

SYLLABUS

Authority and Purpose

This study of potential navigation improvements at Canaveral Harbor, Florida has been prepared by the Canaveral Port Authority (CPA) under the authority granted by Section 203 of Water Resources Development Act (WRDA) of 1986 (P.L. 99-662).

The purpose of this Section 203 study is to determine the feasibility of improvements to the existing Federal navigation project at Port Canaveral¹ and to identify the solution that best meets the economic, environmental, physical, and social needs of the region and the nation. Pursuant to Section 203 of WRDA 1986, this study is also intended to determine the advisability and extent of both Federal and non-Federal participation in cost sharing the proposed improvements.

The Principles and Guidelines require that the plan which maximizes net benefits, the NED plan, be identified. Typically, the incremental analysis includes depths beyond the depth which maximizes net benefits in order to “bracket” the NED plan and to show that net benefits in fact decline at deeper depths. However, ER 1105-2-100 paragraph 3-2 b.(10) Categorical Exemption to NED Plan states:

For harbor and channel deepening studies where the non-Federal sponsor has identified constraints on channel depths it is not required to analyze project plans greater (deeper) than the plan desired by the sponsor.

This study identifies the most economical plan analyzed, the plan that has the greatest net economic benefits of all plans considered. At the request of the non-Federal sponsor, plans greater in depth and width were not analyzed due to financial and logistical constraints.

Problems and Needs

The last major navigation improvements to the Federal navigation project at Port Canaveral were completed by the Corps of Engineers in 1995. Since that time, the demand by users of the Port to accommodate larger and deeper cruise ships and cargo vessels has resulted in a need to provide deeper and wider channels and expanded turning basins. Opportunities exist to increase the efficiency of existing operations by providing deeper and wider channels that allow larger cruise ships to use the Port and larger cargo vessels to carry greater loads.

There are vessels presently calling at Port Canaveral that could significantly benefit from deeper, wider channels, as well as newer, larger vessels that would use Port Canaveral if existing channels were improved. Since 2009, three new cruise ships which are among the largest in the world fleet have been homeported at Port Canaveral and a fourth is due to arrive in spring 2012. All of these vessels exceed the design dimensions of the project (nearly 300 feet longer and nearly 30 feet wider than the design vessel). The Canaveral Port Authority has made

¹ The existing project for deep draft navigation at Canaveral Harbor, Florida, authorized by the River and Harbor Acts of March 1945 and October 1962, and Sections 101, 114, and 117 of the Water Resources Development Act (WRDA) of 30 October 1992. The official name of the Federal project is Canaveral Harbor, Florida. Throughout the remainder of this report, this will be used interchangeably with the locally recognized name, Port Canaveral.

modifications to the Federal project (limited channel widening to 450 feet in selected locations, interim corner cutoff in West Turning Basin) in order to accommodate these vessels temporarily until the project can be upgraded. In addition, the new Seaport Canaveral facility, which began operations in 2010, provides the opportunity for substantial transportation cost savings if the project is deepened and widened to accommodate the longer and deeper tankers (up to 250 feet longer and 5 feet deeper than the design vessel) that Seaport Canaveral would like to use to transport petroleum products to their new facility. Additional transportation cost savings from project deepening would also accrue to other bulk carriers (rock, slag, cement), if existing vessels could be loaded more deeply and larger vessel could be used.

Projections for cruise traffic and cargo movements indicate sustained growth. The costs of transporting commodities could be significantly reduced if larger, more fully loaded vessels could call at Port Canaveral. Additionally, the cost of vessel operations within the Port could be substantially reduced by the improved vessel maneuverability afforded by a wider channel. Navigational safety, especially surge impacts on moored cargo and naval vessels, would be substantially improved by a wider channel.

Alternatives Considered

This study identified and evaluated alternatives to solve the following problems and take advantage of the following opportunities: 1) reduce ship congestion at Port Canaveral; 2) accommodate recent and anticipated future growth in cargo and cruise vessel traffic; 3) improve the efficiency of operations and improve safety for cruise ships and cargo vessels currently operating within the Port complex; 4) allow for use of the Port by larger cruise ships and larger and more efficient cargo vessels; and 5) allow for development of additional terminals/berths without encroaching on the existing Federal channels and turning basins.

Potential improvements evaluated in this study include: the No Action Plan; non-structural alternatives; and structural alternatives such as deepening and widening of navigational channels, expansion of the turning basins, and expanded wideners at the port. All viable alternative plans were considered that had the potential to improve the efficiency of operations and reduce the costs to cargo shippers and cruise lines. The only viable alternatives identified in the analysis involved various combinations of channel deepening, widening, turning basin extensions, and expanded wideners that would allow larger vessels to operate more efficiently and safely within in the Federal navigation project.

The formulation of alternative plans carefully considered the optimization of channel widths and depths to maximize net average annual benefits and contributions to the NED account. This included identification of design vessels (cruise and cargo) and associated dredging requirements, identification of structural and non-structural improvements, and estimation of incremental costs and benefits. The plan formulation process also considered the characteristics and quality of dredged material and requirements for disposal. All non-Federal ancillary facilities that are required to deliver project benefits were identified, costs estimated, and are included as associated costs in the alternative evaluation and economic analysis. All plans were evaluated using the System of Accounts framework established in the Principles and Guidelines (P&G 1983) promulgated by the Water Resources Council. The final alternatives were evaluated based on comparison to the No Action Plan, in order to identify the plan that maximized net economic benefits to the nation. Physical conditions at the Port constrained the array of

alternatives that were evaluated such that the most economical plan analyzed may be a smaller scale plan than the NED Plan. Environmental impacts were identified and evaluated to determine conformity with environmental laws, policies, and other guidelines. Finally, as previously mentioned, the views of the public were solicited and considered in the alternative formulation and evaluation process.

The Recommended Plan

The recommended plan, which is the most economical plan analyzed consists of widening the main ship channel from the harbor entrance inland to the West Turning Basin and West Access Channel, from its current authorized width of 400 feet to 500 feet. In addition to widening, deepening of the existing Federal project and expansion of turning basins is recommended in the following reaches:

- Outer Reach, Cut 1A: deepen from -44' to -46' for a length of 11,000';
- Outer Reach, Cut1B: deepen from -44' to -46' depth for a length of 5,500';
- Outer Reach, Cut 1: deepen from -44' to -46' for the 5,300' long portion of Cut 1 that is seaward of buoys 7/8 (Station 0+00 to Station 53+00). The remainder of Cut 1 from buoys 7/8 to the apex of the channel turn, a length of 7,200', would also be deepened from -44' to -46';
- US Navy Turn Widener: deepen from -44' to -46' X 7.7 acres (triangular shaped area) bounded by outer and middle reaches to the north and northeast and the civil turn widener to the southwest;
- Civil Turn Widener: deepen from -41' to -46' X 15.6 acres (irregular shaped area) bounded to the north and northeast by the middle reach and the US Navy turn widener;
- New Turn Widener: deepen to -46' X 23.1 acres (irregular shaped area) bounded to the north and northeast by the civil turn widener and Cut 1 of the outer reach. To maintain the sediment trap's design capacity, it is proposed that the trap be deepened consistent with the new channel depth, and slightly expanded to the south;
- Middle Reach: deepen from -44' to -46' for a length of 5,658' and widen from 400' to 500' for a length of 2,282'. The middle reach extends from the apex of the channel turn westward to the western boundary of the Trident access channel;
- Inner Reach, Cut 2 and Cut 3: deepen from -40' to -44' and widen from 400' to 500' for a length of 3,344';
- Trident Access Channel and Trident Basin: With exclusive use by US Navy, the Trident Access channel connects the middle reach to the Trident basin. Existing dimensions are -44' project depth throughout an irregularly shaped area to remain as is, except at the southern boundary of the existing Trident Access channel, where the new 100' north side channel widener will consume a portion of the Trident Access Channel;
- Middle Turning Basin: expand and deepen to encompass 68.9 acres to a project depth of -43' and a turning circle diameter of 1422'. The existing -39' federal project provides a turning circle diameter of 1200';

- West Access Channel (east of Station 260+00): deepen from -39' to -43' and widen from 400' to 500' for a length of 1,840'; and
- West Turning Basin and West Access Channel (west of Station 260+00): expand the existing federally authorized turning circle from 1,400' diameter at a depth of -31' to 1,725' X 141 acres at a depth of -35'. The existing West Turning circle was deepened and is maintained to -35' by the Canaveral Port Authority. As part of the proposed expansion and shifting of the turning circle, the federally authorized depth will be increased to -35'.

The recommended plan for commercial navigation is economically feasible based upon a 50-year project life at the current FY 2013 price levels and Federal discount rate of 3.75 percent. The total average annual benefits are \$5,393,000, total average annual costs are \$2,647,000, which result in total net annual benefits of \$2,747,000, and a benefit-cost ratio of 2.0 to 1.

Plan Implementation

In accordance with the provisions of Federal laws and policies, the Federal share of the first cost of implementing the recommended plan is estimated to be \$27,927,000. The estimated non-Federal share of the recommended plan is \$15,462,000, including lands, easements, rights-of-way, disposal areas, and associated non-Federal costs. Incremental annual maintenance costs are estimated to be \$633,400 annually and will be shared between the Federal and non-Federal sponsor 71% - 29% in accordance with the cost sharing breakdown for General Navigation Features. The Federal share of incremental annual maintenance costs is currently estimated to be \$452,200. Maintenance of any non-Federal ancillary facilities is a 100% non-Federal responsibility.

While the feasibility study was being conducted, a new fleet of larger cruise ships arrived at Port Canaveral. The dimensions of these vessels exceeded the design limits of the existing Federal navigation project (as predicted by the feasibility study) so, at the request of the cruise lines and Canaveral Pilots, CPA made the decision to advance construction of a portion of the planned improvements to the project to accommodate this new fleet of larger vessels, rather than turn them away. Navigation improvements in the West Turning Basin were constructed by the CPA in advance of completing the feasibility study in order to maintain safe navigation within the harbor for the newer, larger cruise ships that were entering the Port Canaveral fleet within the last several years.

The construction costs of these completed components (\$13,775,063) are not included as a project cost in this report, because a prior agreement or authorization for these improvements to the existing Federal project was not yet in place between the Corps of Engineers and the non-Federal sponsor, the Canaveral Port Authority. However, as has been the case for a number of previous Federal navigation projects, the CPA intends to seek post-facto credit for those costs as part of the specific Congressional authorization for construction of the project improvements recommended in this report. The proposed project, including the costs of the advanced construction of navigation improvements, remains economically justified and the recommended plan does not change if the expended costs of this completed element are included. The required

environmental documentation and coordination was also conducted by CPA prior to construction of these navigation improvements.

This Section 203 Study report includes an Integrated Final Environmental Assessment prepared in accordance with the requirements of the National Environmental Policy Act. This report is being submitted by the Canaveral Port Authority to the Assistant Secretary of the Army (Civil Works) for approval, processing of the NEPA document, and submission to Congress for authorization of construction. Upon approval and authorization, the study will proceed to preconstruction, engineering and design (PED), and construction by the Corps of Engineers. The schedule to proceed with construction is estimated to be as early at 2013, subject to Congressional authorization and appropriations, and the project base year is estimated to be 2014.

Environmental Considerations

This report includes an integrated Final Environmental Assessment, which will be processed by the U.S. Army Corps of Engineers as a Final Environmental Assessment, and was prepared in accordance with the requirements of the National Environmental Policy Act. This Final Environmental Assessment presents the assessment and evaluation of impacts to environmental resources and other attributes in accordance with Federal and State laws, ordinances, regulations, statutes, and other guidelines. The selected plan will result in minor, short-term adverse impacts related to temporary disruptions to the marine algal community, sea turtle feeding habitat, a temporary increase in turbidity, and temporary transportation disruptions during construction. The selected plan has been found to be in conformance with Federal, State, and local statutes and policies.

Agency and Public Coordination

Coordination with the public and with Federal, State, and local agencies (Section 8: Public Involvement, Review and Consultation) was conducted to aid in the formulation and evaluation of the Recommended Plan. Public and agency views including informal comments received to date from representatives of the 45th Space Wing, Weather Squadron, Cape Canaveral Air Force Station U.S. Environmental Protection Agency, Seminole Tribe of Florida, U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Coast Guard, Florida Department of Environmental Protection, and Florida Fish and Wildlife Conservation Commission, which have indicated no opposition or major issues with the proposed action.

Section 203 of WRDA 86 states:

SEC 203. STUDIES OF PROJECTS BY NON-FEDERAL INTERESTS.
PUBLIC LAW 99-662, NOV. 17, 1986. 33 USC 2231.

*(a) SUBMISSION TO SECRETARY - A non-Federal interest may on its own undertake a feasibility study of a proposed harbor or inland harbor project and submit it to the Secretary. To assist non-Federal interests, the Secretary shall, as soon as practicable, promulgate guidelines for studies of harbors or inland harbors to provide sufficient information for the formulation of studies.*⁶

(b) REVIEW BY SECRETARY - The Secretary shall review each study submitted under subsection (a) for the purpose of determining whether or not such study and the process under which such study was developed comply with Federal laws and regulations applicable to feasibility studies of navigation project for harbors or inland harbors.

(c) SUBMISSION TO CONGRESS - Not later than 180 days after receiving any study submitted under subsection (a), the Secretary shall transmit to the Congress, in writing, the results of such review and any recommendations the Secretary may have concerning the project described in such plan and design.

(d) CREDIT AND REIMBURSEMENT - If a project for which a study has been submitted under subsection (a) is authorized by any provision of Federal law enacted after the date of such submission, the Secretary shall credit toward the non-Federal share of the cost of construction of such project an amount equal to the portion of the cost of developing such study that would be the responsibility of the United States if such study were developed by the Secretary.

The United States Army Corps of Engineers (USACE) is the lead agency under the National Environmental policy Act of 1969 (NEPA).

1.2 Study Purpose and Scope

The Canaveral Port Authority (CPA) was created by a Special Act of the Florida state legislature in 1953 (the year the Port was dedicated), and is an independent governmental agency of the State of Florida that operates the Port. The CPA is also the non-Federal sponsor of the Federal navigation project at Port Canaveral.

The Canaveral Port Authority has conducted this Section 203 study to determine the feasibility of improvements to the Federal navigation project at Port Canaveral. Potential improvements include deepening and widening of navigational channels, expansion of the West Turning Basin, and expanded wideners at the port. The purpose of these potential improvements is to efficiently accommodate larger cruise ships and cargo vessels which are already using or projected to use the port in the very near future. These proposed improvements will also increase the efficiency and safety of cargo and naval vessel operations by reducing the current disruptions to cargo and naval operations from the surge effects of operating these extremely large cruise ships under high wind conditions in the narrow federal channel. This study identifies and evaluates alternatives that will:

⁶ Guidelines for implementation of Section 203 (WRDA 86) studies were prepared by the Corps and are contained in ER 1165-2-122, Studies of Harbor or Inland Harbor Projects by Non-Federal Interests, 26 August 1991. This guidance was used in the development of the Port Canaveral Section 203 Study

- 1) reduce congestion at Port Canaveral;
- ★ 2) accommodate recent and anticipated future growth in cargo and cruise vessel traffic;
- 3) improve the efficiency and safety of operations for cruise ships, cargo vessels, and naval vessels within the Port complex;
- 4) allow for use of the Port by larger cruise ships and larger and more efficient cargo vessels; and
- ★ 5) allow for development of additional terminals/berths without encroaching on the existing Federal channels and turning basins.

In February of 2002, the Jacksonville District, U.S. Army Corps of Engineers prepared an Initial Appraisal Study under the authority of Section 107 of the River and Harbor Act of 1960, as amended. Section 107 provides the U.S. Army Corps of Engineers authority to develop and construct small⁷ navigation projects. The Initial Appraisal Report concluded that there was a Federal interest in conducting a feasibility study to evaluate expanding and deepening the West Turning Basin. However, funds were not available for the Corps of Engineers to initiate the feasibility phase of the Section 107 study at that time. Subsequently, concerns by CPA regarding the adequacy of the width of the Main Access Channel and wideners led to a desire to also evaluate project widening as another potential improvement. It was determined that widening in addition to expanding the West Turning Basin would result in a project that exceeded the cost limits of the Section 107 authority, requiring a new congressionally authorized feasibility study under the Corps' General Investigations Authority. Because no new project authorization bills had passed since the time of the Section 107 Initial Appraisal, Port Canaveral chose to conduct their own feasibility study under the authority of Section 203 of WRDA 1986.

Since the last major Canaveral Harbor navigation capacity improvements were completed by the Corps of Engineers in 1995, Port Canaveral has experienced significant growth in cargo volume, cruise traffic, and the size and frequency of vessels calling at the port. Over the intervening years, the Canaveral Port Authority has made major investments in landside infrastructure to accommodate burgeoning growth at the Port and the region that it serves. At the present time, Port Canaveral is the second busiest cruise port in the U.S., and has recently experienced record levels of commodity tonnage.

Port congestion and inadequate channel capacity have become major issues, providing the impetus for CPA to conduct this Section 203 study. Pursuant to Section 203 of WRDA 1986, this study is intended to determine the feasibility and extent of Federal and non-Federal participation in improving Port Canaveral, consistent with the Federal objective of maximizing contributions to National Economic Development (NED), and consistent with protecting the nation's environment.

⁷ Section 107 Projects are limited to a maximum of \$4,000,000 in Federal project costs. In addition to the per project limit, total Federal expenditures for construction and Operate, Maintain, Repair, Replace, and Rehabilitate (OMRR&R) under the Section 107 authority are limited to the greater of \$4,500,000 or 2.25 times the Federal costs of the project, including costs for the feasibility through the construction phases.

prior to the arrival of the *Freedom of the Seas*. Other dimensions are similar to the Voyager Class. As discussed in Section 2.5.3 Existing Port Canaveral Cruise Ship Operations, limited additional dredging outside of authorized project limits was conducted in order for the *Mariner of the Seas* (Voyager Class) to operate safely within Port Canaveral.

Prior to bringing a Freedom Class vessel to Port Canaveral, additional limited dredging beyond existing authorized channel and turning basin dimensions, as recommended by the Pilots and RCI, was conducted. This additional dredging included expanding the southeast corner of the present entrance to the West Turning Basin to enable access by a Freedom Class vessel. The immediate widening of the West Turning Basin entrance is referred to as the Interim Corner Cut-Off. The Pilots stated their willingness to transit a Freedom Class vessel through Port Canaveral if these interim modifications to the Federal navigation channel were made, but only under the condition that further improvements (including full length channel widening) would be forthcoming. The Pilots have stated that interim channel modifications are not a long term solution to the restrictions on navigation of a Freedom Class vessel at Port Canaveral. Additional discussion of without-project condition vessel operations is contained in Section 3.4 Port Operations.

3.2 Terminal Facilities

3.2.1 Cargo Terminals

Recently completed construction projects include extending SCP4 and widening SCP1. Ongoing construction includes building North Cargo Berths 5 and 6, which are projected to be in operation in 2013. The largest difference between existing and without-project conditions for Port Canaveral's cargo terminal facilities will be the completion of Seaport Canaveral's (formerly Vitol) 36 acre, 2.8 million barrel petroleum product storage facility. This fuel terminal is located on the port's North Cargo Area adjacent to the Middle Turning Basin (North Cargo Piers 1-2). Initial construction, which was completed in December 2009, includes 24 storage tanks with a combined capacity of 2.8 million barrels. Initial construction cost was \$45 million. Seaport Canaveral Terminal capacity is more than three times the existing capacity at Transmontaigne's facility (formerly Coastal Fuels). Seaport Canaveral has delivery contracts in place and the first delivery occurred in February 2010. As of September 2011, 3.3 million tons of petroleum products have been delivered to the facility. The facility currently has 24 storage tanks with a capacity of 2.84 million barrels and a six lane truck rack. At full build-out, whenever that might occur, Seaport Canaveral will have 31 storage tanks with a capacity of 3.79 million barrels. Additional development at the facility may also include a pipeline to the Orlando International Airport and potentially a biodiesel production plant. Full build-out, jet fuel pipeline, and the biodiesel plant are all potential developments at Seaport Canaveral, which have not been included as elements that affect project benefits because of their speculative nature.

3.2.2 Cruise Terminals

Under without-project conditions, the Canaveral Port Authority undertook a \$32 million effort in 2010 to upgrade and expand Cruise Terminal (CT) 8 to accommodate the new, larger Disney vessels. The first of these new, larger vessels, the *Disney Dream*, entered service at Port Canaveral in January 2011. The second of two new Disney cruise ships, the *Disney Fantasy*,

began sailing from Port Canaveral in March 2012. These vessels are 128,000 Gross Registered Tonnage (GRT), with a draft of 27 feet, length overall of 1,115 feet, and a beam at the waterline of 121 feet. The older Disney ships are 83,000 GRT (with 965 feet LOA, 106 feet beam, and 25 feet draft), so the new vessels are considerably longer and wider, although they will still employ traditional propulsion systems. Completed modifications to CT 8 to accommodate the new larger Disney cruise ships include berth extension and additional mooring features without compromising the safety of navigation for cruise vessel traffic to and from adjacent CT 10. The passenger terminal was also substantially upgraded, and additional plans are being drawn up better accommodate up to 4,000 passengers.

CT 10 was modified in 2009 to accommodate RCI's new Freedom Class vessel. Prior to modifications CT 10 was capable of berthing a vessel with a maximum length of 1,020 feet. The new Freedom Class vessels are 1,112 feet LOA. Completed modifications to CT 10 include the construction of a mooring dolphin to the east of the existing pier and additional pier extension, which satisfy the requirements of the larger vessel. The passenger terminal was also enlarged to accommodate up to 3,500 passengers.

3.3 Economic Conditions

Even throughout the recent severe economic downturn, the population of the six-county region encompassing the project area continued to grow at a significant rate. For example, the population of Brevard County grew 14.1% from 2000 to 2010 (see Section 2.2.4). Under a medium growth scenario generated by the Bureau of Economic and Business Research (BEBR)¹⁵ at the University of Florida, the six-county port hinterland region is projected to increase population by 43% (1.4 million people) between 2010 and 2035, an average annual growth rate of 1.45%. This projected regional population growth is proportionately greater than projected statewide growth, which is projected to increase by 33%, an average annual rate of 1.1%. Table 3-1 presents the BEBR population growth estimates for the port's six-county hinterland region.

¹⁵ BEBR, 2010

Table 3-1
Six-County Regional Population Projections (2010 – 2035)

County	2010	2035	Population Increase	Percent Increase	Average Annual Growth Rate
Brevard	554,900	727,200	172,300	31.1%	1.1%
Lake	293,500	487,700	194,200	66.2%	2.1%
Orange	1,111,000	1,623,200	512,200	46.1%	1.5%
Osceola	273,300	506,400	233,100	85.3%	2.5%
Seminole	423,700	548,900	125,200	29.5%	1.0%
Volusia	506,500	636,600	130,100	25.7%	0.9%
Region Total	3,162,900	4,530,000	1,367,100	43.2%	1.45%
Florida	18,773,400	24,970,700	6,197,300	33.0%	1.15%

Source: Bureau of Economic and Business Research, University of Florida; Publication 156; March 2010

In addition to the projected population growth within the port's hinterland, operation of the Seaport Canaveral fuel terminal will expand the area historically serviced by the existing fuel terminal at Port Canaveral. Transmontaigne cannot expand or substantially change its operation due to permit and zoning constraints within the City of Cape Canaveral. Transmontaigne's facility is off port property and surrounded by residential development, drastically limiting its growth potential. Seaport Canaveral's business plan and physical plant design do not suffer from the same limitations and are aimed at expanding the existing hinterland for fuel beyond the area serviced by Transmontaigne to include the Orlando area and the Orlando International Airport.

The Florida 2006 Energy Plan states that 90% of the state's waterborne deliveries of fuel oil are handled by three principal ports: Tampa, Jacksonville, and Port Everglades. On Florida's east coast, there is only a very small volume handled at Fort Pierce, apart from Jacksonville, Port Everglades, and Port Canaveral. The hurricane seasons of 2004 and 2005 demonstrated severe disruptions of fuel distribution within Florida, which prompted the state to assess its need for expanded distribution and storage infrastructure improvements and contingency planning. The Florida 2006 Energy Plan's first recommendation for transportation fuels was to "facilitate diverse petroleum supply and distribution mechanisms into and within Florida". The new Seaport Canaveral Terminal adds capacity at a strategic location in central Florida, because of its proximity to Orlando and its mid-coast location between major delivery ports at Jacksonville and Port Everglades.

The Annual Energy Outlook 2011 projects (Table 3-2) that the South Atlantic region will increase its share of the nation's gasoline consumption from 39.6% in 2010 to 44.3% in 2035. Similarly, the South Atlantic region's distillate fuel consumption is expected to increase from 32.7% to 35.1% of national consumption. Overall, gasoline consumption in the South Atlantic region is projected to increase by 15.4% during 2010 through 2035, an annual rate of 0.6%. Distillate fuel consumption in the South Atlantic region is projected to increase by 40.2% from 2010 through 2035, an annual rate of 1.4%. The South Atlantic region's ethanol consumption in gasoline is projected to increase by 86.3% over the same period, an annual growth rate of 2.5%.

National ethanol net imports are projected to increase by a factor of more than 300 from less than 1,000 barrels per day in 2010 to more than 250,000 barrels per day by 2035.

Table 3-2
Fuel Consumption Projections in Millions of Barrels per Day (2010 – 2035)

Fuel	2010	2035	Consumption Increase	Percentage Increase	Average Annual Growth Rate
<u>National</u>					
Gasoline	9.02	9.31	0.29	3.2%	0.1%
Distillate	3.73	4.87	1.14	30.6%	1.1%
Ethanol Imports	0.0008	0.2562	0.2554	32,534%	---
<u>South Atlantic</u>					
Gasoline	3.57	4.12	0.55	15.4%	0.6%
Distillate	1.22	1.71	0.49	40.2%	1.4%
Ethanol in Gasoline	0.248	0.462	0.214	86.3%	2.5%

Source: Annual Energy Outlook 2011; South Atlantic Supplemental Regional Table (Table 5)

3.4 Port Operations

3.4.1 Commodity Projections

The without-project condition commodity forecast for Port Canaveral is based on recent historical commodity volumes and growth at the port, projected demographic and economic growth in the port's hinterland (see Section 3.3 Economic Conditions), and on existing port development. As discussed in Section 2.4, growth in overall commodity tonnage at Port Canaveral has been growing steadily over the past 40 years, although volumes of specific commodities have fluctuated significantly. Commodities with the most consistent historical growth have been construction-related commodities such as lumber, cement, and stone products and petroleum products (see Sections 2.4.1 and 2.4.2).

The effects of the recent recession were first seen in a total tonnage reduction from 2006 to 2007. By 2008, total tonnage had been reduced to 53% of 2006 levels. Since 2008, total tonnage at Port Canaveral has risen, though not yet to pre-recession levels. Total tonnage for 2009 was 9.64% greater than total 2008 tonnage, and 2010 total tonnage was 22.5% greater than total 2009 tonnage. By 2011, the Port's total tonnage was 99.9% of 2006 tonnage (Table 2-19). The effects of the recession have not impacted all commodities equally. Tonnage for lumber and cement has substantially reduced, but petroleum products and stone products have increased. Overall, residual tonnage impacts due to the recession are expected to be short-lived.

The commodity forecast used in this analysis focuses only on the four categories of bulk commodities that are carried on vessels large enough to potentially benefit from navigation improvements at Port Canaveral: fuel, rock, slag, and cement. Other commodities handled at Port Canaveral, such as lumber, salt, food products, etc., will continue to be carried on vessels

which are too small to require navigation improvements at Port Canaveral. Therefore, these other commodity groups are excluded from further analysis.

Rock (aggregate, limestone, and granite) forecasts were provided by the CPA based on term sheets for the two major bulk handling firms operating at the port. The term sheet is a planning document used by both the operator and the CPA to allocate resources and terminal area. The term sheet provides a revenue stream estimate for the CPA and is used to establish minimum guarantee fees. As a consequence of the guarantee fees, the projections contained in the term sheets are both conservative and as accurate as possible. The term sheets for both firms provide commodity projections from 2011 through 2035. In this analysis, there is no further growth projected for these commodities beyond growth identified in the term sheets, due to forecast uncertainty.

Port Canaveral is uniquely situated as the only deep water port on Florida's central east coast with the ability to handle and store the amount of rock products identified in the term sheets. The commercial importance of Port Canaveral's location, as explained by the operators, is that continued infrastructure development along the Orlando/Interstate 4 corridor requires more rock products than can be supplied through existing and historical local sources. The fixed location of rail infrastructure and the inability to develop potential sources within the Everglades due to land use constraints increase the need for imported rock products. At the same time, vessels carrying international rock products are increasing in size, lowering per unit transportation costs and increasing their cost competitiveness in the central Florida market. For example CSL, one of the world's major bulk carriers which calls regularly at Port Canaveral, will have a new fleet of Panamax bulk vessels in service by 2012 with draft capabilities of 44 feet.

Seaport Canaveral began operation in February 2010. From February 2010 through September 2011, Seaport Canaveral has handled 3.3 million tons of petroleum products. A detailed analysis of individual point-to-point shipments from the twelve month period from August 2010 through July 2011 was used to inform the Seaport Canaveral forecast (Table 2-25). The Transmontaigne facility, which also handles petroleum products, operates in a very different way than the Seaport Canaveral facility, due to its use as one of three Transmontaigne east Florida facilities which share deliveries and coordinate operations. The Transmontaigne facility, which cannot expand due to its proximity to residential development, does not provide a reference for future operations at Seaport Canaveral.

In early 2010, a short-term (2011 – 2013) forecast for Seaport Canaveral, based on current contracts, was provided by the terminal operator. This forecast, which projected an approximate 50% utilization of the Seaport Canaveral facility, included the recessionary impact of existing and near-term economic conditions. Actual Seaport Canaveral tonnage for point-to-point vessels during the 12 month period from August 2010 through July 2011 was 1,272,625 tons, which is 15.87% larger than the projection provided in 2010 (1,098, 334 tons). The actual 1,272,625 tons was used in place of the 2011 forecast and the remaining two short-term forecast years (1.4 million tons in 2012 and 1.9 million tons in 2013) were increased by 15.87% to 1.65 million tons in 2012 and 2.21 million tons in 2013. The long-term forecast (2014 – 2064) is based on the South Atlantic annual growth rates for gasoline (0.6%) and distillate fuel (1.4%) consumption, as presented in the Annual Energy Outlook 2011. These growth rates are proportionally applied to the short-term 2013 forecast (2.21 million tons; 1.78 million tons gasoline and 0.44 million tons distillate fuel) to generate the long-term (2014 – 2064) forecast..

The cement forecast is based on observed recent growth and includes the substantial impact that the recent recession had on cement imports. Domestic cement production is historically supplemented with imported cement. During the period from 1997 through 2007, cement imports, on average, accounted for 20.6% (23.6 million tons) of national cement consumption¹⁶. In 2009, cement import tonnage had fallen to 6.2 million tons and domestic consumption had fallen to a level equivalent to consumption in 1991. There have been no cement imports to Port Canaveral in 2009 – 2011. Nonetheless, the two cement terminal facilities at Port Canaveral, even though they have recently been idle, are being constantly maintained in operating condition on a monthly basis by Continental Cement (south side terminal) and CEMEX (north side terminal). These terminals have not been closed and the cement industry projects a strong recovery in cement imports due to pent up demand, environmental regulations restricting domestic cement production, and the permanent closure of domestic cement production plants that have not weathered the current economic downturn.

The Portland Cement Association (PCA) produced an analysis of projected future industry characteristics in 2011 titled “Overview Impact of Existing and Proposed Regulatory Standards on Domestic Cement Capacity”. The PCA analysis projects domestic cement consumption, production, and imports through 2025 under two regulatory scenarios. One regulatory scenario includes the effects of five currently enacted environmental regulations and two proposed regulations (the with-current emissions policy condition). The second regulatory scenario excludes these existing and proposed regulatory standards (the without-current emissions policy condition). The implications of these two policy scenarios is that imports are expected to increase more rapidly as a percentage of total cement usage under current emissions policy due to regulatory impacts on the level and cost of domestic production.

Under the with-current emissions policy scenario, the most likely condition for USACE planning purposes, U.S. cement consumption is projected by the PCA to increase from observed 2010 levels (68.9 million tons) to 170.8 million tons in 2025, an annual growth rate of 6.2%. Cement imports under the with-current emissions policy scenario are projected to increase from observed 2010 levels (5.9 million tons) to 82.0 million tons in 2025, an annual growth rate of 19.2%. This reflects an increasing share of imports versus domestic production over this period.

Even under the without-current emissions policy scenario, which favors domestic production over imports, the PCA projects that cement imports are projected to grow at an annual rate of 15.0%, achieving 48.0 million tons in 2025. Under the without-current emissions policy scenario, the PCA projects that cement imports at the national level will more than double between 2010 and 2015. One important contributing factor to the PCA import projections under both policy scenarios is that domestic production is expected to level off beginning in 2015. Under the without-current emissions policy scenario, domestic production levels off at a greater tonnage than under the with-current emissions policy scenario.

The cement forecast uses the Port’s 2007 level of imports (536,000 tons) as the cement tonnage projected to be achieved in 2015, which represents a much slower return of consumption levels than projected by the Portland Cement Association. This 2007 level of imports is 42% of the peak level (1.3 million tons) achieved in 2006. The projected growth rate for cement imports through Port Canaveral is based on the observed relationship between historical population

¹⁶ USGS Cement Statistics, last modification: December 13, 2010

growth in the port's six-county hinterland and growth in cement imports. This relationship is based on the assumption that increases in population require increases in infrastructure, such as buildings and roads, which are cement intensive structures. During the years from 2000 to 2006, the six-county population grew at an average annual rate of 2.96% and cement imports at Port Canaveral increased at a rate of 5.73%. BEBR population projections indicate an average annual population increase of 1.45% from 2010 through 2035 for the six-county region. Based on the observed proportional relationship between population growth and cement imports during the years from 2000 through 2006, the projected average annual increase in cement imports for a 1.45% population growth rate would be 2.81% $[(1.45\%/2.96) * 5.73\% = 2.81\%]$.

Note that the cement import tonnage growth assumptions used in this analysis (no resumption of cement imports at Port Canaveral until 2015 with a subsequent growth rate of 2.8% thereafter) are considerably lower than the cement industry's projections. The impact of alternative cement forecasts on project benefits are assessed in Section 6.8 Risk and Uncertainty.

Ground granulated blast furnace slag is a by-product of iron and steel production that is an input into concrete production and a substitute for Portland cement. Unground blast furnace slag is the import commodity, which is typically ground at and distributed from marine terminal facilities such as the Hanson plant and terminal at Port Canaveral. The forecast for slag is based on observed 2011 tonnage. The annual growth rate for slag is the same growth rate used for cement. The slag facility at Port Canaveral does not have the consistent historical use, due to ownership changes, that would allow for a separate growth rate to be developed in a manner similar to the cement growth rate.

Fly ash, which is a residual product of coal combustion, is also a substitute for Portland cement and an alternative product to slag. Fly ash and slag compete as low cost replacements for Portland cement in concrete production. The USGS reports¹⁷ that USEPA regulations, which reclassify fly ash as a hazardous waste, will likely result in increased sales and market share of slag as a substitute for fly ash as an input into concrete production. The USGS states that long-term growth in the supply of slag is likely to rely primarily on imports because of environmental restrictions on domestic production¹⁸. A sensitivity analysis for the slag forecast is presented in Section 6.8 Risk and Uncertainty.

Domestic slag consumption has not fallen as much as domestic cement consumption has fallen during the recent recession. This is because the market share of slag as an input to concrete production has been increasing relative to Portland cement as more concrete design specifications are written to include slag as a component of concrete mix. The net reliance on imported slag, as compared to domestically produced slag, has also increased from 2006 to 2010 from 8% to 10% of domestic consumption. The slag facility at Port Canaveral has an annual capacity of 600,000 tons, which is projected to be achieved in this forecast by 2045. Projected growth for slag is discontinued after 2045. Slag is the only commodity at Port Canaveral that reaches a capacity constraint before the end of the evaluation period.

The forecasted commodity tonnages for each of the potentially benefitting commodities are presented in Table 3-3. One important perspective on these forecasts is that they do not include

¹⁷ U S Geological Survey, Mineral Commodities Summaries, Iron and Steel Slag, January 2011.

¹⁸ US Geological Survey, Mineral Commodities Summary, Iron and Steel Slag, January 2011

the effects of potential future development at the Port. Because its cruise business has not been negatively affected by the recent economic downturn, the port has had the financial resources to continue to improve and expand its infrastructure even during the recessionary period, increasing its competitiveness relative to other ports for new business once the recessionary period is over. For example, the forecasts do not include any new commodity shipments through North Cargo Berths 5, 6 & 8, which are currently under development by Port Canaveral and should be completed within the next several years. The CPA is aggressively looking for opportunities to increase trade opportunities, such as containerized shipping; and has undeveloped, or under-developed real estate available for future port expansion. Additionally, these forecasts do not attempt to account for any future effects of the Panama Canal Expansion on Port trade.

Table 3-3
Base Case Commodity Forecast – Selected Years (Tons)

	2011	2020	2030	2040	2050	2060
Aggregate	400,000	800,000	800,000	800,000	800,000	800,000
Cement	---	616,178	812,881	1,072,376	1,414,710	1,414,710
Limestone	600,000	960,000	960,000	960,000	960,000	960,000
Granite	400,000	640,000	640,000	640,000	640,000	640,000
Slag	235,856	302,646	399,260	526,715	604,973	604,973
Gasoline ¹	874,905	1,851,168	1,965,285	2,086,438	2,215,059	2,351,609
Distillate Fuel ¹	223,429	479,947	551,534	633,800	728,336	836,973

Note: 2011 data based on observed FY 2011 tonnage reported by CPA

¹ Includes only Seaport Canaveral point-to-point tonnage

3.4.2 Cargo Fleet Forecast

Channel depths at Port Canaveral will be the same under existing and without-project conditions. Large bulk carriers and tankers are constrained by existing channel depths as described in Section 2.4.3, and will continue to be constrained under without-project conditions. Vessels operating under this constraint include vessels carrying stone products (aggregate, limestone, and granite), cement, slag, and petroleum products.

The vessels of the future without-project fleet are based on the vessels observed at the port in 2006, 2007 and 2008, with the exception of Seaport Canaveral Terminal tankers, which are instead based on Seaport Canaveral point-to-point vessels which arrived during August 2010 – July 2011. The number of future vessel calls for each commodity is based on the project commodity level divided by the average delivered tonnage per vessel call observed in 2006. Future without-project fleet operations at the port are expected to exhibit the same characteristics and patterns which were observed in 2006. For example, cement vessels delivered both full and partial loads in 2006, and are projected to deliver similar sized loads under without-project conditions. The distribution of cargo to vessels of different sizes is also based on the observed 2006 distribution. For example granite and limestone vessels were sorted into two categories

based on average Length overall (LOA) and arrival draft. Based on this categorization, 38% of granite and limestone was delivered on vessels with an average LOA of 597 feet and an arrival draft of 36.0 feet, and 62% was delivered on vessels with an average LOA of 753 feet and an arrival draft of 39.5 feet. These proportions and vessel sizes are used in the without-project condition fleet projections. Table 3-4 presents the projected number of vessel calls for the commodities that would potentially benefit from navigation improvements at Port Canaveral.

Table 3-4
Base Case Without-Project Condition Cargo Vessel Calls for Selected Years

	2020	2030	2040	2050	2060
Aggregate	5	5	5	5	5
Cement	10	14	20	26	35
Limestone	16	16	16	16	16
Granite	16	16	16	16	16
Slag	7	9	12	14	14
Gasoline ¹	44	47	50	53	56
Distillate Fuel ¹	11	13	15	17	20

¹ Includes only Seaport Canaveral point-to-point vessels

3.4.3 Cruise Ship Forecast and Operations

The overall industry demand for cruise ship services is projected to exhibit strong growth in the near-term. The Cruise Lines Industry Association (CLIA) estimates that 16.4 million people experienced multi-day cruises in 2011 (CLIA, 2012). Of the 30 new cruise ships currently scheduled for delivery into the North American fleet between 2008 and 2012, 16 are destined for service in the Caribbean, and 8 are slated for world-wide service. All but three of these new vessels are larger than 110,000 gross registered tons with passenger capacities of approximately 2,500 or more. The largest new vessel classes, RCI's Freedom Class, RCI's Oasis Class, the two new Disney vessels, and the Norwegian Cruise Lines Epic (previously Project F3) Class, all have vessels scheduled to be deployed in Caribbean service, as does Carnival's new Dream Class vessels, which are similar in size to RCI's Voyager Class.

The demand for cruise ship services at Port Canaveral is projected to remain strong. The consistently high cruise ship utilization levels at Port Canaveral (Table 2-21) have not been reduced during the recent economic downturn. Discussions with port personnel indicate that cruise lines are marketing their cruise packages as a relatively low cost family vacation and that more passengers are driving to the port in order to reduce total vacation costs. The most recent cruise ship utilization data available for the port indicates that overall multi-day cruise ship utilization levels for 2010 and the first half of 2011 are relatively unchanged from utilization levels during 2005 through 2009.

Cruise ship operations at Port Canaveral under without-project conditions will be very similar to operations under existing conditions, which includes the interim channel modifications that allow temporary use of the channel by the *Freedom of the Seas*. As of January 2011, Port Canaveral is the home port for three new vessels: RCI's *Freedom of the Seas*, *The Disney Dream* and Carnival Cruise Line's *Carnival Dream* (Table 2-15). In March 2012, the second new Disney vessel, *The Disney Fantasy* was homeported at Port Canaveral and one of the smaller Disney vessels currently homeported at Port Canaveral is projected to be re-deployed.

The *Freedom of the Seas* is the largest cruise ship projected to use Canaveral Harbor's Federal channel system in the near-term (Table 3-5). Under without-project conditions, regularly scheduled use of Port Canaveral by the *Freedom of the Seas* is projected to be restricted by wind conditions. The Port Canaveral Pilots consider the Freedom Class vessels to be too large for regularly scheduled unassisted passage through Port Canaveral's existing channels, based on the vessel's length and effective beam under normal high wind conditions. The Interim Corner Cutoff modification to the West Turning Basin was conducted to provide a temporary solution to allow these vessels to call at the Port until a permanent improvement to the navigation project can be implemented. Until that time, the Freedom Class vessels exceed design constraints of the Federal navigation channel and will require tug assist under normal high wind conditions.

The new Disney cruise ships, which are deployed from Port Canaveral, are narrower, but longer than the Freedom Class vessels. The Port Canaveral Pilots project that these vessels will be operated under more restrictive wind condition criteria than the previous Disney fleet because, although they are larger than the existing Disney vessels, they will have traditional propulsion equipment. The new Disney vessels also are projected to require tug assist under normal high wind conditions. The new Norwegian F3 Class vessel, *Epic*, is projected to use Port Canaveral as a port of call.

RCI has been in contact with the CPA concerning Oasis Class vessels using Port Canaveral as a potential port of call and as a port of refuge during emergency conditions. Under without-project conditions, including interim channel modifications, Oasis Class vessels are too large to operate in Canaveral Harbor's Federal channels on a regularly scheduled basis. Simulation-based evaluations conducted for the Oasis Class indicate an Oasis Class vessel could potentially operate in Port Canaveral in a limited fashion under with-project conditions, however; Oasis Class vessels are not projected to use Port Canaveral and the benefits calculations do not include any benefits related to Oasis Class vessels.

Table 3-5
Present and Future Large Cruise Ships and Classes

Cruise Ship or Class	Design Draft (ft)	Length Overall (ft)	Beam at Waterline (ft)	Disp. At Design Draft (m. tons)	Side Wind Sail Area	GRT
Disney <i>Dream & Fantasy</i> Homeport 2011 & 2012	27	1,115	121	62,414	132,181	128,000
CCL <i>Dream</i> Homeport 2009	27	1,004	122	58,262	126,404	130,000
RCI Voyager Class Homeport 2003 - 2009	28	1,021	127	62,716	119,523	138,000
NCL <i>Epic</i> Port of Call	29	1,081	133	73,761	144,959	150,000
Cunard <i>Queen Mary 2</i> Potential Port of Call	33	1,131	135	79,827	139,716	150,000
RCI <i>Freedom of the Seas</i> Homeport 2009	28	1,112	127	71,019	140,092	158,000
RCI Oasis Class Potential Port of Call	30	1,187	154	106,000	168,664	220,000

Other Florida ports also have structural constraints that preclude calls by the larger vessels. New, larger cruise ships have air drafts in excess of 200 feet. Freedom Class vessels have an air draft of 210 feet, as do Voyager Class vessels. Oasis Class vessels have an air draft of 230 feet. Cruise ship activity at the ports of Tampa and Jacksonville are constrained by bridge heights:

- Tampa: Sunshine Skyway Bridge 175 feet vertical clearance (Tampa Bay Pilots Port Guide, 2004); and
- Jacksonville: Dames Point Bridge 169 feet vertical clearance (St. Johns Bar Pilots Association, www.jaxpilots.com).

Other alternative ports for Caribbean cruise destinations include Charleston, SC, Galveston, TX and San Juan, PR. However, each of these ports has constraints which would not allow the largest new cruise ships to be homeported there. Charleston is limited by berth space availability - the largest cruise ships cannot fit into Charleston's limited berth space (300 linear feet plus 150 feet provided by a mooring dolphin), although adjacent cargo berth space is occasionally used. Galveston's passenger volumes have shown strong growth since 2003 (from 377,000 in 2003 to 616,000 passengers in 2006) but remain less than half of Port Canaveral's levels. Continued strong passenger growth at Galveston is constrained by berth availability: only 2 cruise ship berths comprising 2,000 linear feet. San Juan is a limited alternative because of significantly higher air travel costs.

3.5 Environmental and Cultural Resources

Undeveloped upland habitat within Port Canaveral consists primarily of historic spoil disposal sites and disturbed shrub/brushland. Under the future without-project condition, much of the upland communities within the Port will be developed. There are currently a number of proposed projects such as a hotel and conference center, Canaveral Cove Phase II, and the Seaport Canaveral fuel tank farm that would be constructed on much of the undeveloped (or

4. PROBLEMS, OPPORTUNITIES AND CONSTRAINTS

This section of the Section 203 Study Report:

1. defines the water resource problems (i.e., negative conditions) that were addressed in the study;
2. identifies the opportunities (i.e., desirable future outcomes) that were identified during the study to resolve the problems and improve water resources conditions in the study area;
3. establishes the planning objectives (i.e., desired results) that were used to guide plan formulation; and
4. identifies the constraints (i.e., conditions to avoid, things that cannot be changed) which limited the development and selection of alternative plans.

4.1 Problems

Five major problems have been identified based on the analysis of existing and without-project conditions at Port Canaveral. These problems are summarized below and discussed in the following paragraphs. The five major problems are:

1. Channel and turning basin dimensions at Port Canaveral limit the size of cruise ships that are able to call at the Port and impact large cruise ship operations within the Port.
- ★ 2. Channel dimensions and depths at Port Canaveral limit the size and efficient utilization and movement of cargo vessels that call at the Port.
3. Surges occur at cargo and Navy piers due to the passage of large cruise ships through the narrow ship channel. Surge effects cause damages to cargo and Naval vessels, such as parted lines and minor connection damage, personnel injuries, and result in cargo ships having to stop loading and unloading activities while the cruise ships pass.
- ★ 4. Congestion at cargo berths is expected (future without project conditions) to result in vessel delays and additional transportation costs.
- ★ 5. Channel and turning basin dimensions are restricting the port's ability to develop new cargo and cruise terminals needed to accommodate growing demand and larger vessels.

4.1.1 Problem 1: Cruise Ship Size Limitations

Current and future cruise ships calling and expected to call at Port Canaveral are constrained by channel widths and the dimensions of the West Turning Basin.

4.1.1.1 Channel Widths

The existing channels and turning basins were sized for much smaller vessels than are currently calling at Port Canaveral. The navigation project improvements authorized in 1992 (WRDA 1992) and completed in 1995 justified widening and deepening the project based on a composite design vessel (a 67,000 Dead Weight Tonnage (DWT) tanker and a 45,000 DWT bulk cement carrier) with an average length of 750 feet, a beam of 100 feet, and maximum draft of 40 feet. Cruise ships calling at the Port at that time were not large enough to be constrained by channel dimensions.

Since the time of the 1992 authorization, the cruise ships calling at Port Canaveral have increased substantially in Gross Registered Tonnage (GRT), length, beam, draft, and passenger capacity. As the second busiest cruise port in the world serving the world's largest cruise destination (the Caribbean), Port Canaveral attracts among the largest cruise vessels currently afloat.

The largest cruise vessel currently homeported at Port Canaveral is the Royal Caribbean International (RCI) Freedom Class vessel, *Freedom of the Seas*. The *Freedom of the Seas* has the following dimensions: 160,000 GRT; length 1,112 feet; beam 127 feet; draft 28 feet; and passenger capacity 3,634. This vessel replaced the *Mariner of the Seas* at Port Canaveral, a Voyager Class 138,000 GRT vessel, with a length of 1,020 feet, a beam of 127 feet (at the waterline), a draft of 29 feet, and a capacity of 3,114 passengers.

There are currently two Freedom Class vessels in the RCI fleet, *Liberty of the Seas* and *Freedom of the Seas*. The *Liberty of the Seas* is currently homeported in Miami.

The *Mariner of the Seas*, the smaller Voyager Class vessel, had difficulty during adverse weather conditions navigating the current 400 foot wide channel, maneuvering the channel bends, and operating within the 1,400 foot West Turning Basin. Given its larger size, the Freedom Class faces even greater difficulties. The wind and wave climate at Canaveral Harbor influence the transit conditions for cruise vessel traffic (Engineering Appendix: Section 1.3 Site Environmental Conditions). The wind, in particular, influences cruise ship transits due to the very large freeboard area of these vessels. Safe navigation inside the harbor requires a balance between vessel speed and good ship handling capability to manage the yaw of the vessel or "crab angle" as it moves through the waterway under the influence of moderate to high wind conditions.

A vessel's "crab angle" is defined as the difference between the ship heading and the actual course made good, sometimes also called the "drift angle". Cruise ships transiting the channels at Port Canaveral are susceptible to "crabbing" because their large superstructure acts as a sail in the wind and moderate speeds must be maintained to avoid surge impacts on moored vessels and to maintain braking control of the vessel. The wider the "crab angle", the larger the effective beam of the vessel.

The first ship in the next generation of RCI cruise ships, the Oasis Class *Oasis of the Seas* is homeported in Port Everglades and began service in November 2009. The Oasis Class is now the world's largest cruise ships. The Oasis Class vessels have a capacity of at least 5,400 passengers, weigh approximately 220,000 GRT, and will have a length of 1,186 feet, beam of 154.2 feet, and draft 2 feet deeper than the Freedom Class (approximately 30 feet). The first two Oasis Class vessels deployed out of Ft. Lauderdale. Port Canaveral currently does not have sufficient channel dimensions to be a homeport for an Oasis Class vessel. This projected deployment schedule is consistent with passenger demand for cruise ship services which is focused on east Florida ports (56% of all U.S. passenger departures in 2006) and Caribbean destinations (71% of all U.S. passenger destinations in 2006).

As explained in Section 3.4, the Canaveral Pilots Association considers the Oasis Class vessels to be too large for regularly scheduled passage through Port Canaveral's channels under without-project conditions, based on the vessel's length and effective beam under normal high wind conditions. The newest, largest cruise ships are designed with propulsion systems intended to allow them to transit ports without tug assists. However, under high wind conditions and

considering the narrow channels and turns at Port Canaveral, these vessels will require tug assist to conduct channel transits.

The existing authorized channel width (400 feet) is only 2.6 times the beam of the Oasis Class vessel (and 3.1 times the beam of the Freedom Class vessel), which is substantially below international and USACE channel width design guidelines¹⁹. Corps channel width design guidelines range from 3.5 to 4.0 times design ship width, with consideration of various environmental and operational factors. The overall vessel length (LOA) of the Oasis Class vessel (1,186 feet) is an additional 74 feet longer than the Freedom Class. This increase in beam and length over the Freedom Class will preclude the Oasis Class from transiting through Port Canaveral's channels under without project future conditions.

4.1.1.2 Turning Basins

As previously stated, the dimensions of the West Turning Basin (WTB) are inadequate for existing vessels homeported at Port Canaveral and cannot safely accommodate future cruise ships projected to call at Port Canaveral. The WTB is currently 1,400 feet in diameter, authorized to -31 feet, and maintained at -35 feet by the CPA. Corps design guidelines for turning basins are contained in EM 1110-2-1613 (excerpt below).

9-2. *Turning Basins. c. Size. (1) The size of the turning basin should provide a minimum turning diameter of at least 1.2 times the length of the design ship where prevailing currents are 0.5 knot or less. Recent ERDC/WES simulator studies have shown that turning basins should provide minimum turning diameters of 1.5 times the length of the design setup where tidal currents are less than 1.5 knots. The turning basin should be elongated along the prevailing current direction when currents are greater than 1.5 knots and designed according to tests conducted on a ship simulator. Turning operations with tankers in ballast condition or other ships with high sail areas and design wind speeds of greater than 25 knots will require a special design study using a ship simulator [emphasis added].*

The WTB diameter is considered by the Pilots to be inadequate for the Freedom Class vessels (1.26 times vessel LOA). The minimum acceptable WTB diameter for the Freedom Class vessel, as determined in STAR Center simulations conducted on the *Freedom of the Seas* in 2009, was 1,675 feet. The design cruise ship (*Freedom of the Seas*) is well powered and highly maneuverable. However, the wind sail area of these classes of ultra-large cruise ships is extremely significant and results in large applied forces in the moderate to high (30 knot) design winds experienced at Port Canaveral. Therefore, in consideration of safety and vessel operations under high wind conditions, the minimum effective WTB diameter is 1,725 feet (1.55 times LOA).

The West Turning Basin authorized dimensions are 1,400 feet by -31 feet and it is maintained at -35 feet by CPA. The authorized depth of -31 feet was justified based on the maximum operating draft of the smaller cargo and cruise vessels using the west basin at the time of the 1992 authorization. Currently, RCI's Voyager and Freedom class cruise ships, and similarly sized CCL and Disney cruise ships are nearly 300 feet longer than the 1992 design vessel and have operating drafts of 28 to 30 feet. These vessels also cannot use tidal advantage because of

¹⁹ EM 1110-2-1613, 31 May 06, Hydraulic Design of Deep-Draft Navigation Projects, Table 8-2

their rigid sailing schedules. In addition, the azimuth steering equipment of these ultra-large modern cruise ships, which allow them to navigate into Ports without tug assist, also require adequate clearance (typically 1-2 meters) between the vessel and channel bottom to function properly. For these reasons, the authorized dimensions of the WTB are not considered adequate for safe navigation of the current cruise ship fleet. Alternatives to increase the diameter and depth of the WTB are evaluated in this report in order to meet the needs of the current cruise ship fleet.

4.1.2 Problem 2: Cargo Vessel Size Limitations

Current and future cargo vessels calling at Port Canaveral are constrained by channel and turning basin depths.

The existing channels and turning basins at Port Canaveral were sized for smaller cargo vessels than those currently calling at Port Canaveral. The design vessel used for the 1992 deepening and widening project was a composite design vessel (a 67,000 DWT tanker and a 45,000 DWT bulk cement carrier) with an average length of 750 feet, a beam of 100 feet, and maximum operating draft of 40 feet.

The largest cargo vessels currently calling at Port Canaveral (and those projected to call in the without-project condition), are vessels carrying stone products, slag, cement, and petroleum products. Table 4-1 presents the largest cargo vessels which called at Port Canaveral in 2006. The two dry bulk vessels, the *Gdynia* (65,738 DWT, 738' LOA, 105.6' beam, 42.4' design draft) and the *Bernardo Quintana A* (67,044 DWT, 753' LOA, 105.6' beam, 43.3' design draft) each arrived at Port Canaveral depth limited, with a 39.5-foot operating draft. The only other vessel to arrive with a 39.5-foot operating draft in 2006 was the tanker *Falcon* (dimensions unknown), which delivered power plant fuel oil.

Table 4-1
Largest Cargo Vessels to Call at Port Canaveral in 2006

Ship	Maximum Draft (ft)	Length Overall (ft)	Beam at Waterline (ft)	Deadweight Tonnage (m. tons)
Gdynia (Dry Bulk-Aggregate)	42.4	738	105.6	65,738
Bernardo Quintana A (Dry Bulk-Limestone)	43.3	753	105.6	67,044
Bregen (Liquid Bulk-Gasoline)	44.7	797	105.6	68,159

The tanker, *Bregen* (68,159 DWT, 797' LOA, 105.6' beam, 44.7' design draft), delivered fuel oil to Transmontaigne, arriving with only a 26-foot sailing draft. Vessels delivering fuel oil to Transmontaigne often arrive at drafts less than the port's operating maximum draft and also less than the vessel's maximum operating draft. These vessels arrive less than fully loaded because Port Canaveral is one of several ports called on by these vessels and they often arrive at Port

Canaveral partially offloaded after already having delivered fuel oil to other ports during their inbound voyage.

Under without-project conditions, the commodities projected to demonstrate the most growth, with the exception of lumber, are the same commodities which use the largest cargo vessels calling at the port: i.e., stone products, cement, slag, and petroleum products (see Sections 3.4.1 and 3.4.2). Bulk vessels carrying these commodities to Port Canaveral generally range in size from 60,000 Dead Weight Tons (DWT) to 80,000 DWT. A statistical description of dimensions for vessels ranging from 60,000 DWT and 80,000 DWT is presented in the Economics Appendix (Table 4-2). Tankers projected to call at Seaport Canaveral Terminal will be the largest cargo vessels calling at the Port, with sizes up to 100,000 DWT or more. A statistical analysis of vessel dimensions in the appropriate DWT range, as opposed to the dimensions of a specific vessel, is presented because, based on the historic record of cargo vessel calls at the Port, no single specific large bulk vessel is likely to make regular repeated calls at Port Canaveral. A discussion of the characteristics of the world fleet in the appropriate DWT range is a better representation of the characteristics of vessels that are likely to use the Port under future without and with project conditions.

The maximum operational draft at Port Canaveral, as stated in the *Port Canaveral Operational Guidelines*, is currently 39.5 feet. Vessels arriving with an operating draft of 39.5 feet must time their arrival at the port with high water. Vessels arriving with operational drafts greater than 36 feet must arrive with a rising tide. The effects of channel depth constraints on cargo vessels at Port Canaveral were presented previously in Sections 2.5.6 and 2.5.7. These sections present data which show that large cargo vessels typically arrive at the port with operating drafts just less than the 36-foot restriction imposed by the port's operational guidelines.

Projected operating drafts for the future large cargo vessel fleet calling at Port Canaveral are expected to be depth constrained in the same manner as under existing conditions, including point-to-point petroleum product vessels calling at the Seaport Canaveral fuel terminal. The point-to-point vessels calling at Seaport Canaveral Terminal are projected to avoid the need for tidal advantage in the same manner as observed under existing conditions. The tug/barges and multi-port delivery vessels arriving at Seaport Canaveral Terminal do not require tidal advantage and are not anticipated to benefit from any project improvements.

Large cargo vessels in the fleet currently calling at the Port, and large cargo vessels projected to use the Port in the future without-project condition cannot load to their most efficient potential due to channel depth constraints. As shown in Table 4-1, the design drafts of the majority of these vessels are in excess of the channel constraint and the vessels could be filled more deeply if not for the Port's channel restrictions. Because of the 39.5 foot channel restriction, these vessels must light-load in order to transit the navigation channel. Channel depth constraints directly impact Port Canaveral cargo terminal operators and carriers. Port Canaveral's cargo terminal facilities are capable of handling larger vessel loads for each of the following impacted commodities: stone products, cement, slag, and petroleum products. The channel depth constraint reduces the effectiveness and efficiency of cargo terminal operations by restricting the size of individual vessel loads, which causes equipment to be underutilized. Carriers are similarly operating at less than optimum efficiency when vessels are light-loaded and more trips are required to deliver the same quantity of cargo.

4.1.3 Problem 3: Surge Effects and Safety

Under existing and without-project conditions, cruise ships transiting the channel in normal high wind conditions (i.e., winds in excess of 15 knots) generate water surges due to the speeds required to maintain headway and reduce crab angles to provide safe bank clearance in the 400 foot wide channel. These surges result from the piston-effect of the Post-Panamax width vessels transiting the narrow channel, which pushes water into (and then pulls water out of) the Trident Basin and Middle Turning Basin and also pulls vessels away from the multi-use berths adjacent to the channel, primarily the Trident Basin, NCP 3 & 4 and CT 3²⁰. These surges have caused damage to cargo and naval vessels, damage to connecting equipment, and have caused serious injuries. The port's standard operating procedures include distribution of a Surge Warning Letter to all port users, which recommends appropriate attention to mooring lines and cessation of loading and unloading activities during cruise ship passage under moderate and more severe wind conditions. Surge effects are caused, in part, by the existing narrow channel dimensions and would be reduced by increasing channel dimensions.

Surge effects directly impact port tenants who must stop loading and unloading activities during cruise ship transits. Cessation of loading and unloading activities causes inefficiencies at the dock and adds to the total time that the vessel must spend in port. Surge effects may be offset by the placement of a tug, which pushes the vessel against the dock as the cruise ship passes through the channel, however this also contributes to the overall cargo cost. Under existing and historical conditions, the use of an assisting tug to offset surge forces has occurred only infrequently. Under future without-project conditions, which include substantially larger cruise ships and tankers moored at the vulnerable piers NCP 1 & 2, tug assist is projected to occur more frequently.

An analysis of vessel-induced surge was commissioned in 2011 by the Canaveral Port Authority (CPA). The Naval Ordnance Test Unit (NOTU), a United States Air Force 45th Space Wing (USAF 45 SW) tenant on the Cape Canaveral Air Force Station (CCAFS) and the USAF 45 SW (the Mission Partners) requested the study to demonstrate that the recommended project and the present and foreseeable future ship traffic will not adversely impact current or future NOTU and CCAFS port operations within the Trident and Middle Basins. NOTU accommodates various classes of US and UK Navy submarines at Trident wharf located on the eastern side of the Trident Basin. NOTU and the Military Sealift Command (MSC) accommodate various military ships at Poseidon wharf located on the southeastern side of Middle Basin. The Boeing Evolved Expendable Launch Vehicle (EELV) berth and the AF wharf are located at the north end of Middle Basin. The EELV berth supports the Delta IV rocket launch program at CCAFS. The AF wharf is used for a variety of small scale ship and barge operations.

NOTU has experienced surge effects on vessels moored at both the Poseidon and Trident wharves when outbound cruise ships, departing from West Basin, are required to increase transit speed under the occasional occurrence of high quartering or cross-wind conditions. Under the existing navigation project conditions, operational mitigation measures have been employed for several years to manage the surge effects. Those measures include increased coordination and notification of conditions between the Canaveral Harbor Pilots and NOTU Port Operations,

²⁰ Passing ship forces on vessels moored parallel to the channel and perpendicular to the channel are discussed in greater detail in the Engineering Appendix.

diligent tending of moored vessel lines in preparation for transit, and use of tugs to restrain vessel movements at the wharves. USAF 45 SW and NOTU expressed the need for a surge study to demonstrate that the recommended navigation channel widening and deepening plan will result in no additional impact on current and future port operations. The CCAFS and NOTU collectively identified a number of facilities and operations of concern that were incorporated into the surge modeling.

4.1.3.1 Surge Effects Modeling

Large cruise ships transiting the Canaveral Harbor main channel cause motions and forces on moored vessels at berths along the main channel or at berths within the east and middle basins. Transiting vessels pass moored vessels in the main channel in a parallel configuration and in the basins in perpendicular or oblique orientation. These motions and forces are typically referred to as surge or passing effects. Over the last decade and on a limited number of occasions, passing effects have caused mooring lines to part or failed facility fixtures, damaged shore side connections and personnel gangways, and injured shipboard personnel.

Passing effects are more problematic in complex or confined waterway configurations such as Canaveral Harbor and its east-west main channel, which is constrained by the Canaveral Locks system and three dead-end basins oriented in the north-south direction and positioned north of the main channel. Recent modeling and research suggests that in addition to the passing ship-moored ship interaction due to the flow effects surrounding a transiting vessel, the free surface effects associated with long period (low-frequency) waves that may be generated even by slow moving ships in channels and harbors with restricted water depths, sloping banks, and bulkheads, can significantly contribute to moored vessel motions and forces.

Physical and numerical modeling on this subject for both open water and more confined boundary conditions has been advanced in this decade. In 2005 and 2007, the Ocean Engineering Program within the U.S. Naval Academy accomplished a series of parallel and perpendicular passing model test cases in open water conditions, where the free surface effects would not be present. Since 2004, the Department of Marine and Transport Technology, Delft University of Technology in the Netherlands has developed and enhanced numerical modeling of both the primary flow potential method for ships moored in open water conditions and most recently a model based on potential flow but to also include the free surface effects where harbor boundary conditions create discontinuities in the flow field. Most recently, Coast & Harbor Engineering developed numerical modeling tools for vessel hydrodynamics and loading on berthed vessels that address the complete range of vessel-generated hydrodynamic (surge) effects. These proprietary numerical models with various levels of validation represent the state of the art for passing ship-moored ship analysis. The Navy's model test data and empirical force formulations that are in the public domain provide a means of estimating the passing ship effects on moored ships as limited to open water conditions, which does not represent the situation at Port Canaveral.

The free surface effects, which are long period water level fluctuations, arise from the excitation and interaction of the water motions associated with the flow field moving with the passing ship by the surrounding harbor geometry. Port Canaveral's constrained geometry, the size of the largest cruise ships operating within Port Canaveral's constrained geometry, and the speed cruise ships need to maintain during channel transits all work to increase the magnitude and severity of

dynamic motions and forces that may be experienced by moored ships in basins adjacent to channels.

With the start of Seaport Canaveral's tanker operations in Port Canaveral's Middle Basin at north cargo piers 1 & 2, there is a growing awareness of and intolerance to injury, disruption of operations, and environmental impacts that accidental disconnections could generate as a result of certain passing ship conditions. It is anticipated that the increase in large cruise ship passing traffic events will increase the incidence of passing effects on moored tankers with potentially detrimental consequences. In fact, a moored vessel at NCP 2 recently experienced surge effects that parted lines as a result of consecutive outbound cruise ship traffic. The surge effects were experienced some 13 minutes following the passing departure of the *Freedom of the Seas*.

Coast & Harbor Engineering performed the numerical modeling in accordance with a rigorous modeling plan coordinated and endorsed by the Mission Partners to evaluate several combinations of berthed vessel scenarios at commercial and military berths under without-project and with-project channel dimensions. The berthed vessels included detailed three-dimensional hull definitions for commercial and military surface ships and submarines. The passing vessel scenarios included the consecutive outbound transit of the *Carnival Fantasy*, the *Freedom of the Seas*, and the *Disney Dream* in a timed sequence, from the West Basin, a typical Saturday late afternoon departure scenario. The passing vessel conditions considered prescribed track, speed, and leeway carried relative to the existing conditions and recommended plan channel centerlines as fully coordinated with the Canaveral Pilots. Attachment F to the Engineering Appendix contains the existing conditions and recommended plan modeling domain drawings.

4.1.3.2 Surge Modeling Presentation and Results

The dynamic surge effects within the harbor, at key locations and berths, and passing ship forces for select berthed vessel scenarios were demonstrated in a presentation at the CPA on September 20, 2011, and delivered to the CPA, the Mission Partners, the Canaveral Pilots, the U.S. Coast Guard, and the Canaveral Harbor Section 203 Project Team. The presentation compared the modeled impacts under "without-project" and "with-project" channel dimensions.

Key findings shared during the presentation include:

- The numerical modeling reproduced the primary surge effects as observed by the Canaveral Pilots and associated with the present channel (existing conditions) as follows:
- Significant and consistent surge effects at SCP4 due to the limited separation between the passing and berthed vessel (parallel passing case);
- Surge effects at Trident Wharf for passing speeds of 7.5 knots or greater—very large distance between the passing and berthed vessel (perpendicular passing case);
- Delayed surge effects at NCP2 occurring some 10 to 15 minutes following the departure of one or more cruise ships; and
- Water level retreat and wave breaking at the north jetty area just east of the Trident Access Channel.

Surge modeling results under with project conditions are discussed in Section 6.4.1.1.

4.1.4 Problem 4: Future Berth Congestion

Berth congestion resulting in vessel delays will become a problem in the future without-project condition. Port facilities are already highly utilized and under without-project conditions will become increasingly congested. The mid-range commodity growth scenario predicts berth usage as high as 80% for the north cargo berths shared by Seaport Canaveral tankers, salt, slag, and lumber products. The frequency and duration of tanker calls at NCP 1 and 2 will likely cause some traffic to shift to other berths as available. South cargo berths are currently shared by petroleum products, stone products, cement, perishable items, newsprint and lumber. Congestion at cargo berths reduces the effectiveness and efficiency of cargo vessels and landside facilities. Vessel delays due to berth congestion have historically occurred sporadically at the multi-purpose berths along the south cargo piers. Projected growth in commodity movements, especially at NCP 1 and 2 when Seaport Canaveral's operation commences, at Port Canaveral will result in a larger number of cargo vessels that will have to wait offshore for a berth to become available.

4.1.5 Problem 5: Limitations on New Cargo and Cruise Terminals



Channel and turning basin dimensions are restricting the port's ability to develop new cargo and cruise terminals needed to accommodate growing demand. Because existing large vessels are operating at or above channel design dimensions, there is little or no opportunity to develop new berths and terminals to accommodate future growth in cargo and cruise services. Given the current levels of growth, the Port will need to develop new landside facilities and infrastructure to keep pace with demand. However, inadequately sized channels and turning basins are already beginning to impinge on vessel handling facilities which lie immediately adjacent to the navigation channel and turning basins. Absent expansion of the channels and turning basins, there are limited opportunities to develop new facilities.

4.2 Opportunities

There are opportunities for Port Canaveral to more effectively and efficiently meet the demand for the cruise and cargo services it provides. Opportunities for improvement include:

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1. improve the efficiency of large cruise ship operations within the Port and accommodate larger cruise ships at the Port;
 2. allow existing cargo vessels to be loaded more efficiently;
 3. allow larger cargo vessels to be used that can deliver more cargo at lower unit cost;
 4. increase the efficiency and safety of cargo and naval vessel operations by reducing surge effects on existing vessels and piers; and
 5. accommodate development of more efficient berths and terminals.

Widening and deepening navigation channels, the West Turning Basin, and wideners would increase the efficiency of cargo vessels and cruise ships using the Port, as well as allow the use

of larger more efficient vessels²¹. This will result in significant transportation cost savings when compared to the expected future without-project condition, especially as navigation traffic and congestion increases in the future. The plan formulation section of this analysis presents a detailed quantitative assessment of the benefits resulting from alternative plans which take advantage of these opportunities.

4.3 Federal Objective

The federal objective in formulating alternative plans is based largely on contributions to NED. Contributions to NED are increases in the net value of the national output of goods and services expressed in monetary units. Contributions to NED are the direct net economic benefits that accrue in the planning area and in the rest of the Nation. NED benefits for deep draft navigation projects are transportation cost savings that typically result from general navigation features, such as channels, dredged material disposal facilities, turning basins, etc. Transportation cost savings are calculated as reductions in the cost of transporting goods from their ultimate origin to their ultimate destination. Cargo vessel-related transportation cost savings typically result from more efficient use of the existing cargo fleet and from the use of larger, more efficient cargo vessels in the future. Cargo vessel-related transportation cost savings are the basic type of economic benefits typically used for navigation project justification and cost-sharing purposes.

Additionally, Federal law and Corps of Engineers guidance identifies cruise ship-related benefits as commercial navigation benefits for project justification and cost sharing purposes. Section 230 of the Water Resources Development Act of 1996 specifically directs that benefits generated by cruise ships are categorized as commercial navigation benefits. Planning Guidance Letter #97-06 (07Jul97) provides specific implementation guidance for Section 230 of WRDA 1996. PGL #97-06 states that the benefits generated by cruise ships are to be based on more efficient ship operations and increased tourism or enhanced tourism experience. In addition, PGL #97-06 states that cruise ship related benefits are to be considered commercial navigation benefits for project justification and cost sharing purposes. The Navigation chapter of the Corps' Policy Digest, EP 1165-2-1 (30Jul99), restates the implementation guidance contained in PGL #97-06 in Section 12-4-c.

4.3.1 Other Planning Objectives

In addition to the Federal objective, other project specific planning objectives have been identified, which guided the plan formulation process in this analysis. Based on the problems posed by the combination of channel and berth constraints, continued population and economic growth in the port's hinterland, and ongoing port facility development, as detailed in Section 4 Problems and Opportunities, the following planning objectives have been established to assist in the development of management measures and evaluation of alternative plans:

- Objective 1: Reduce the requirement for tug assists to cruise ships and docked cargo vessels under high wind conditions from 2014 to 2064 (base year plus 50 years)

²¹ Channel widening and deepening also provides a benefit to naval operations by reducing the period of tide-restricted access to the Trident Basin. The monetary value of this project benefit has not been calculated in the economic analysis.

- Objective 2: Allow for deeper and more efficient loading of bulk vessels at Port Canaveral from 2014 to 2064
- Objective 3: Allow for more efficient operations through use of longer and deeper draft bulk vessels at Port Canaveral from 2014 to 2064
- Objective 4: Reduce damages to berthed vessels from surge effects of vessel transit through the Port Canaveral main channel from 2014 to 2064; and
- Objective 5: Support national defense requirements and needs, which include coordination with military tenants of the port and reduction of surge effects on the port's military infrastructure from 2014 to 2064.

4.4 Constraints

The principal constraint on the formulation of alternatives for navigation improvements at Port Canaveral is avoidance of significant impacts to protected species located at or near Port Canaveral, including the:

- West Indian Manatee;
- Right Whale;
- Least Tern;
- Florida Scrub Jay;
- Southeastern Beach Mouse;
- Gopher Tortoise; and
- a variety of Sea Turtles, including Loggerhead, Leatherback, Green, Hawksbill and Kemp's Ridley.

Of the species listed above, it should be noted that only the West Indian Manatee, Gopher Tortoise, and Sea Turtles are located within the Port boundaries. The other species are located outside the Port, but within the region (Section 2.6.7 Protected Species).

Two resources constraints on the formulation of alternative plans include avoidance of:

- impacts of the existing land and waterfront uses (docks, wharves, terminals) at Port Canaveral on the range of alternatives under consideration;
- impacts on adjacent shoreline erosion.

Much of the Port's current terminal and berth configuration cannot be altered to any considerable degree without incurring unacceptable service disruptions and extremely significant expense to relocate or replace those facilities that the project is intended to serve. Therefore, the non-Federal sponsor, the Canaveral Port Authority, has requested that channel widening alternatives considered be limited to no greater than a 500 foot channel, under the Categorical Exemption to the NED Plan provision of ER 1105-2-100 (Paragraph 3-2.b.(10)). Similarly, the Canaveral Port Authority has requested that channel deepening alternatives considered be limited to no greater than a -44 foot deep channel.