

FINAL ORDER ADOPTING

PORT CANAVERAL INLET MANAGEMENT PLAN

WHEREAS on April 24, 1996, the Florida Department of Environmental Protection (Department) adopted the Port Canaveral Inlet Management Study Implementation Plan, which established inlet sand bypassing objectives, calling for restoration of critically eroded downdrift beaches, and calling for implementation of a comprehensive beach and offshore monitoring program that would be used to identify beach placement locations for future bypassing efforts and to revalidate the adopted sediment budget, and

WHEREAS the existing inlet protocol to bypass all beach compatible dredged material to downdrift beaches in eroded areas was determined by the sediment budget developed in the study, *Port Canaveral Inlet Management Plan* (Bodge, K.R., 1994), which was conducted in partnership with the Canaveral Port Authority, and

WHEREAS the sand bypassing objectives of the Port Canaveral Inlet Management Study Implementation Plan have been accomplished by a sand bypassing program that has been successfully developed, which involves the excavation of 7,900 feet of beach north of the inlet and placement on the beaches to the south, and

WHEREAS in 2008, the Florida Legislature amended Section 161.142, Florida Statutes, finding, “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, the U.S. Army Corps of Engineers is the entity that is responsible for the maintenance dredging and sand bypassing at Port Canaveral Harbor. They are the entity deemed responsible for the extent of erosion and for measures to correct such erosion, and

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 description of coastal processes in this document are not intended to affect title to real property or real property boundaries.

WHEREAS the Department and the Canaveral Port Authority contracted with Olsen & Associates, Inc., to compile new and historical data and information regarding coastal processes and inlet and shoreline dynamics, and to update the inlet sediment budget as reported in *Port Canaveral Inlet Management Plan: 2013 Sediment Budget Update* (OAI, 2014), and

WHEREAS the Department has developed an updated implementation plan that contains corrective measures to mitigate the identified impacts of the inlet, and

WHEREAS this revised inlet management plan is consistent with the Department's program objectives under Chapter 161, Florida Statutes,

THEREFORE:

The Department does hereby adopt the following implementation strategies, as set forth in the attachment, "Port Canaveral Inlet Management Plan – 2014 Update," hereby incorporated by reference. Future inlet management activities shall be consistent with the following five strategies:

1) Continue the existing comprehensive beach and inlet hydrographic monitoring program to evaluate performance and impact of existing bypassing and nourishment projects and to update and define the inlet sediment budget. Beach profile monitoring data shall be used to determine erosion¹ and accretion quantities from the beaches north and south of the inlet along the area of inlet influence, specifically including monitoring from CCAFS42 to R75.4.

2) Continue the authorized inlet sand bypassing protocol by excavating the beach quality sediments north of Port Canaveral Inlet between CCAFS38 and the north jetty at CCAFS29, with placement of material south of Port Canaveral Inlet between R1 and R20. **Preference shall be given to an increased fill density towards the south end of the fill area in order to maximize bypassed sand placement benefits.**

3) The average annual bypassing objective for Strategy #2 shall achieve a minimum placement of 156,000 cy per year equivalence of beach quality material from the beach borrow area north of the inlet and placement between R1 and R20.

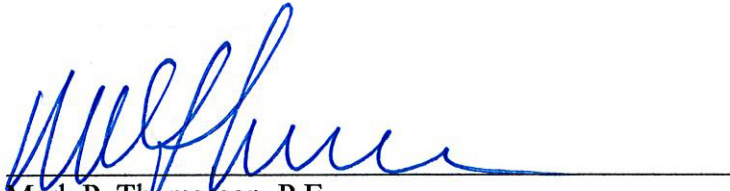
4) In order to bypass the natural net annual longshore sediment transport (approximately 210,000 cy), in addition to the minimum bypassing quantity in Strategy #3, an additional quantity equal to at least 54,000 cy per year equivalence of beach quality material shall be placed between R20 and R75, with priority placement south of R42. The priority source for this material shall be the beach borrow area north of the inlet; however, other approved sources shall be acceptable.

5) All suitable material from maintenance dredging the Canaveral Harbor Entrance and the south jetty sediment trap containing less than 20% fines shall be placed in the authorized nearshore disposal area in the vicinity of R28 to R38 offshore from Cocoa Beach.

Inlet management actions 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 that implement these adopted strategies shall be eligible for state financial participation pursuant to Section 161.143, Florida Statutes, subject to Department approval and an appropriation from the Florida Legislature. The level of State funding shall be determined based upon the activity being conducted and the Department's applicable statutes and 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 the adopted inlet management strategies. Nothing in this plan precludes the evaluation and potential adoption of other strategies for the effective management of Port Canaveral Inlet and the adjacent beaches through further revision to that plan as may be properly adopted.

Execution of this Final Order constitutes agency action. Any person whose substantial interests will be determined or affected by the Final Order may petition the Department for a formal or informal administrative hearing pursuant to Section 120.569 or 120.57, Florida Statutes, as set forth in the attached Notice of Rights, to challenge the provisions of this Final Order.

APPROVED FOR ADOPTION



Mark P. Thomasson, P.E.

Division of Water Resource Management
Department of Environmental Protection

8/6/14

Date

FILING AND ACKNOWLEDGEMENT

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


Deputy Clerk

8/7/14

Date

NOTICE OF RIGHTS

The Department's proposed agency action shall become final unless a timely petition for an administrative hearing is filed under Sections 120.569 and 120.57, Florida Statutes, before the deadline for filing a petition. The procedures for petitioning for a hearing are set forth below.

A person whose substantial interests are affected by the Department's proposed action decision may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, Florida Statutes. The petition must contain the information set forth below and 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. Petitions must be filed within twenty-one days of receipt of this written notice.

Under Rule 62-110.106(4), Florida Administrative Code, a person whose substantial interests are affected by the Department's action may request an extension of time to file a petition for an administrative hearing. Requests for extension of time must be filed (received by the clerk) with the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000, before the end of the time period for filing a petition for an administrative hearing. The Department may, for good cause shown, grant the request for an extension of time. 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.

Petitions filed by any persons other than those entitled to written notice under Section 120.60(3), Florida Statutes, must be filed within twenty-one days of publication of the notice or within twenty-one days of receipt of the written notice, whichever occurs first. Under Section 120.60(3), Florida Statutes, however, any person who asked the Department for notice of agency action may file a petition within twenty-one days of receipt of such notice, regardless of the date of publication.

The failure of any person to file a petition or request for extension of time 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, Florida Statutes, 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, Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based 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, and telephone number of the petitioner; the name, address, and telephone number 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; 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.

A petition that does not dispute the material facts on which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301, Florida Administrative Code.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under Section 120.573, Florida Statutes, is not available.

Once this decision becomes final, any party to the final agency action has the right to seek judicial review of it under Section 120.68, Florida Statutes, by filing a notice of appeal under Rule 9.110 of the Florida Rules of Appellate Procedure with the clerk of the Department in the Office of General Counsel, Mail Station 35, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000, and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice of appeal must be filed within thirty days after this decision is filed with the clerk of the Department.

PORT CANAVERAL
INLET MANAGEMENT PLAN
2014 UPDATE

Introduction

Pursuant to Subsection 161.101(2), Florida Statutes, the Florida Department of Environmental Protection (Department) is the beach and shore preservation authority for the State of Florida. As part of the Departments’ statewide beach management plan adopted pursuant to Section 161.161, Florida Statutes, the Department is adopting this inlet management plan for Port Canaveral Inlet in Brevard County, Florida (**Figure 1**). This plan updates an existing plan for Port Canaveral Inlet to make the plan consistent with current statutes and observed erosion¹ conditions.

On April 24, 1996, the Department adopted the *Port Canaveral Inlet Management Study Implementation Plan*. This plan was based upon recommendations and supporting data compiled in the study report, *Port Canaveral Inlet Management Plan [Technical Report]* (Bodge, 1994), and studies conducted by the U. S. Army Corps of Engineers on Canaveral Harbor. The study was conducted in partnership with the Canaveral Port Authority, under the provisions of Section 161.161, Florida Statutes, for the purposes of evaluating the erosive impact of the inlet on adjacent beaches, and to recommend corrective measures to mitigate identified impacts.

The adopted plan (FDEP, 1996) established inlet sand bypassing objectives and called for implementation of a comprehensive beach and offshore monitoring program. The sand bypassing objectives of the 1996 inlet management plan were accomplished by placement of inlet maintenance dredging material on the beaches south of the inlet, and through the establishment of a beach bypassing program with material obtained from the beaches north of the inlet. The *Strategic Beach Management Plan* (FDEP, 2008) further adopted a minimum average annual bypassing objective of 156,000 cy to be placed to the south of Port Canaveral Inlet.

In 2013, the Department and the Canaveral Port Authority sponsored an update study of Port Canaveral Inlet, to compile new and historical data and information regarding coastal processes,

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 description of coastal processes in this document are not intended to affect title to real property or real property boundaries.

inlet and shoreline dynamics. In March 2014, *Port Canaveral Inlet Management Plan – 2013 Sediment Budget Update* (OAI, 2014) was completed by Olsen Associates, Inc., and developed an updated sediment budget for the inlet.



Figure 1. Port Canaveral Inlet and vicinity (image from FDOT, 2009).

Statutory Responsibilities and Program Objectives

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

“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 161.143, Florida Statutes,

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

The Canaveral Port Authority is the local sponsor of the federally-authorized Canaveral Harbor Federal Navigation Project. The U.S. Army Corps of Engineers is the entity responsible for maintenance dredging, and consequently, mitigating the extent of erosion caused by the inlet, as specified in Subsection 161.142(6), Florida Statutes. The Canaveral Harbor Federal Sand Bypass Project is a congressionally authorized part of the Canaveral Harbor Federal Navigation Project. Port Canaveral is a deep water port as listed in Paragraph 403.021(9)(b), Florida Statutes.

History of Port Canaveral Inlet (Hunt, 1980; Moehle, 2003; OAI, 2014)

Port Canaveral Inlet is located at the approximate midpoint of peninsular Florida on the central Atlantic coast (**Figure 2**). In 1939, the Florida Legislature created the Canaveral Port District, which obtained funding authority in 1941. In 1945, the U.S. Congress, under the Rivers and Harbors Act, authorized construction of a deep water harbor and channel on the recurving shoreline immediately south of Cape Canaveral. The Act provided for a jetty-protected ocean entrance channel of 300 to 400-foot width and a turning basin of 1,000-foot width, each with a 27-foot depth (MLW). Also authorized was a dike around the harbor to prevent water exchange with the Banana River, a 50-foot by 250-foot lock in the perimeter dike, and a 7.4 mile barge canal connecting the lock to the Atlantic Intracoastal Waterway.

Construction of Canaveral Harbor commenced June 6, 1950, and the initial dredge cut through the barrier beach occurred in October 1951. Construction was suspended in March 1952 when channel shoaling became too excessive to achieve any progress with further dredging. The ocean channel was about 90% complete. In 1953, the Florida Legislature replaced the Canaveral Port District through the creation of the current Canaveral Port Authority and Port District.

The emergency construction of jetties and bank revetments commenced in June 1953. The south jetty was constructed to a length of 813 feet with a south bank revetment of 445 feet. The north

jetty was constructed to a length of 1,150 feet with a north bank revetment of 300 feet. With the exception of the lock, the port construction was substantially complete in September 1954.

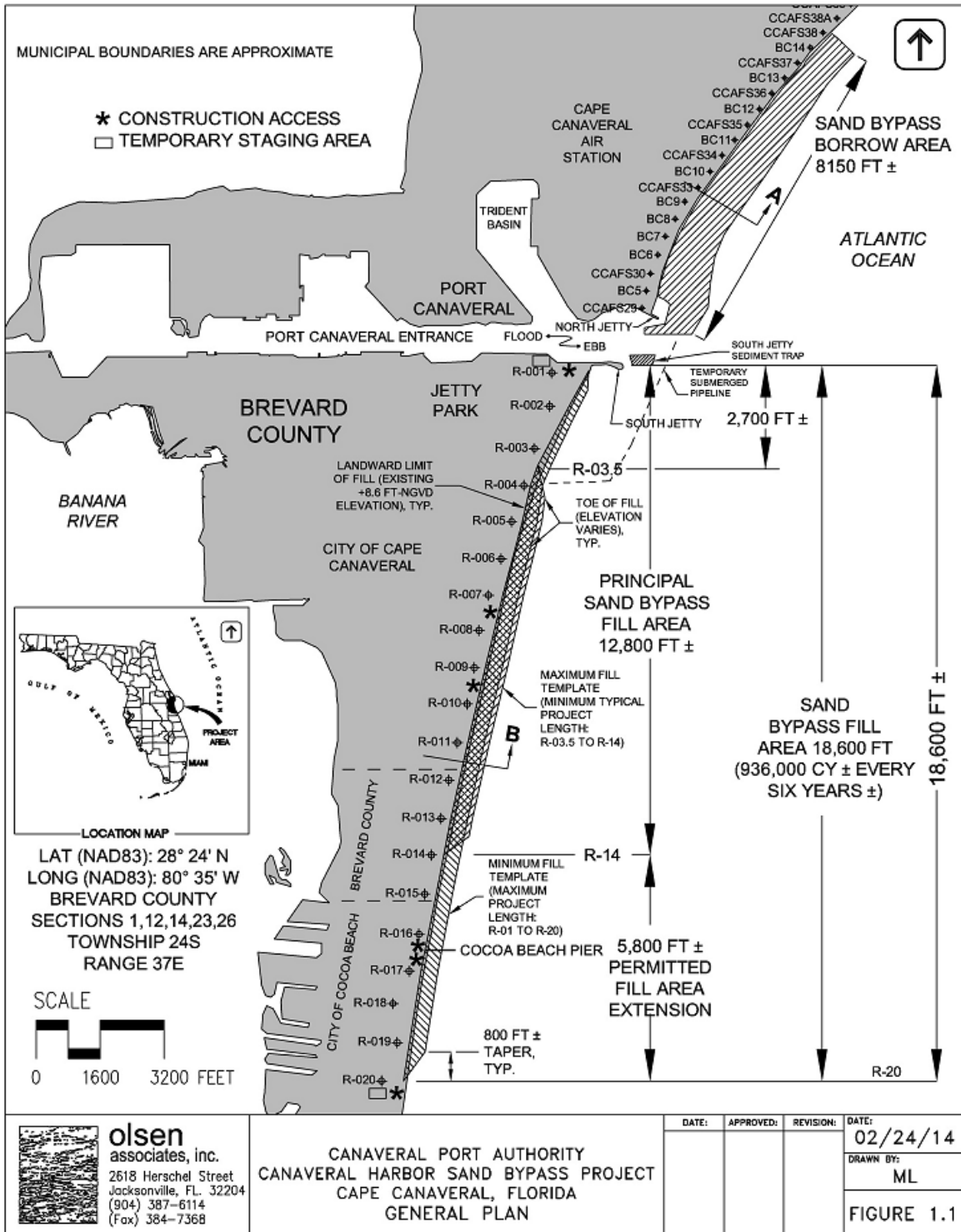


Figure 2. Vicinity map of Port Canaveral Harbor and adjacent beaches within the Canaveral Harbor Federal Sand Bypass Project (OAI, 2014).

In 1956, U.S. military improvements were initiated at the port following a large acquisition of land around the port. The entrance channel was deepened from the original 27-foot depth to a new 36-foot depth to accommodate larger vessels of the U.S. Navy. The turning basin was likewise deepened to 33 feet. The deepening was completed in mid-1957. In 1961, further deepening brought the entrance channel to a 37-foot depth and the turning basin to 35 feet. Port Canaveral was also designated by the U.S. Treasury as an official customs port of entry.

In 1965, a 90-foot by 600-foot lock was constructed, the barge canal was enlarged and deepened, and the perimeter dike was relocated 4,000 feet to the west to accommodate a west turning basin expansion (2,000 feet by 2,700 feet). In addition, approximately 120,000 cy of material was dredged from the inner channel and placed on the beach south of the inlet.

In 1972, approximately 200,000 cy of sand was obtained from the beach north of the inlet and placed on the beach south of the inlet between FDEP reference monuments R1 and R14. Bulkheads were also constructed on the north side (3,100 feet) and south side (3,157 feet) of the west turning basin in 1972. Between 1974 and 1975, the U.S. Navy excavated over 9 million cy of material to construct the Trident Submarine turning basin to 41 feet deep. In addition, the entrance channel was dredged to 43 feet. Of this, approximately 2.8 million cy of material was placed along 2.1 miles of beach immediately south of the inlet. Additional Trident Basin material totaling 467,000 cy was hauled by truck to Patrick Air Force Base beaches between FDEP reference monuments R53 and R75 from 1980 to 1996.

The first nearshore disposal operation from harbor entrance maintenance was conducted in 1992, involving the placement of 160,000 cy into the designated Nearshore Disposal Area (NDA), followed by another 200,000 cy of entrance maintenance in 1993, and 133,000 cy from an inner basin widener/deepener project in 1994, of which uncertain fractions entered the active littoral system. In the spring of 1994, the Port excavated 100,000 cy of sand from an upland cruise ship terminal and placed it on the beach south of the inlet between R5 and R11. During 1994 and 1995, the Corps of Engineers raised the elevation, sand tightened and lengthened the south jetty by 500 feet. During 1995, the first sand bypass operation was conducted from excavating a nearshore borrow area to mean high water along the beach north of the inlet, resulting in the placement of 956,800 cy of sand along the beach to the south. An additional 323,000 cy of material from entrance channel maintenance was placed in the NDA. The Port also trucked 40,000 cy of sand from upland borrow pits to Cocoa Beach and placed the material between R34 and R38.

In 1996, the Department adopted the *Port Canaveral Inlet Management Study Implementation Plan* (FDEP, 1996). This was followed by the second sand bypass operation in 1998, involving the placement of 1,035,400 cy between R3 and R14, from beach excavation between 1,000 and 7,400 feet north of the inlet. In addition, temporary north jetty sand tightening with sand filled geotextile containers was conducted. And the U.S. Air Force trucked 163,000 cy of sand from an upland source at Canaveral Harbor to Patrick AFB between R60 and R70.

The federal Brevard County Shore Protection Project (BCSPP) – North Reach (Canaveral and Cocoa Beach) was constructed between R3 and R53 between 2000 and 2001 with the placement of 2.8 million cy of sand dredged from the Canaveral Shoals. Concurrently, the Patrick Air Force Base Beach Restoration Project was constructed with the placement of 541,100 cy of sand between R53 and R70 obtained from the Canaveral Shoals.

An independent coastal expert (ICE) study was commissioned by the Corps of Engineers and concluded that the inlet's estimated littoral impact was 336,000 cy/yr prior to initiation of the 1995 sand bypass operation and south jetty improvements (Kriebel et al, 2002).

Hurricanes Frances and Jeanne in September 2004, inflicted severe damage to the beaches and coastal construction of Brevard County (Clark et al, 2004). The port and entrance channel sustained substantial shoaling due to the extended period of northeast swell that transported littoral sediments reducing navigable depths from 41 to 27 feet in the channel and effectively closed the port to all traffic. Emergency excavation placed at least 350,000 cy of material into the North Reach Nearshore Disposal and Sand Rehandling Area (NDSRA). This material has not yet been rehandled by dredging or moved by natural processes.

Post-hurricane nourishment projects were conducted in 2005 at both North Reach (BCSPP) and Patrick AFB with material obtained from the Canaveral Shoals. At North Reach, approximately 401,600 cy was placed between R33 and R54.5, and approximately 353,000 cy was placed between R8 and R19. At Patrick AFB, approximately 275,000 cy was placed between R54.5 and R75.3. In addition at the port, the Corps of Engineers raised the elevation, sand tightened and lengthened the north jetty 300 feet.

In 2007, the South Jetty Sediment Trap was excavated with the offshore disposal of non-beach compatible material. This was followed by the third sand bypass operation, which placed approximately 750,000 cy between R4 and R10, from dredging the beach between 1,450 and 4,950 feet north of the inlet. In 2010, the fourth sand bypass operation transferred approximately 683,100 cy from 800 to 4,900 feet north of the inlet to the south generally between R2 and R12. In 2011, the first Patrick AFB sand bypass operation hauled by truck 51,050 cy from above mean high water along the Canaveral Sand Bypass beach borrow area, and placed as dune restoration between R65 and R75. Also in 2011, nearly 200,000 cy of material was excavated from the South Jetty Sediment Trap in its first maintenance project, but only 27,500 cy was deemed suitable for placement in the NDA. Additional trap maintenance in 2013 placed no material in the NDA. Post-Hurricane Sandy projects were conducted in 2014, including a second Patrick AFB sand bypass of 17,000 cy placed between R64 and R70, and nourishment of North Reach with approximately 975,000 cy obtained from Canaveral Shoals and placed between R6 and R24 and between R34 and R54.

Table 1 provides a summary of the mitigative sand placement projects south of Port Canaveral Inlet between 1972 and 2012 (OAI, 2014). In addition, **Table 2** provides a summary of inlet impacts between 1954 and 2012 (OAI, 2014).

Table 1. Summary of the Mitigative Sand Placement Projects South of Port Canaveral Inlet between 1972 and 2012 (OAI, 2014)

Year	Location/Description	Mitigation Quantity (cy)	South Reach Quantity (cy)	Notes
1972	Cape Canaveral	200,000		
1974	Cape Canaveral	2,850,000		
1980	Indialantic/Melbourne		540,000	(a)
1992	Cocoa Beach NDA	79,000		
1993	Cocoa Beach NDA	50,000		
1994	Cape Canaveral	100,000		
1994	Cocoa Beach NDA	68,000		
1995	Sand Bypass I	783,000		
1995	Cocoa Beach NDA	122,000		
1980-1995	Patrick AFB	380,000		
1996	Cocoa Beach Truck Haul	40,000		
1998	Sand Bypass II	1,035,000		
1996-1998	Patrick AFB	250,000		
2001	Patrick AFB - Restoration	557,000		(b)
2001-02	North Reach - Restoration	3,138,000		(b)
2002-03	South Reach - Restoration		1,346,000	(a);(c)
<i>Subtotal 1972 - 2003</i>	<i>Mitigation 1972 - 2003</i>	<i>9,652,000</i>	<i>1,886,000</i>	
2005	North Reach – Post-Storm	754,600		
2005	Patrick AFB – Post-Storm	321,500		
2005	South Reach – Post-Storm		578,900	(a)
2006	Cocoa Beach NDA	60,000		
2007	Sand Bypass III	750,000		
2010	South Reach - Nourishment		650,000	(a)
2010	Sand Bypass IV	683,100		
2011	PAFB - Sand Bypass I	51,000		
2011	S. Jetty Sediment Trap - NDA	27,500		
<i>Subtotal 2005 - 2012</i>	<i>Mitigation 2005 - 2012</i>	<i>2,647,700</i>	<i>1,228,900</i>	
Total	Mitigation 1954 - 2012	12,299,700	3,114,900	

Notes:

- (a) Sand placed to South Reach or otherwise south of PAFB not included as inlet mitigation, per ICE study.
- (b) Initial hydraulic fill beach restoration with actual placed volumes estimated to be 557,000 cy and 3,138,000 cy. The ICE study had placement values of 2,798,000 cy to the North Reach and 541,000 cy to PAFB.
- (c) Actual placed volumes estimated to be 1,514,081 cy. Values from ICE study cited in Table 1.

Table 2. Summary of Inlet Impacts between 1954 and 2012, excluding Mitigation (OAI, 2014)

Years	# Yrs.	Rate (cy/yr)	Total Quantity (cy)	Notes
1954-1995	41	336,000	13,776,000	(a)
1996-2003	8	210,000	1,680,000	(b)
2004	1	510,000	510,000	(c)
2005-2012	8	210,000	1,680,000	(d)
1954-2012	58	304,241	17,646,000	

Notes:

- (a) Inlet impact from ICE study (Kriebel et al 2002), pre-sand-tightening of south jetty.
- (b) Inlet impact from ICE study, post-sand-tightening of south jetty.
- (c) Includes 300,000 cy impact from 2004 hurricanes; sand washed into inlet and not placed to NDA.
- (d) Post-sand-tightening of the north jetty; impounds net drift north of inlet.

Implementation of the Adopted Inlet Management Plan – 1996

The following implementation actions were adopted in the *Port Canaveral Inlet Management Study Implementation Plan* (FDEP, 1996):

1) Bypassing of all beach compatible dredged material to downdrift beaches in eroded areas.

As a first priority, place material on the beach in areas most in need and environmentally suited. As a minimum, bypassing of material shall meet average annual placement objectives as stated in the sediment budget. 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.

2) Place suitable material in designated near-shore disposal areas in the event that beach placement is not a viable alternative.

Nearshore disposal is contingent upon satisfactory performance of previously conducted projects. It appears that for maximum benefit, nearshore disposal should concentrate on placement of material in shallower water depths than previously used.

3) Restore downdrift beaches to mitigate the effects of the inlet.

This measure should be pursued under the federal Brevard County Shore Protection Project or other available state or federal authorizations.

4) Extend, sand tighten and raise the elevation of the south jetty. Upon completion of the improvements evaluate the feasibility and need for a channel widener/deposition basin.

5) Modify and improve the north jetty. Construct and monitor the performance of a pilot deposition basin at the north jetty.

6) Investigate the feasibility of utilizing a hydrocyclone or other innovative technologies to recover beach compatible material from channel maintenance dredging activities.

7) Implement a comprehensive beach and offshore monitoring program subject to the approval of the Department.

These actions were supplemented in the *Strategic Beach Management Plan* (FDEP, 2008), with the following strategy:

Bypass all beach compatible dredged material to downdrift beaches in eroded areas most in need; at a minimum, bypassing of material shall meet an average annual objective of 156,000 cubic yards.

Implementation action 1, modified in 2008, requires all beach compatible dredge material to be placed on the beaches to the south of the inlet with a minimum target bypassing objective of 156,000 cy/yr. Little beach compatible sand has been obtained by maintenance dredging the channel and port basins. However, a sand bypassing program has been successfully developed, which involves the excavation of 7,900 feet of beach north of the inlet and placement on the beaches to the south, generally between R1 and R15. Between 1995 and 2014, the average annual rate of bypassing has been 180,000 cy/yr (OAI, 2014). In addition, there has been another 68,000 cy/yr of sand hauled by truck to Patrick AFB.

Implementation action 2 has lost its importance since the north and south jetty sand tightening and lengthening projects, as well as since the sand bypassing projects were implemented. There continues to be nearshore disposal of channel maintenance dredge material, involving only the beach compatible fraction, which is placed in the authorized NDA. However, little beach sand is making it past the jetties now, so the beach compatible fraction of the channel maintenance dredge material has become very small.

Implementation action 3 has resulted in the restoration of Canaveral, Cocoa Beach, and Patrick AFB south of the inlet. Over 13.3 million cy of sand has been placed since 1972 through May 2014, which represents approximately 75 percent of the estimated historical inlet impacts since 1954 (OAI, 2014).

Implementation actions 4 and 5 have been completed. The south jetty was raised, extended, and sand tightened in 1995, and the South Jetty Sediment Trap was excavated in 2007. The north jetty extension, raising, and sand tightening was completed in 2007. The construction and monitoring of a pilot deposition basin was accomplished through the sand bypassing excavation and monitoring since 1995.

Implementation action 6 was addressed when the hydrocyclone technology was investigated and found to be of limited practical use. To recover beach compatible sediment from the basins and channel, the dredged material containing up to 20% fines is placed in the nearshore disposal area; however, the quantity of beach sediments entering the inlet has been substantially reduced.

Implementation action 7 calls for a comprehensive beach and offshore monitoring program, which has been conducted since 1995. Based upon this monitoring program, the sediment budget was to be updated by December 31, 2001. The sediment budget was updated in 2001, 2008, 2011, and 2013 (OAI, 2012; OAI, 2014).

In summary, each of the seven actions adopted in the 1996 inlet management plan have been successfully completed or are continuing to be implemented.

Update Sediment Budget through 2013

The inlet's impact on the beaches to the south has previously been investigated with substantial consistency. The inlet appears to act as a total littoral sink to sediment transport along the adjacent shorelines. The ICE study determined the inlet's area of influence extended 10 to 15 miles south of the inlet and included segments that are today covered by the North Reach federal beach restoration project and the Patrick AFB beach restoration project (Kriebel et al, 2002). Both the ICE study and the original inlet management study (Bodge, 1994) concluded the estimated southward longshore transport at the inlet location prior to its construction was between 180,000 and 240,000 cy/yr. Bodge (1994) determined a pre-inlet net longshore transport south of the inlet to be approximately 210,000 cy/yr to the south; however, the inlet's impact to those south side beaches that included sediment trapping of the northward sand transport, was actually 254,500 cy/yr. Walton (1995) evaluated the Department's beach profile data between 1972 and 1986, and concluded a 250,000 cy/yr loss to the beaches up to 14 miles south of the inlet. He likewise compared a smaller shoreline data set over the period of 1972 and 1994 with a consistent conclusion.

Bodge (1994) delineated the shoal features in the navigation channel between 1985 and 1992 and found an accumulation of 213,000 cy/yr. As mentioned in the inlet's history, the south jetty was raised, lengthened, and sand tightened in 1995. This activity essentially blocked further northward transport of littoral sediments off the beach south of the inlet. The ICE study (Kriebel et al, 2002) reported a loss of 210,000 cy/yr from the beaches south of the inlet after the 1995 jetty improvements, which also matched the pre-inlet southward longshore transport they calculated. They also concluded that the Corps' planned bypassing protocol of 156,000 cy/yr coupled with the shore protection project's planned maintenance nourishment of 86,000 cy/yr, which would provide a total of 242,000 cy/yr to the impacted beaches, would sufficiently mitigate the inlet's ongoing impacts.

Most recently, the Canaveral Port Authority and the Department sponsored a new sediment budget analysis, which has been completed and reported in *Port Canaveral Inlet Management Plan – 2013 Sediment Budget Update* (OAI, 2014). This analysis brings together all the pertinent physical monitoring data and dredge and fill records for the period between January 1995 and mid-2012, which represents the entire 17.5 years of bypassing under the adopted inlet management plan.

Figure 3 provides the update sediment budget for the area of inlet influence both north and south of the inlet. Currently, the area of greatest observed erosion stress is between R1 and R20, which is the immediate 3.5-mile segment south of and nearest the inlet. To the south, between R23 and R42, exists over 3 miles of shoreline that shows stability or minor erosion. OAI (2014) has discerned a weak nodal point in longshore transport (or a slight drift divide) around R6, about a mile south of the inlet. North of this point, transport may be somewhat greater towards the inlet. The shoreline within the first half mile of the inlet (R1-R3.5) shows stability or minor erosion. Bypassed sand placement benefits would be improved with placement between R6 and R20 and with increased fill density towards the south end of the placement limits, near R14 (OAI, 2014).

North of the inlet, as shown in **Figure 3**, the net rate of sand accumulation along the sand bypass borrow area (BC14 to north jetty) is +212,000 cy/yr. The control area north of the sand bypass

borrow area experiences accretion of approximately +33,000 cy/yr. Currently, the Corps of Engineers has a nominal bypass objective of 156,000 cy/yr; however, up to +212,000 cy/yr could be removed without causing net erosion to the area.

Also shown in **Figure 3**, for the area of inlet impact extending 13.7 miles south of the inlet (R1-R75.3), the contemporary erosion losses amount to approximately -201,000 cy/yr. In the immediate 3.5-mile segment south of the inlet (R1-R20), the erosion losses amount to approximately -146,000 cy/yr. The remaining -55,000 cy/yr in losses are sustained between R20 and R75.3; however, given some gains of approximately +28,000 cy/yr between R23 and R42, the Cocoa Beach segment between R15 and R53 only experienced erosion of -7,000 cy/yr and Patrick AFB sustained roughly -66,000 cy/yr in losses. Excluding the accretion of +28,000 cy/yr between R23 and R42, the gross erosion over the 13.7 miles south of the inlet would be -229,000 cy/yr.

The current sand management activities are depicted in green on **Figure 3**, to include the Corps of Engineers' bypassing operation from the bypass borrow area north of the inlet to the fill area immediately south of the inlet. Also shown are the North Reach Shore Protection Project and the Patrick AFB nourishment projects with sand obtained from offshore, as well as the truck-haul bypassing efforts to Patrick AFB.

Recommended Inlet Management Plan

The Department staff recommends the following implementation plan be adopted to meet the requirements of Chapter 161, Florida Statutes. Future inlet management activities shall be consistent with the following five strategies.

1) Continue the existing comprehensive beach and inlet hydrographic monitoring program to evaluate performance and impact of existing bypassing and nourishment projects and to update and define the inlet sediment budget. Beach profile monitoring data shall be used to determine erosion and accretion quantities from the beaches north and south of the inlet along the area of inlet influence, specifically including monitoring from CCAFS42 to R75.4.

2) Continue the authorized inlet sand bypassing protocol by excavating the beach quality sediments north of Port Canaveral Inlet between CCAFS38 and the north jetty at CCAFS29, with placement of material south of Port Canaveral Inlet between R1 and R20. **Preference shall be given to an increased fill density towards the south end of the fill area in order to maximize bypassed sand placement benefits.**

3) The average annual bypassing objective for Strategy #2 shall achieve a minimum placement of 156,000 cy per year equivalence of beach quality material from the beach borrow area north of the inlet and placement between R1 and R20.

4) In order to bypass the natural net annual longshore sediment transport (approximately 210,000 cy), in addition to the minimum bypassing quantity in Strategy #3, an additional quantity equal to at least 54,000 cy per year equivalence of beach quality material shall be placed between R20 and R75, with priority placement south of R42. The priority source for this material shall be the beach borrow area north of the inlet; however, other approved sources shall be acceptable.

5) All suitable material from maintenance dredging the Canaveral Harbor Entrance and the south jetty sediment trap containing less than 20% fines shall be placed in the authorized nearshore disposal area in the vicinity of R28 to R38 offshore from Cocoa Beach.

Implementation Discussion

Implementation Strategy #1

A comprehensive beach and inlet hydrographic monitoring program is the most important element to managing the future sediment budget at Port Canaveral Inlet. Topographic and bathymetric surveys provide the most reliable data to estimate the volumetric impact of the inlet and to establish a placement protocol that complies with the statutory mandate of Section 161.142, Florida Statutes. At present, surveys conducted for the inlet bypassing, channel maintenance, and shore protection projects will continue to provide sufficient monitoring data for future inlet management.

Implementation Strategy #2

A future sediment budget is dependent upon meteorological conditions and the resulting wave climate, which is difficult to predict. The most practical means of determining a sand placement protocol is to utilize the most recent volumetric change data for the beaches adjacent to the inlet. *Port Canaveral Inlet Management Plan – 2013 Sediment Budget Update* (OAI, 2014) provides this data and is the basis for the adopted sediment budget shown in **Figure 3**. The updated sediment budget indicates that the optimum sand bypassing placement area is between R6 and R20. To maximize bypass sand placement benefits, there should be an increased fill density towards the south end of the fill area, particularly toward R14.

Implementation Strategy #3

The initial four sand bypassing events of the Canaveral Harbor Federal Sand Bypass Project has placed approximately 3.43 million cubic yards of sand from the beach borrow area north of the inlet to the beaches south of the inlet between R1 and R15. Since 1995, this equates to 180,000 cy/yr through 2014, and 163,000 cy/yr to the next planned bypass event in 2016. This quantity exceeds the objective of 156,000 cy/yr set forth in the *Brevard County, Florida, Shore Protection Project Review Study* (USACE, 1996). The contemporary erosion stress south of the inlet between R1 and R20 is approximately -146,000 cy/yr. The placement of 156,000 cy/yr meets the erosion stress immediately south of the inlet and feeds the North Reach Shore Protection Project.

Implementation Strategy #4

Roughly 29% of the erosion within 13.7 miles south of the inlet is observed south of R53, within Patrick Air Force Base. The shoreline between R23 and R42 is currently stable. Bypassing of sand to Patrick AFB (roughly 10-14 miles south of the inlet) requires a separate method from the operation conducted within 3.5 miles of the inlet. Such bypassing can be achieved by a continuance of the truck haul placements by Patrick AFB, or by periodic nourishment with material obtained from the Canaveral Shoals. Although the beach bypassing borrow area north of the inlet is the most ideal site for a truck haul project to Patrick AFB beaches, other upland borrow sources may be acceptable provided the sand quality is acceptable.

Implementation Strategy #5

The continuance of nearshore disposal of channel maintenance dredge material, involving only the beach compatible fraction, is recommended to be placed in the authorized NDA. Since the sand tightening and lengthening of both jetties, little beach sand is now being transported into the navigation channel. This has resulted in the beach compatible fraction of the channel maintenance dredge material becoming very small. Placement of material in the NDA would be a good candidate site for a sediment tracer test to determine with greater accuracy the fraction of material that actually returns to the beach.

References

- Bodge, K.R., 1994. *Port Canaveral Inlet Management Plan [Technical Report]*, Olsen Associates, Inc., Jacksonville, FL.
- Clark, R.R. et al, 2004. *Hurricane Frances & Hurricane Jeanne: Post-storm Beach Conditions and Coastal Impact Report with Recommendations for Recovery and Modifications of Beach Management Strategies*, Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems, 93 pp.
- Florida Department of Environmental Protection, 1996. *Port Canaveral Inlet Management Study Implementation Plan*, 8 p.
- Florida Department of Environmental Protection, 2008. *Strategic Beach Management Plan*.
- Hunt, S.D., 1980. *Port Canaveral Entrance, Glossary of Inlets Report No. 9*, University of Florida, Florida Sea Grant Report Number 39, 50 p.
- Kriebel, D., Weggel, R., Dalrymple, R., 2002. *Independent Study Report: Brevard County, Florida Shore Protection Project*, Independent Coastal Expert Team Report prepared for U.S. Army Corps of Engineers, Jacksonville District, 92 p.
- Moehle, R., 2003. *Staying the Course: Port Canaveral – the First 50 Years*, Wolf Jessee Paquin Communications, 94 p.
- Olsen Associates, Inc., 2012. *Port Canaveral Inlet Management Plan: 2011 Sediment Budget Update*.
- Olsen Associates, Inc., 2014. *Port Canaveral Inlet Management Plan: 2013 Sediment Budget Update*, 231 p.
- U.S. Army Corps of Engineers, 1989. *Canaveral Harbor, Florida – Sand Bypass System*, General Design Memorandum.
- U.S. Army Corps of Engineers, 1993. *Canaveral Harbor, Florida Sand Bypass System*, General Reevaluation Report with Environmental Assessment.
- U.S. Army Corps of Engineers, 1996. *Brevard County, Florida, Shore Protection Project Review Study: Feasibility Report with Final Environmental Impact Statement*, Jacksonville District.
- Walton, T., 1995. *Limited Response Sub-study for Brevard County Erosion Mitigation*, U.S. Army Corps of Engineers.