

Ft. Pierce Inlet Management Plan

Office of Resilience and Coastal Protection

Florida Department of Environmental Protection

May 2022



Final Order Adopting Ft. Pierce Inlet Management Plan

WHEREAS, pursuant to Section 161.161, Florida Statutes, the Florida Department of Environmental Protection shall “evaluate each improved, modified or altered inlet and determine whether the inlet is a significant cause of beach erosion. With respect to each inlet determined to be a significant cause of beach erosion, the plan shall include the extent to which such inlet causes beach erosion and recommendations to mitigate the erosive impact of the inlet, including, but not limited to, inlet sediment bypassing; improvement of infrastructure to facilitate sand bypassing; modifications to channel dredging, jetty design and disposal of spoil material; establishment of feeder beaches; and beach restoration and beach nourishment.”

WHEREAS on May 30, 1997, the department adopted the Ft. Pierce Inlet Management Implementation Plan, which contained corrective measures to mitigate the identified impacts of the inlet; and

WHEREAS in 2008, the Florida Legislature amended Section 161.142, Florida Statutes, finding, “The Legislature recognizes the need for maintaining navigation inlets to promote commercial and recreational uses of our coastal waters and their resources. The Legislature further recognizes that inlets interrupt or alter the natural drift of beach-quality sand resources, which often results in these sand resources being deposited in nearshore areas or in the inlet channel, or in the inland waterway adjacent to the inlet, instead of providing natural nourishment to the adjacent eroding beaches. Accordingly, the Legislature finds it is in the public interest to replicate the natural drift of sand which is interrupted or altered by inlets to be replaced and for each level of government to undertake all reasonable efforts to maximize inlet sand bypassing to ensure that beach-quality sand is placed on adjacent eroding beaches. Such activities cannot make up for the historical sand deficits caused by inlets but shall be designed to balance the sediment budget of the inlet and adjacent beaches and extend the life of proximate beach restoration projects so that periodic nourishment is needed less frequently;” and

WHEREAS in 2020-21, the department and St. Lucie County sponsored an inlet management study of Ft. Pierce Inlet performed by Olsen Associates, which compiled new survey data and

information regarding its coastal processes and inlet and shoreline dynamics and updated its sediment budget; and

WHEREAS, in May 2022, the department finalized the development of an updated inlet management plan that contains corrective measures to mitigate the identified inlet erosion impacts to adjacent beaches; and

WHEREAS, St. Lucie County is responsible for dredging and sand bypassing at Ft. Pierce Inlet and, therefore, responsible for implementation of the inlet management plan; and

WHEREAS, this inlet management plan (attached) is consistent with the department's program objectives under Chapter 161, Florida Statutes,

THEREFORE:

The department does hereby adopt the following updated implementation strategies, as set forth in the attached **Ft. Pierce Inlet Management Plan**. Future inlet management activities conducted by St. Lucie County shall be consistent with the following four strategies:

- 1) **A comprehensive beach and inlet hydrographic monitoring program** shall be conducted to evaluate the performance and impact of existing sand bypassing and nourishment projects and to periodically update the inlet sediment budget. Beach and nearshore surveys between FDEP Reference Monuments R-1 and R-60 shall be conducted. Periodic inlet hydrographic surveys to include the inlet channel and the ebb and flood shoals should also be conducted. Along with topographic and hydrographic surveys of the inlet system and adjoining beaches, hydraulic monitoring may be conducted to enhance future modeling input data for investigations of inlet management alternatives.
- 2) **Sand bypassing shall be performed from the inlet system to the adjacent Atlantic-fronting beaches to the south of the inlet between the south jetty near FDEP Reference Monument R34 and R41.** The quantity of material to be bypassed shall be based on available quantities documented through the monitoring protocol of Strategy #1 above.

- 3) On an average annual basis, the initial target inlet sand bypassing quantity shall be 140,000 cubic yards per year to the south.** This target quantity may be modified or updated based on a minimum of four years of additional monitoring data indicating a change in the sediment budget.
- 4) The source of sediment for meeting the target sand bypassing quantities in Strategy #3 may be the Ft. Pierce Inlet navigation channel, the authorized inlet sediment impoundment basin or as otherwise authorized by permit. The navigation channel and authorized sediment impoundment basin shall be prioritized for a portion of the bypass material, but other alternatives may be considered for further geotechnical and engineering design and permitting and implementation to develop an environmentally acceptable project with suitable quality sediment.** Acceptable beach quality sand may also be obtained from inland sand mines or offshore sources to achieve the target sand bypassing quantities.
- 5) The Phase I pilot sediment impoundment basin shall be constructed as authorized.** Based upon the performance of the reduced capacity pilot basin, the full design sediment impoundment basin shall be constructed, as appropriate.
- 6) Evaluate possible alternatives to facilitate the bypassing of sand from the shoreline north of the inlet to the downdrift beaches.**

Inlet management actions conducted by St. Lucie County that implement the strategies contained in this plan are subject to further evaluation and subsequent authorization or denial, as part of the department's permitting process. Activities other than the federal navigation project that implement these adopted strategies shall be eligible for state financial participation pursuant to Section 161.143, Florida Statutes, subject to department approval of a funding request and an appropriation from the Florida Legislature. The level of state funding shall be determined based on the activity being conducted and the department's rules. The department may choose not to participate financially if the proposed method of implementation is not cost effective or fails to meet the intent of Section 161.142, Florida Statutes and this final order. Activities ineligible for cost sharing include, but are not limited to navigational construction, operation, and maintenance activities, except those elements whose purpose is to place or keep sand on adjacent beaches. Nothing in this plan precludes the evaluation and potential adoption of other strategies for the effective management of Ft. Pierce Inlet and the adjacent beaches.

Approval of Adoption

Alex Reed

Alex Reed
Director of the Office of Resilience and Coastal Protection
Florida Department of Environmental Protection

Filing and Acknowledgement

FILED, on this date with the designated Deputy Clerk, pursuant to
Section 120.52, F.S., receipt of which is hereby acknowledged.

Alexander Robson

Deputy Clerk

05-10-2022

Date

Electronic Copies Furnished to:

STATE OF FLORIDA - DEPARTMENT OF ENVIRONMENTAL PROTECTION
Lainie Edwards, Ph.D., Deputy Director, Office of Resilience and Coastal Protection
2600 Blair Stone Road Tallahassee, Florida 32399-2400
Crystal Anderson, Office of General Counsel
Greg Garis, Beaches, Inlets and Ports Program
Bob Brantly, Coastal Engineering and Geology Group
Michael Isaacson, Beaches Funding Program
DEP Agency Clerk

ST. LUCIE COUNTY – EROSION DISTRICT
Joshua Revord, P.E., Coastal Project Manager

OLSEN ASSOCIATES
Dr. Kevin Bodge, P.E., Consultant

Notice of Rights

This action is final and effective on the date filed with the clerk of the department unless a petition for an administrative hearing is timely filed under Sections 120.569 and 120.57, F.S., before the deadline for filing a petition. On the filing of a timely and sufficient petition, this action will not be final and effective until further order of the department. Because the administrative hearing process is designed to formulate final agency action, the hearing process may result in a modification of the agency action or even denial of the request for a variance or waiver.

Petition for Administrative Hearing

A person whose substantial interests are affected by the department's action may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, F.S. Pursuant to Rule 28-106.201, F.A.C., a petition for an administrative hearing must contain the following information:

- (a) The name and address of each agency affected and each agency's file or identification number, if known;
- (b) The name, address, telephone number and any e-mail address of the petitioner; the name, address, telephone number and any email address of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests are or will be affected by the agency determination;
- (c) A statement of when and how the petitioner received notice of the agency decision;
- (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
- (e) A concise statement of the ultimate facts alleged, including the specific facts that the petitioner contends warrant reversal or modification of the agency's proposed action;

- (f) A statement of the specific rules or statutes that the petitioner contends require reversal or modification of the agency's proposed action, including an explanation of how the alleged facts relate to the specific rules or statutes; and
- (g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wishes the agency to take with respect to the agency's proposed action.

The petition must be filed (received by the clerk) in the Office of General Counsel of the department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000. Also, a copy of the petition shall be mailed to the applicant at the address indicated above at the time of filing.

Time Period for Filing a Petition

In accordance with Rule 62-110.106(3), F.A.C., petitions for an administrative hearing must be filed within 21 days of receipt of this written notice. The failure to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under [Sections 120.569](#) and 120.57, F.S., or to intervene in this proceeding and participate as a party to it. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, F.A.C.

Extension of Time

Under Rule 62-110.106(4), F.A.C., a person whose substantial interests are affected by the department's action may also request an extension of time to file a petition for an administrative hearing. The department may, for good cause shown, grant the request for an extension of time. Requests for extension of time must be filed with the Office of General Counsel of the department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, FL 32399-3000, before the applicable deadline for filing a petition for an administrative hearing. A timely request for extension of time shall toll the running of the time period for filing a petition until the request is acted upon.

Table of Contents

Introduction..... 1

Program Objectives and Statutory Responsibilities for Inlet Management..... 2

History of Ft. Pierce Inlet..... 3

Adopted Inlet Management Plan of 1997 13

Inlet Management Studies, 2000-2021, and Update Sediment Budget 15

Recommended Inlet Management Plan Strategies 19

References..... 22

Introduction

Pursuant to Subsection 161.101(2), Florida Statutes, the Florida Department of Environmental Protection (Department or FDEP) is the beach and shore preservation authority for the State of Florida. As part of the Department's statewide beach management plan adopted pursuant to Section 161.161, Florida Statutes, the Department is adopting this inlet management plan for Ft. Pierce Inlet in St. Lucie County, Florida.

Ft. Pierce Inlet Management Plan updates strategies for Ft. Pierce Inlet that were adopted in the *Ft. Pierce Inlet Management Implementation Plan* (FDEP, 1997) to be consistent with current statutes and observed erosion¹ conditions. The *Strategic Beach Management Plan* (FDEP, 2020) called for coordinating with the USACE to bypass all beach compatible navigation channel maintenance dredging material to downdrift beaches south of the inlet; placing supplemental material (from upland sources or offshore sources) on the downdrift beaches south of the inlet, such that the combined total of material from all sources equals or exceeds 130,000 cy on an average annual basis; constructing a sediment impoundment basin (sand trap) within the inlet to facilitate bypassing of sand from the inlet to the downdrift beaches (see **Figure 4**); implementing a comprehensive beach and inlet monitoring program; and, updating the inlet management plan. The Department and St. Lucie County sponsored an updated inlet management study of Ft. Pierce Inlet in 2018-21 that was performed by Olsen Associates, Inc.

¹ As used in this document, the term "erosion" means wearing away of land or the removal of consolidated or unconsolidated material from the coastal system by wind or wave action, storm surge, tidal or littoral currents or surface water runoff. As used in this document, the term "accretion" means the buildup of land or accumulation of unconsolidated material within the coastal system caused by wind and wave action, storm surge, or tidal or littoral currents. The descriptions of coastal processes in this document are not intended to affect title to real property or real property boundaries.

Program Objectives and Statutory Responsibilities for Inlet Management

In 2008, the Florida Legislature amended Section 161.142, Florida Statutes, finding,

“The Legislature recognizes the need for maintaining navigation inlets to promote commercial and recreational uses of our coastal waters and their resources. The Legislature further recognizes that inlets interrupt or alter the natural drift of beach-quality sand resources, which often results in these sand resources being deposited in nearshore areas or in the inlet channel, or in the inland waterway adjacent to the inlet, instead of providing natural nourishment to the adjacent eroding beaches. Accordingly, the Legislature finds it is in the public interest to replicate the natural drift of sand which is interrupted or altered by inlets to be replaced and for each level of government to undertake all reasonable efforts to maximize inlet sand bypassing to ensure that beach-quality sand is placed on adjacent eroding beaches. Such activities cannot make up for the historical sand deficits caused by inlets but shall be designed to balance the sediment budget of the inlet and adjacent beaches and extend the life of proximate beach restoration projects so that periodic nourishment is needed less frequently.”

Pursuant to Section 161.143, Florida Statutes,

“Studies, projects and activities for the purpose of mitigating the erosive effects of inlets and balancing the sediment budget of the inlet and adjacent beaches must be supported by separately approved inlet management plans or inlet components of the statewide comprehensive beach management plan.”

St. Lucie County and the U.S. Army Corps of Engineers have been the entities responsible for dredging Ft. Pierce Inlet and consequently, mitigating the extent of beach erosion caused by the inlet, as specified in Subsection 161.142 (6), Florida Statutes.

History of Ft. Pierce Inlet

Ft. Pierce Inlet is in St. Lucie County on the southeast coast of Florida connecting the Atlantic Ocean with the Indian River lagoon (**Figure 1**). The inlet separates Ft. Pierce Inlet State Park to the north from the beach community of Ft. Pierce Beach to the south. The Ft. Pierce Inlet Federal Navigation Channel passes through Ft. Pierce Inlet and connects with the Atlantic Intracoastal Waterway, which extends north and south of the inlet. Hutchinson Island extends 21 miles to the south to St. Lucie Inlet and Orchid Island extends 29 miles to the north at Sebastian Inlet.

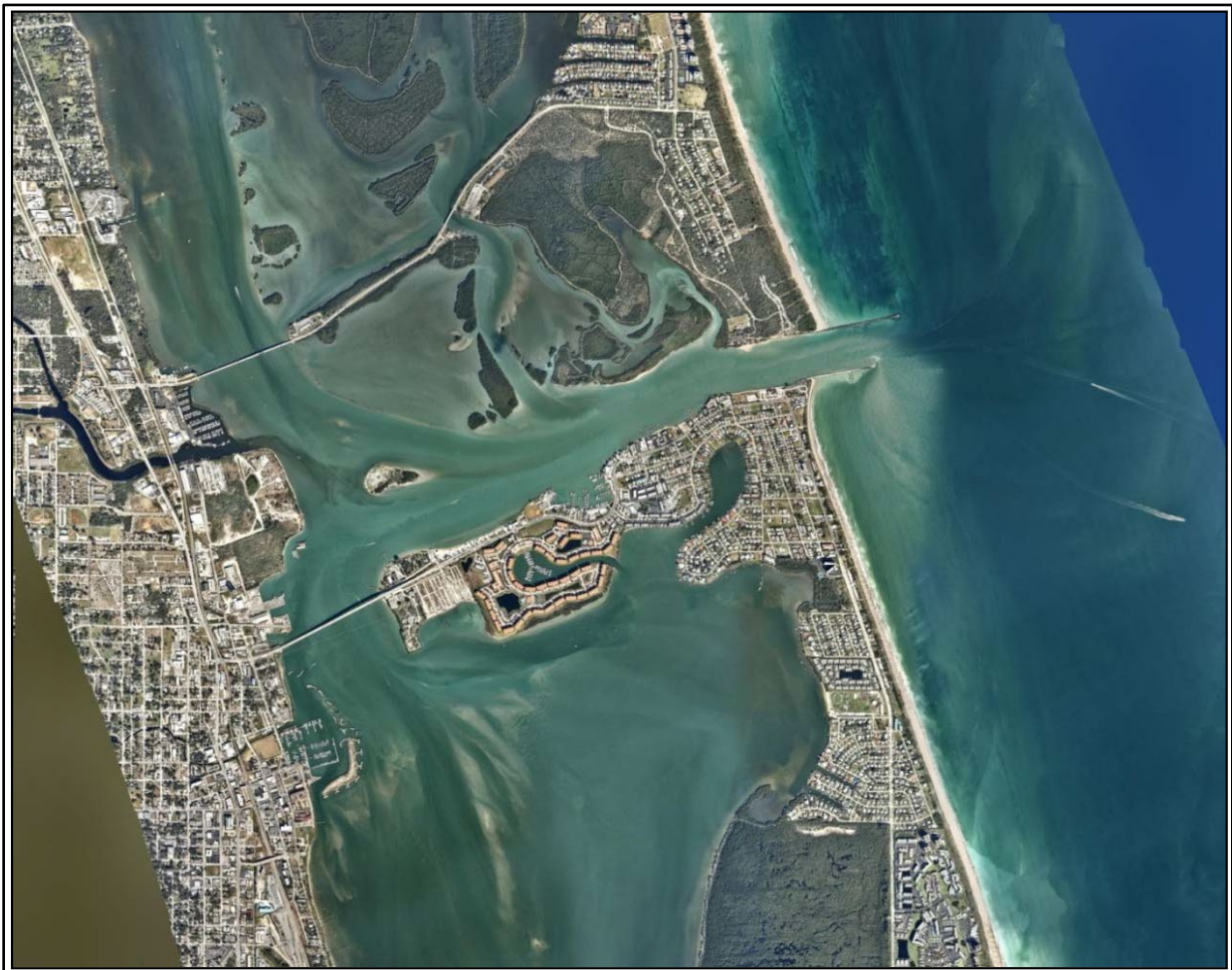


Figure 1. 2016 aerial photograph of Fort Pierce Inlet and surrounding waterways (OAI 2021).

It is important to understand the history of Ft. Pierce Inlet, its evolution and prior inlet management activities, and beach erosion control activities along the adjacent beaches, to gain a

perspective on the inlet's dynamics and the need to change inlet management strategies over time. A prior natural inlet, known as Indian River Inlet, was located 2.7 miles north (R-19) of Ft. Pierce Inlet, and closed sometime in the early 1900s. This inlet was shown on early Spanish surveys dating to 1605. Walton (1974) shares much of the known history about this earlier natural inlet.

Following closure of the small natural Indian River Inlet, there was a need to reestablish boating access for fishing vessels and local commerce. The Ft. Pierce Inlet District was established in 1918 by the Florida Legislature as a special taxing district comprising most of St. Lucie County. Dredging of the original channel commenced in 1920, and following jetty construction, the final barrier cut was made on May 8, 1921 (Wilson, 2021). The original channel was four feet deep and 100 feet wide and was protected with native coquina rock jetties that were 400 feet long and spaced 900 feet apart. Tidal currents scoured the new inlet's depths to 12 feet and northeast waves penetrated the channel and severely eroded the south channel bank. The District completed its channel dredging in August 1929. The completed channel was 3,200 feet long, 240 feet wide, and 25 feet deep from offshore to the shoreline, and then 3,000 feet long, 180 feet wide, and 22 feet deep across the Indian River to a turning basin, 900 by 775 feet wide at the town of Ft. Pierce, where a port terminal was constructed.

Between 1926 and 1927, the District reconstructed the jetties and extended them to 1,800 feet on the north and 1,200 on the south (**Figure 2**). In addition, the inlet banks were armored with native coquina limestone revetments. With the dredged material excavated from crossing the Indian River, a parallel causeway was constructed about 3,950 feet long and 900 feet south of the channel. The harbor was officially opened to commerce on February 22, 1930. However, shoaling problems were encountered soon after and the U.S. Congress authorized funds to conduct channel maintenance. The Deficiency Act of March 4, 1931, authorized \$20,000, and the War Department Appropriation Act of March 4, 1933, provided an additional \$30,000 for inlet maintenance dredging. The Rivers and Harbors Act of August 30, 1935, established federal responsibility for maintaining channels, jetties, and revetments, and for enlarging channels and the turning basin. The federal project was completed by the U.S. Army Corps of Engineers in 1938 (USACE, 1984).



Figure 2. 1926 aerial photograph of the Ft. Pierce causeway, channel and inlet with newly constructed jetties (courtesy of Ft. Pierce Inlet District, St. Lucie County).

Little data exists regarding the adjacent beach conditions prior to opening the inlet. Substantial changes occurred after opening. To the north of the inlet for at least a mile, accretion of the shoreline took place as the inlet's north jetty created an impoundment of beach sand. To the south of the inlet, erosion has prevailed. Between 1930 and 1957, at its worst 1,200 feet south of the inlet, the shoreline receded up to 450 feet.

The severe erosion conditions south of the inlet resulted in the Ft. Pierce Beach Erosion District being organized in 1949 by special act of the Florida Legislature. The Erosion District covered the northern portion of Hutchinson Island between Ft. Pierce Inlet and the Martin County line. In 1957, the Coastal Engineering Laboratory of the University of Florida was funded to conduct a study of the erosion south of Ft. Pierce Inlet. Various recommendations were developed, but no actions were funded at that time.

The March 1962 northeaster was the worst storm event to affect the area during the 20th century. Along with severe beach and dune erosion along the coast, storm surge flooding inundated roads and damaged numerous homes south of the inlet. Local emergency projects involved trucking sand for beach fill. Congress authorized the Ft. Pierce Federal Shore Protection Project in 1965 and provided for federal participation in initial beach restoration and maintenance nourishment of the shoreline 1.3 miles south of the inlet (between R34 and R41). In 1967, the St. Lucie County Erosion District was created by special act of the Legislature. An initial beach restoration project in 1971 and a maintenance project in 1980 excavated 1,064,000 cubic yards of sand from a nearshore borrow area and nourished 1.3 miles of eroded beach south of the inlet. OAI (2021) notes various smaller nourishment projects between 1987 and 1998, with sand obtained from upland sand mines and from maintenance and new work dredging projects.

The U.S. Army Corps of Engineers (USACE) conducted a Section 111 study in 1982 to determine the effects of the federal navigation project on the adjacent shorelines. The study concluded that 60 percent of the shoreline erosion for 1.3 miles south of Ft. Pierce Inlet was due to the effects of maintenance dredging of the inlet and construction of the jetties. A Segment 934 report by the USACE in 1996, extended federal participation in the 1.3-mile beach project until 2020.

In 1988, Congress authorized a channel and harbor improvement project at Ft. Pierce Inlet. Between June 1995 and August 1996, the project was constructed with an entrance channel 1.8 miles long, 30 feet deep, and 400 feet wide; an interior channel 1.9 miles long, 28 feet deep, and 250 feet wide; a turning basin 28 feet deep with a turning radius of 1,100 feet; a north channel extension 450 feet long, 28 feet deep and 250 feet wide; and berthing areas adjacent both the north channel extension and the turning basin.

In 1997, a southward extending spur groin was constructed on the inlet's south jetty (**Figure 3**). The groin extends for a length of 200 feet and is located 450 feet west of the terminal east end of the jetty. The groin was constructed to reduce northward sand transport from the beach back into Ft. Pierce Inlet in hopes of reducing the high beach erosion rate and to reduce inlet shoaling. Between 1930 and 2021, 3,452,600 cubic yards of material was dredged from Ft. Pierce Inlet. Of this inlet dredge material, between 1973 and 2017, 473,250 cubic yards of sand was placed on

the beach south of the inlet. **Table 1** by Olsen Associates, Inc. (2021) enumerates all the channel dredging projects and inlet sand bypassing since 1930.

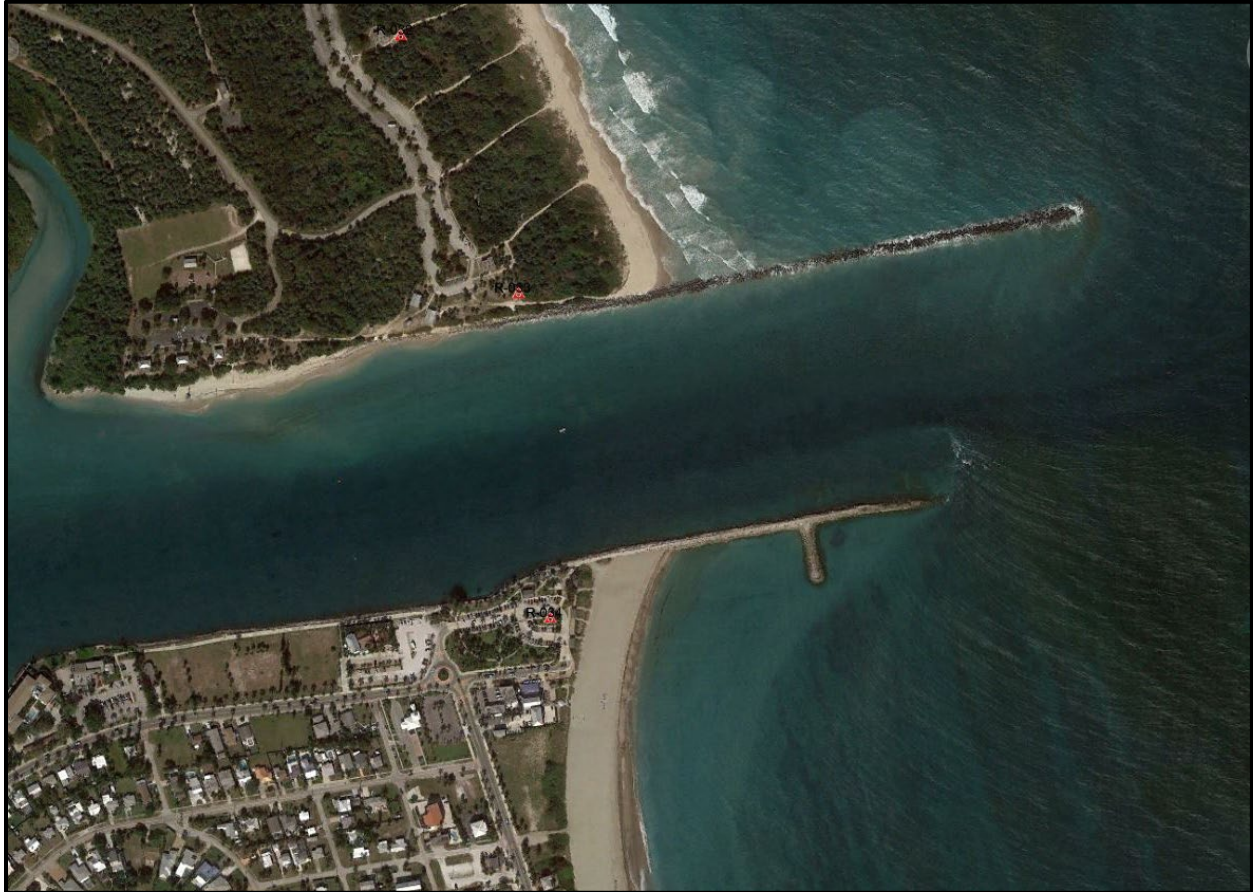


Figure 3. 2019 aerial photograph of the Fort Pierce Inlet entrance channel and jetties including the spur groin (Google Earth image).

Table 1. Maintenance Dredging events at Ft. Pierce Inlet from 1930 to 2021 (OAI, 2021).

Date	Maintenance Dredged – Cubic Yards	Placement to Beach	Dredge Area	Notes
1930	40,000		Channel	
1931	94,908		Channel & Bar	
1933	182,167		Channel & Bar	
1934	124,708		Channel & Turning Basin	

Date	Maintenance Dredged – Cubic Yards	Placement to Beach	Dredge Area	Notes
1935	113,177		Channel	
1936	129,385		Channel	
1937	103,860		Channel & Turning Basin	(1)
1938	103,400		Channel & Turning Basin	
1939	162,244		Channel	
1940	219,463		Channel & Turning Basin	
1941	53,793		Channel	
1942	63,340		Channel & Turning Basin	
1944	63,133		Channel	
1945	10,900		Channel	
1947	215,480		Channel & Turning Basin	
September 1949	78,000		Turning Basin	
September 1949	62,700		Channel	
December 1951	59,400		Channel	
1952	58,106		Channel	
March 1954	73,300		Turning Basin	
March 1954	54,300		Channel	
November 1955	76,700		Channel & Turning Basin	

Date	Maintenance Dredged – Cubic Yards	Placement to Beach	Dredge Area	Notes
September 1956	76,231		Channel & Turning Basin	
February 1957	44,000		Turning Basin	
February 1957	48,000		Channel	
January 1958	12,083		Channel	
November 1959	24,417		Channel & Turning Basin	
September 1966	184,972		Channel & Turning Basin	
November 1973	36,100	36,100	Maintenance Dredge channel	
November 1973	121,200		Channel & Turning Basin	
January 1974	0		Channel & Turning Basin	(4)
March 1974	8,492		Channel	
March 1976	14,600		Channel	
July 1978	49,800	49,800	Channel	
October 1980	14,600		Channel & Turning Basin	
May 1983	106,300		Channel	
November 1985	11,000		Channel	
December 1987	29,800	29,800	Channel	
January 1989	47,800	47,800	Channel	
March 1990	55,700	55,700	Maintenance Dredge channel	

Date	Maintenance Dredged – Cubic Yards	Placement to Beach	Dredge Area	Notes
November to January 1993 - 1994	7,200	7,200	Channel	
November to January 1993 - 1994	77,470		Turning Basin	
September 1995	0		Turning Basin	(2)
September 1995	0		Berthing Areas	(2)
1995-1996	14,000	14,000	Channel Modification	(2)
1997	19,400	19,400	Maintenance Dredge channel	
January 1998	23,300	23,300	Channel & Turning Basin	
2002	93,524		Fort Pierce Harbor	
May 2014	153,000	153,000	Ft. Pierce Harbor	
April to May 2017	37,150	37,150	ICWW	(3)
2018 through 2022	0	0	No inlet maintenance work	
TOTAL	3,452,600	473,250		

(1) Assumed - 10% of New Work Dredging Volume.

(2) New Work for modification; 10% of channel assumed maintenance.

(3) 74,300 cubic yards placed from ICWW to beach; 50% nominally "ascribed" to maintenance dredging of inlet.

(4) 219,000 cubic yards dredged and placed to upland; assumed not maintenance.

In 1999, the USACE conducted the third beach nourishment of the 1.3-mile restoration project with the placement of 830,000 cubic yards of sand from the Capron Shoals located four miles southeast of Ft. Pierce Inlet. The nourishment projects increased in frequency and volume averaging 430,000 cubic yards every two years through 2021, as shown in **Table 2** (OAI, 2021).

Table 2. Ft. Pierce Beach Fill Placement, R34-R41 (OAI, 2021).

Date	Offshore or Upland – Cubic Yards	Inlet Maintenance Dredging – Cubic Yards	Note
July 1971	718,000		
November 1973		36,100	
July 1978		49,800	
1980	346,000		
December 1987		29,800	
January 1989		47,800	
March 1990		55,700	(1)
1992 - 1994	14,400		
November - January 1993 - 1994		7,200	(1)
March 1995	54,400		
1995 - 1996	143,350	14,000	(2)
1997		19,400	
January 1998		23,300	
March 1999	830,000		
2000 - 2002	20,000		
April 2003	336,000		

Date	Offshore or Upland – Cubic Yards	Inlet Maintenance Dredging – Cubic Yards	Note
April 2004	406,000		
May 2005	616,000		
April 2007	503,800		
May 2009	189,600		
April 2011	62,700		
March 2012	499,800		
May 2013	436,800		
May 2014		153,000	
February - May 2015	319,090		
April - May 2017	37,150	37,150	(3) ICWW
April - May 2018	501,280		
March - May 2020	81,000		Truck Haul
April - May 2021	503,400		
Total	6,618,800	473,250	
Total of Offshore, Upland and Inlet		7,092,050	

(1) Value per Taylor (2017)

(2) Value uncertain: 120,000-166,700 (new work?); 10% from maintenance.

(3) ICWW dredging (74,300 cubic yards) assumed split 50/50 between inlet maintenance and 'other' external source.

On May 2, 2016, the department issued Joint Coastal Permit No. 0327791-001-JC to construct a 3.1± acre sediment impoundment basin with a width of approximately 180 feet, a length of approximately 800 feet, and a maximum dredge depth of -32 ft. NAVD. The siting of the

authorized impoundment basin is about 500 feet west of the location where sediment passes through the north jetty into the inlet. Inlet ebb currents will likely prevent the impoundment of a portion of the sediment passing through the north jetty, whereas inlet flood currents will likely transport a portion of the sediment westward to the impoundment basin. The authorized impoundment basin is considered a pilot project, referred to as Phase 1, which will be monitored and assessed for performance. This project commenced construction in the fall/winter of 2021 (Figure 4).

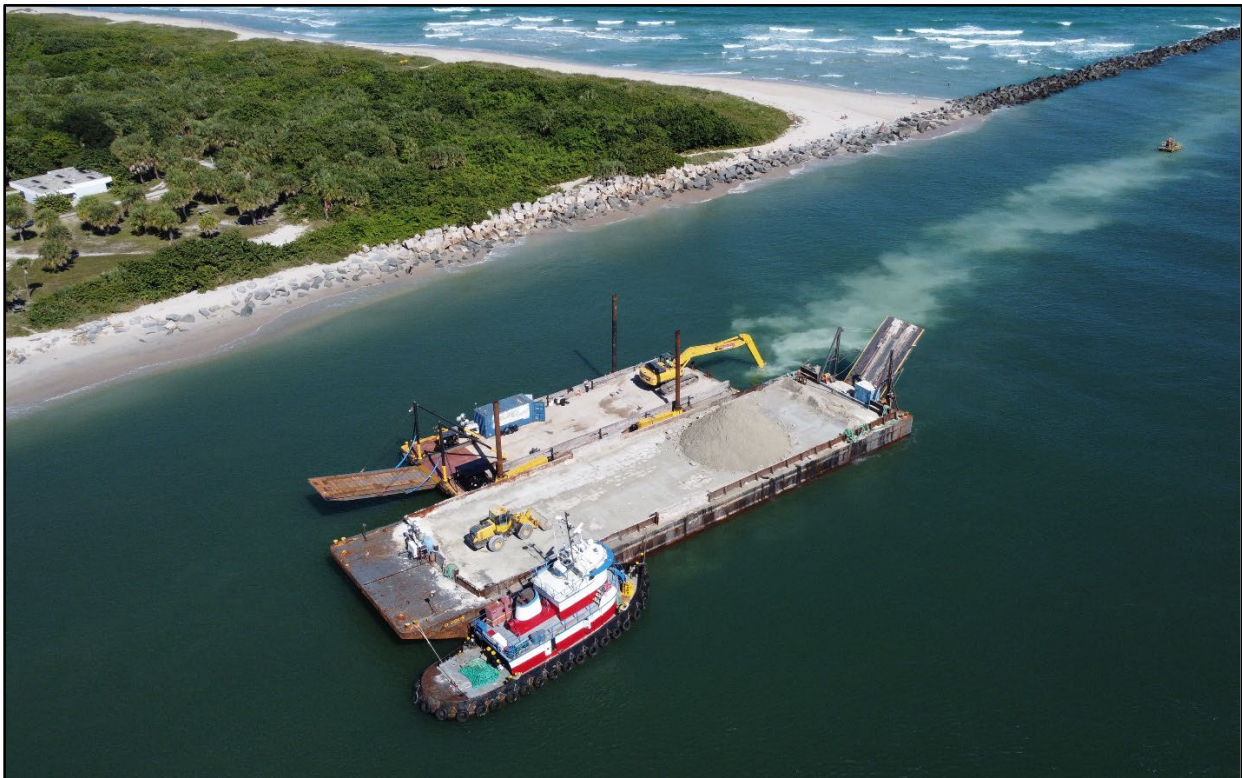


Figure 4. Ft. Pierce Inlet sediment impoundment basin under construction by Ahtna Marine and Construction Inc. (Photo courtesy of Joshua Revord with St. Lucie County and taken on 11-15-2021).

Adopted Inlet Management Plan of 1997

In January 1996, an inlet management study of Ft. Pierce Inlet was completed by Coastal Planning & Engineering, Inc., sponsored by the Department and St. Lucie County, which addressed the extent to which the inlet causes beach erosion and provided recommendations to mitigate erosion (CP&E, 1996). The study developed a sediment budget for the inlet and the entire county shoreline that represented the time period between 1966 and 1998. The sediment

budget determined a net southerly incident littoral drift of 106,600 cubic yards per year. The study recommended a bypass objective of 130,000 cubic yards with material obtained from various sources including dredging the inlet channel, dredging from the nearshore north of the inlet, dredging from offshore south of the inlet, and trucking in sand from upland mines. On May 30, 1997, the Department adopted the Ft. Pierce Inlet Management Implementation Plan calling for the following implementation actions (FDEP, 1997).

- 1) Initial restoration of 2.3 miles of beach south of the inlet.
- 2) Placement of all beach compatible maintenance or offshore dredged material on downdrift beaches. Material shall be placed on beaches in areas of greatest need.
- 3) Placement of supplemental material from upland sources, or dredged from nearshore north of the inlet, or from seaward of depth of closure on the beaches south of the inlet such that the combined total of material from all sources equals or exceeds 130,000 cubic yards on an average annual basis at a minimum.
- 4) Improvement of the south jetty to incorporate a spur jetty or other measures to reduce backflow of material into the inlet.
- 5) The sediment budget contained in the study report is adopted as an interim measure and shall be formally validated or redefined in subsequent revisions of the plan based on a comprehensive monitoring plan by December 31, 2001.
- 6) Implement a comprehensive inlet, beach, and offshore monitoring program subject to approval of the Department.
- 7) Evaluate possible alternatives to facilitate the bypassing of sand from the shoreline north of the inlet to the downdrift beaches.

The strategies adopted in the 1997 inlet management plan were wholly or substantially conducted.

Inlet Management Studies, 2000-2021, and Update Sediment Budget

Pursuant to Strategy 5 of the adopted inlet management plan, Taylor Engineering, Inc. (2001) conducted a study to update the sediment budget, and evaluate improvements conducted under Strategy 4. Both the CP&E (1996) study and the Taylor (2001) study determined broad impacts over the inlet cell boundaries of between 135,200 and 138,000 cubic yards per year on the beach south of the inlet.

Taylor (2004) investigated the feasibility of sand bypassing at the inlet. This study recommended a mobile jet pump bypassing plant and a north jetty sand tightening project. By letter of July 23, 2004, the Bureau of Beaches and Coastal Systems did not concur with these study recommendations and did not adopt them in an updated inlet management plan. The Bureau recommended further investigation be conducted of a sediment deposition basin within the inlet and a north jetty weir. Taylor Engineering, Inc., conducted additional studies evaluating sand trapping and evaluated the performance of sediment basin alternatives (Taylor, 2009; Taylor, 2010). These studies recommended a sediment basin inside the inlet immediately adjacent to and parallel with the north jetty. However, hard bottom resource concerns have resulted in a pilot sediment basin sited about 500 feet west of the optimum design location.

Between March and December 2016, the department and the county sponsored a sand tracer study conducted by Environmental Tracing along with CSA Ocean Sciences and Taylor Engineering, Inc. (ETS, 2017). The study showed the net transport of tracer sand on the beach north of the inlet was to the south and through the north jetty into the inlet. Tracer sand on the beach south of the inlet moved back and forth along the beach with slow movement trending to the south, but no tracer sand was collected that recirculated back north into the inlet.

Between 2016 and 2021, additional studies were conducted by Olsen Associates, Inc. to update the inlet's sediment budget (OAI, 2018; OAI, 2019; OAI, 2021). These studies developed sediment budgets for (1) 1972-1997, prior to the initial inlet management plan, (2) 1996/97-2016, during contemporary beach fill projects, and (3) a balanced sediment budget for one-year annual conditions.

OAI (2018) evaluated (i) inlet history, dredge and fill activity, prior studies, (ii) historical shoreline change from 1883 to 2016, (iii) beach volume changes from 1972 through 2016, (iv)

bathymetric changes across the interior, channel and ebb shoal, (v) observations of inlet morphology, (vi) wave transformation, longshore sediment transport modeling, and shoreline change modelling along the entire St. Lucie County shoreline, and (vii) formulation of the inlet sediment budget derived from all the inputs. With an update bathymetric survey in 2018, OAI further evaluated morphology and sediment transport potential along the shoreline from 1967 to 2018, and also evaluated the effects of the nearshore borrow area that was dredged in 1971 and 1980 (OAI, 2019a; OAI, 2019b). OAI (2021) updates the analyses, figures and tables with inlet dredging and beach nourishment values through spring of 2021. This latest study report focused on providing a balanced sediment budget for one-year annual conditions and a resulting bypassing objective for an update inlet management plan.

OAI conducted extensive wave modelling along the county's shoreline. From the wave modelling, they computed longshore transport potential at each R-monument north and south of the inlet (**Figure 5**). The results showed a spike in southerly transport potential immediately south of the inlet from R34 to about R37. From 0 at the jetty the longshore transport potential increases to nearly 300,000 to 350,000 cubic yards per year to the south. Then it drops abruptly to an ambient rate of about 100,000 cubic yards per year to the south at R41. Between R41 and R46 it then drops to nearly 0. South of R46 to R60 the net transport potential is about 100,000 cubic yards per year to the south. The longshore transport potential was also computed along the shoreline for the hypothetical "no inlet" case. The results were similar to the "with inlet" bathymetry still showing a spike in southerly drift between R34 and R40. That suggested that the acceleration in southerly directed transport rate across the inlet's location was due in part to the broad presence of offshore shoals and reefs, magnified by the formation of the inlet's ebb shoal. OAI compared the transport potential between 1967 and 2018 inlet bathymetries and found that the continuing seaward expansion of the circle-shaped ebb shoal platform compounded the effects of the offshore seabed, increasing the focus of wave and transport energy south of the inlet.

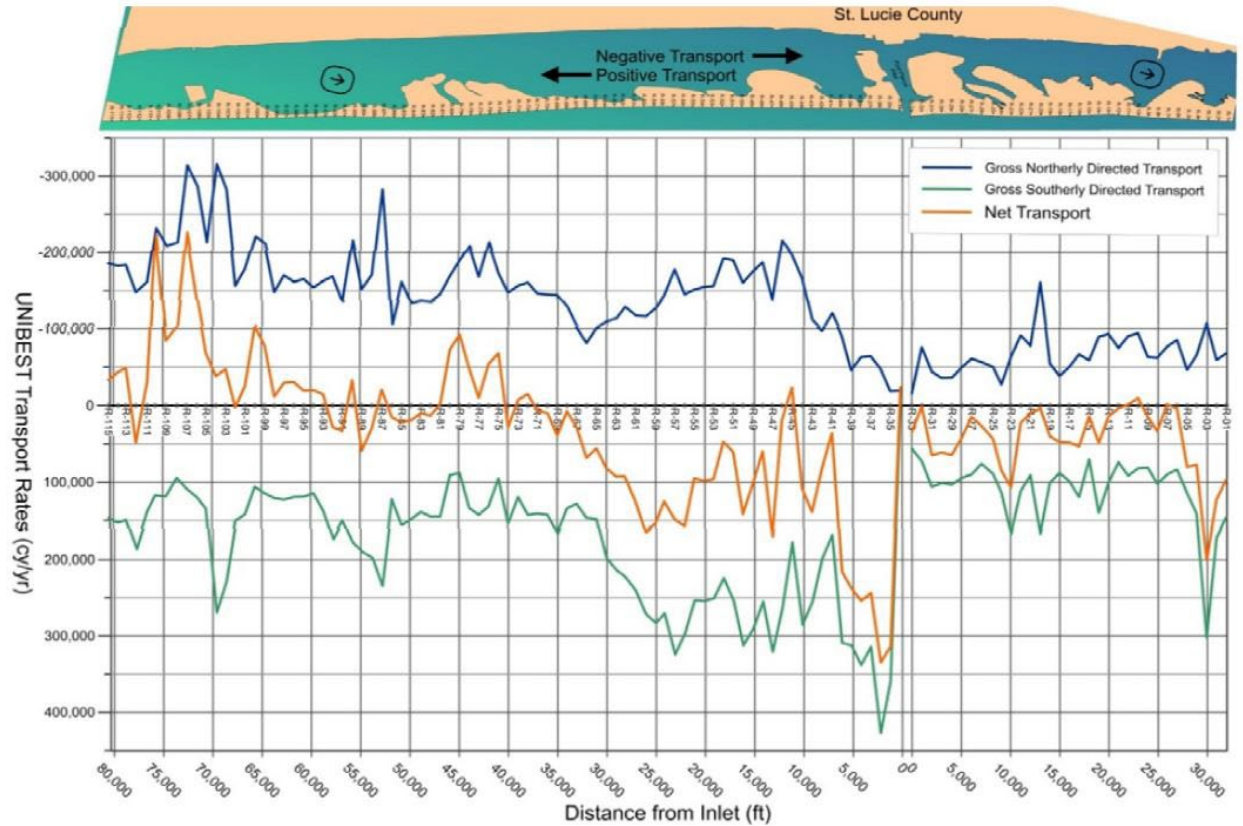


Figure 5. UNIBEST modeled net and gross transport rates at each of the 115 R-Monuments along the St. Lucie County coastline. Positive values indicate transport directed toward the south, (OAI 2021).

These studies revealed that the contemporary beach fill activities masked the actual annual inlet impact. The placement of about 225,000 cubic yards per year to the south of the inlet, from 1996 to 2021, barely maintained the beach between nourishments and was between 1.6 and 2 times the inlet's annual impact as determined by inlet shoaling, ebb and flood shoal losses, and updrift beach impoundment. A single-year bypass requirement of 140,000 cubic yards was determined necessary for the 1.3 miles south of the inlet. However, this quantity could not be linearized over multiple years because the local erosion rate increases with greater volumes of fill placement. This anomaly is most likely caused by the inlet's ebb shoal and offshore morphology that has caused a higher southward littoral drift potential immediately south of the inlet. Meantime, the placement of about 225,000 cubic yards per year restored the critically eroded, inlet-adjacent shoreline within 1.3 and 2.3 miles south of the inlet (R41-R46) which had otherwise not been nourished since the inlet was constructed.

Figure 6 presents the 2021 update Ft. Pierce Inlet balanced sediment budget for one-year annual conditions developed by OAI (2021).

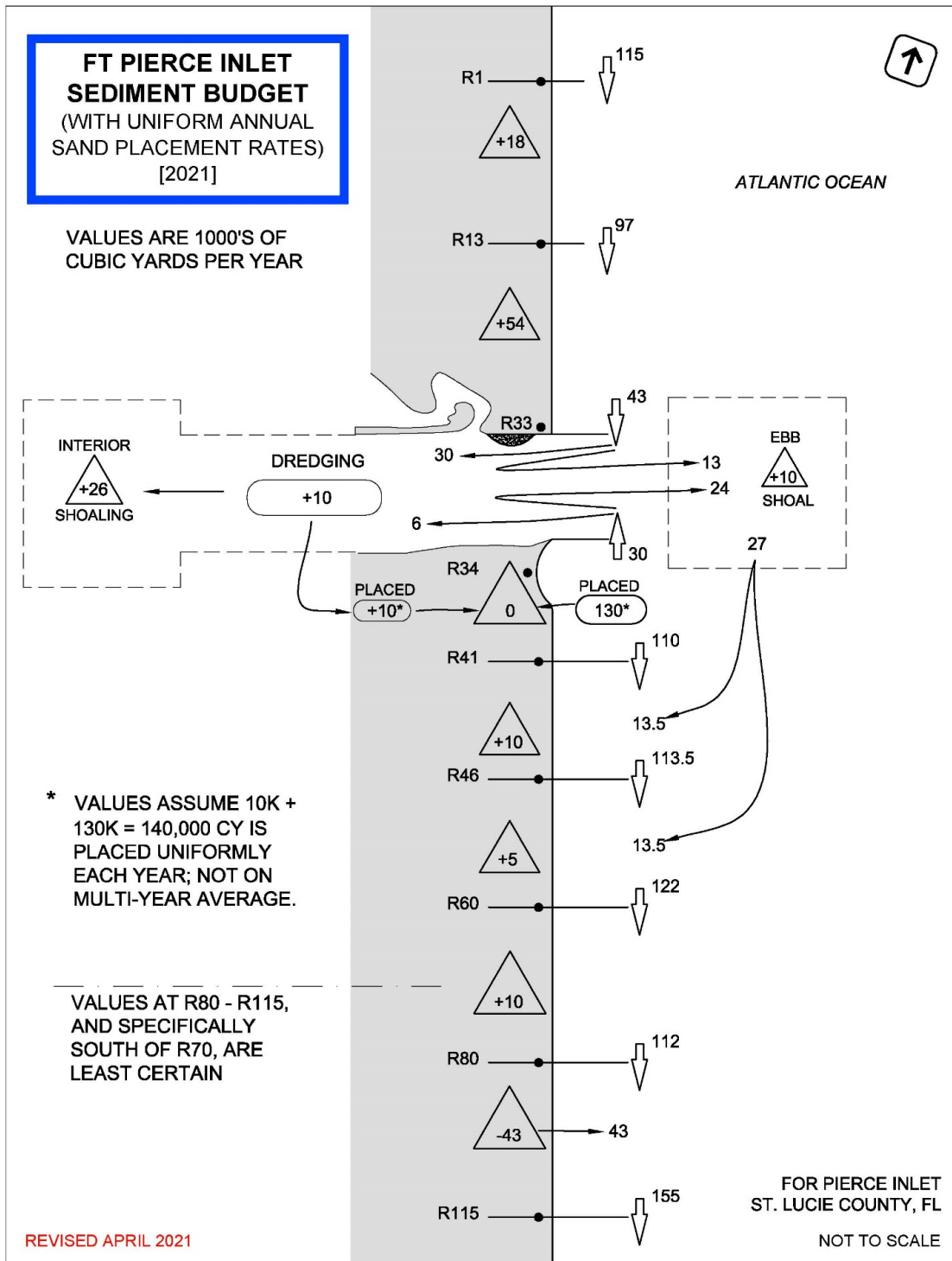


Figure 6. Contemporary Ft. Pierce Inlet Sediment Budget updated through 2021 (OAI 2021).

Due to the increasing erosion rate of beach fill projects south of the inlet that exceeds the equivalent annual inlet bypass placement of 140,000 cubic yards per year, the county and the USACE are evaluating the feasibility of stabilizing the 1.3-mile beach management project with a groin field. Reducing the non-inlet erosion effects with structures in combination with an inlet bypassing program is recommended by OAI (2021). Preliminary analysis has indicated potential benefit of constructing a limited structural field south of the inlet to increase short-term shoreline stability and reduce sand placement that exceeds the inlet's target requirement of 140,000 cubic yards per year. Detailed engineering investigation will be required to further evaluate and design a structural alternative that will optimize the frequency and quantity of sand placement for comprehensive sediment management at Fort Pierce Inlet and Fort Pierce Beach, consistent with the identified target inlet sand bypassing quantity

Recommended Inlet Management Plan Strategies

The Department staff recommends the following inlet management strategies be adopted to meet the requirements of Chapter 161, Florida Statutes.

- 1) A comprehensive beach and inlet hydrographic monitoring program** shall be conducted to evaluate the performance and impact of any sand bypassing and nourishment projects, and to periodically update the inlet sediment budget. Beach and nearshore surveys between FDEP Reference Monuments R1 and R60 shall be conducted. Periodic inlet hydrographic surveys to include the inlet channel and the ebb and flood shoals should also be conducted. Along with topographic and hydrographic surveys of the inlet system and adjoining beaches, hydraulic monitoring may be conducted to enhance future modeling input data for investigations of inlet management alternatives.

Discussion – A comprehensive beach and inlet hydrographic monitoring program is the most important element to manage the sediment at Ft. Pierce Inlet. Topographic and bathymetric surveys provide reliable data to estimate the volumetric impact of the inlet on adjacent beaches and to establish a sand placement protocol that complies with Section 161.142, Florida Statutes.

- 2) **Sand bypassing shall be performed from the inlet system to the adjacent Atlantic-fronting beaches to the south of the inlet between the south jetty near FDEP Reference Monument R34 and R41.** The quantity of material to be bypassed shall be based on available quantities documented through the monitoring protocol of Strategy #1 above.

Discussion – The beach immediately south of Ft. Pierce Inlet is the adjacent eroded beach directly impacted by the inlet system. The beaches 2.3 miles to the south of Ft. Pierce Inlet (R34-R46) are currently designated critically eroded by the Department (FDEP, 2021).

- 3) **On an average annual basis, the initial target inlet sand bypassing quantity shall be 140,000 cubic yards per year to the south.** This target quantity may be modified or updated based on a minimum of four years of additional monitoring data indicating a change in the sediment budget.

Discussion – The recent sediment budget indicates a need to place an annual quantity of approximately 140,000 cubic yards of sand on the eroded beaches south of the inlet to account for the inlet’s impact. Additional sand may be placed that is obtained from acceptable offshore sources or inland sand mines to account for the inlet’s effect of compounding the rate of sand placement losses, or to mitigate sand losses that are not attributable to the inlet.

- 4) **The source of sediment for meeting the target sand bypassing quantities in Strategy #3 may be the Ft. Pierce Inlet navigation channel, the authorized inlet sediment impoundment basin or as otherwise authorized by permit. The navigation channel and authorized sediment impoundment basin shall be prioritized for a portion of the bypass material, but other alternatives may be considered for further geotechnical and engineering design and permitting and implementation to develop an environmentally acceptable project with suitable quality sediment.** Acceptable beach quality sand may also be obtained from inland sand mines or offshore sources to achieve the target sand bypassing quantities.

Discussion – Maintenance dredging of the federal navigation channel accounts for about 10,000 cubic yards per year bypassed to the beaches south of the inlet. The authorized Phase I sediment

impoundment basin is to have a capacity of about 45,000 to 50,000 cubic yards that may be bypassed when constructed, as sediment becomes optimally available within the basin.

5) The Phase I pilot sediment impoundment basin shall be constructed as authorized.

Based upon the performance of the reduced capacity pilot basin, the full design sediment impoundment basin shall be constructed, as appropriate.

Discussion – An expanded impoundment basin may provide a bypass volume of up to 140,000 cubic yards. Should the basin be strategically sited to maximize the entrapment of beach sediment passing through the north jetty, substantially improved inlet sediment bypassing may be achieved, though multi-year deposition to and periodic bypass from the basin.

6) Evaluate possible alternatives to facilitate the bypassing of sand from the shoreline north of the inlet to the downdrift beaches.

Discussion – This was strategy #7 of the 1997 inlet management plan. While Taylor (2004) evaluated the feasibility of bypassing sand from the beaches north of the inlet to the eroded beaches south of the inlet, an update evaluation is appropriate due to changing technologies, socio-economic conditions, beach and inlet changes, major storm impacts, and the potential to modify the sediment impoundment basin and the north jetty.

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