TAYLOR ENGINEERING, INC.

Volusia County Countywide Beach Profile and Inlet Survey 2024

Volusia County, FL

December 2024

10199 Southside Boulevard, Suite 310
Jacksonville, Florida 32256
904-731-7040 | www.taylorengineering.com

Volusia County Countywide Beach Profile and Inlet Survey 2024
Volusia County, FL

Prepared for

Volusia County

Task Assignment No. 30, PC3470, RSQ No. 20-SQ-175IF

by
Taylor Engineering, Inc.
10199 Southside Blvd., Suite 310
Jacksonville, FL 32256
(904) 731-7040

December 2024

Taylor Project Number: C2024-035

Report production team: Nicole McClain, P.E.; Natalie Lamb, P.G.; Kyle Rumaker, E.I.; Wendy K. Laurent, P.E.; Christopher Bender, Ph.D., P.E., BC.CE

TABLE OF CONTENTS

1 INTRODUCTION 1

1.1 Overview 1

1.2 Report Organization 2

2 DATA COLLECTION 5

2.1 Nourishment History 5

2.2 Survey History 8

2.2.1 Beach Profile Surveys 8

2.2.2 Ponce de Leon Inlet Surveys 9

2.3 Tidal Datums 11

3 BEACH PROFILE SURVEY RESULTS 11

3.1 Overview 11

3.2 Shoreline Positions 13

3.2.1 2019 Baseline Condition (July 2019) versus 2024 Condition (August – October 2024) 13

3.2.2 2022 Post-Nicole Condition (November 2022) versus 2024 Condition (August – October 2024) 13

3.2.3 2023 Condition (October 2023) versus 2024 Condition (August – October 2024) 14

3.3 Beach Volume Changes 16

3.3.1 2019 Baseline Condition (July 2019) versus 2024 Condition (August – October 2024) 16

3.3.2 2022 Post-Hurricane Nicole Condition (November 2022) versus 2024 Condition (August – October 2024) 17

3.3.3 2023 Condition (October 2023) versus 2024 Condition (August – October 2024) 17

4 PONCE DE LEON INLET BATHYMETRIC ANALYSIS 22

5 SUMMARY 32

REFERENCES 33

APPENDIX A Beach Profile Plots
APPENDIX B Reference Monument Data and 2024 Profile Extent
APPENDIX C MHW Contours on 2024 Aerials
APPENDIX D MHW Shoreline Positions
APPENDIX E Beach Volume Change
APPENDIX F 2024 Beach Monitoring Photographs
APPENDIX G Trap Bag Analysis

LIST OF FIGURES

Figure 1.1 Volusia County Location Map ... 4
Figure 4.1 Ponce de Leon Inlet Subareas ... 25
Figure 4.2 2017, 2022, and 2024 Ponce de Leon Shoreline Position ... 26
Figure 4.3 2017 Topo/Bathymetry at Ponce de Leon Inlet ... 27
Figure 4.4 2022 Topo/Bathymetry at Ponce de Leon Inlet ... 28
Figure 4.5 2024 Topo/Bathymetry at Ponce de Leon Inlet ... 29
Figure 4.6 2017-2024 Bathymetry Changes at Ponce de Leon Inlet ... 30
Figure 4.7 2022-2024 Bathymetry Changes at Ponce de Leon Inlet ... 31

LIST OF TABLES

Table 1.1 Volusia County Seaside Communities ... 2
Table 2.1 Volusia County Beach Fill Placement History (FDEP, 2023; FDEP, 2024c; FDEP, 2024e) ... 7
Table 2.2 FDEP Beach Profile Survey History ... 9
Table 2.3 Ponce de Leon Inlet Survey History ... 11
Table 2.4 FDEP MHW Elevations for Volusia County ... 11
Table 3.1 Average MHW Shoreline Change by Community ... 15
Table 3.2 Average Volume Change by Community (cubic yards/foot) ... 19
Table 3.3 Total Volume Change by Community (cubic yards) ... 20
Table 4.1 2017 – 2024 Ponce de Leon Inlet Volume Changes ... 24
Table 4.2 2022 – 2024 Ponce de Leon Inlet Volume Changes ... 24

1 INTRODUCTION

This report presents the results of a countywide beach profile and inlet survey, conducted between April and October of 2024, to characterize the evolution of Volusia County's (County) beaches and the Ponce de Leon Inlet (Inlet). This study is a part of the County's annual monitoring effort that began in 2019. Since 2019, the County has been taking a proactive role in monitoring and managing their beaches and Inlet through a comprehensive beach and inlet hydrographic monitoring program; the monitoring provides critical data for documenting beach and inlet condition changes and assists in the management of these valuable resources. Additionally, in 2024, the County began a study to assess the current risks to the County's shoreline and evaluate the feasibility of different management strategies. The County contracted Taylor Engineering to complete the feasibility study, which is scheduled for completion in 2025. Of note, the U.S. Army Corps of Engineers (USACE) authorized a federal feasibility study in 2006 for the Volusia County Shore Protection Project, although it has yet to be funded.

This report, prepared for the County, presents the 2024 countywide beach profiles and shoreline positions with comparisons to the 2019 baseline condition, the 2022 post-Hurricane Nicole condition, and the 2023 condition. Notably, these comparisons represent the shoreline prior to Hurricane Milton, which further eroded the County's shoreline in October 2024; a separate letter report, anticipated in early 2025, will discuss Hurricane Milton's impacts to the County's beaches. The 2019 survey collected data countywide to establish a baseline condition for future beach assessments and monitoring. The 2023 and 2024 surveys collected data countywide to capture the significant morphology changes to the beach in the wake of the active 2022 Hurricane season. Interim data collection efforts (2020, 2021, and 2022) surveyed beach profiles at all monuments in the Ponce de Leon Inlet area of influence (R-120 to R-170) and every third monument elsewhere throughout the County. Notably, this report does not include comparisons to any of the interim data collection efforts; however, the analysis does include a comparison to the post-Hurricane Nicole data. Taylor Engineering extracted profiles from the USACE Joint Airborne LiDAR Bathymetry Technical Center of Expertise (JALBTCX) post-event LiDAR data collected in November 2022, approximately 2-3 weeks following Hurricane Nicole.

1.1 OVERVIEW

Volusia County is located south of Flagler County and north of Brevard County along the central-east coast of Florida. The County encompasses 42 miles of Atlantic Ocean shoreline, with just under three miles in North Peninsula State Park, located at the northern County extent and managed by the Florida Department of Environmental Protection (FDEP), and just under five miles encompassed by the Canaveral National Seashore and managed by U.S. National Park Service at the southern County border. FDEP, pursuant to rule 62B-36.002(5), Florida Administrative Code (F.A.C.), defines a critically eroded shoreline as:

> *A segment of the shoreline where natural processes or human activity have caused or contributed to erosion and recession of the beach or dune system to such a degree that upland development, recreational interests, wildlife habitat, or important cultural resources are threatened or lost. Critically eroded shorelines may also include peripheral segments or gaps between identified critically eroded areas which, although they may be stable or slightly erosional now, their inclusion is necessary for continuity of management of the coastal system or for the design integrity of adjacent beach management projects.*

As of 2024, FDEP defined 27.2 miles of the County's shoreline as critically eroded, 2 miles as non-critically eroded, and 0.6 miles of critically eroded inlet shoreline. Critically eroded shorelines encompass FDEP reference monuments R-0 to R-4, R-24 to R-33, R-51 to R-143, R-148 to R-149 (inlet north bank), and R-160.8 to R-207.8. R-143 to R-148.2 and portions of Canaveral National Seashore are listed as non-critically eroded (FDEP, 2024a).

Historically, the most erosive events within the County include Hurricane Dora (1964); the November and December Nor'easters of 1981; the Thanksgiving Day Storm of 1984; Hurricanes Floyd and Irene (1999); Tropical Storm Gabrielle (2001); Hurricanes Charley, Frances, and Jeanne (2004); Hurricanes Ophelia and Wilma (2005); Subtropical Storm Andrea, the October Nor'easters, and Tropical Storm Noel (2007); Hurricane Matthew (2016); Hurricane Irma (2017); Hurricane Dorian (2019); numerous Nor'easters in 2020/2021, 2022; and Hurricanes Ian and Nicole (2022; FDEP, 2023). Notably, in October 2024, Hurricane Milton induced erosion along the County's shoreline as it made its way across the Florida peninsula. Surveyors collected the data associated with this report between August and October, before Hurricane Milton impacted the County; thus, the 2024 survey dataset represents the pre-storm conditions. As such, the County contracted Taylor Engineering to conduct a small, unmanned aircraft system (sUAS) aerial survey of the County's beaches to document post-Hurricane Milton conditions; this survey and the impacts of Hurricane Milton will be documented in a separate letter report.

Figure 1.1 and **Table 1.1** present an overview of the County and its coastal municipalities—this breakdown of the coast is consistent with past reports and is based on political boundaries. These segments assist in presenting community trends and allow for comparisons to previous monitoring activities. It should be noted that the community trends could be defined based on coastal processes, but these boundaries would be dynamic and could change from year to year, making comparisons challenging.

Table 1.1 Volusia County Seaside Communities

Community	Bounding R-Monuments	Critically Eroded Shoreline (FDEP, 2024a)
North Peninsula	R-0 to R-16	R-0 to R-4
Ormond-by-the-Sea	R-16 to R-47	R-24 to R-33
Ormond Beach	R-47 to T-67	R-51 to R-67
Daytona Beach and Daytona Beach Shores	T-67 to R-122	R-67 to R-122
Wilbur-by-the-Sea	R-122 to R-128	R-122 to R-128
Ponce Inlet	R-128 to R-148	R-128 to R-143; R-148.2 to R-148.8 (Inlet North Bank)
New Smyrna Beach	R-149 to R-185	R-160.8 to R-185
Silver Sands and Bethune Beach	R-185 to T-208	R-185 to R-207.8
Canaveral National Seashore Park*	T-208 to R-234	None

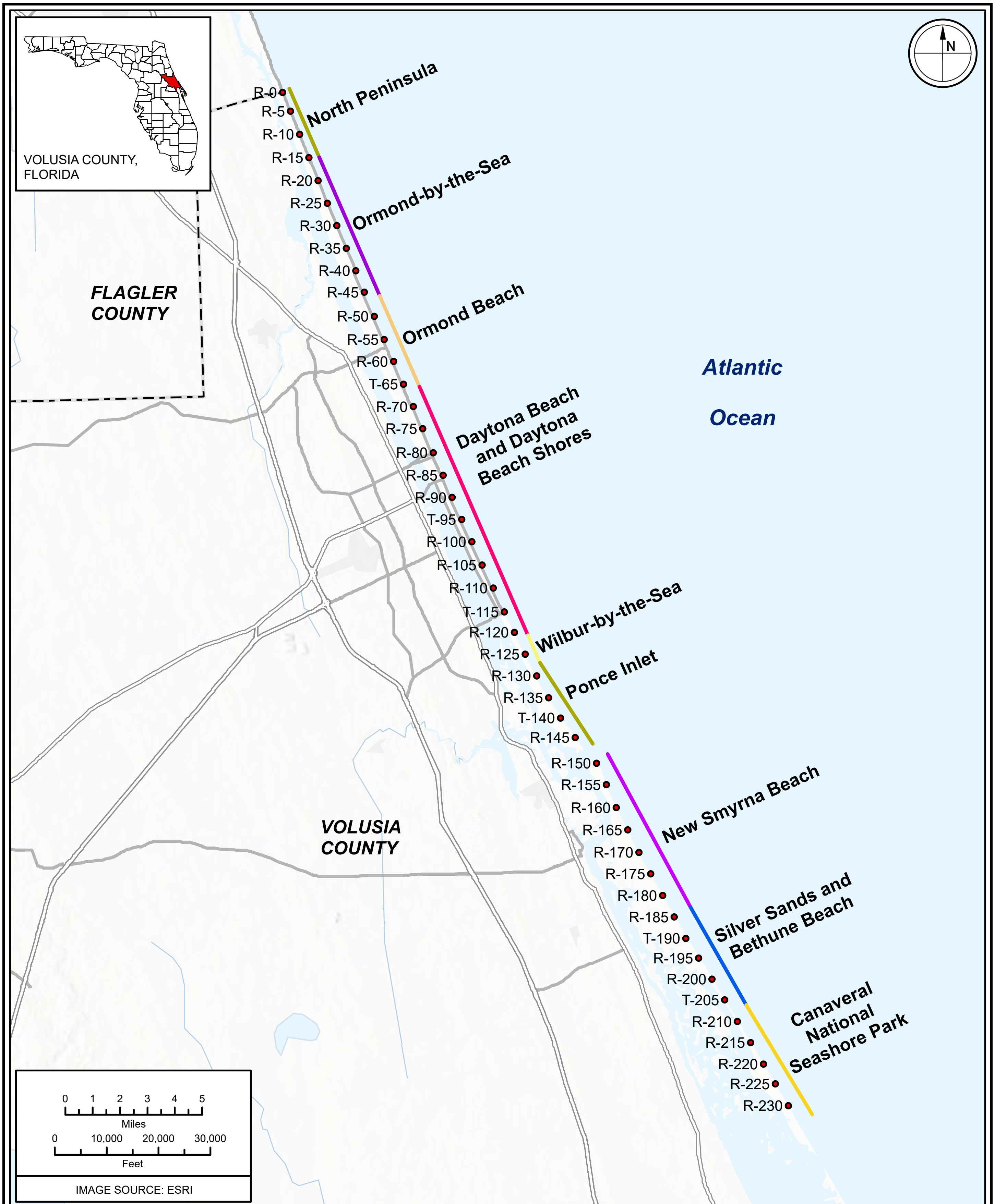
* Federally managed and not included within County monitoring efforts

1.2 Report Organization

Following this introduction, Section 2.0 reviews the countywide nourishment history, provides details (e.g., date and location) of available beach surveys, and presents the tidal datums defined by FDEP for the County. Section 3.0 presents the results of the Mean High Water (MHW) shoreline change and volume change analyses by community. Section 4.0 provides a bathymetric analysis of Ponce de Leon Inlet. Section 5.0 summarizes this study, and a list of references completes the report.

Appendix A contains beach profile plots of the 2019, 2022 post-Nicole, 2023, and 2024 surveys from monuments R-0 to T-208. Appendix B presents a table of the FDEP reference monument coordinates, elevation, and associated profile azimuth. Appendix C contains 2024 aerial photos overlaid with surveyed MHW contours for 2019, 2022 post-Nicole, 2023, and 2024. Appendix D provides the MHW shoreline positions and changes in tabular and graphical formats, while Appendix E illustrates volume changes in tabular and graphical formats. Appendix F presents the 2024 monitoring photographs.

Following Hurricanes Ian and Nicole in 2022, the County provided optional shoreline stabilization through placement of beach compatible sediment within geotextile cubes known as trap bags; this method aims to stabilize upland escarpments, prevent further erosion, and provide support to areas where seawalls have failed. As an addition to this annual monitoring report, Appendix G provides a brief analysis on the success of the use of trap bags to help stabilize these vulnerable stretches of shoreline.



TAYLOR ENGINEERING INC. 10199 SOUTHSIDE BOULEVARD SUITE 310 JACKSONVILLE, FL 32256 CERTIFICATE OF AUTHORIZATION # 4815	VOLUSIA COUNTY BEACH AND INLET MONITORING	PROJECT	C2024-065
	FIGURE 1.1 VOLUSIA COUNTY LOCATION MAP	DRAWN BY	WL & PL
		SHEET	1 of 1
		DATE	DEC 2024

L:\2024\C2024-017 Volusia Co Feasibility Assessment\GIS\APRX\VolusiaData.aprx

2 DATA COLLECTION

2.1 NOURISHMENT HISTORY

Aside from the 2006 and the upcoming 2025 emergency dune restorations to the north and south of the Inlet, bypassing efforts involving the beneficial use of dredge materials from the Inlet comprise the majority of placement events in Volusia County. The County, USACE, and the Florida Inland Navigation District (FIND) have conducted numerous regional sediment management (RSM) beach fill operations, placing material both north and south of Ponce de Leon Inlet as recommended in the IMP. These placement events contribute to the proper management of the Inlet and its adjacent beaches. **Table 2.1** documents the dredging history of the Inlet since 1973, including projects that placed dredge materials in the nearshore region as well as within the Inlet itself. Historically, the RSM projects placed sediment on both the subaerial and subaqueous portions of the beach—the exact placement area is often determined by the current conditions and the requirements within the active permits.

Between 2014 and 2023, all sediment bypassing events placed material in the nearshore area south of the Inlet. Recognizing the bypassing goals, the County permitted the placement area north of the Inlet to include the nearshore and subaerial beach. The two most recent beneficial use projects occurred in 2019 and 2023—in 2019, USACE placed sediment from Ponce de Leon Inlet in the south nearshore region of R-158 to R-166, and in 2023 USACE placed sediment from the Inlet in the nearshore region of R-125 to R-148 (FDEP, 2020; Brantley, 2023). Of note, nearshore placement may provide increased protection and indirectly nourish the beach through cross-shore sediment transport or the redistribution of sediment from the nearshore towards or onto the subaerial beach; however, although trends may indicate accretion of sediment on the subaerial beach, no one has studied the fate of the placed material and the effectiveness of this nourishment method for this site within Volusia County.

Following the 2004 hurricane season and the impacts of Charley, Frances, and Jeanne, the County undertook a dune restoration project in 2006. This project encompassed a 5.2-mile-long segment of beach, extending from R-161 to R-189 within New Smyrna Beach. The project placed approximately 745,000 cy of sediment sourced from the FIND dredge material management area (DMMA) MSA-434 and an additional 22,000 cy of material sourced from FIND DMMA V-26 (Taylor Engineering, 2007; FDEP, 2023).

In 2024, the County submitted permits for two regional sediment management projects. Similar to the 2006 New Smyrna Beach dune restoration project, the first beneficial use project includes the placement of a minimum of 500,000 cy of sand between R-160.5 and R-191.5 with material originating from Rattlesnake Island (FIND site MSA 434/434C South; FDEP, 2024b). The beach template includes a variable dune crest at +10 ft-NAVD88 with a 1V:10H foreshore slope; in areas where the landward dune extent cannot tie into existing elevations, it features a 1V:4H slope. The second project is a beneficial use of dredged material project and involves pumping approximately 1,000,000 cy of beach compatible material from the federal channel onto the beach to form a stockpile between R-139 and R-145 (FDEP, 2024c). The County will then truck sand from the stockpile up the beach, placing it on the beaches to the north between R-66 and R-145. The proposed beach template includes a berm at +10 ft-NAVD88 that varies in width and ties into the existing elevations at 1V:10H. The berm shall tie into upland features and have a uniform shore-parallel extent (FDEP, 2024d).

At the County's northernmost extent, the Florida Department of Transportation (FDOT) is actively constructing a secant wall and an associated dune restoration within North Peninsula State Park and Ormond Beach (R-0 to R-5 and R-25 to R-32; FDEP, 2024e). Additionally, approximately 1 mile north of the Flagler County/Volusia County line, the USACE and Flagler County completed the initial nourishment of the Flagler County Coastal Storm Risk Management project in September 2024, a beach fill project that placed approximately 1.7 million cy of sand from an offshore borrow area. The template features a dune at +19 ft-NAVD88 and a 140 ft sloping berm from +11 ft-NAVD88. The USACE anticipates that this project will be renourished on an 11-year interval (USACE, 2024). Sand from this large-scale project area may result in positive, downdrift impacts for Volusia County and should be considered when analyzing the health of the County's beaches.

Table 2.1 Volusia County Beach Fill Placement History (FDEP, 2023; FDEP, 2024c; FDEP, 2024e)

Date	Volume (cubic yards)	Dredging Location	Placement Location
1973	120,204	Ponce de Leon Inlet	North Offshore
1974	433,751	Inlet/South Shoal	North Spit Breach Closure
1974	89,167	Ponce de Leon Inlet	North Beach
1975	138,009	Ponce de Leon Inlet	North Offshore
1976	12,515	Ponce de Leon Inlet	North Offshore
1976	137,936	Ponce de Leon Inlet	North Offshore
1978	40,821	Ponce de Leon Inlet	North Offshore
1978	434,558	Ponce de Leon Inlet	North Beach
1984	82,212	Ponce de Leon Inlet	North Beach
1985	899,996	Ponce de Leon Inlet	North Beach
1989	868,967	Ponce de Leon Inlet	North Beach
1994	214,700	IWW	North Bank
1999	32,000	IWW	South Beach Nearshore
2005	115,339	Ponce de Leon Inlet	North Beach
2006	766,000	DMMA (MSA 434/434C)	R-161 to R-187 dunes
2008	432,073	IWW	South Beach Nearshore
2009	137,008	Ponce de Leon Inlet	North Beach
2011	30,000	Ponce de Leon Inlet	South Beach Nearshore
2012	51,160	Ponce de Leon Inlet	North Beach Nearshore
2013	141,600	Ponce de Leon Inlet	North Beach Nearshore
2014	46,170	Ponce de Leon Inlet	South Beach Nearshore
2015	130,215	Ponce de Leon Inlet	South Beach Nearshore
2017	34,850	Ponce de Leon Inlet	South Beach Nearshore
2018	16,080	Ponce de Leon Inlet	South Beach Nearshore
2019	410,047	Ponce de Leon Inlet and IWW	South Beach Nearshore
2023	60,676	Ponce de Leon Inlet and IWW	North Beach Nearshore
2025*	~500,000+	DMMA (MSA 434/434C)	R-160.5 to R-191.5 dunes
2025*	~1,000,000	Ponce de Leon Inlet	R-66 to R-145
Total (excluding anticipated projects)**: 5,876,054 cubic yards**			

*Projects pending

2.2 SURVEY HISTORY

As previously mentioned, since 2019, the County has been taking a more proactive role in monitoring and managing their beaches and inlet through a comprehensive beach and inlet hydrographic monitoring program; the monitoring provides critical data for documenting beach and inlet condition changes and assists in the management of these valuable resources. This study is part of the County's annual monitoring efforts which began in 2019. Historic shoreline comparisons and detailed information for the 2019-2023 data are found in the following reports: Taylor Engineering, 2019; Taylor Engineering, 2020a; Taylor Engineering, 2021; Taylor Engineering, 2022; Taylor Engineering, 2023a. Additionally, Taylor Engineering, 2023b and Taylor Engineering, 2023c document the impacts of Hurricanes Ian and Nicole.

2.2.1 BEACH PROFILE SURVEYS

Volusia County, FDEP, and USACE have sponsored the collection of beach profile data throughout the County. **Table 2.2** summarizes the timeline for the beach profile datasets available through FDEP's Beach Profile Network; it should be noted that the survey extents vary, and some surveys are limited (every third monument, wading depth, etc.). The 2019 survey acts as the baseline for this and future analyses simply due to it being the first in this annual monitoring effort. Appendix A contains beach profile plots of the 2019, 2022 post-Nicole, 2023, and 2024 survey data for each monument throughout the study area.

Notably, the 2024 survey, performed between August and October before the passing of Hurricane Milton, does not capture the current, post-storm conditions of the shoreline. Additionally, the seaward extent of the USACE JALBTCX post-Nicole LiDAR data collected in November 2022 is limited due to the LiDAR's penetration below the water surface and averages -6.4 ft-NAVD88 across the examined profiles; the extent for each individual profile can be found in Appendix B. Throughout the County, only seven of the post-Nicole profiles extend slightly beyond the -15 ft-NAVD88 contour with none extending below -16 ft-NAVD88. Additionally, sharp changes in elevation are not captured well due to the resolution of the LiDAR and its' grid size—an example of where this commonly occurs is at the landward extent of a profile where a seawall or pool is located.

Appendix B lists the monument locations, associated profile azimuths, and alongshore distances for each beach profile used in this study, along with the extent for each individual profile for the November 2022 post-Nicole data. These monuments are part of an extensive network of survey control points that FDEP (formerly the Florida Department of Natural Resources) established and has maintained since the early 1970s. FDEP currently maintains these monuments, which serve as consistent base points to originate beach profile surveys. For consistency, the MHW shoreline position analysis references the monument locations in Appendix B.

Table 2.2 FDEP Beach Profile Survey History

Dates	Monuments
June 1972	R-1 to R-234
July 1984	R-1 to R-234
September 1987	R-1 to R-234
June 1988	R-0 to R-234
May 1989	R-1 to R-234
August 1993	R-1 to R-234
February 1997	R-57 to R-207
June 2001	R-130 to R-165
August 2003	R-1 to R-234
August 2003	R-2 to R-234
May 2004	R-161 to R-193
November 2004	R-161 to R-193
November 2005	R-155 to R-195
September 2006	R-155 to R-195
October 2007	R-149 to R-229
December 2007	R-1 to R-148
October 2011	R-1 to R-169
September 2014	R-1 to R-209
June 2016[1]	R-0 to R-234
November 2016[1]	R-0 to R-234
July 2017	R-0 to R-234
September 2017[1]	R-0 to R-234
July 2019	R-0 to R-208
July 2020[2]	R-0 to R-208
October 2021[2]	R-0 to R-208
August 2022[2]	R-0 to R-208
November 2022 (Post-Nicole)[1]	R-0 to R-208
October 2023	R-0 to R-208
August – October 2024	R-0 to R-208
October – November 2024[1]	R-0 to R-208
November-December 2024[1]	R-16 to R-208

[1]Extracted from LiDAR or sUAS data, limited offshore extent

[2]Interim Survey- collected data at all monuments in the inlet area of influence and every 3rd monument elsewhere

2.2.2 PONCE DE LEON INLET SURVEYS

Historically, Volusia County and USACE sponsor the collection of inlet bathymetric data at Ponce de Leon Inlet. **Table 2.3** summarizes the timeline for the inlet datasets available; notably, some of the surveys only include certain inlet features and often then extent limit hydrographic analyses. The County is currently completing an assessment of the inlet and adjacent waterways to quantify shoaling and investigate the compatibility of the sediment within the shoals to the beach, it is anticipated that this report will be released in early 2025. Previous Inlet studies are listed below:

- **Volusia County Interim Countywide Beach Profile and Inlet Survey, Taylor Engineering, 2022–** This monitoring effort analyzed the 2017 and 2022 Inlet survey data and determined significant accretion occurred in the Inlet complex during the five-year monitoring period despite two dredging operations.

- **Ponce de Leon Inlet Sediment Budget Update, Taylor Engineering, October 2019 revised July 2020 and Ponce de Leon Inlet Management Plan, Florida Department of Environmental Protection, September 2020–** Taylor Engineering completed an update for the Ponce de Leon sediment budget in 2019/2020. The study analyzed three periods: 1986/87 to 2001, 2001 to 2017, and 1986/87 to 2017. During each time period, the subaerial dry beaches to the north and south accreted, demonstrating the benefit of the Inlet's sediment back- and by-passing efforts. As a result of the updated sediment budget, FDEP published the Ponce de Leon Inlet Management Plan, which updates the Inlet's goals and strategies to accomplish them.

- **Sediment Budget Update Ponce de Leon Inlet and Adjacent Beaches, Taylor Engineering, 2003–** Taylor Engineering presented comparisons between the 1986/1987, 1994, and 2001 surveys; the report documented deficiencies in the 1993 and 1994 beach profile surveys that prohibited an accurate representation of the conditions.

- **Ponce de Leon Inlet, Florida, Site Investigation, USACE, 1999–** The USACE initiated the Coastal Inlets Research Program (CIRP) in 1993, and Ponce de Leon Inlet was the first site approved for field study. The long-term comprehensive monitoring program began in September 1995 and continued through October 1997. At the site, the CIRP collected: wave height, wave period, wave direction, water levels, current velocity, and wind velocity. The study also investigated the Inlet's bathymetry, sediment characteristics, and captured aerial imagery. The USACE, outlined additional Inlet surveys collected in May 1925, August 1943, July 1994, October 1944, September 1995, October 1996, August 1997, September 1997, and December 1997; however, the data is not currently available (King et al., 1999).

- **Ponce de Leon Inlet Management Plan, Taylor Engineering, March 1994–** The first Inlet Management Plan for Ponce de Leon Inlet evaluated the morphologic and hydraulic conditions before and after the construction of the Inlet. The study determined that the Inlet increased erosion at the adjacent beaches and outlined recommendations to mitigate the adverse effects of the Inlet construction.

Table 2.3 Ponce de Leon Inlet Survey History

Dates	Description	Surveyor
September 1986	Inlet	U.S. Coast and Geodetic Survey and USACE
April 1990	Inlet	U.S. Coast and Geodetic Survey and USACE
January 1992	Inlet Channel	USACE
July 1994	Inlet Channel	USACE
June 2001	Inlet, Flood Shoal, Ebb Shoal	Morgan & Eklund
August 2017	Inlet, Flood Shoal, Ebb Shoal	Morgan & Eklund
September 2022	Inlet, Flood Shoal, Ebb Shoal	Morgan & Eklund
April 2024	Inlet Channel and Flood Shoal	Morgan & Eklund
August 2024	Inlet Ebb Shoal	Morgan & Eklund

2.3 Tidal Datums

This study applied the MHW elevations defined by FDEP for the County (obtained via FDEP mhwrequest, personal communications, 2019). Notably, multiple MHW elevations span the County's expansive length of shoreline. **Table 2.4** presents the MHW elevation in ft, referenced to NAVD88, and the associated stretch of shoreline as defined by FDEP and applied in this study.

Table 2.4 FDEP MHW Elevations for Volusia County

R-Monument	Elevation (feet-NAVD88)
R-0 to R-20	+1.4
R-21 to R-80	+1.3
R-81 to R-163	+1.2
R-164 to R-234	+1.1

3 BEACH PROFILE SURVEY RESULTS

3.1 Overview

Project monitoring generally includes analyses of topographic and bathymetric data to determine the evolution of Volusia County's beaches over time. This analysis investigates two common beach evolution parameters— changes to the shoreline position and profile volume within the study area. Taylor Engineering evaluated changes to the parameters both between and at FDEP R-monument transect locations to compare the gross scale spatial and temporal evolution of the beach, including alongshore and cross-shore changes. Alongshore changes occur between FDEP R-monument transects and show broad, community-wide, and countywide trends, while cross-shore changes occur along the R-monument transects and show localized trends.

Calculating the distance from a given point (the reference monument) to a known elevation tracks the change in shoreline position. This analysis uses the MHW elevation, which varies from +1.1 to +1.4 ft-NAVD88 from north to south across the study area as described in Section 2.3, to track the shoreline position.

Tracking volumes between reference monuments (spatially) and surveys (temporally) provides a historical perspective of the project's evolution and performance. The volume analysis for this report segregates cross-shore volumes into the following vertical compartments: dune to MHW, MHW to -15 ft-NAVD88, and below -15 ft-NAVD88 to the profile extent. Changes above MHW represent variations to the subaerial or dry beach— the area the public typically considers the beach. Changes below MHW, also called subaqueous changes, indicate the volume remaining below the water surface and still within the active profile. The MHW to -15 ft-NAVD88 compartment represents the most dynamic area with significant changes in the position and elevation of the offshore bar. Below -15 ft-NAVD88, bathymetry changes are usually less pronounced, and historic profiles typically converge to common elevations; we refer to this offshore limit where no significant changes occur to the bottom elevation and sediment exchange is limited as the depth of closure.

Notably, specifying a finite depth of closure applicable across the entire monitoring domain proved difficult for this countywide dataset. The profiles become steeper (deeper offshore depths for a finite distance offshore) as the distance from the ebb shoal increases. Thus, for a set distance offshore, a flatter profile (closer to the ebb shoal) extends to a shallower depth than one further away from the ebb shoal. The profiles at R-150 to R-153, just south of the inlet, do not extend deeper than -20 ft-NAVD88, whereas many of the profiles further to the north and south extended beyond -40 ft-NAVD88 (see profile plots in Appendix A). The following volume analysis used the full data extents, applying the maximum offshore survey extent at each profile as the offshore limit of volume calculations.

As mentioned in Section 1.1, the County's beaches are divided into nine coastal communities; this monitoring report analyzes eight of the nine regions spanning from R-0 to T-208 and excludes the federally managed Canaveral National Seashore. A weighted average procedure incorporates the alongshore (controlling) distance between monuments. This weighted average, applied to the MHW and volume analyses, establishes a comparative basis between alongshore segments of beach. In general, a monument's controlling distance extends between the halfway points of adjacent monuments. Exceptions to this rule occur at the north and south ends of the monitoring area and at Ponce de Leon Inlet. At R-0 and T-208, the controlling distances extend only halfway towards the adjacent monument within the monitoring area. Surrounding Ponce de Leon Inlet, the controlling distances extend to the adjacent jetty.

The following shoreline and beach volume analyses compare the 2019, 2022 post-Nicole, and 2023 surveys to the 2024 monitoring survey. Appendix A contains beach profile plots of the survey data at each monument within the study area.

3.2 SHORELINE POSITIONS

Changes in the MHW shoreline position demonstrate the alongshore and cross-shore evolution of the beach monitoring area. Viewing MHW shoreline positions on recent aerial photographs of the monitoring area provides a convenient way to qualitatively evaluate the evolution and performance of the beach. Appendix C presents the July 2019, November 2022, October 2023, and August – October 2024 MHW shorelines on aerial photography of the County. The MHW lines derive from the contour positions along the monument profiles and straight lines connect the contour positions between monuments. The figures also include the coastal construction control line (CCCL) for reference.

Appendix D presents the MHW shoreline positions as a function of distance from each monument for the July 2019, November 2022, October 2023, and August – October 2024 conditions and the MHW shoreline position changes for the three comparison periods. A positive value represents seaward shoreline advance while a negative value represents landward shoreline retreat. **Table 3.1** summarizes the weighted average shoreline change results for each Volusia County coastal community.

3.2.1 2019 BASELINE CONDITION (JULY 2019) VERSUS 2024 CONDITION (AUGUST – OCTOBER 2024)

The comparison of the 2019 MHW shoreline position and 2024 MHW shoreline position indicates significant average shoreline retreat throughout Volusia County with extreme retreat occurring from Ormond Beach to Ponce Inlet. Of note, Hurricane Ian (September 2022) and Hurricane Nicole (November 2022) induced catastrophic erosion throughout the County, including the loss of infrastructure and large portions of the existing protective dune system (Taylor Engineering, 2023b; Taylor Engineering, 2023c). Similar to what was reported for the 2019-2020, 2019-2021, 2019-2022, and 2019-2023 comparisons (Taylor Engineering, 2020a; Taylor Engineering, 2021; Taylor Engineering, 2022; Taylor Engineering, 2023a), Daytona Beach and Daytona Beach Shores experienced the greatest shoreline retreat since 2019, averaging 109 ft of retreat across these communities. The average shoreline retreat generally decreases throughout the communities to the north and south of Daytona Beach and Daytona Beach Shores. Notably, this community primarily consists of seawalls immediately upland from the beach, and many seawall failures occurred as a result of the 2022 hurricane season. Overall, the MHW shoreline position retreated an average of 56 ft across the County since 2019.

3.2.2 2022 POST-NICOLE CONDITION (NOVEMBER 2022) VERSUS 2024 CONDITION (AUGUST – OCTOBER 2024)

Although the comparison of the 2019 shoreline position to the 2024 shoreline position demonstrates significant recession throughout the County, the comparison of the 2022 post-Nicole MHW shoreline position and 2024 MHW shoreline position shows that average shoreline advancement occurred across all communities, except in Ormond Beach where near neutral shoreline retreat occurred (-1 ft). The shoreline advance observed during this comparison period indicates the seaward movement of the MHW contour and suggests post-storm recovery of the beach following Hurricanes Ian and Nicole. The largest average community advance occurred in the communities of Ponce Inlet (94 ft), Wilbur-by-the-Sea (59 ft), New Smyrna Beach (50 ft), and Daytona Beach and Daytona Beach Shores (47 ft). Notably, in the summer of 2023, USACE dredged approximately 60,700 cy of sediment from the Intracoastal Waterway (IWW) and the Inlet and placed the material in the nearshore placement area north of the Inlet (R-125 to R-148). The significant shoreline advancement at Ponce Inlet might be related to the nearshore placement event;

however, without more detailed monitoring it is difficult to infer this. Overall, the MHW shoreline position advanced an average of 37 ft across the County.

3.2.3 2023 CONDITION (OCTOBER 2023) VERSUS 2024 CONDITION (AUGUST – OCTOBER 2024)

Comparison of the 2023 MHW shoreline position to the 2024 MHW shoreline position reveals average shoreline retreat from North Peninsula to Daytona Beach and Daytona Beach Shores and average shoreline advance from Wilbur-by-the-Sea to Silver Sands and Bethune Beach. In the communities where average shoreline advance occurred, the shoreline advance is less than that of the 2022 post-Nicole to 2024 comparison suggesting continued post-storm recovery from Hurricanes Ian and Nicole. However, the communities in the County's northern extent all experienced minor to moderate retreat of the MHW shoreline position suggesting that post-storm recovery and the onshore movement of sediment is no longer controlling in those communities. Overall, the County's shoreline advance and retreat over the past year was net-neutral, averaging an advance of 1 ft across the County.

Table 3.1 Average MHW Shoreline Change by Community

2019 – 2024 Average MHW Shoreline Change by Community				
Community	**MHW Elevation Range (feet-NAVD88)**	**July 2019 to August – October 2024 Average MHW Shoreline Change (feet)**	**November 2022 to August – October 2024 Average MHW Shoreline Change (feet)**	**October 2023 to August – October 2024 Average MHW Shoreline Change (feet)**
North Peninsula – R-0 to R-16	+1.4	-29.0	16.2	-3.2
Ormond-by-the-Sea – R-16 to R-47	+1.4 to +1.3	-38.9	9.9	-7.9
Ormond Beach – R-47 to T-67	+1.3	-71.2	-0.6	-27.3
Daytona Beach and Daytona Beach Shores – T-67 to R-122	+1.3 to +1.2	-108.9	47.3	-3.9
Wilbur-by-the-Sea – R-122 to R-128	+1.2	-88.8	59.3	3.5
Ponce Inlet – R-128 to R-148	+1.2	-40.1	94.2	31.8
New Smyrna Beach – R-149 to R-185	+1.2 to +1.1	-28.3	50.3	6.6
Silver Sands and Bethune Beach – R-185 to T-208	+1.1	-7.7	22.3	12.8
Volusia County Study Area – R-0 to R-208	**+1.4 to +1.1**	**-56.2**	**37.4**	**0.7**

3.3 BEACH VOLUME CHANGES

As discussed in Section 3.1, beach volume changes indicate beach evolution and performance. Taylor Engineering calculated volume changes at each monument within the following vertical compartments: dune to MHW, MHW to -15 ft-NAVD88, and below -15 ft-NAVD88 (extending offshore to the maximum common survey extent at each monument for each survey comparison). The total volume above MHW represents the subaerial or dry beach, while below MHW changes represent the subaqueous portion of the beach.

Appendix E presents beach volume changes on a monument-by-monument basis for each volume compartment. **Table 3.2** provides an overview of the weighted average volume change by community presented in units of cubic yards per foot of shoreline (cy/ft) and **Table 3.3** presents the values in cubic yards (cy). Of note, extending the volume calculations offshore to the maximum common survey extent at each monument for each survey comparison, as opposed to limiting the calculations to a consistent distance offshore (e.g., 3,000 ft offshore), results in volume changes that reflect the available data to the greatest degree possible.

Data shortcomings that should be noted include the offshore extent of the November 2022 post-Hurricane Nicole LiDAR data (Appendix B). Due to the limited extent of the November 2022 data, the volume changes are calculated between only above and below MHW for the 2022 post-Nicole to 2024 comparison period. These data limitations are further detailed in Section 2.2.1.

3.3.1 2019 BASELINE CONDITION (JULY 2019) VERSUS 2024 CONDITION (AUGUST – OCTOBER 2024)

The 2019 to 2024 volume change analysis documents the countywide beach volume changes over the past five years. Looking at a county-wide scale, the County experienced an average net accretion of 27 cy/ft. Like the 2023 monitoring effort, significant sediment accretion occurred beyond the -15 ft-NAVD88 contour, averaging 42 cy/ft. Moderate erosion occurred in both volume compartments above -15 ft-NAVD88.

Looking on a monument-by-monument basis, the subaerial beach volumes fluctuate primarily between moderate to significant erosion at nearly all monuments throughout the communities north of the Inlet. Volume changes above MHW to the south of the Inlet indicate mixed minor to moderate erosion and accretion occurred throughout the communities. The most significant erosion of the subaerial beach occurred just south of Ponce Inlet, while the largest stretch of accretion occurred in the Silver Sands and Bethune Beach community. Below MHW and above -15 ft-NAVD88, erosion primarily occurred throughout the County with minimal net accretion occurring within North Peninsula and Ormond-by-the-Sea. The greatest average erosion occurred in Wilbur-by-the-Sea and Ponce Inlet with both communities experiencing significant erosion between MHW and -15 ft-NAVD88. Beyond the -15 ft-NAVD88 contour, accretion dominated throughout all communities; the most significant sediment gain occurred just north of the Inlet in the Ponce Inlet community. Evident in the profile plots (Appendix A), and similar to findings in the 2023 monitoring, the sediment gain experienced beyond -15 ft-NAVD88 is likely a result of the shifting and redistribution of offshore sandbars, the subaerial, and the nearshore beach as a result of the 2022 hurricane season.

Overall, accretion controlled the profile extent throughout the monitoring area for the 2019-2024 period due to the extreme accretion below the -15 ft-NAVD88 contour. Moderate erosion controlled the comparison period above the -15 ft-NAVD88 contour; however, the significant accretion beyond the -15 ft-NAVD88 contour outweighed the erosion experienced in the subaerial and nearshore beach.

3.3.2 2022 POST-HURRICANE NICOLE CONDITION (NOVEMBER 2022) VERSUS 2024 CONDITION (AUGUST – OCTOBER 2024)

The 2022 post-Nicole to 2024 volume change analysis documents the countywide beach volume changes and recovery following Hurricanes Ian and Nicole. During this time, the County experienced net accretion averaging approximately 10 cy/ft. Notably, the volume analysis for this comparison period is limited to an average extent of -6.4 ft-NAVD88 and does not include the significant offshore movement witnessed in the previous comparison. The seaward extent is limited due to the resolution of the USACE JALBTCX post-Nicole LiDAR data; the extent for each individual profile can be found in Appendix B. Notably, there are some locations where sharp elevation changes are not captured well due to the resolution of the LiDAR data. The County primarily experienced accretion across the profiles, with the volume compartment above MHW gaining 7.0 cy/ft and the volume compartment below MHW gaining 3 cy/ft.

Taking a closer look at each community, minor to moderate accretion control the subaerial beach trends at nearly all monuments. Each community experienced average accretion above MHW, and the greatest accretion occurred in the two communities just north of the Inlet (Wilbur-by-the-Sea and Ponce Inlet). Below MHW, mixed minor to moderate accretion and erosion occurred throughout the County. The greatest average accretion occurred in Silver Sands and Bethune Beach, while the greatest erosion occurred in Ponce Inlet and Wilbur-by-the-Sea. Due to the limited seaward extent of the post-Nicole LiDAR data, very few profiles extend to or beyond the -15 ft-NAVD88 contour and are thus not included within this summary. Similar to what was reported in the 2023 Volusia County Countywide Beach Profile Survey Report (McClain, Laurent, Bender, and Marino, 2023), the total changes indicate minor to moderate accretion occurred during the comparison period, suggesting continued post-storm recovery of the beach.

3.3.3 2023 CONDITION (OCTOBER 2023) VERSUS 2024 CONDITION (AUGUST – OCTOBER 2024)

The 2023 to 2024 volume change analysis documents the countywide beach volume changes over the past year. On a county-wide scale, the County experienced net erosion averaging -16 cy/ft, and similar to the 2019 comparison, the majority of the sediment loss occurred below the -15 ft-NAVD88 contour. Above the -15 ft-NAVD88 contour, a mixture of erosion and accretion occurred throughout the communities with minor accretion controlling on the countywide scale (averaging less than 1 cy/ft above MHW and 2 cy/ft between MHW and the -15 ft-NAVD88 contour).

Taking a closer look at the data reveals subaerial beach volume trends fluctuate between minor erosion and accretion throughout the County. The communities of Wilbur-by-the-Sea and Ponce Inlet experienced the largest average accretion. Below MHW and above -15 ft-NAVD88, beach volume trends again fluctuate between erosion and accretion; however, the magnitude of the fluctuations are much larger indicating significant changes are occurring in the nearshore as the beach continues to recover. Beyond the -15 ft-NAVD88 contour, erosion controlled, with significant movement of sand within North Peninsula, Ormond-by-the-Sea, Daytona Beach and Daytona Beach Shores, Wilbur-by-the-Sea, and Ponce Inlet.

Analyzing the profile extent for the 2023 – 2024 comparison period, erosion controlled every community except for Silver Sands and Bethune Beach where on average minor accretion occurred. Although accretion controlled the volume compartments above the -15 ft-NAVD88 contour, the significant sand movement below the -15 ft -NAVD88 contour contributed to an overall net loss in beach volume over the past year.

Table 3.2 Average Volume Change by Community (cubic yards/foot)

July 2019 to August-October 2024 Average Volume Change by Community

Community	Average Volume Change above MHW (cubic yards/foot)	Average Volume Change MHW to -15 feet-NAVD88 (cubic yards/foot)	Average Volume Change -15 feet-NAVD88 to Profile Extent (cubic yards/ foot)	Total Average Volume Change (cubic yards/foot)
North Peninsula – R-0 to R-16	-7.8	1.4	18.6	12.2
Ormond-by-the-Sea – R-16 to R-47	-6.7	2.9	24.0	20.2
Ormond Beach – R-47 to T-67	-7.0	-5.7	49.2	36.6
Daytona Beach and Daytona Beach Shores – T-67 to R-122	-10.1	-9.6	47.8	28.1
Wilbur-by-the-Sea – R-122 to R-128	-11.9	-35.1	58.7	11.7
Ponce Inlet – R-128 to R-148	-15.8	-28.7	77.4	32.9
New Smyrna Beach – R-149 to R-185	-6.5	-5.1	22.7	11.1
Silver Sands and Bethune Beach – R-185 to T-208	0.4	-0.5	56.5	56.3
Volusia County Study Area	**-7.9**	**-7.4**	**42.0**	**26.7**

November 2022 to August-October 2024 Average Volume Change by Community

Community	Average Volume Change above MHW (cubic yards/foot)	Average Volume Change MHW to -15 feet-NAVD88 (cubic yards/foot)	Average Volume Change -15 feet-NAVD88 to Profile Extent (cubic yards/foot)	Total Average Volume Change (cubic yards/foot)
North Peninsula – R-0 to R-16	2.5	-2.5	-	0.1
Ormond-by-the-Sea – R-16 to R-47	1.6	8.0	-	9.6
Ormond Beach – R-47 to T-67	5.6	-0.8	-	4.8
Daytona Beach and Daytona Beach Shores – T-67 to R-122	8.1	1.3	-	9.4
Wilbur-by-the-Sea – R-122 to R-128	12.2	-7.9	-	4.4
Ponce Inlet – R-128 to R-148	15.9	-7.9	-	8.1
New Smyrna Beach – R-149 to R-185	9.1	7.5	-	16.6
Silver Sands and Bethune Beach – R-185 to T-208	3.1	14.5	-	17.6
Volusia County Study Area	**7.0**	**3.2**	**-**	**10.1**

October 2023 to August-October 2024 Average Volume Change by Community				
Community	**Average Volume Change above MHW (cubic yards/foot)**	**Average Volume Change MHW to -15 feet-NAVD88 (cubic yards/foot)**	**Average Volume Change -15 feet-NAVD88 to Profile Extent (cubic yards/foot)**	**Total Average Volume Change (cubic yards/foot)**
North Peninsula – R-0 to R-16	-1.8	15.4	-31.8	-18.2
Ormond-by-the-Sea – R-16 to R-47	-1.5	17.3	-35.2	-19.5
Ormond Beach – R-47 to T-67	-1.9	11.4	-13.5	-4.0
Daytona Beach and Daytona Beach Shores – T-67 to R-122	0.1	-3.6	-16.5	-20.0
Wilbur-by-the-Sea – R-122 to R-128	3.8	-16.0	-31.2	-43.4
Ponce Inlet – R-128 to R-148	5.2	-8.9	-29.8	-33.5
New Smyrna Beach – R-149 to R-185	0.6	-4.5	-4.0	-7.9
Silver Sands and Bethune Beach – R-185 to T-208	1.6	3.3	-2.9	1.9
Volusia County Study Area	**0.4**	**2.1**	**-18.2**	**-15.7**

Table 3.3 Total Volume Change by Community (cubic yards)

July 2019 to August-October 2024 Total Volume Change by Community				
Community	**Volume Change above MHW (cubic yards)**	**Volume Change MHW to -15 feet-NAVD88 (cubic yards)**	**Volume Change -15 feet-NAVD88 to Profile Extent (cubic yards)**	**Total Volume Change (cubic yards)**
North Peninsula – R-0 to R-16	-115,800	20,600	276,400	181,200
Ormond-by-the-Sea – R-16 to R-47	-194,600	84,800	694,600	584,800
Ormond Beach – R-47 to T-67	-132,100	-107,400	934,200	694,600
Daytona Beach and Daytona Beach Shores – T-67 to R-122	-523,300	-501,300	2,487,600	1,462,900
Wilbur-by-the-Sea – R-122 to R-128	-68,500	-201,800	337,900	67,500
Ponce Inlet – R-128 to R-148	-302,200	-549,300	1,481,500	630,000
New Smyrna Beach – R-149 to R-185	-221,000	-173,400	769,400	375,100
Silver Sands and Bethune Beach – R-185 to T-208	8,000	-11,200	1,223,400	1,220,200
Volusia County Study Area	**-1,549,500**	**-1,439,000**	**8,205,000**	**5,216,300**

November 2022 to August-October 2024 Total Volume Change by Community

Community	Volume Change above MHW (cubic yards)	Volume Change MHW to -15 feet-NAVD88 (cubic yards)	Volume Change -15 feet-NAVD88 to Profile Extent (cubic yards)	Total Volume Change (cubic yards)
North Peninsula – R-0 to R-16	37,700	-36,500	-	1,100
Ormond-by-the-Sea – R-16 to R-47	46,300	232,200	-	278,400
Ormond Beach – R-47 to T-67	106,200	-14,300	-	91,900
Daytona Beach and Daytona Beach Shores – T-67 to R-122	419,700	67,100	-	486,700
Wilbur-by-the-Sea – R-122 to R-128	70,500	-45,400	-	25,200
Ponce Inlet – R-128 to R-148	304,800	-151,100	-	154,100
New Smyrna Beach – R-149 to R-185	307,100	254,500	-	561,700
Silver Sands and Bethune Beach – R-185 to T-208	66,800	315,100	-	381,900
Volusia County Study Area	**1,359,100**	**621,600**	**-**	**1,981,000**

October 2023 to August-October 2024 Total Volume Change by Community

Community	Volume Change above MHW (cubic yards)	Volume Change MHW to -15 feet-NAVD88 (cubic yards)	Volume Change -15 feet-NAVD88 to Profile Extent (cubic yards)	Total Volume Change (cubic yards)
North Peninsula – R-0 to R-16	-26,700	228,400	-472,200	-270,500
Ormond-by-the-Sea – R-16 to R-47	-43,700	500,300	-1,020,700	-564,100
Ormond Beach – R-47 to T-67	-36,900	216,500	-256,400	-76,800
Daytona Beach and Daytona Beach Shores – T-67 to R-122	7,100	-184,900	-859,500	-1,037,400
Wilbur-by-the-Sea – R-122 to R-128	21,900	-92,200	-179,700	-249,900
Ponce Inlet – R-128 to R-148	99,300	-170,100	-569,900	-640,600
New Smyrna Beach – R-149 to R-185	21,300	-152,600	-136,600	-267,900
Silver Sands and Bethune Beach – R-185 to T-208	35,000	70,400	-63,600	41,800
Volusia County Study Area	**77,300**	**415,800**	**-3,558,600**	**-3,065,400**

4 PONCE DE LEON INLET BATHYMETRIC ANALYSIS

This chapter documents observed changes to the Ponce de Leon Inlet complex through the analysis of the August 2017, September 2022, and April – August 2024 bathymetric surveys. As stated in Section 2.1, numerous RSM beach fill operations bypassed material from Ponce de Leon Inlet to both the north and south subaerial and subaqueous beaches. Since the August 2017 survey, Inlet dredging of the federal channel occurred in 2018, 2019, and 2023, placing approximately 236,000 cy in the nearshore area to the south of the Inlet and approximately 61,000 cy in the nearshore area north of the Inlet (**Table 2.1**). **Tables 4.1** and **4.2** present the volume changes associated with the 2017, 2022, and 2024 surveys, broken down by the Inlet subareas (**Figure 4.1**); the changes since 2017 depict multiple dredging events, including a large 400,000 cy event in 2019, while the changes since 2022 only depicts one small scale event.

Taylor Engineering applied digital terrain modeling techniques to the survey data to create continuous three-dimensional surfaces of the Inlet bathymetry to represent each survey. Constantly eroding channel banks, shoaling, and a dramatically changing shoreline position characterize Ponce de Leon Inlet. This dynamic environment has built emergent shoals in historically subaqueous areas and, conversely, has eroded historically upland areas into subaqueous areas. These changes are evident in **Figure 4.2**, which illustrates the Inlet shoreline positions in 2017, 2022, and 2024; the shoreline position is based on the mean low water value -2.7 ft-NAVD88. Notably, **Figure 4.2** shows the changes to the central portion of the Inlet's flood shoal and the new emergent islands at the convergence of the Inlet's throat and interior.

Due to the dynamic environment, data representing upland elevations as well as Inlet bathymetry are required to fully document the changes inside Ponce de Leon Inlet. Unfortunately, many of the Inlet surveys provide only limited upland elevation information due to dangers associated with having to embark and disembark the survey vessel. Thus, to quantify the volume changes inside the Inlet and at the ebb shoal, approximate elevations of the emergent areas in each survey year were incorporated into the DTM-generated surfaces. The team utilized the 2017 surface from the Inlet Management Plan Update where the LiDAR data captured in November 2016 helped determine the elevations of the Inlet's shoals and banks. Unfortunately, LiDAR data were not collected near the time of the 2022 survey; however, coverage across the inlet is sufficient for data processing and volume analyses associated with this update. For the 2024 survey data, the team first stitched together the April and August 2024 data; they then used 2024 post-Milton LiDAR to fill in data gaps along the shoals and banks.

This analysis applied the three-dimensional representations of Inlet bathymetry to compare the 2017 to 2024 and the 2022 to 2024 surveys. The comparisons identified regions and magnitudes of accretion and erosion. **Figure 4.3**, **Figure 4.4**, and **Figure 4.5** present the 2017, 2022, and 2024 bathymetric surfaces, respectively. Figure 4.6 presents the 2017 to 2024 bathymetric changes, and **Figure 4.7** presents the 2022 to 2024 bathymetric changes. **Table 4.1** summarizes the 2017-2024 Inlet volume changes, depicted in Figure 4.6, rounded to the nearest hundred cubic yards and cubic yards per year. Additionally, **Table 4.2** summarizes the 2022-2024 Inlet volume changes, depicted in **Figure 4.7**, again rounded to the nearest hundred cubic yards per year.

The 2017 to 2024 bathymetric comparison indicates 281,500 cy of sediment left the inlet complex (the net of 1,646,300 cy of sediment lost and 1,364,800 cy of sediment gained), averaging a loss of approximately 40,200 cy/yr. Notably, during this period, USACE dredged approximately 520,000 cy of sediment from the inlet. According to **Figure 4.6**, the most significant volume changes between 2017 and 2024 occurred along the shoals adjacent to the Inlet's north bank where significant accretion occurred and within the northern section of the central interior subarea; directly adjacent to the significant accretion, significant erosion also occurred indicating a shift of the channel. Generally, areas of significant erosion and accretion occurred close to each other, indicating localized redistribution of material.

The 2022 to 2024 bathymetric comparison indicates 8,900 cy of sediment entered the Inlet complex (the net of 993,100 cy of sediment lost and 1,002,100 cy of sediment gained), averaging a gain of approximately 1,800 cy/yr. Similar to the 2017 to 2024 comparison, the 2022 to 2024 comparison also shows the most dynamic and significant volume changes occurring within the Inlet's center interior subarea (**Figure 4.7**). During this comparison period, moderate erosion also occurred within the Inlet throat along the federal channel. The Inlet nearshore experienced the largest sediment gains, followed by the south bank subarea where shoaling is observed in the channels stemming south from the Inlet.

Table 4.1 2017 – 2024 Ponce de Leon Inlet Volume Changes

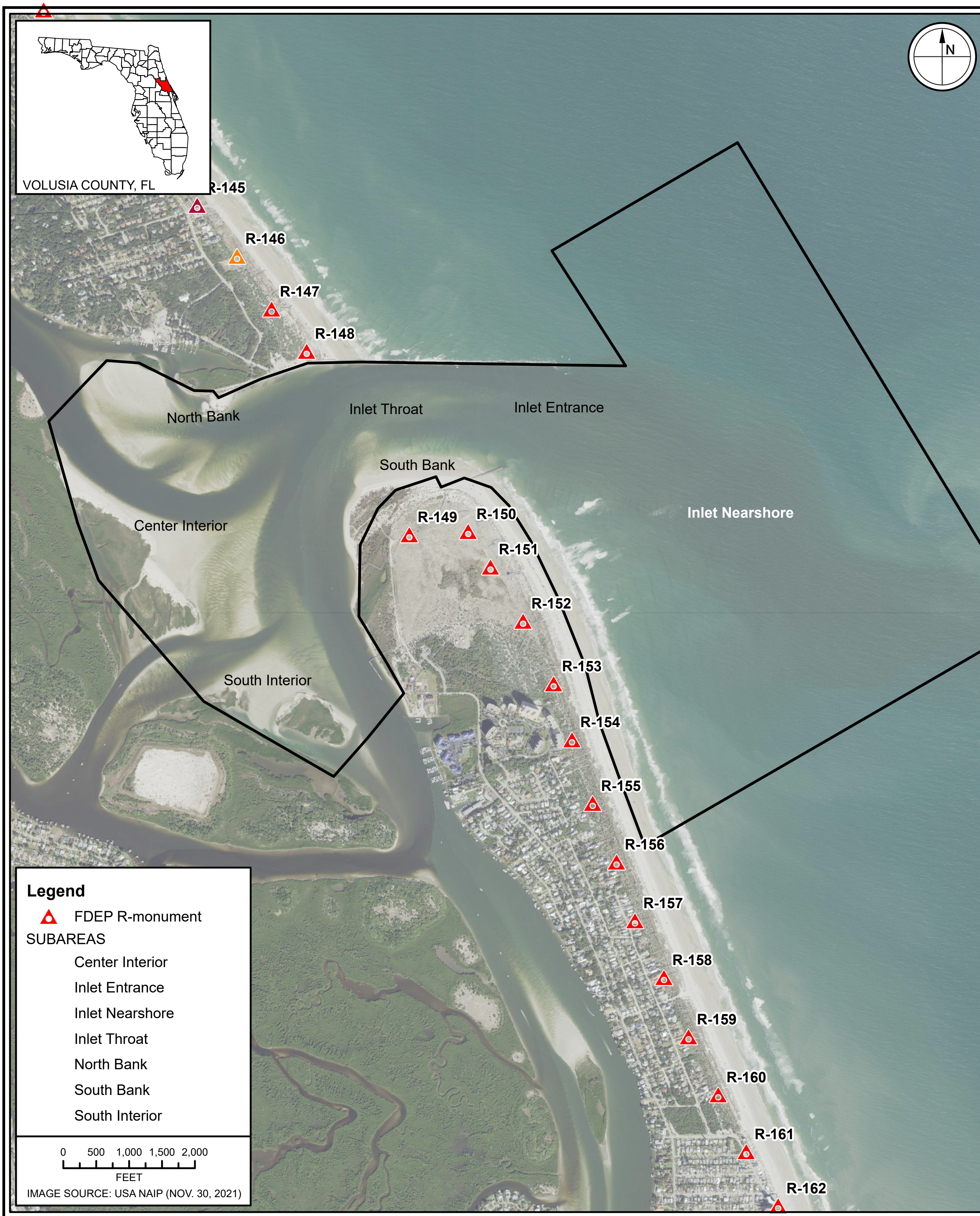
August 2017 to April-August 2024 Inlet Volume Changes						
Subarea	**Erosion (cubic yards)**	**Accretion (cubic yards)**	**Net (cubic yards)**	**Erosion (cubic yards per year)**	**Accretion (cubic yards per year)**	**Net (cubic yards per year)**
Inlet Nearshore	-1,050,200	971,700	-78,500	-150,000	138,800	-11,200
Inlet Entrance	-95,800	97,900	2,100	-13,700	14,000	300
Inlet Throat	-490,300	80,600	-409,800	-70,000	11,500	-58,500
North Bank	-87,000	77,800	-9,200	-12,400	11,100	-1,300
South Bank	-131,000	231,100	100,100	-18,700	33,000	14,300
Center Interior	-623,400	780,200	156,800	-89,100	111,500	22,400
South Interior	-218,800	97,300	-121,600	-31,300	13,900	-17,400
Inlet Total*	**-1,646,300**	**1,364,800**	**-281,500**	**-235,200**	**195,000**	**-40,200**

* Inlet Total does not include the Inlet nearshore (ebb shoal)

Table 4.2 2022 – 2024 Ponce de Leon Inlet Volume Changes

September 2022 to April-August 2024 Inlet Volume Changes						
Subarea	**Erosion (cubic yards)**	**Accretion (cubic yards)**	**Net (cubic yards)**	**Erosion (cubic yards per year)**	**Accretion (cubic yards per year)**	**Net (cubic yards per year)**
Inlet Nearshore	-531,600	929,800	398,200	-106,300	186,000	79,600
Inlet Entrance	-117,700	66,600	-51,000	-23,500	13,300	-10,200
Inlet Throat	-312,600	286,900	-25,700	-62,500	57,400	-5,100
North Bank	-70,900	37,500	-33,300	-14,200	7,500	-6,700
South Bank	-79,300	178,500	99,100	-15,900	35,700	19,800
Center Interior	-270,200	358,800	88,600	-54,000	71,800	17,700
South Interior	-142,400	73,700	-68,700	-28,500	14,700	-13,700
Inlet Total*	**-993,100**	**1,002,100**	**8,900**	**-198,600**	**200,400**	**1,800**

* Inlet Total does not include the Inlet nearshore (ebb shoal)



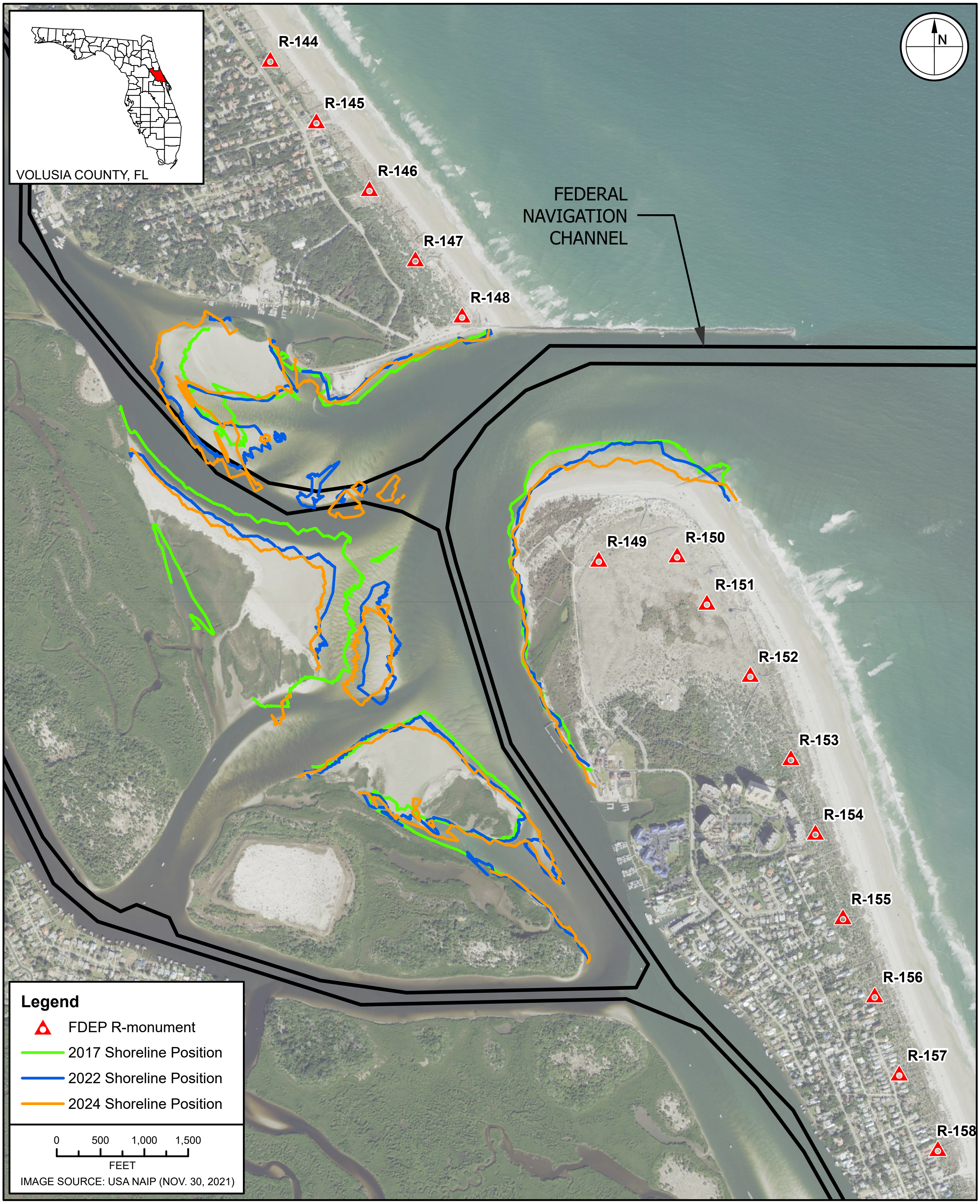
TAYLOR ENGINEERING INC.
10199 SOUTHSIDE BOULEVARD
SUITE 310
JACKSONVILLE, FL 32256
CERTIFICATE OF AUTHORIZATION # 4815

VOLUSIA COUNTY BEACH AND INLET MONITORING

FIGURE 4.1
PONCE DE LEON INLET SUBAREAS
VOLUSIA COUNTY, FLORIDA

PROJECT	C2024-035
DRAWN BY	PL
SHEET	1 of 1
DATE	DEC 2024

S:\Projects\C2024_035_VolusiaCounty2024BeachProfiles\APRX\VolusiaCountyInletAnalysis.aprx



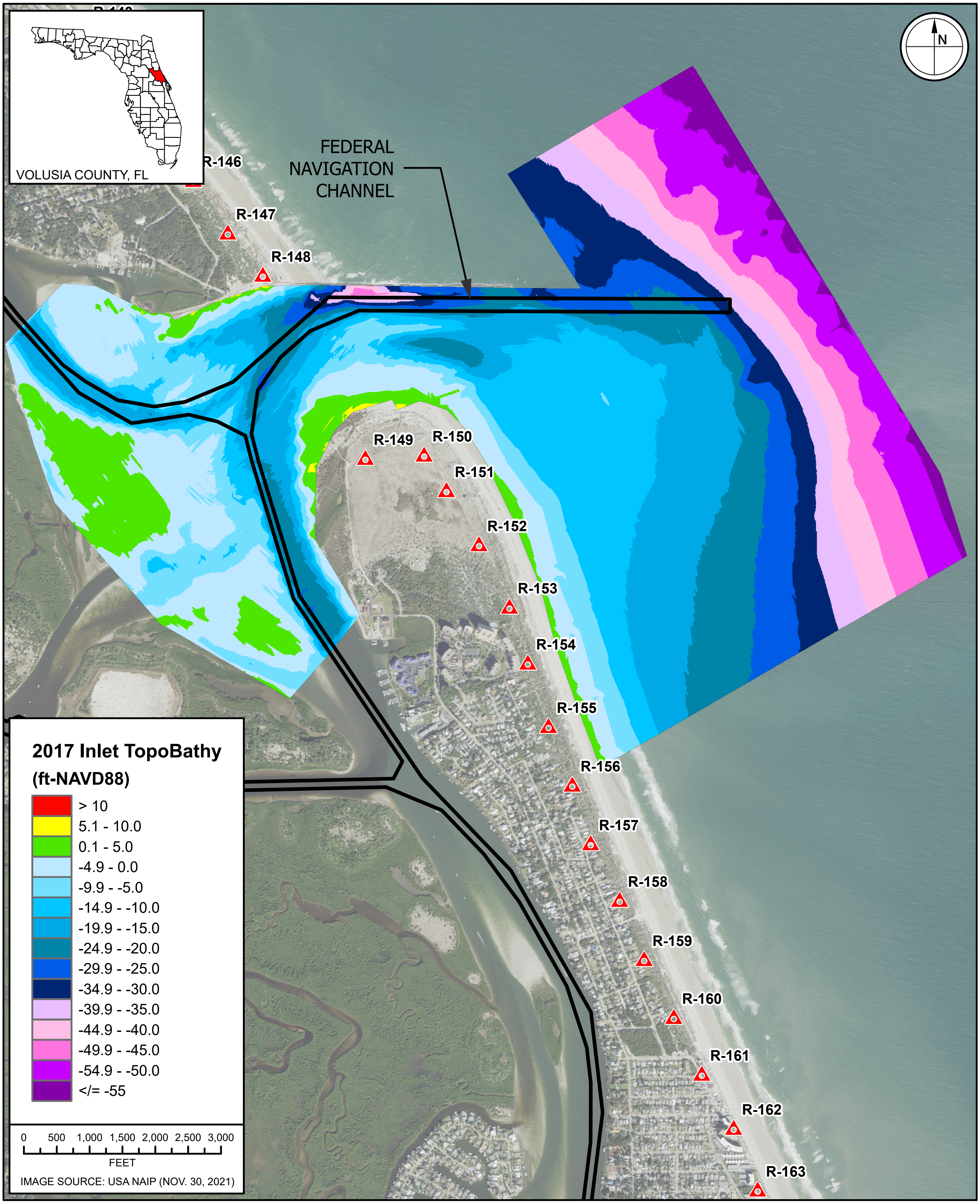
TAYLOR ENGINEERING INC.
10199 SOUTHSIDE BOULEVARD
SUITE 310
JACKSONVILLE, FL 32256
CERTIFICATE OF AUTHORIZATION # 4815

VOLUSIA COUNTY BEACH AND INLET MONITORING

FIGURE 4.2
2017, 2022 AND 2024 SHORELINE POSITION
PONCE DE LEON INLET
VOLUSIA COUNTY, FLORIDA

PROJECT	C2024-035
DRAWN BY	PL
SHEET	1 of 1
DATE	DEC 2024

S:\Projects\C2024_035_VolusiaCounty2024BeachProfiles\APRX\VolusiaCountyInletAnalysis.aprx



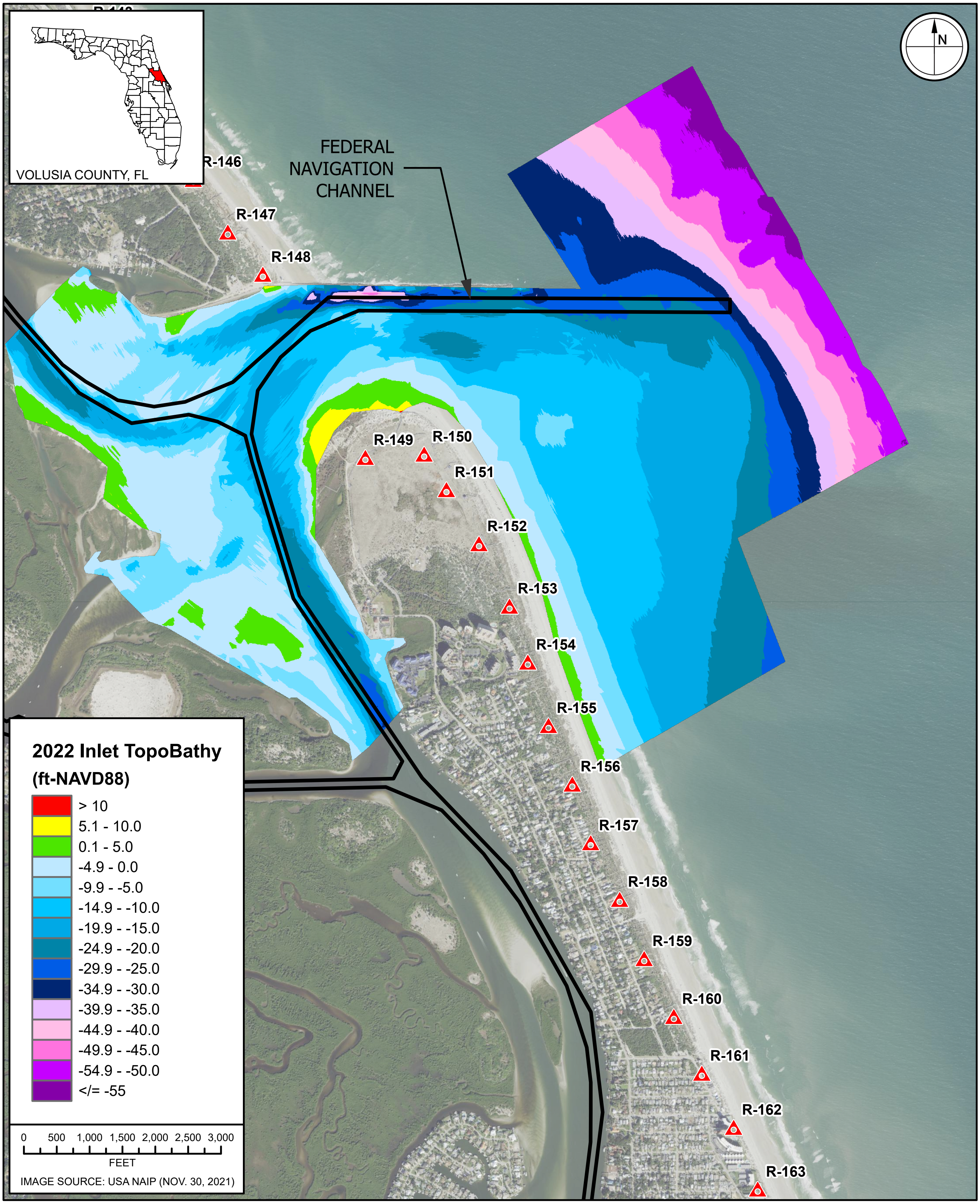
TAYLOR ENGINEERING INC.
10199 SOUTHSIDE BOULEVARD
SUITE 310
JACKSONVILLE, FL 32256
CERTIFICATE OF AUTHORIZATION # 4815

VOLUSIA COUNTY BEACH AND INLET MONITORING

FIGURE 4.3
2017 TOPO/BATHYMETRY AT
PONCE DE LEON INLET
VOLUSIA COUNTY, FLORIDA

PROJECT	C2024-035
DRAWN BY	PL
SHEET	1 of 1
DATE	DEC 2024

S:\Projects\C2024_035_VolusiaCounty2024BeachProfiles\APRX\VolusiaCountyInletAnalysis.aprx



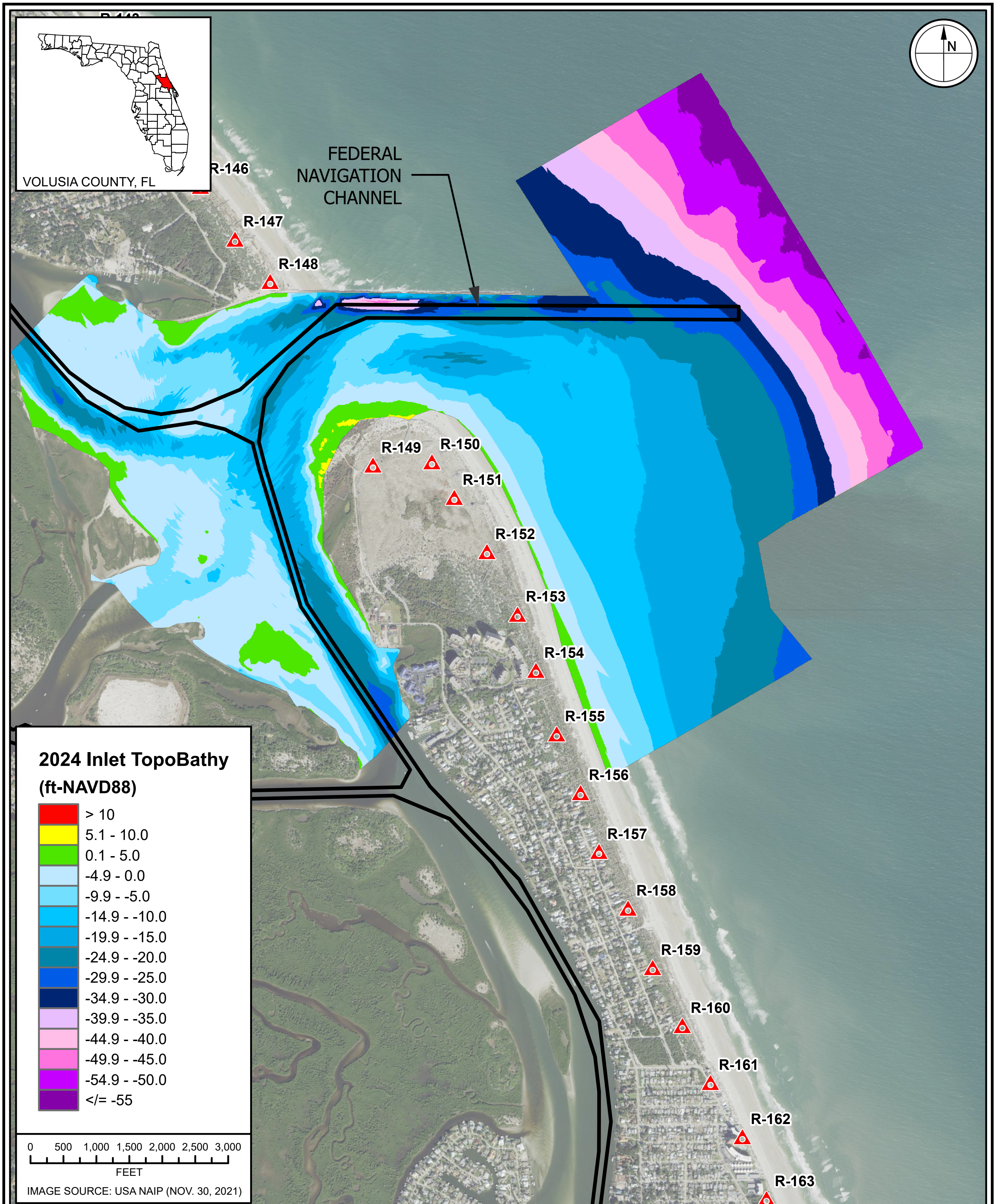
TAYLOR ENGINEERING INC.
10199 SOUTHSIDE BOULEVARD
SUITE 310
JACKSONVILLE, FL 32256
CERTIFICATE OF AUTHORIZATION # 4815

VOLUSIA COUNTY BEACH AND INLET MONITORING

FIGURE 4.4
2022 TOPO/BATHYMETRY AT
PONCE DE LEON INLET
VOLUSIA COUNTY, FLORIDA

PROJECT C2024-035
DRAWN BY PL
SHEET 1 of 1
DATE DEC 2024

S:\Projects\C2024_035_VolusiaCounty2024BeachProfiles\APRX\VolusiaCountyInletAnalysis.aprx



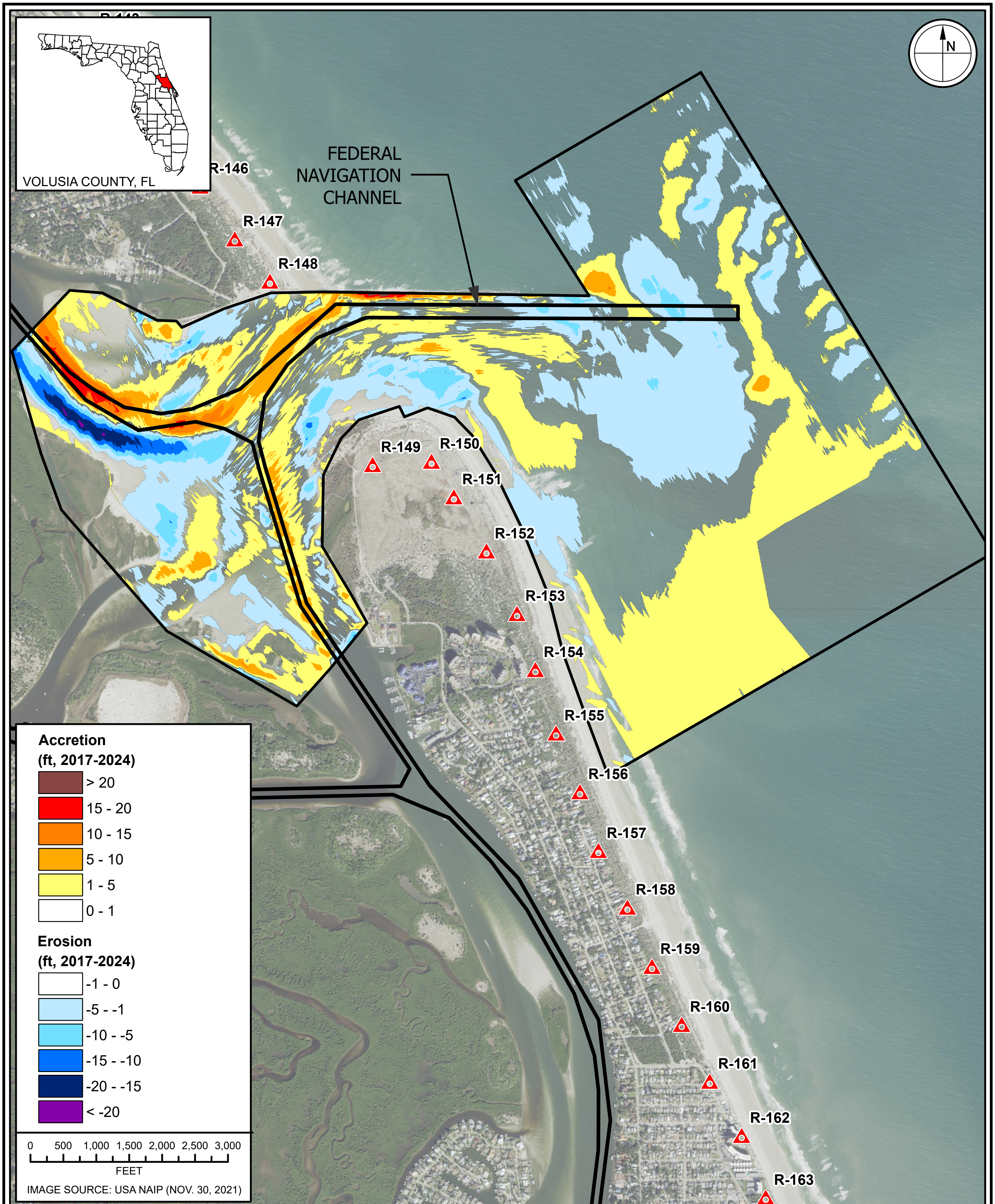
TAYLOR ENGINEERING INC.
10199 SOUTHSIDE BOULEVARD
SUITE 310
JACKSONVILLE, FL 32256
CERTIFICATE OF AUTHORIZATION # 4815

VOLUSIA COUNTY BEACH AND INLET MONITORING

FIGURE 4.5
2024 TOPO/BATHYMETRY AT
PONCE DE LEON INLET
VOLUSIA COUNTY, FLORIDA

PROJECT C2024-035
DRAWN BY PL
SHEET 1 of 1
DATE DEC 2024

S:\Projects\C2024_035_VolusiaCounty2024BeachProfiles\APRX\VolusiaCountyInletAnalysis.aprx



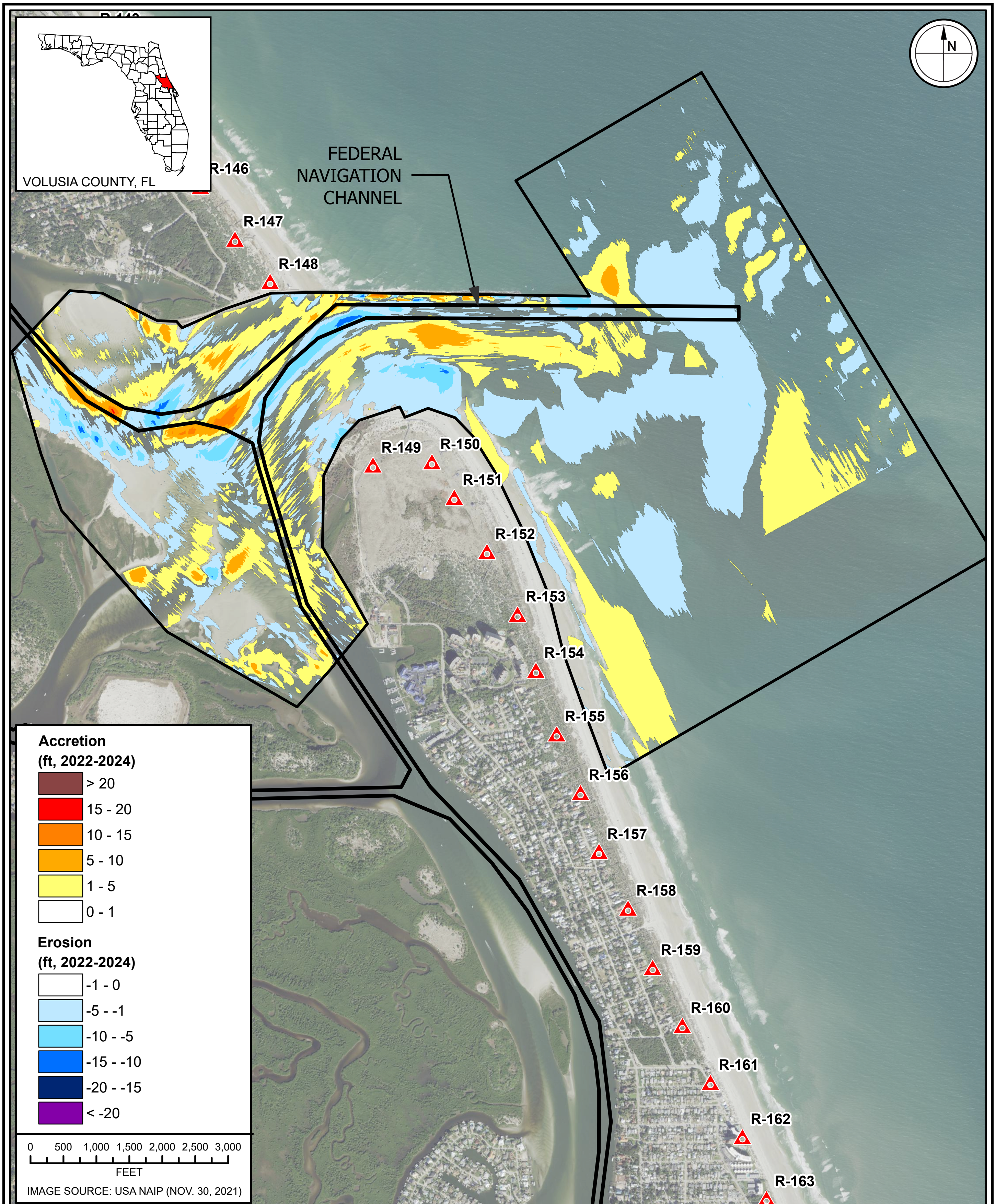
TAYLOR ENGINEERING INC.
10199 SOUTHSIDE BOULEVARD
SUITE 310
JACKSONVILLE, FL 32256
CERTIFICATE OF AUTHORIZATION # 4815

VOLUSIA COUNTY BEACH AND INLET MONITORING

FIGURE 4.6
2017 - 2024 BATHYMETRY CHANGES
AT PONCE DE LEON INLET
VOLUSIA COUNTY, FLORIDA

PROJECT	C2024-035
DRAWN BY	PL
SHEET	1 of 1
DATE	DEC 2024

S:\Projects\C2024_035_VolusiaCounty2024BeachProfiles\APRX\VolusiaCountyInletAnalysis.aprx



TAYLOR ENGINEERING INC.
10199 SOUTHSIDE BOULEVARD
SUITE 310
JACKSONVILLE, FL 32256
CERTIFICATE OF AUTHORIZATION # 4815

VOLUSIA COUNTY BEACH AND INLET MONITORING

FIGURE 4.7
2022 - 2024 BATHYMETRY CHANGES
AT PONCE DE LEON INLET
VOLUSIA COUNTY, FLORIDA

PROJECT C2024-035
DRAWN BY PL
SHEET 1 of 1
DATE DEC 2024

S:\Projects\C2024_035_VolusiaCounty2024BeachProfiles\APRX\VolusiaCountyInletAnalysis.aprx

5 SUMMARY

This monitoring report presents the results of a countywide beach profile and a comprehensive Inlet survey conducted during summer/fall of 2024 to characterize Volusia County's beach and Inlet evolution. The 2019 to 2024 survey data comparison revealed the County's beaches experienced moderate to major retreat. Moderate erosion occurred above the -15 ft-NAVD88 contour, while similar to 2023, significant accretion occurred below the -15 ft-NAVD88 contour as unprecedented volumes of sand moved offshore during Hurricanes Ian and Nicole. The 2022 Post-Hurricane Nicole to 2024 comparison revealed significant overall shoreline advance and volumetric gains in all communities. Notably, communities directly north of the Inlet experienced the greatest subaerial accretion with the gains mimicking their subaerial losses since 2019. The 2022 Post-Hurricane Nicole to 2024 comparison period also revealed that although the beach recovery following Hurricanes Ian and Nicole continued, recovery slowed from the previous monitoring report, and a sand deficit still exists on the subaerial beach and within the nearshore when comparing to the 2019 survey data. The October 2023 to August – October 2024 surveys revealed primarily minor to moderate shoreline retreat north of Wilbur-by-the-Sea and minor to moderate shoreline advance in Wilbur-by-the-Sea and the other communities to the south. Overall, minor accretion occurred above the -15 ft-NAVD88 contour; however, below the -15 ft-NAVD88 contour, significant offshore erosion occurred, suggesting continued shifting of large amounts of sand outside of the nearshore region. Notably, since the August – October 2024 survey, Hurricane Milton impacted the County and induced erosion to their shoreline. A separate letter report, anticipated in early 2025, will discuss Hurricane Milton's impacts to the County.

The Inlet bathymetric analysis indicated that since 2017, the channel going north from the Inlet's center interior continued to shift south from the 2022 survey results. The net Inlet volume change from 2017 to 2024 indicated erosion occurred, and the most significant erosion occurred within the Inlet throat. The net Inlet volume change from 2022 to 2024 revealed that minor accretion occurred. Although an Inlet dredging event occurred in 2023, the dredging event did not offset the overall sediment accretion in the Inlet in the two-year monitoring period.

Taylor Engineering suggests the continued close monitoring of the critically eroded shorelines in the County and continued surveying of storm damage following significant storm events. Beyond this, the County should continue to be proactive in their beach and Inlet monitoring and maintenance. Although some continued post-storm recovery and onshore movement of sediment occurred in the past year, the 2024 storm season brought significant events that eroded the shoreline further. We anticipate that the sand placement activities planned for 2025 should help alleviate the continued sand need following Hurricanes Ian and Nicole.

Following the completion of the ongoing study to evaluate the coastal risk within each of Volusia County's coastal communities and the feasibility of different beach management strategies, Taylor Engineering recommends implementation of the beach management strategies, especially within the most vulnerable and at-risk communities. We recommend the County continue to monitor its beaches to establish a record of erosion and accretion trends and to document the effects of storms. A longer monitoring period is recommended in order to better document the long-term changes to the County's beaches, monitor for future events, and help better understand the effects of nearshore placement events. Taylor Engineering suggests the County continue its beach and inlet monitoring plan, which consists of a complete county-wide beach and inlet survey every five years and interim beach surveys annually.

REFERENCES

Brantley, L. 2023. *Ponce De Leon Inlet and IWW MD, Volusia County, Florida Notice of Completion – FDEP Permit No. 0308009-001-JC.* USACE, Jacksonville District, Jacksonville, FL.

Florida Department of Environmental Protection (FDEP). 2020. *Ponce de Leon Inlet Management Plan.* FDEP, Office of Resilience and Coastal Protection, Tallahassee, FL.

Florida Department of Environmental Protection (FDEP). 2023. *Strategic Beach Management Plan: Northeast Atlantic Coast Region*. Tallahassee, FL.

Florida Department of Environmental Protection (FDEP). 2024a. *Critically Eroded Beaches in Florida*. FDEP, Office of Resilience and Coastal Protection. Tallahassee, FL.

Florida Department of Environmental Protection (FDEP). 2024b. *Joint Coastal Permit, Volusia County Nourishment, 0428162-002-JM*. FDEP, Office of Resilience and Coastal Protection. Tallahassee, FL.

Florida Department of Environmental Protection (FDEP). 2024c. *Joint Coastal Permit Application (pending), Volusia County Ponce De Leon Inlet Maintenance Dredging, 0308009-010-JN*. FDEP, Office of Resilience and Coastal Protection. Tallahassee, FL.

Florida Department of Environmental Protection (FDEP). 2024d. *Joint Coastal Permit Application (pending), Volusia County Nourishment, 0428162-003-JM*. FDEP, Office of Resilience and Coastal Protection. Tallahassee, FL.

Florida Department of Environmental Protection (FDEP). 2024e. Coastal Construction Control Line *Permit VO002076 AR*. FDEP, Office of Resilience and Coastal Protection. Tallahassee, FL.

Google Earth V 7.3.6.9796. 2024. *Volusia County, Florida*. 29°01’40.74” N 81°04’31.68” W. Accessed December 2024, at https://www.earth.google.com.

Taylor Engineering, Inc. 1994. *Ponce de Leon Inlet Management Plan*. Taylor Engineering, Inc. Jacksonville, FL.

Taylor Engineering, Inc. 2003. *Sediment Budget Update Ponce DeLeon Inlet and Adjacent Beaches.* Taylor Engineering, Inc. Jacksonville, FL.

Taylor Engineering, Inc. 2007. *New Smyrna Beach Emergency Dune Restoration Project, Post-Construction Monitoring Report*. Taylor Engineering, Inc. Jacksonville, FL.

Taylor Engineering, Inc. 2019. *Volusia County Countywide Beach Profile Survey 2019*. Taylor Engineering, Inc. Jacksonville, FL.

Taylor Engineering, Inc. 2020a. *Volusia County Interim Countywide Beach Profile Survey 2020*. Taylor Engineering, Inc. Jacksonville, FL.

Taylor Engineering, Inc. 2020b. *Ponce de Leon Sediment Budget Update*. Taylor Engineering, Inc. Jacksonville, FL.

Taylor Engineering, Inc. 2021. *Volusia County Interim Countywide Beach Profile Survey 2021*. Taylor Engineering, Inc. Jacksonville, FL.

Taylor Engineering, Inc. 2022. *Volusia County Interim Countywide Beach Profile and Inlet Survey 2022*. Taylor Engineering, Inc. Jacksonville, FL.

Taylor Engineering, Inc. 2023a. *Volusia County Interim Countywide Beach Profile Survey 2023*. Taylor Engineering, Inc. Jacksonville, FL.

Taylor Engineering, Inc. 2023b. *Volusia County Beach Monitoring – 2022 Hurricane Season*. Taylor Engineering, Inc. Jacksonville, FL.

Taylor Engineering, Inc. 2023c. *Volusia County Post Hurricane Nicole FEMA Analysis.* Taylor Engineering, Inc. Jacksonville, FL.

Trudnak, M. 2024. *Permit 0428162-002-JM Modification Request – Volusia County Nourishment*. INTERA – GEC. Gainesville, FL.

U.S. Army Corps of Engineers (USACE). 1999. *Ponce de Leon Inlet, Florida, Site Investigation*. USACE, Waterways Experiment Station, Vicksburg, MS.

U.S. Army Corps of Engineers (USACE). 2024. *Jacksonville District Competes Initial Construction of Flagler County Coastal Storm Risk Management Project.* Accessed December 2024, at https://www.saj.usace.army.mil/Missions/Civil-Works/Shore-Protection/Flagler-County/