post-Construction)	12 months	+178,700	-77,600	+101,100
May 2013 to April 2015 (Years 4 & 5 Post-Construction)	23 months	+286,000	-217,100	+68,900
April 2015 to May 2017 (Years 6 & 7 Post-Construction)	25 months	+144,900	-328,500	-183,600
May 2017 to May 2018 (Year 8 Post-Construction)	12 months	+136,800	-71,400	+64,400
May 2018 to September 2018	4 months	+24,400	-246,300	-221,900
September 2018 to December 2018	3 months	+188,700	-5,400	+183,300
December 2018 to March 2019 (BD/AD 18/19 Project)	3 months	+63,700	-1,229,300	-1,165,600
March 2019 to May 2020 (Year 1 Post-2018/19)	14 months	+239,200	-105,600	+133,600
May 2020 to May 2021 (Year 2 Post-2018/19)	12 months	+199,000	-121,800	+77,300
May 2021 to May 2022 (Year 3 Post-2018/19)	12 months	+150,300	-11,800	+138,500
May 2022 to May 2023 (Year 4 Post-2018/19)	12 months	+56,000	-39,700	+16,300
May 2023 to April 2024 (Year 5 Post-2018/19)	11 Months	+47,800	-75,200	-27,400
April 2024 to October 2024 (Most recent survey period)	6 Months	+136,700	-11,400	+125,300
Since 2009/10 Construction (March 2010 to October 2024)	177 months	**+2,272,100**	**-2,753,100**	**-481,900**
Since 2018/19 Construction (March 2019 to October 2024)	67 months	**+829,000**	**-365,500**	**+463,600**

Table 4.2: Jay Bird Shoals borrow area theoretical volume available above -22 ft-NGVD. (The 2009/10 and 2019 periods of excavation are highlighted in green)

Survey	Volume above -22 ft-NGVD (CY)			
	Area 1	**Area 2**	**Area 3**	**Total**
October 2009 (Pre-2009/10 Excavation)	812,200	1,593,100	1,330,000	**3,735,300**
March 2010 (Post-2009/10 Excavation)	89,100	540,900	1,291,600	**1,921,600**
May 2011 (1 Year Post-2009/10)	157,900	685,600	1,275,500	**2,119,000**
May 2012 (2 Years Post-2009/10)	154,900	734,400	1,237,900	**2,127,200**
May 2013 (3 Years Post-2009/10)	186,300	844,000	1,200,200	**2,230,500**
April 2015 (5 Years Post-2009/10)	232,300	992,800	1,081,500	**2,306,600**
May 2017 (7 Years Post-2009/10)	289,300	942,100	898,800	**2,130,200**
November 2017 (7.5 Years Post-2009/10)	297,400	969,600	923,000	**2,190,000**
May 2018 (8 Years Post-2009/10)	315,200	966,400	912,800	**2,194,400**
September 2018 (8.5 Years Post-2009/10)	318,600	862,600	800,000	**1,981,200**
December 2018 (Pre-2018/19 Excavation)	355,000	945,200	858,900	**2,159,100**
March 2019 (Post-2018/19 Excavation)	398,700	332,900	286,200	**1,017,800**
May 2020 (1 Years Post-2019 Project)	383,000	356,600	410,900	**1,150,500**
May 2021 (2 Years Post-2019 Project)	387,700	379,000	464,000	**1,230,700**
May 2022 (3 Years Post-2019 Project)	407,400	447,700	508,000	**1,363,100**
May 2023 (4 Years Post-2019 Project)	406,500	464,200	509,300	**1,380,000**
April 2024 (5 Years Post-2019 Project)	401,700	468,700	490,000	**1,360,400**
October 2024 (5.5 Years Post-2019 Project)	409,500	519,600	550,700	**1,479,800**

5. Ongoing and Planned or Proposed Activities

5.1 Oak Island & Jay Bird Shoals Borrow Area Post-Construction Monitoring

Between November 2024 and March 2025, the Village of Bald Head Island constructed a 1.052 Mcy beach fill along two segments of South Beach. On average, the berm and mean high water line advanced seaward by about 120 ft, mol. Simultaneously, the thirteen (13) structure sand-tube groin field was replaced under a separate contract. The project borrow area for the beach fill was an expansion of a portion of a previously developed Jay Bird Shoal area (ref. CAMA 9-14 and SAW-2012-00040).

As a result of borrow area expansion, the Village of Bald Head Island as permittee, was required to reestablish a Technical Advisory Committee (TAC) and initiate monitoring of the easternmost end of Oak Island (within the Town of Caswell Beach). Both the beach surveys and aerial photography components of an agreed upon Oak Island Monitoring Plan were initiated in the spring of 2025, concurrent with similar island-wide monitoring activities at Bald Head Island. The latter included annual surveys of the expanded borrow area in Jay Bird Shoals dredged for the 2024/25 beach fill.

5.2 Re-inititation of a Permit for a Frying Pan Shoals Borrow Area

In early 2017, the Village of Bald Head Island submitted permit applications with associated in-depth geotechnical studies and environmental analyses necessary to develop a long-term (and large scale) borrow area located within Frying Pan Shoals. The purpose of such a borrow area was to ensure compliance with Permit conditions necessitating the maintenance of the updrift fillet associated with the 2015 terminal groin project and to allow for large-scale beach renourishment of South Beach. Historically, sand placement from an alternate area has been required to supplement the scheduled temporal gap in the disposal of channel maintenance sand on Bald Head Island by the Wilmington District, USACE. In conflict with the previously described fundamental tenets of the Wilmington Harbor Sand Management Plan, all beach quality channel maintenance material to be excavated in the fall of 2025 is to be placed on Oak Island. This action will necessitate a borrow area for excavation and fill placement by the Village during the upcoming nominal 6-year disposal cycle.

In June 2017, the National Marine Fisheries Service (NMFS) issued concerns related to permits associated with the near-term use of the Frying Pan Shoals (FPS) borrow area *without first exploring and exhausting other viable sand source alternatives*. Realistically, the only alternate borrow area available for near-term sand placement at Bald Head Island was sand remaining in the previously permitted Jay Bird Shoals (JBS) borrow area. Accordingly, in consideration of the NMFS request, the Village agreed to withdraw their existing application and prioritize the use of the previously authorized borrow area. With the virtual depletion of the expanded JBS borrow area, resulting from the 2024/25 renourishment project, the Village plans to reinitiate the permitting of a long-term area located within Frying Pan Shoals before the end of the year.

5.3 Wilmington Harbor Deepening Project

In 2019, the Port of Wilmington, NC sponsored the formulation of a Section 203 Report which proposed a plan to deepen and widen (in places), the federal navigation project which extends from the Atlantic Ocean up the Cape Fear River to the Port of Wilmington. The Village of Bald Head Island had formally submitted comments to the record which address deficiencies in the project analyses and which requested clarification of impacts addressed or unaddressed by the consultant prepared report. In September 2025, the Wilmington District, USACE published a Draft Letter Report and Draft EIS for the Wilmington Harbor Section 403, Wilmington Harbor Navigation Project, Wilmington, North Carolina. As part of the 45 day public review process, the Village submitted comments for the record.

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