ST. JOHNS COUNTY, FLORIDA

South Ponte Vedra Beach, Vilano Beach, and Summer Haven Reaches

COASTAL STORM RISK MANAGEMENT PROJECT

FINAL INTEGRATED FEASIBILITY STUDY

AND ENVIRONMENTAL ASSESSMENT

March 2017

INTEGRATED FEASIBLITY REPORT
& ENVIRONMENTAL ASSESSMENT

March 2017

ST. JOHNS COUNTY, FLORIDA
South Ponte Vedra Beach, Vilano Beach, and Summer Haven Reaches
Coastal Storm Risk Management Project

RESPONSIBLE AGENCY: U.S. Army Corps of Engineers, Jacksonville District

March 2017

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Using this Document

Report Reference Materials: To ease navigation through the report, a fold-out map (Figure 1-1) has been provided at the end of the report to be used while reading the document to serve as a reference with key points and landmarks.

Organization of this report follows Exhibit G-7 (Feasibility Report Content) provided in Appendix G of ER 1105-2-100 (30 June 2004), documenting the iterative **U.S. Army Corps of Engineers (USACE) Plan Formulation Process.** The planning process consists of six major steps:

(1) Specification of problems and opportunities

(2) Inventory, forecast, and analysis of existing conditions within the study area

(3) Formulation of alternative plans

(4) Evaluation of the effects of the alternative plans

(5) Comparison of the alternative plans

(6) Selection of the Recommended Plan based upon the comparison of the alternative plans

Steps may be repeated as problems become better understood and new information becomes available.

Steps 1 and 2 are discussed in **Chapters 1-2**, and provide the foundation for developing alternative plans and selection of a Recommended Plan outlined in **Chapter 3**.

Each chapter, summary graphic, as well as the executive summary describes plan development as it progresses through the integrated environments that shape a Coastal Storm Risk Management (CSRM) project: the **physical environment** (currents, tides, sea level rise, etc.) and the **economic environment** (infrastructure and its vulnerability to damages). Concerns relative to plan formulation and National Environmental Policy Act (NEPA) review are summarized and encapsulated in the discussions of these environments.

The recommended format of an **Environmental Assessment (EA)** is provided in 40 CFR 1502.10 and has been integrated into this Feasibility Report.

Note that sections pertinent to the NEPA analysis are denoted with an asterisk.

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EXECUTIVE SUMMARY

Introduction

Infrastructure along the St. Johns County shoreline is subject to damage from waves, erosion, and inundation caused by coastal storms. Developed areas, as well as portions of State Road A1A (SR A1A), the major evacuation route for the region, are vulnerable. This study investigates alternatives for a unified plan that addresses these vulnerabilities, as well as incidental opportunities for maintenance of environmental habitat and recreation for three reaches along the Atlantic shoreline of St. Johns County, Florida.

Purpose and Need

This report is an interim response to the study authority. This single purpose Coastal Storm Risk Management (CSRM) study will focus on the erosion problems and potential storm damage susceptibility of structures along three reaches of the Atlantic Ocean shoreline in St. Johns County, Florida as follows: South Ponte Vedra Beach, Vilano Beach, and Summer Haven. The non-federal sponsor is St. Johns County, Florida, represented by the Board of County Commissioners.

There is Federal interest in a Recommended Plan with a Benefit-to-Cost Ratio (BCR) of 1.3.

Study Area

All 42 miles of the St. Johns County shoreline are authorized for study in the interest of coastal storm risk management. Reaches within the study area currently experiencing coastal storm damages were selected as project reaches. The three reaches in this study include, from north to south:

- South Ponte Vedra Beach: R84 – R104 (3.8 miles)
- Vilano Beach: R104 to R117 (2.6 miles) and R117 to St. Augustine Inlet North Sand Trap Groin (1.1 miles)
- Summer Haven: R197 – R209 (2.3 miles)

*R monuments refer to Florida Department of Environmental Protection (FDEP) survey monuments used for geographic reference.

The boundaries of all of the subject reaches and FDEP R monuments are illustrated in Figure 1-1 on the fold-out map located on the back page of this report. The existing Federal CSRM project constructed in St. Augustine Beach is also shown in Figure 1-1 for reference.

Problems and Opportunities

It is projected that storm-induced erosion, inundation, and wave attack in the study area will continue damaging infrastructure and limiting habitat. Without a Federal project, it is likely that the sponsor and private homeowners would take steps to combat erosion and property loss, risking that these efforts might not be coordinated in a holistic fashion or incorporate regional concerns, such as sediment movement and environmental/habitat considerations.

Seawalls, or other protective armor, have been constructed along portions of all three, and it is anticipated that more will be constructed in the coming years. Such structures often protect one property while causing accelerated erosion to adjacent, unarmored properties, while cutting off the vital exchange of sand from dunes to the beach during storm events. By accelerating erosion and cutting off the dunes, the structures also negatively impact the habitat of species such as nesting sea turtles.

Without a project, certain portions of the study area, such as Summer Haven, may require abandonment and retreat in order to protect lives and property. Continued erosion, breaching, and overwash of Summer Haven may eventually impact the Intracoastal Waterway (IWW) which follows the Matanzas River to the east of Summer Haven (Figure 1-1).

Storm damages, especially erosion, throughout most of the project area could jeopardize SR A1A, which is designated as a National Scenic and Historic Coastal Byway and is the only evacuation route for the region and a major north-south thoroughfare for the area. After the 2008 hurricane season, areas of the dune were eroded to within five feet of SR A1A in portions of the Vilano Beach reach. SR A1A has already been relocated westward within the Summer Haven reach due to erosion. Additional detail is provided in Chapter 2 – Existing and Future Without-Project Conditions.

Existing problems in the study area include:

- Storm damages due to erosion, inundation, and waves threatening infrastructure
- Loss of natural habitat
- Shoreline erosion threatening recreational opportunities
- Shoreline erosion threatening hurricane evacuation route (SR A1A)
- Beach/dune interaction limited or eliminated

Opportunities are positive conditions in the study area that may result from implementation of a Federal project such as:

- Reduce storm damage to infrastructure
- Protect/enhance habitat/environmental resources
- Retain recreation

- Protect hurricane evacuation route, SR A1A
- Protect/enhance beach/dune interaction
- Implement recommendations in the FDEP St. Augustine Inlet Management Plan to use the St. Augustine Inlet as a sand source for beaches to the north of the inlet

Alternative Plans and the Recommended Plan

A number of structural and non-structural management measures were considered to address problems and realize opportunities listed above. A Recommended Plan has been developed to manage coastal risk in an environmentally acceptable and engineeringly-feasible manner. The non-federal sponsor, St. Johns County, has not opted for a Locally Preferred Plan. Therefore, the National Economic Development (NED) plan is the Recommended Plan of which the sponsor is in support.

The Recommended Plan includes beach and dune nourishment within the Vilano Beach reach and a small portion of the South Ponte Vedra Beach reach. The design includes construction of a 60-foot equilibrated berm extension from the +8.0 foot 1988 North Atlantic Vertical Datum (NAVD88) contour between the R monuments R103.5 and R116.5 along 2.6 miles of shoreline. The project template will include a dune feature varying in height between +14.0 to +20.0 feet NAVD88, reflecting the average 2015 dune position. Tapers of a maximum length of one thousand feet will extend from the northern and southern ends of the berm extension, connecting the extension to the existing shoreline. The addition of tapers results in sand placement from R102.5 to R117.5 along three miles of shoreline.

The St. Augustine Inlet system will be the sand source for the Recommended Plan. Currently, there is approximately 6.5 million cubic yards of beach-quality sand available within the inlet system. This volume is more than adequate to meet the initial construction volume. The periodic nourishment volume is approximately 866,000 cubic yards every 12 years. The FDEP St. Augustine Inlet Management Plan states that the bypassing objective is 278,000 cubic yards per year of which one third should go to beaches to the north. One third of the bypassing objective is 92,666 cubic yards per year. Over 12 years, 1.1 million cubic yards would be available to meet the 866,000 cubic yard need for a periodic nourishment event.

Use of the inlet system would implement a Regional Sediment Management (RSM) strategy where the Recommended Plan's sand needs can be combined with maintenance of the St. Augustine Inlet Federal navigation channel and potentially the renourishment of the existing Federal Shore Protection Project at St. Augustine Beach, south of the inlet (see foldout on final page of this report). Such a strategy would realize significant cost savings and minimize potential environmental impacts from multiple dredge mobilizations as outlined in the Engineer Research and Development Center (ERDC) 2016 technical report, *Regional Sediment Management Strategies for the Vicinity of St. Augustine Inlet, St. Johns County, Florida*.

The existing Federal Shore Protection Project at St. Augustine Beach uses a hydraulic dredge to acquire sand from the St. Augustine Inlet system, and the Recommended Plan could potentially use the same

dredge. Dredging of the St. Augustine Inlet Federal navigation channel also typically uses a hydraulic dredge. Therefore three Federal projects in the same vicinity could potentially use the same dredge for construction or maintenance. Each time construction or maintenance of the projects could be combined would result in minimization of environmental impacts and a cost savings of at least $4,000,000 by combining three separate dredge mobilizations into one.

Environmental Considerations

Most of the adverse effects of the Recommended Plan would be temporary in nature, and would primarily occur during, or within one year, of construction. Ultimately, the Recommended Plan would have a beneficial effect on sea turtle nesting habitat through the maintenance of a nesting beach and the prevention of seawall structures being constructed along this stretch of shoreline. USACE has developed measures through continued coordination with resource agencies throughout the state to minimize the temporary effects to nesting sea turtles resulting from beach placement of sand. The Recommended Plan also maintains nesting and foraging habitat for shorebirds and seabirds. Effects to Essential Fish Habitat would be temporary in nature due to turbidity during construction, and there are no hardbottom habitats in the project area that would be affected.

Cost Estimate and Implementation

Total project first costs and cost share breakdown in FY17 price levels are tabulated in Tables ES-1 and ES-2. The Project First Costs are $78,417,000 over 50 years. Initial construction will be cost shared at 23% Federal and 77% non-federal. Periodic nourishments will be cost shared at 17.7% Federal and 82.3% non-federal.

ES-1: Recommended Plan Cost Summary (Project First Cost) (FY17 Price Levels).

	Cost Summary (Project First Costs) (FY17 Price Levels) St. Johns County, FL CSRM Project R102.5 - R117.5 (total placement area, including tapers)			
WBS		INITIAL CONSTRUCTION		PERIODIC NOURISHMENT
	Item	**Total Item Cost**		**Total Item Cost**
017	Mob/Demob	$3,052,000		$9,147,000
017	Beach Fill	$10,110,000		$21,138,000
017	Associated General Items	$254,000		$597,000
	Subtotal	$13,416,000		$30,882,000
01	Real Estate			
	- lands and damages	$0		$0
	- administrative	$2,514,000		$0
	- Federal admin.	$1,571,000		$0
	- non-federal admin.	$943,000		$0
30	PED	$1,203,000		$4,884,000
31	Construction Management	$1,096,000		$2,574,000
017	Dune vegetation	$1,009,000		$3,027,000
30	Post-Project Monitoring	$164,000		$493,000
	Subtotal	$5,986,000		$10,978,000
	Contingency (28%)	$5,432,000		$11,721,000
	Total	**$24,834,000**		**$53,583,000**
	Total Project Cost for 50 year period of Federal participation = $78,417,000			

ES-2: Recommended Plan Cost Sharing (Project First Cost) (FY17 Price Levels).

St. Johns County, FL CSRM Project **Summary of Project Cost Sharing (Project First Costs) (FY17 Price Levels)** **R102.5 - R117.5 (total placement area, including tapers)**					
Initial Construction					
Item	Federal Cost Share	Federal Cost	Non-federal Cost Share	Non-federal Cost	Project First Cost
Coastal Storm Risk Management Costs	23.0%	$5,712,000	77.0%	$19,122,000	$24,834,000
Non-federal LERRD Contribution*	0.0%	$0	100.0%	$943,000	
Non-federal Cash Contribution				$18,179,000	
Periodic Nourishment					
Periodic Nourishment	17.7%	$9,484,000	82.3%	$44,099,000	$53,583,000
Initial Construction + Periodic Nourishment					
Final Project Cost Share and Cost (50 years)	-	$15,196,000	-	$63,221,000	$78,417,000
* Includes non-federal admin costs only NOTE: Dollar values are rounded					

The average annual costs and benefits, shown in Table ES-3, of the Recommended Plan in FY17 price levels and 2.875% discount rate, are $2,031,000 and $2,653,000 respectively. The average annual net benefits for the recommended plan are $622,000 and the benefit cost ratio (BCR) is 1.3 to 1.

ES-3: Economic Summary of the Recommended Plan.

Economic Summary	Primary Storm Damage Reduction Benefits	Primary Storm Damage Reduction + Incidental Recreation Benefits
Price Level	FY17	FY17
FY17 Water Resources Discount Rate	2.875%	2.875%
Average Annual Structure & Contents Damage & Armor Costs Benefits	$1,683,000	$1,683,000
Average Annual Land Loss Benefits	$278,000	$ 278,000
Average Annual Incidental Recreation Benefits	$ -	$ 692,000
Average Annual Total Benefits	$1,961,000	$ 2,653,000
Average Annual Costs	$2,031,000	$2,031,000
Average Annual Net Benefits	**($70,000)**	**$622,000**
Benefit Cost Ratio	**0.97**	**1.3**

Table ES-4 displays additional benefit and cost information including Interest During Construction (IDC), OMRR&R, and Benefit to Cost ratios at 2.875%.

ES-4: Equivalent Annual Benefits and Costs.

Equivalent Annual Benefits and Costs **October 2016 (FY17) Price Level, 50-Year Period of Analysis, 2.875% Discount Rate**	
Initial Construction	$ 24,834,000
1st Renourishment	$ 16,926,000
2nd Renourishment	$ 16,926,000
3rd Renourishment	$ 18,521,000
3rd Renourishment to Project End	$ 1,209,000
Total First Cost[1]	$ 78,416,000
Interest During Construction (IDC)	$ 47,000
Total Investment Cost	**$ 78,463,000**
Average Annual Investment Cost	$ 1,996,000
Annual OMRR&R (100% non-federal)	$ 35,000
Total Average Annual Cost	**$ 2,031,000**
Average Annual Storm Damage Reduction Benefits (Including Land Loss)	$ 1,961,000
Average Annual Recreation Benefits	$ 692,000
Average Annual Total Benefits	$ 2,653,000
Average Annual Net Benefits	**$ 622,000**
Benefit-Cost Ratio (computed at 2.875%)	1.3

[1]Does not match Total Project Cost Summary (TPCS) exactly due to rounding.

Coordination with Agencies and the Public

An initial scoping period for the project was conducted from August 17, 2005 through September 17, 2005. As the study progressed, USACE anticipated that an Environmental Impact Statement (EIS) might be required. A second scoping period was held from September 16, 2008 to October 16, 2008. A notice of intent to draft an EIS was published in the Federal Register on April 5, 2010. Subsequently, it became evident that no significant impacts to the human or natural environments were anticipated. USACE decided to initially prepare an Environmental Assessment (EA), rather than continue with the previous plans to draft an EIS. The draft EA and draft Finding of No Significant Impact (FONSI) were made available to the public for a 45-day public comment period from February 17, 2016 to April 4, 2016.

This proposed project has been coordinated with the following agencies: U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), U.S. Environmental Protection Agency (EPA), Florida

State Clearinghouse, Florida State Historic Preservation Office (SHPO), and FDEP. The FDEP, Bureau of Beaches and Coastal Systems, National Marine Fisheries Service (NMFS) Habitat Conservation Division, and the Bureau of Ocean and Energy Management (BOEM) have all accepted USACE's invitations to participate as cooperating agencies in this study.

Residual Risk

The proposed project would greatly reduce, but not completely eliminate, future coastal storm risk and damages. Coastal storm damages, caused primarily by erosion, are reduced by approximately 71% (not including prevention of land loss) in the location of the Recommended Plan over the 50-year period of analysis; therefore, the residual damages would be 29% in this area. The greatest residual risk remains in the South Ponte Vedra Beach reach, where justifiable improvements could be made if public access was made available.

Most of the benefits are associated with reductions in damage to single-family residences and reductions to future armor costs to protect ocean front residences and SR A1A.

The Recommended Plan will reduce damages but does not have a specific design level. In other words, the project is not designed to fully withstand a certain category of hurricane or a certain frequency storm event. The project is not claiming any benefits beyond 500 feet inland from the Mean High Water (MHW) line; damages to structures past this extent were not calculated. Notably, infrastructure on the backside of the barrier island on which the project area is located, albeit outside of the project area, are susceptible to impacts from sea level rise in the future. Structures within the project area would continue to be subject to damage from hurricane winds and windblown debris. Even new construction is not immune to damage, especially from these processes. The project purpose is coastal storm risk management, and the Recommended Plan is not designed to prevent loss of life.

Public safety risks can be reduced by actions taken at the local, state, and Federal levels. Table ES-5 describes the actions that can be taken by the entities associated with this project to improve public safety, as well as the limitations of their actions. The greatest level of public safety is achieved when concerted action is taken at local, state, and Federal levels to improve public safety in a comprehensive manner. Table ES-6 describes pertinent project information for the Recommended Plan.

Table ES-5: Roles for Public Safety.

	Can Do	Can Not Do
St. Johns County	• Can implement non-structural risk reduction efforts including building and zoning regulations. • Can implement emergency management plans and strategies. • Can sponsor and cost share in a Federal Recommended Plan.	• Cannot conduct a coastal storm risk management study in a systems context encompassing all engineering and environmental considerations on their own.
State of Florida	• Can implement non-structural risk reduction efforts including building and zoning regulations. • Can implement emergency management plans and strategies. • Can perform maintenance of SR A1A and repair on an emergency basis.	• Cannot conduct a coastal storm risk management study in a systems context encompassing all engineering and environmental considerations on their own.
U.S. Army Corps of Engineers	• Can implement a cost-shared Recommended Plan that reduces coastal risk and damage to infrastructure, providing additional protection to critical evacuation route SR A1A beyond what the county and state can provide.	• Cannot enforce building and zoning regulations. • Cannot implement local emergency management plans or strategies.

Pertinent Project Information for the Recommended Plan

Table ES-6: Pertinent Project Information.

Recommended Plan Description	The Recommended Plan includes beach and dune nourishment within the Vilano Beach reach and a small portion of the South Ponte Vedra Beach reach. The design includes construction of a 60-foot equilibrated berm extension from the +8.0 foot 1988 North Atlantic Vertical Datum (NAVD88) contour between the R monuments R103.5 and R116.5 along 2.6 miles of shoreline. The project template will include a dune feature that reflects the average 2015 dune position. Tapers of a maximum length of one thousand feet will extend from the northern and southern ends of the berm extension, connecting the extension to the existing shoreline. The addition of tapers results in sand placement from R102.5 to R117.5 along 3 miles of shoreline. A dredge will be used to fill the template with sand from the St. Augustine Inlet system.
Average # Nourishment Events	1 initial construction event, 3 periodic nourishment events
Average Volume of Initial Construction	1,310,000 cubic yards
Average Volume of Each Periodic Nourishment	866,000 cubic yards
Average Periodic Nourishment Interval	12 years
Initial Construction Duration	approximately 3.3 month
Recommended Plan Total Project Cost (including contingency)	$78,417,000 (FY17 price levels)
Cost sharing	Initial construction: 23.0% Federal / 77.0% non-federal Periodic nourishments: 17.7% Federal / 82.3% non-federal
Benefit-to-Cost Ratio (BCR)	1.3

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CHAPTER 1
INTRODUCTION

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1 INTRODUCTION*

1.1 FEDERAL PROJECT PURPOSE*

The Water Resources Development Act (WRDA) of 1986 assigns costs of Federal Coastal Storm Risk Management (CSRM) projects to appropriate purposes. Project reaches that provide hurricane and storm damage reduction are assigned a maximum Federal share of 65% for initial construction. Specifically for beach renourishment projects, WRDA 1999 assigned a 50% Federal share for future renourishments. Project reaches that provide for separable recreation are not federally cost shared. The Federal government does not participate in work realizing separable recreation benefits such as constructing a beach only for recreational purposes (and not hurricane and storm damage reduction purposes) or constructing recreation facilities. Recreation is not considered to be a high priority output or primary project output under current Department of Army policy, as described in ER 1105-2-100. This policy precludes Federal funds to support construction of CSRM projects which depend on separable recreation benefits for economic justification, or for which incidental recreation benefits greater than 50% are needed for justification (ER 1105-2-100 section 3-4.b(4)(a)).

1.2 STUDY BACKGROUND AND LOCATION*

Infrastructure along the St. Johns County shoreline is subject to damages from waves, erosion, and storm surge caused by coastal storms. Developed areas, as well as portions of State Road A1A (SR A1A), a major evacuation route for the region and designated National Scenic and Historic Coastal Byway, are vulnerable. All 42 miles of the St. Johns County shoreline are authorized for study in the interest of Coastal Storm Risk Management.

The Reconnaissance Report (Section 905(b) Analysis) for St. Johns County, Florida, Shore Protection (USACE 2004) recommended evaluation of 3.8 miles of St. Johns County's 42 miles of shoreline in a feasibility study. The 3.8 miles were composed of 1.4 miles in Vilano Beach and 2.4 miles in Summer Haven. These areas were selected based on the following: the shoreline lengths were designated as critically eroded by the State of Florida, other portions of the St. Johns County shoreline had authorized Federal CSRM projects such as St. Augustine Beach, or other portions of shoreline did not include infrastructure susceptible to damage. Between 2004 and 2008, additional areas were threatened by erosion causing the State of Florida to deem South Ponte Vedra as critically eroded. This reach was then added to the feasibility study. Additionally, the Vilano Beach reach in the feasibility study was expanded south to St. Augustine Inlet, beyond the bounds of the state's designated critical erosion area, at the sponsor's request, in order to fully evaluate this section of the county shoreline as a contiguous system.

This St. Johns County CSRM Feasibility Study and Environmental Assessment (EA) investigates alternatives for a unified plan that addresses coastal storm risk management, as well as incidental opportunities for

maintenance of environmental habitat and recreation for three reaches along the Atlantic shoreline of St. Johns County, Florida. The non-federal sponsor is St. Johns County, Florida.

The three reaches in this study comprise 9.8 miles and include, from north to south:

- South Ponte Vedra: R84 – R104 (3.8 miles)
- Vilano Beach: R104 to R117 (2.6 miles) and R117 to St. Augustine Inlet north sand trap groin (1.1 miles) totaling 3.7 miles
- Summer Haven: R197 – R209 (2.3 miles)

*R-monuments refer to Florida Department of Environmental Protection (FDEP) survey monuments used for geographic reference.

The St. Augustine Beach reach, separate from the above reaches and not included in this study, has previously been studied and authorized for Federal participation in coastal storm risk management for a period of 50 years of Federal participation. The St. Augustine Beach reach spans 2.5 miles of St. Johns County Atlantic Ocean shoreline between FDEP R monuments R137 through R150, including the southern portion of Anastasia State Park and the northern portion of the City of St. Augustine Beach.

The boundaries of all of the subject reaches and the FDEP R monuments are illustrated in Figure 1-1 located on the following page. Figure 1-1 has also been included as a foldout on the last page of the report to aid periodic reference of study area boundaries, and other key reference points, while reading this document.

Figure 1-1. Project Map with Key Boundaries and Reference Points.

In recent years, both South Ponte Vedra Beach and Vilano Beach have experienced erosion and infrastructure damage prompting state assistance. Impacts to homes and infrastructure since 2004 have resulted in the construction of temporary structures, such as seawalls, by property owners. Summer Haven has experienced significant erosion and threats to infrastructure since the mid-1900s, resulting in the construction of a protective rock revetment and landward relocation of SR A1A.

South Ponte Vedra Beach Reach

Vilano Beach Reach

St. Augustine Beach – Constructed

Summer Haven Reach

Figure 1-2: South Ponte Vedra Beach, Vilano Beach, and Summer Haven reaches of the project area. The constructed St. Augustine Beach project, located south of St. Augustine Inlet, is also shown.

St. Johns County is located in the northeast Atlantic coast of Florida, midway between the Florida/Georgia state line and Cape Canaveral. The county is bounded to the north by Duval County and to the south by

Flagler County. The county has approximately 42 miles of Atlantic coastal shoreline composed of three barrier islands separated by St. Augustine Inlet and Matanzas Inlet. The South Ponte Vedra Beach and Vilano Beach reaches are located north of the St. Augustine Inlet, and the Summer Haven reach is located south of the Matanzas Inlet as shown in Figure 1-1 and Figure 1-2.

Combined, the three reaches total 9.8 miles of shoreline. On average, the study area extends approximately 500 feet inland from the Mean High Water (MHW) line. The St. Johns County, Florida, General Reevaluation Report (GRR) (USACE 1998), which recommended beach nourishment along St. Augustine Beach, determined 300 feet to be the approximate extent of shoreline recession from a 100-year storm. The extent of shoreline recession in the current study area is expected to be similar since geographic characteristics and wave climate closely resemble those discussed in the 1998 GRR. To ensure adequate data collection, an additional 200 feet was added to the 100-year storm recession. This data collection "buffer" ensures that sufficient data is collected for input into the economic model, Beach-fx, being applied to this study. Beach-fx measures damages to infrastructure from waves, erosion, and inundation.

Development along the Atlantic coast of St. Johns County began in the early 1900s. Of the three reaches included in the study area, Summer Haven was the first to be developed. Its early beach cottages eventually washed away, and between 1960 and today, additional homes were built resulting in 27 homes that remain along the landward side of Old SR A1A[1]. Substantial development in South Ponte Vedra Beach and Vilano Beach began around 1950. Shore protection efforts were initiated in these two areas soon after development, when damages from hurricanes and coastal storms began to threaten infrastructure.

Frequent northeast storms (nor'easters) impact this coast in the fall and winter, while tropical storms and hurricanes impact the area from June through November. While hurricanes generate damaging waves and storm surge, these storms are typically short-lived. On the other hand, nor'easters are generally more damaging due to their longer duration. The county has a history of damaging storms. Between 1830 and the present, an average of one tropical storm system has passed within 50 miles of the study area every three years.

Various types of hard structures such as seawalls and revetments have been constructed along the coast since 1892. In response to the Ash Wednesday storm of 1962, the Federal Office of Emergency Planning authorized 1,800 feet of granite revetment and 1,130 feet of road pavement at Summer Haven. Two years later, after Hurricane Dora (1964), Federal emergency funds were provided for more stabilization at Summer Haven.

[1]Old SR A1A refers to approximately 2,700 and 3,600 feet of the original SR A1A, which has been relocated landward following frequent storm damage.

Protection of SR A1A is of major importance since it is the only hurricane evacuation route leading to roads off the islands. Dependence on this one artery for evacuation makes safe escape from coastal storms difficult for residents in the project area. Maintenance of SR A1A in Summer Haven became so problematic that the road was relocated landward in 1979. In areas of Vilano Beach, erosion of the protective dunes reached within five feet of SR A1A in 2008.

The project area was defined, and expanded upon as necessary, by the FDEP designation of critically eroded beaches in the area. The FDEP defines a "critically eroded area" as "…a segment of the shoreline where natural processes or human activity have caused or contributed to erosion and recession of the beach or dune system to such a degree that upland development, recreational interests, wildlife habitat, or important cultural resources are threatened or lost," (FDEP 2015). Gaps between critically eroded areas may also be deemed critical if their inclusion is needed to maintain design integrity of beach management projects. South Ponte Vedra Beach was designated as a critically eroded area in 2007, Vilano Beach in 2006, and Summer Haven in 1989.

1.3 STUDY SPONSOR

The non-federal sponsor is St. Johns County, Florida.

1.4 STUDY PURPOSE AND NEED*

The purpose of this study is to determine whether there is economic justification and Federal interest in coastal storm risk management in additional reaches of St. Johns County. If it is found that there is a Federal interest, the further purpose of the study is to analyze alternatives and formulate a recommended plan for coastal storm risk management to include incidental opportunities for maintenance of environmental habitat within the South Ponte Vedra Beach, Vilano Beach, and Summer Haven reaches of the St. Johns County coastline.

Problems and opportunities within the study area are summarized below and described in detail in Chapter 3. Specific problems in the study area include:

- Storm damages due to erosion, inundation, and waves threatening infrastructure
- Loss of natural habitat
- Shoreline erosion threatening recreational opportunities
- Shoreline erosion threatening a hurricane evacuation route (SR A1A)
- Beach/dune interaction limited or eliminated

Opportunities exist to:

- Reduce storm damages to infrastructure within the study area
- Protect/enhance habitat/environmental resources
- Retain recreation
- Protect a hurricane evacuation route (SR A1A)
- Protect/enhance beach/dune interaction
- Implement recommendations in the FDEP St. Augustine Inlet Management Plan to use the St. Augustine Inlet as a sand source for beaches to the north

An array of alternatives will be analyzed in order to arrive at a recommended plan that addresses the above problems and maximizes opportunities while being technically sound, environmentally acceptable, and economically justified. Examples of management measures considered and combined into alternatives include: no action (doing nothing), retreat, changes to zoning and building codes, shore protection using hard structures (seawalls, revetments, groins, etc.), shore protection using soft structures (beach nourishment, etc.), and combinations of the above.

1.5 STUDY AUTHORITIES*

Section 110 of the Rivers and Harbors Act of 1962 (Public Law 87-874) gave the Secretary of the Army broad authorization to survey coastal areas of the United States and its possessions in the interest of beach erosion control, hurricane protection, and related purposes, provided that surveys of particular areas would be authorized by appropriate resolutions.

As a result, portions of the St. Johns County shoreline experiencing severe erosion were studied extensively. The St. Johns County, Florida, General Reevaluation Report (GRR) (USACE 1998) recommended beach nourishment along St. Augustine Beach, and initial construction was completed in January 2003.

Relative to this feasibility study, on June 21, 2000, House Resolution 2646 granted authority for a survey of the St. Johns County study area, which reads as follows:

> *"Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, That in accordance with Section 110 of the Rivers and Harbors Act of 1962, the Secretary of the Army, acting through the Chief of Engineers, is requested to survey the shores of St. Johns County, Florida, with particular reference to the advisability of providing beach erosion control works in the area north of St. Augustine Inlet, the shoreline in the vicinity of Matanzas Inlet, and adjacent shorelines, as may be necessary in the interest of hurricane protection, storm damage reduction, beach erosion control, and other related purposes."*

This resolution authorized a reconnaissance report which was completed in 2004 and concluded that there was a Federal interest in conducting a feasibility study for the beaches of St. Johns County. The

study area for the reconnaissance report included the entire St. Johns coastline, but focused on the Vilano Beach and Summer Haven reaches because those were designated as critically eroded areas by the FDEP at that time. The South Ponte Vedra Beach reach was added to the study area after the reconnaissance report was completed in 2004. Its addition was requested by the sponsor due to increased erosion occurring around R90 in 2007. Significant and rapid loss of beach width and dunes protecting several structures led to FDEP designating R84 to R94 (2 miles) a critically eroded area due to threats to private development and SR A1A. South Ponte Vedra Beach's geographic proximity to the Vilano Beach reach, as well as its similar development and storm damage issues, made its inclusion in this feasibility study reasonable. The southern boundary of the South Ponte Vedra Beach reach was extended to R104 to abut the Vilano Beach reach and to investigate the feasibility of providing uninterrupted shore protection along the coast.

1.6 RELATED DOCUMENTS*

1.6.1 RELATED USACE STUDIES

Summaries of prior Federal studies relevant to this project are as follows:

a. 1965 – Beach Erosion Control (BEC) Study, St. Johns County, Florida (USACE 1965). The report was completed in response to a resolution of the Committee on Public Works of the U.S. Senate, adopted January 7, 1963, and a resolution of the Committee on Public Works of the House of Representatives, adopted June 19, 1963. The report recommended protective and recreational beaches with periodic nourishment (60 feet wide at 11 feet above mean sea level) for 2.2 miles of shoreline at South Ponte Vedra Beach, 1.4 miles at Anastasia State Park and St. Augustine Beach, and 1.4 miles at Crescent Beach. The Benefit-to-Cost Ratio (BCR) ratio was 1.2. The Board of County Commissioners of St. Johns County advised that the local share of the cost of the considered improvements was entirely prohibitive, therefore the District and Division Engineers recommended that no improvements for beach erosion control be undertaken by the U.S. Army Corps of Engineers (USACE) at that time (negative report – no sponsor support).

b. 1977 (Revised 1979) – St. Johns County Beach Erosion Control (BEC) Project Feasibility Report (USACE 1979). The study area included the entire St. Johns County coastline. Study efforts, after preliminary investigation of the county's Atlantic coastline, were concentrated primarily on the problem area along the ocean shoreline of St. Augustine Beach and Anastasia State Recreation Area. The report recommended construction of a sand beach width of 60 feet at elevation 12 feet above mean low water from "A" Street north to include the southern 4,000 feet of the recreation area. The total length of the coastline to be protected, including transitions, would be 2.5 miles. The BCR equaled 1.25. A significant portion of the project benefits were associated with predicted increases in recreational output. Sec. 501 (Title V) of WRDA 1986 authorized the project as

recommended by the Chief of Engineers Report, dated February 26, 1980, at a total cost of $18,200,000.

c. 1982 – Section 14 Study, Summer Haven, St. Johns County, Florida (USACE 1982). The study was completed in response to a request from St. Johns County for Federal assistance in the construction of shore protection measures for the county road, Old SR A1A, along the coastline in Summer Haven.

d. 1990 – Special Report for the St. Johns County Beach Erosion Control (BEC) Project (USACE 1990). The report was prepared in accordance with WRDA'86 which limited Federal participation in recreation projects. Maximization of net primary benefits identified the National Economic Development (NED) plan as an 80-foot berm extension along 2.5 miles of the St. Johns County shoreline (St. Augustine Beach) with three groins required to reduce future nourishment costs. The BCR for this project was 0.61 (less than 1) resulting in an unfavorable recommendation of no Federal participation at that time.

e. 1994 – Economic Update (EU) Report (USACE 1994). The report was conducted at the direction of the U.S. Congress utilizing General Investigation (GI) funds. The EU was conducted in accordance with special instructions provided with the fiscal year 1994 work allowance. The EU, dated November 1994, was approved in March 1995 and found that Federal participation in the authorized shore protection project on St. Augustine Beach was economically justified at that time. Subsequently, Congress appropriated money to proceed with a General Reevaluation Report (GRR) for the project as part of the pre-construction, engineering, and design (PED) phase.

f. 1997 – St. Johns County, Florida Shore Protection Project: General Reevaluation Report (GRR) – Technical Review Conference (USACE 1997). The report summarized the general reevaluation of the federally-authorized shore protection project, which became the 1998 GRR for St. Augustine Beach. Modifications to the project were investigated in the interest of reducing total project costs.

g. 1998 – St. Johns County, Florida Shore Protection Project: General Reevaluation Report (GRR) with Final Environmental Assessment (USACE 1998). The report recommended the construction of a 60 foot berm extension from the Mean High Water line along St. Augustine Beach between R monuments R137 and R150. The BCR equaled 1.9.

h. 1998 – Post Authorization Change Report (USACE 1998). The recommended plan in the 1998 GRR for St. Augustine Beach exceeded the cost authorized by Section 501 of WRDA 1986 beyond the maximum cost increase provisions in Section 902 of WRDA'86 (PL 99-662). The 902 limit was $39,649,000, whereas the total project cost of the selected plan was $190,500,000. The report justified the cost increase.

i. 2004 – Reconnaissance Report (905(b) Analysis) St. Johns County, Florida, Shore Protection Project (USACE 2004). Authorized by 2000 H.Res. 2646, the report recommends that the St. Johns County, Florida, Shore Protection Study proceed into the feasibility stage. Authority for the report authorized a survey of the shores of St. Johns County with particular reference to the advisability of providing beach erosion control works in the areas north of St. Augustine Inlet, the shoreline in the vicinity of Matanzas Inlet, and adjacent shorelines. The report focused on Vilano Beach and Summer Haven.

j. 2005 – Project Information Report - Rehabilitation Effort for the St. Johns County Erosion Control and Hurricane Protection Project, St. Johns County, Florida (USACE 2005). The report determined that the project area (St. Augustine Beach) was eligible for emergency renourishment due to impacts from the 2004 hurricane season.

k. 2006 – Project Information Report - Rehabilitation Effort for the St. Johns County, Erosion Control and Hurricane Protection Project, St. Johns County, Florida (USACE 2006). The report determined that the project area (St. Augustine Beach) did not meet key criteria related to a significant storm event and therefore was not eligible for emergency renourishment.

l. 2016 - Regional Sediment Management Strategies for the Vicinity of St. Augustine Inlet, St. Johns County, Florida – Engineer Research and Development Center (ERDC) Technical Report, ERDC/CHL TR-16-12 (USACE 2016).

1.6.2 RELATED NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) STUDIES

a. 1998 – General Reevaluation Report (GRR) with Final Environmental Assessment (EA) and Findings of No Significant Impact (FONSI), St. Johns County, Florida, Shore Protection Project. The EA evaluated the construction of a 60- foot berm at a location approximately 2.7 miles south of St. Augustine Inlet, with placement extending to the south approximately 2.5 miles along the shoreline of St. Augustine Beach. The sand source for the project was the St. Augustine Inlet ebb tide shoal and navigation channel.

b. 2010 – Final Environmental Assessment (EA) and Findings of No Significant Impact (FONSI), Maintenance Dredging, St. Augustine Inlet and Adjacent Intracoastal Waterway, St. Johns County, Florida. This document evaluates maintenance dredging of the St. Augustine Inlet and the adjacent Intracoastal Waterway (IWW), including IWW Cuts SJ-28 to SJ-30, a portion of the inlet flood shoal, and a portion of the inlet entrance channel along Porpoise Point. The placement location for beach-quality material is the shoreline within Anastasia State Park and St. Augustine Beach between R132 and R152. The placement location for non-beach-compatible material would be placed in a nearshore placement area between R141 and R146. There was a FONSI associated with this document signed on January 19, 2011.

c. 2015 – Final Supplemental Environmental Assessment (EA) and Findings of No Significant Impact (FONSI), Maintenance Dredging, St. Augustine Inlet and Adjacent Intracoastal Waterway, St. Johns County, Florida. The Supplemental EA evaluated maintenance dredging of the St. Augustine Inlet and the adjacent Intracoastal Waterway. Beach-compatible material was proposed to be placed along the shorelines of South Ponte Vedra Beach and Vilano Beach. Non-beach-compatible material was proposed to be placed in the nearshore area north of the inlet.

1.6.3 PRIOR NON-FEDERAL STUDIES

Summaries of prior non-federal studies relevant to the project are as follows:

a. 1975 – Independent study by the St. Johns County Board of Commissioners of possible solutions to the county's erosion problems – *St. Johns County Beach Erosion Control Study* by Florida Coastal Engineers, Inc., of Jacksonville, Florida.

b. 2001 – Strategic Beach Management Plan for the Northeast Atlantic Coast Region (Florida Department of Environmental Protection, October 2001). This report presents data, analysis, and recommendations for managing the northeast Florida coastline, specifically the Sea Islands, and the St. Johns, Flagler, and Volusia county beaches and inlets. Special attention is placed on determining strategies for inlets and critically eroded beaches.

c. 2009 – St. Johns County Shore Stabilization Feasibility Study for South Ponte Vedra and Vilano Beach Regions (PBS&J 2009). A private homeowners' organization, South Ponte Vedra-Vilano Beach Restoration Association, Inc. (SPVV), partnered with St. Johns County and the State of Florida to gain an overall understanding of the coastal processes affecting the study area and to recommend a shore stabilization solution. Draft conclusions of the study stated that the recent significant shoreline recession and erosion are most likely attributable to increases in storm activity, and that adjacent infrastructure and habitable structures are vulnerable to future storm impacts. Furthermore, the study indicated that the condition was unlikely to adequately recover naturally within the foreseeable future, and that shoreline remediation is warranted to protect upland infrastructure. Specifically, the study recommended beach nourishment with 2,527,100 cubic yards of sand from R84 to R117 (6.5 miles) and renourishment every five to six years. The project would include a 100-foot wide berm at +10 feet NAVD88 and a dune feature with a 10-foot crest width. The dune feature was proposed to mitigate for historical dune losses and enhance the protection of upland areas.

d. 2014 – St. Augustine Inlet Management Implementation Plan (FDEP 2014). This implementation plan was developed in coordination with USACE, Jacksonville District to modify sand bypassing recommendations contained in the original, 1997, inlet management plan. Key to the study area, the plan states that a portion of sediment dredged from the inlet should be placed on beaches

north of the inlet. This plan is not a USACE report and does not authorize new Federal actions or modify any existing authorizations. The Federal St. Johns County Shore Protection Project uses St. Augustine Inlet as its authorized, least cost, sand source, thereby accomplishing a portion of the sand bypassing described in the report. This feasibility study also proposes to use the inlet as the most economical sand source. Such use would be in keeping with the state's plan, accomplishing sand bypassing to the north of the inlet. Sand bypassing to the north, within the Recommended Plan area, does not currently occur and would not occur without authorization of the Recommended Plan and is therefore not included in the existing condition or the future without-project condition.

e. 2015 – Strategic Beach Management Plan for the Northeast Atlantic Coast Region (Florida Department of Environmental Protection, June 2015). The report presents data, analysis, and recommendations for managing the northeast Florida coastline, specifically St. Johns, Flagler, and Volusia counties' beaches and inlets. Special attention is placed on determining strategies for inlets and critically eroded beaches.

f. 2015 – Critically Eroded Beaches in Florida (FDEP 2015). This report provides an inventory of Florida's erosion problem areas, including areas within this report's study area.

1.7 FEDERAL PROJECTS NEAR STUDY AREA

Projects near the study area include:

a. St. Johns County, Florida Shore Protection Project, St. Augustine Beach, Florida. The project area is comprised of the 2.5 miles of St. Johns County Atlantic Ocean shoreline located between FDEP R monuments R137 through R150. The project area includes the southern portion of Anastasia State Park and the northern portion of St. Augustine Beach. The Recommended Plan consists of beach-fill with 600-foot transition sections at the northern and southern limits of the project. The design template berm elevation is +12.0 feet (MLW) and would result in extension of the pre-project Mean High Water shoreline by 60 feet (USACE 1998). At the location of the seaward extent of the design berm, the design template slopes 1V:20H seaward to the location of the MLW line and 1V:30H out to the intersection with the existing profile. Initial construction of the project required placement of approximately 2,100,000 cubic yards of design fill and 1,600,000 cubic yards of advance material; 3,700,000 cubic yards total. During initial construction, additional material was dredged and placed north of the project area within Anastasia State Park. This work was funded by FDEP. The primary borrow source for construction was the St. Augustine Inlet ebb shoal located approximately 4.5 miles from the center of the project area. Periodic nourishment would be provided every five years over the 50-year period of Federal participation using about 1,600,000 cubic yards of material per event. The project was completed in January 2003 and renourished in 2005 and 2012.

b. St. Augustine Harbor. This project includes a channel 16 feet deep by 200 feet wide along the best natural alignment across the inlet bar; a 12-feet deep channel to the Intracoastal Waterway; a sand trap groin (about 1,880 feet long; built in 1941) on the north side of the inlet extending seaward from the shore of Vilano Beach; a sand-tight jetty (about 3,695 feet long; built in 1957) on the south side of the channel extending seaward from the shore of Conch Island parallel to and coextensive with the groin (future landward extension of the groin and jetty - deferred); and a channel 10 feet deep by 100 feet wide in the San Sebastian River from the Intracoastal Waterway to the King Street bridge, with a turning area near the upper end. The project sponsor is the St. Augustine Port, Waterway, and Beach Commission. The inlet (St. Augustine Inlet) is an improved tidal inlet connecting the Tolomato and Matanzas Rivers (part of the Intracoastal Waterway) to the Atlantic Ocean. Originally a natural inlet called Salt Run, the natural inlet was located about 400 yards south of its current location until it was relocated in 1940. Beach-quality maintenance material from inlet and channel dredging is placed on the beaches located south of the inlet and, as of 2015, in the nearshore zone north of the inlet.

c. Intracoastal Waterway (IWW). The Intracoastal Waterway is part of the Atlantic Intracoastal Waterway system that provides an inland navigation channel from New York to Miami. By 1965 the United States had completed the project from Jacksonville to Fort Pierce, Florida, including St. Johns County, to the authorized depth of 12 feet and a width of 125 feet. The Florida Inland Navigation District (FIND) provides the items of local cooperation for the waterway and performs maintenance in the absence of Federal funding. The principal items of local cooperation are lands, easements, rights-of-way, and dredged material disposal areas. In view of recent limited Federal funding for annual waterway maintenance, FIND currently pays most of the maintenance dredging costs for the waterway. The IWW near Matanzas Inlet is subject to shoaling and must be regularly dredged to maintain navigation. Maintenance dredging of this area is between 150,000 to 200,000 cubic yards per year (personal communication FIND, 2003). This material can be pumped into the dredged material management area, MSA SJ-1, until the 800,000 cubic yard capacity is reached. In 1999, approximately 765,000 cubic yards was pumped from MSA SJ-1 and the IWW onto the beach at Summer Haven. The dredged material has been pumped directly onto the beach at Summer Haven since 2007. This sand is fine grained with a low percentage of fine material (less than 5% passing a #200 sieve.) The fine sand placed on Summer Haven tends to migrate rapidly from the beach (FDEP 2000). Beach-quality sand dredged from the IWW near St. Augustine Inlet is typically placed on the beaches south of the inlet.

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CHAPTER 2

EXISTING AND FUTURE WITHOUT PROJECT CONDITIONS

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2 EXISTING AND FUTURE WITHOUT-PROJECT CONDITIONS

2.1 GENERAL SETTING*

This chapter describes conditions as they currently exist, and as they are projected to exist if a project is not implemented, within the South Ponte Vedra Beach, Vilano Beach, and Summer Haven reaches. Information gathered in this step helps to describe the problems and opportunities, and forecast future conditions. The future without-project (FWOP) condition is the most likely condition of the study area without construction of a Federal project over the next 50 years.

It is projected that storm-induced erosion, inundation, and wave attack in the study area will continue damaging infrastructure, limiting habitat, and jeopardizing storm evacuation and relief efforts. Without a Federal project, it is likely that the sponsor and private homeowners would take steps to combat erosion and loss of property; running the risk that these efforts might not be coordinated in a holistic fashion, or incorporate regional concerns, such as sediment movement and environmental/habitat considerations.

The St. Johns County coastline totals 42 miles, spanning three island segments that vary in width from 750 feet to three miles. The islands are separated from the mainland by the Matanzas River, Guana River, Salt Run, and the Tolomato River. The Intracoastal Waterway (IWW) follows the Matanzas and Tolomato Rivers. A dune system backs much of the shoreline, varying in height from 10 to 21 feet, relative to the North American Vertical Datum of 1988 (NAVD88). This is approximately equal to 10.5 to 21.5 feet above Mean Sea Level (MSL).

In recent years, seawalls, or other protective armor, have been constructed along portions of the South Ponte Vedra Beach reach and the Vilano Beach reach, and it is anticipated that more will be constructed in the coming years. Such structures often protect one property while causing accelerated erosion to adjacent, unarmored properties, while cutting off the vital exchange of sand from dunes to the beach during storm events. By accelerating erosion and cutting off the dunes, the structures also negatively impact habitat of species such as nesting sea turtles. The South Ponte Vedra-Vilano Beach Restoration Association, Inc. (SPVV) has been created in order to evaluate shore protection opportunities available to the homeowners. The association in partnership with the county and state has completed the *St. Johns County Shore Stabilization Feasibility Study for South Ponte Vedra and Vilano Beach Regions* (PBS&J 2009) with results summarized in Chapter 1, under "prior non-federal Studies."

Without a project, certain portions of the study area, such as Summer Haven, may require abandonment and retreat in order to protect lives and property. Continued erosion, breaching, and

overwash of Summer Haven may eventually impact the Intracoastal Waterway (IWW), which follows the Matanzas River to the west of Summer Haven (Figure 1-1).

Storm damages, especially erosion, throughout most of the project area could jeopardize State Road A1A (SR A1A), which is designated as a National Scenic and Historic Coastal Byway, and is the only evacuation route for the region and a major north-south thoroughfare for the area. After the 2008 hurricane season, areas of the dune line were eroded to within five feet of SR A1A in portions of the Vilano Beach reach. SR A1A has already been relocated westward within the Summer Haven reach due to erosion.

2.2 PHYSICAL ENVIRONMENT (CONDITIONS)*

The study area consists of an open sandy coast subject to frequent storm events. Properties adjacent to the shoreline can be categorized as urban, and include residential, commercial, and recreational properties. Many factors influence the coastal processes characteristic to the St. Johns County, Florida shoreline. Natural factors include winds, tides, currents, waves, storm effects, and sea level rise. Human-related (anthropogenic) factors include other shore protection projects, navigation projects, and development. The role of each of these factors, and their contribution to beach erosion in St. Johns County, are briefly described in the following paragraphs. The county's population is approximately 220,000 and increases seasonally with tourist visits. An estimated 6.5 million tourists visit the county annually (sponsor-provided information) of which a large percentage visit the barrier islands and coastline.

2.2.1 STUDY REACHES

The 9.8 mile length of the study area is separated into three reaches referenced to FDEP R monuments:

- South Ponte Vedra: R84 – R104 (3.8 miles)
- Vilano Beach: R104 to R122 (3.7 miles)
- Summer Haven: R197 – R209 (2.3 miles)

2.2.1.1 SOUTH PONTE VEDRA BEACH

Census data are not available for South Ponte Vedra Beach. The website HomeTownLocator.com offers the following population information for the entire community of South Ponte Vedra Beach in which the study reach is located. South Ponte Vedra Beach has a population of 2,300. The population increases periodically throughout the year as vacationers visit the beach. 84% of housing units are occupied and 73% of these are occupied by the owner. The median household income is $146,000 (HomeTownLocator.com).

The South Ponte Vedra Beach reach begins at R84 (see Figure 1-1). This reach was added to the study area after the Reconnaissance Report was completed in 2004. Its addition was necessary due to increased erosion occurring around R90 in 2007. A significant and rapid loss of beach and dune width protecting several structures caused the Florida Department of Environmental Protection (FDEP) to designate R84 to R94 (2 miles) as a critically eroded area due to threats to infrastructure and SR A1A. The southern boundary of the reach was extended to R104 for this feasibility study to border the Vilano Beach reach and to investigate the feasibility of providing uninterrupted shore protection along the coast.

Figure 2-1: South Ponte Vedra Beach – May 11th, 2007.

To date, a number of homeowners have constructed temporary seawalls to protect their properties (Figure 2-1). The reach has a fairly narrow beach with a 15 to 20-foot natural dune. A single row of private homes is constructed on top of, or just landward of, the dune. SR A1A is sited landward of this single row of homes. Further landward of SR A1A, multiple rows of private homes are constructed

with a marsh bordering the western extent of construction. The northern end of the reach is surrounded by the Guana-Tolomato-Matanzas National Estuarine Research Reserve (GTMNERR), which extends, west to east, from the marsh into the Atlantic Ocean (Figure 2-2).

Figure 2-2. Guana-Tolomato-Matanzas National Estuary and Research Reserve boundary (green hatching) bordering the northern portion of the South Ponte Vedra Beach reach.

2.2.1.2 VILANO BEACH

According to the 2010 census, Vilano Beach has a population of 2,700 with a median age of 52. The population increases periodically throughout the year as vacationers visit the beach. Twenty-one percent of the population is over age 65, and 11.5% of the population is under age 15. Seventy-eight percent of housing units are occupied and 77% of these are occupied by the owner. The median household income is $52,000, and 11% of the population is below poverty level (2010-2014 American Community Survey Five-Year Estimates).

The Vilano Beach reach begins at R104, abutting the southern boundary of the South Ponte Vedra reach. The FDEP designated R109 – R117 (1.6 miles) as a critically eroded area in 2006 when rapid erosion began to threaten private development and SR A1A. Due to this erosion, several homes were condemned and five structures were granted permits to construct temporary shore protection structures around an erosional hotspot (an area of rapid and chronic erosion) in the vicinity of R114. Just south of this hotspot, the dune was eroded to within five feet of A1A after the passage of Tropical Storm Fay in 2008. As of 2015, the FDEP has designated R84 – R117 (6.5 miles) as critically eroded.

Figure 2-3. Vilano Beach – August 26th, 2008, including the erosional hotspot at R-114 following Tropical Storm Fay.

The shoreline from R117 to the sand trap groin at St. Augustine Inlet (approximately R122) was included as part of this study's Vilano Beach reach at the request of the local sponsor, St. Johns County. In general, this area has not seen the erosion apparent in the R104 to R117 area, possibly due to its proximity to the north sand trap groin of the St. Augustine Inlet, which inhibits the southward transport of sand.

The northern extent is geographically similar to the South Ponte Vedra reach with a narrow beach and a single row of private homes constructed on top of, or just landward of, a 20-foot high dune. The southern extent of the reach is typified by a 14-foot high dune (on average), multiple rows of development seaward of A1A, and a slightly wider beach north of St. Augustine Inlet. Throughout the reach, multiple rows of development are sited between SR A1A and the marsh.

2.2.1.3 SUMMER HAVEN

Census data is not available for Summer Haven. However, the population is much smaller than both the South Ponte Vedra Beach and Vilano reaches. Additionally, the population does not vary much during tourist seasons due to fewer rental properties, less available beach area, and lack of public beach access. There are approximately 60 structures, mainly single-family homes, within the Summer Haven reach.

The Summer Haven reach begins at R197, just south of the Matanzas Inlet. Development in this reach is sited on a narrow strip of land between a shallow marsh and the Atlantic Ocean. Shore protection of upland development has likely been necessary since original development occurred in the early 1900s. After severe nor'easters in 1962, the President declared St. Augustine Beach and Summer Haven disaster areas, and USACE constructed an 1,800-foot granite revetment along the northern portion of the reach between R197 and R200 (Figure 2-4). After Hurricane Dora in 1964, USACE added 1,070 linear feet of granite revetment to the existing revetment. This revetment fronts the majority of the upland development in the reach. South of the revetment, development is limited to one row of single-family residences. When possible, St. Johns County has been purchasing structures and lands in this southern area and not allowing further development.

SR A1A was originally built along the eastern edge of the reach, between the Atlantic Ocean and private homes. Frequent storm damage to the road prompted its re-siting landward to its current location. Approximately 2,700 feet and 3,600 feet of the original paved road (now called Old SR A1A) remain in the northern and southern extents of the reach respectively (Figure 2-4 and Figure 2-5).

Figure 2-4. Summer Haven reach viewed from its northern end. Granite revetment protects paved sections of Old SR A1A.

Figure 2-5. Summer Haven reach viewed from its southern end. The entire reach is visible, with Matanzas Inlet in the upper right and Old SR A1A located just landward of the beach/dune.

As seen in Figure 1-1, the GTMNERR borders the western perimeter of the reach, but does not extend offshore of the reach as it does in South Ponte Vedra Beach. Figure 2-6 illustrates an example of the GTMNERR bordering a portion of the Summer Haven reach.

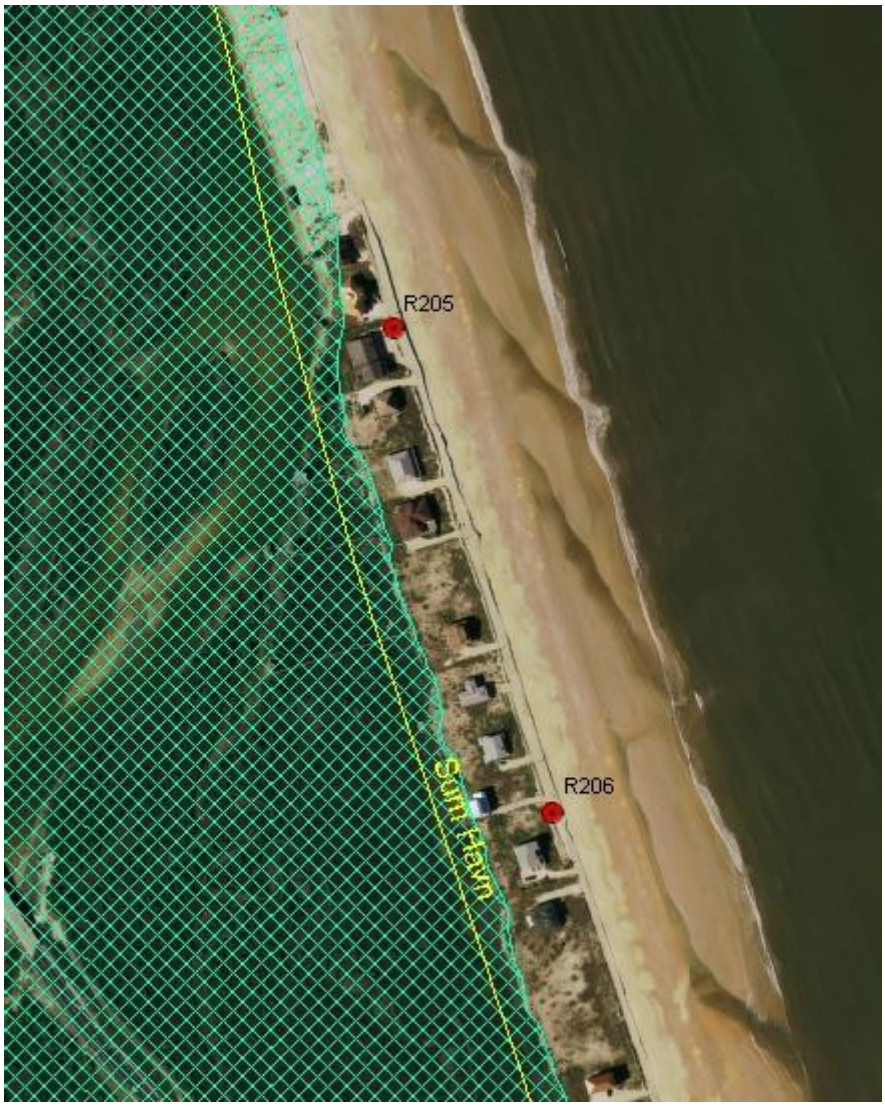


Figure 2-6. GTMNERR boundary (green hatching) bordering the Summer Haven reach.

A narrow beach is exposed at low- to mid-tide north of the revetment, however no significant beach exists seaward of the revetment. South of the revetment, a narrow beach and low dune system fronting private homes is periodically overwashed and breached by storm surge and waves. The most recent breaches occurred in September 2008 (Figure 2-7) during Tropical Storm Fay and October 2016 during Hurricane Matthew. The southern extent of the reach is fronted by a narrow beach exposed at low- and mid-tide and a constructed dune approximately five feet high.

Figure 2-7. Looking south along the Summer Haven reach (around R198). Granite revetment fronts the paved remnant of Old SR A1A. The breach at R200 is shown in the middle of the picture, just beyond the "Road Closed" sign.

2.2.2 HURRICANE EVACUATION ROUTES

EXISTING CONDITIONS

Storm damages, especially erosion, throughout most of the project area could jeopardize National Scenic and Historic Coastal Byway, SR A1A, which is the only evacuation route for the region and a major north-south thoroughfare for the area. After the 2008 hurricane season, areas of the dune line around R115, in the Vilano Beach reach, were eroded to within five feet of SR A1A. SR A1A has already been relocated westward within the Summer Haven reach due to erosion.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

Without a project in place, SR A1A will likely be damaged in portions of the study area. The most vulnerable portion is approximately 500 feet north and 1,500 feet south of R115 in the Vilano Beach reach.

The Florida Department of Transportation (FDOT) has preliminary designs, but no permit or scheduled plans, to construct a seawall in this area for protection of the road. FWOP Beach-fx modeling for this study includes future construction of a seawall in this area. If the road were damaged, hurricane evacuation, emergency response, and storm recovery operations could be jeopardized. Compromising such operations could have life safety consequences.

Within the Summer Haven reach, SR A1A has been relocated landward and elevated, and the new location is west of the study area. Within the Summer Haven reach only, SR A1A is not considered subject to notable damage in its relocated position. However, approximately 2,700 feet and 3,600 feet of the original paved road (now called Old SR A1A) remain in the northern and southern extents of the reach and would be used by a limited number of locals during an evacuation. Old SR A1A is subject to erosion and inundation.

2.2.3 GEOLOGY

The St. Johns County barrier islands have inlets at St. Augustine and at Fort Matanzas. There are low tidal marshes and lagoons between the barrier islands and the mainland. The barrier islands are composed principally of quartz and carbonate sand, and are underlain by silty, clayey marsh deposits that formed at lower sea level stages. The sands are principally fine to medium-grained sand-sized quartz with variable amounts of shell and shell fragments.

Offshore of the beaches and modern barrier islands is the continental shelf. The continental shelf has a broad, shallow, low relief and extends approximately 80 miles offshore near St. Johns County. The shelf contains relic Pleistocene and Holocene terraces and submerged beach sand ridges. The wave climate and sediment transportation system creates a linear sandy coastline.

The northeast coast of Florida consists of a series of sandy barrier islands broken occasionally by inlets. The barrier islands are characterized by dunes and shore parallel beach ridges. Many of the islands display relic beach ridges formed during higher stands of sea level. The formations exposed at the surface are undifferentiated sediments and the Anastasia Formation of Pleistocene and Holocene age (Scott, et al., 2001). These deposits consist of fine to medium quartz sand and lenses of shell and clay of varying thickness. Thick shell beds and erosion of the outcrops of the Anastasia formation near the coast have been firmly cemented to form coquina rock (see Section 2.3.4 for additional information).

The quartz component of the modern barrier island sand has deposited from sand migrating southward along the Atlantic coast, from the reworking of the Pamlico Sand that was previously deposited over the entire region. The remaining component of coastal sediments are typically carbonates, locally produced by calcite-producing plants and animals. Additional carbonate materials are from reworked materials from outcropping Pleistocene formations offshore (Duane and Meisburger, 1969).

2.2.4 NATIVE BEACH

EXISTING CONDITIONS

The native sand on St. Johns County's beaches consists predominately of shelly, poorly sorted, fine to medium grained quartz and carbonate sand, with silt content that averages less than two percent, and ranges in color from light gray and white to brownish gray. The amount of visual shell varies from 3% to 84%, and generally is concentrated on the dry beach above Mean Low Water (MLW). The carbonate content originates from coquina rock outcrops of the Anastasia formation located in the surf zone. Due to the high content of shell, the sediments throughout the berm and mid-tide are significantly coarser than the rest of the beach profile. Some stretches of beach contain a high percentage of coquina shell fragments, which give the sand an orange hue.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The future without-project conditions of the native beach are similar to the existing conditions described above. No change to the sand composition of the native beach are anticipated to occur without the project. With respect to the habitat provided by the native beach in the future without-project condition, increased erosion could decrease the habitat available to nesting sea turtles and to wintering piping plover and red knot. In less developed areas, a potential overwash could increase habitat for piping plover.

2.2.5 SAND SOURCES

The study includes three separate potential sand sources for any necessary beach or dune placement material: the St. Augustine Inlet system, including the ebb, flood, Vilano Point shoals, and the Federal navigation channel; the North Offshore Borrow Area (NOBA); and the South Offshore Borrow Area (SOBA).

2.2.5.1 ST AUGUSTINE INLET SYSTEM SAND SOURCES: EBB, FLOOD, AND VILANO POINT SHOALS, AND FEDERAL NAVIGATION CHANNEL

EXISTING CONDITIONS

In conjunction with this investigation, a Regional Sediment Management (RSM) analysis incorporating navigation projects near the study area (Intracoastal Waterway and St. Augustine Inlet) and the constructed Federal shore protection project at St. Augustine Beach has sought to integrate current and future project sand needs around the inlet vicinity. This work is published in the Engineer Research and Development Center (ERDC) 2016 technical report, *Regional Sediment Management Strategies for the Vicinity of St. Augustine Inlet, St. Johns County, Florida*, ERDC/CHL TR-16-12. The technical report is based, in part, on investigations and modeling completed between 2010 and 2012 cited in the state's Inlet Management Plan for St. Augustine Inlet.

The St. Augustine Inlet system has approximately 6.5 million cubic yards of beach quality sand per FDEP permitting standards. FDEP permits any dredging that would be necessary to access this source. The FDEP

St. Augustine Inlet Management Plan states 278,000 cubic yards of sand can be dredged from the inlet system per year. The material obtained from the inlet system shall be distributed to the adjacent Atlantic Ocean fronting beaches with a placement ratio of approximately one third of material placement to the north and two thirds of material placement to the south. Further details on the inlet system sand sources are available in the Geotechnical Appendix.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

Without a project, the channel and shoals of the St. Augustine Inlet will continue to require regular maintenance dredging as part of the authorized Federal navigation project. Accretion of sediment within the inlet system has the potential to increase habitat for wintering shorebirds that congregate on ephemeral, unvegetated shoals near inlets. In addition, the northern end of Anastasia State Park may migrate and change. This may affect beach mouse habitat if the dunes are altered, which could be either a positive or negative impact depending on the future morphology of the northern shoreline.

2.2.5.2 OFFSHORE SAND SOURCES

EXISTING CONDITIONS

The offshore sand sources are sand shoals on the Outer Continental Shelf. Additional details on the offshore sand sources are available in the Geotechnical Appendix. There are an estimated 400 million cubic yards of sand within the North Offshore Borrow Area (NOBA). Of this, 16 million cubic yards has been fully developed with core borings and related analysis. There are an estimated 130 million cubic yards of sand within the South Offshore Borrow Area (SOBA), of which 14 million cubic yards has been fully developed.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The future without-project conditions of the offshore borrow areas (NOBA and SOBA) are similar to the existing conditions described above.

2.2.6 SHORELINE CHANGE AND EROSION RATES

EXISTING CONDITIONS

Shoreline surveys dating back to 1952 indicate that the St. Johns County shoreline as a whole is experiencing erosion at a rate of 1.0 feet/year (FDEP 2000). Shoreline changes fluctuate over time along the study area. The shoreline of St. Johns County has fluctuated throughout history, with areas undergoing both advancement and recession of the Mean High Water (MHW) position. The analysis detailed in the Engineering Appendix showed that over the long term, from 1972 to 2015, the study area has been receding. In the time between 1972 and 2015, the MHW position in South Ponte Vedra receded an average of 1.3 feet/year. In the Vilano Beach 1 segment, the MHW position receded 1.7 feet/year on

average, while in the Vilano Beach 2 segment, directly north of the St. Augustine Inlet, the MHW position advanced seaward an average of 0.3 feet/year.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The shoreline should experience similar rates of erosion and accretion in the future without-project conditions as described in the existing conditions section above. However, sea level rise may accelerate coastal erosion rates and increase impacts resulting from erosion. Section 2.2.13 provides additional information on sea level change with respect to this study.

2.2.7 WINDS

EXISTING CONDITIONS

Local winds are the primary means of generating the small-amplitude, short period waves that are an important mechanism of sand transport along the study area shoreline. Winds that drive sediment transport from the east-southeast quadrant are generally mild in nature and occur in the spring and summer months. Elevated wind speeds from the north-northeast quadrant in fall and winter months occur during passage of nor'easters, which can cause extensive beach erosion and shorefront damage. Occasionally the area is impacted by the passage of tropical storms that can generate devastating winds, waves, and storm surge, which can cause direct damage to coastal structures and infrastructure.

The Engineering Appendix provides additional detail on winds.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The future without-project conditions of winds are similar to the existing conditions described above.

2.2.8 WAVES

EXISTING CONDITIONS

The wave energy dissipation that occurs as waves enter the nearshore zone and break is the principal driver for sediment transport. Wave height, period, and direction, in combination with tides and storm surge, are the most important factors influencing the behavior of the beach and dune system. The study area is exposed to both short period wind-waves and longer period open-ocean swells originating predominantly from the northeast during spring, fall, and winter months and from the northeast to the southeast during summer months.

Periodic erosion of the study area and associated damage to upland development is attributable to large storm waves produced primarily by nor'easters during the late fall and winter months, and by tropical disturbances, including hurricanes, during the summer months. Because the study area is fully exposed to the open ocean in all seaward directions, the coastline is vulnerable to wave attack from distant storms

(causing long period swells) and local storms (causing short period steep waves). Tropical storm passage is relatively frequent for the study area and even without landfall a system passing within several hundred miles may cause extensive erosion damage to the area. The Engineering Appendix provides additional detail on waves.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The future without-project conditions of waves are similar to the existing conditions described above.

2.2.9 ASTRONOMICAL TIDES

EXISTING CONDITIONS

Astronomical tides are created by the gravitational pull of the moon and sun and are well understood and predictable in magnitude and timing. The National Oceanic and Atmospheric Administration (NOAA) regularly publishes tide tables for selected locations along the coastlines of the United States and selected locations around the world. These tables provide times of high and low tides, as well as predicted tidal amplitudes.

Tides in St. Johns County area are semidiurnal, meaning two high tides and two low tides occur per tidal day. Tidal datums for St. Augustine Beach (NOAA station 8720587) and Vilano Beach ICWW (NOAA station 8720554) are summarized in Table 2-1 and Table 2-2, respectively. The St. Augustine Beach water level station is located on the St. Augustine Beach pier and represents open ocean water levels while the Vilano Beach water level station is located in the Intracoastal Waterway on the SR A1A bridge and represents tides affecting the marsh side of the barrier islands. The difference between Mean High Water (MHW) and Mean Low Water (MLW), known as the mean tide range, equals 4.61 feet at St. Augustine Beach and 4.24 feet at Vilano Beach, Intracoastal Waterway gage.

Table 2-1. Tidal Datums for St. Augustine Beach, FL on the Atlantic Ocean Coast.

Tidal Datum	Elevation Relative to NAVD88 (feet)
Mean Higher High Water (MHHW)	2.01
Mean High Water (MHW)	1.64
North American Vertical Datum (NAVD88)	0.00
Mean Sea Level (MSL)	-0.70
Mean Low Water (MLW)	-2.97
Mean Lower Low Water (MLLW)	-3.13

Table 2-2. Tidal Datums for Vilano Beach, FL on the Marsh Side of the Island.

Tidal Datum	Elevation Relative to NAVD88 (feet)
Mean Higher High Water (MHHW)	1.86
Mean High Water (MHW)	1.53
North American Vertical Datum (NAVD88)	0.00
Mean Sea Level (MSL)	-0.56
Mean Low Water (MLW)	-2.71
Mean Lower Low Water (MLLW)	-2.89

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The future without-project conditions of tides are similar to the existing conditions described above.

2.2.10 CURRENTS

EXISTING CONDITIONS

Nearshore currents affect the supply and distribution of sediment on the sandy beaches of St. Johns County and are composed of alongshore and cross-shore components. Alongshore currents, induced by oblique wave energy, generally determine the long-term direction and magnitude of littoral transport. Cross-shore currents may have a more short-term impact, but can result in both temporary and permanent erosion. The magnitude of these currents is determined by the wave characteristics, angle of waves from offshore, configuration of the beach, and the nearshore profile. For St. Johns County beaches, the net sediment transport is from north to south. This is due to the dominant wave activity from the northeast during the fall and winter months, particularly nor'easter storms.

Adjacent to the St. Augustine Inlet, currents are affected by the ebb and flood tidal flow through the inlet. The terminal groin structure on the north side of St. Augustine Inlet also provides varying degrees of influence on nearshore currents depending on its exposure level.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The future without-project conditions of currents are similar to the existing conditions described above.

2.2.11 STORM EFFECTS

EXISTING CONDITIONS

The beaches of St. Johns County are influenced by tropical systems during the summer and fall and by nor'easters during the late fall, winter, and spring. Although hurricanes typically generate larger waves and storm surge, nor'easters typically have a greater cumulative impact on the shoreline due to longer storm duration and greater frequency of event occurrence. Periodic and unpredictable hurricanes and coastal storms, with their energetic breaking waves and elevated water levels, can change the width and elevation of beaches and accelerate erosion as depicted in Figure 2-8.

The shoreline is expected to naturally modify its beach profile during storms. Storms erode and transport sediment from the subaerial beach into the active zone of storm waves. Once caught in the waves, this sediment is carried along the shore and redeposited farther down the beach, or is carried offshore and stored temporarily in submerged sand bars.

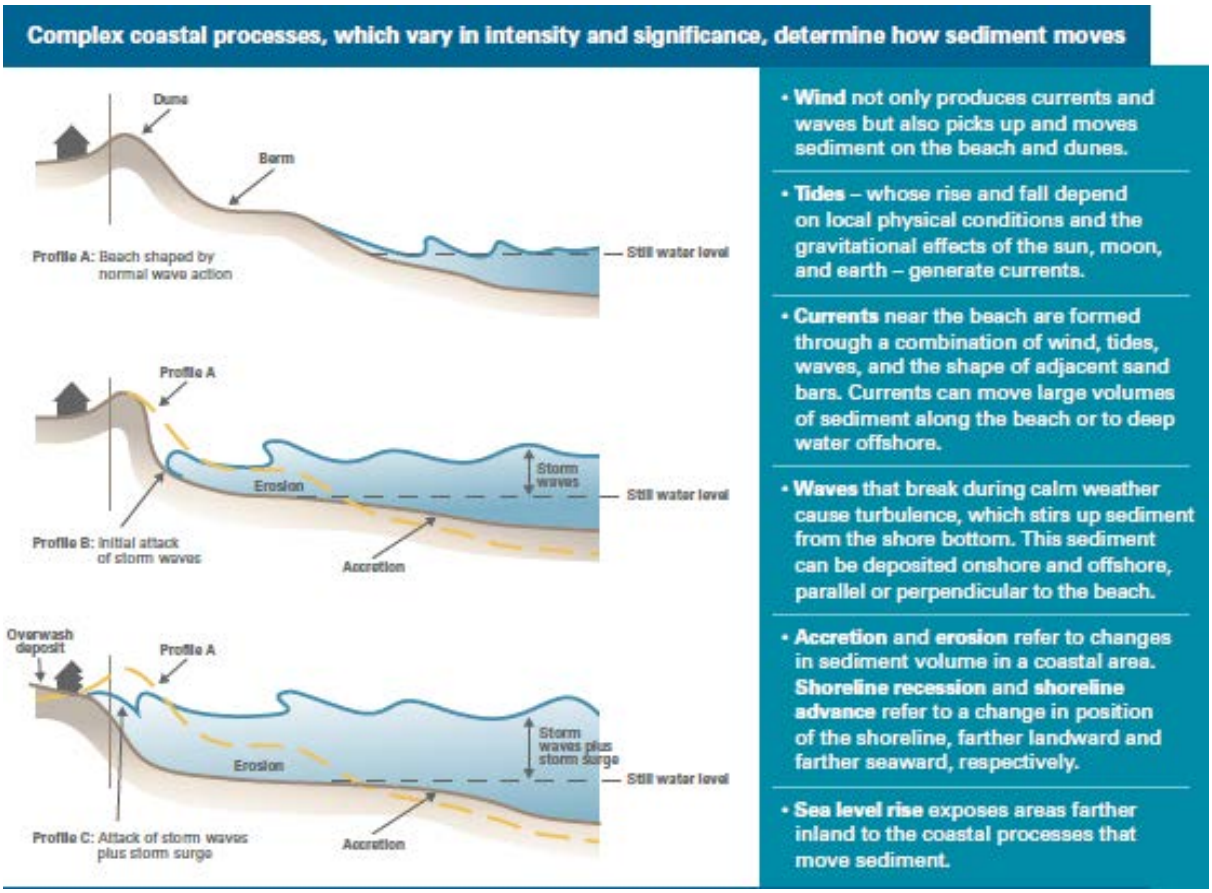


Figure 2-8. Typical coastal processes (from Shore Protection Assessment primer published by USACE-Engineer Research Development Center-ERDC).

After storms pass, waves usually return sediment from the sand bars to the beach, which is restored gradually to its natural equilibrium profile. However, extreme storm events may cause sediment to leave the beach system entirely, sweeping it into inlets, into the back bay (overwash), or moving it far offshore into deep water where waves cannot return it to the beach. This causes the shoreline to recede, or move farther landward.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The future without-project conditions of storms are similar to the existing conditions described above. As sea level in the study area rises in the future, storm effects will be occurring on top of that elevated water level. This will result in storm effects reaching further inland.

2.2.12 STORM SURGE

EXISTING CONDITIONS

Storm surge is defined as the rise of the ocean surface above its astronomical tide level due to physical forces. Surges occur primarily as a result of atmospheric pressure gradients and surface stresses created by wind blowing over a water surface. Strong onshore winds pile up water near the shoreline, resulting in elevated water levels along the coastal region and inland waterways. In addition, the lower atmospheric pressure which accompanies storms also contributes to a rise in water surface elevation. Extremely high wind velocities coupled with low barometric pressures (such as those experienced in tropical storms, hurricanes, and very strong nor'easters) can produce very high damaging water levels. Water level (with storm surge) time series are critical for input into shoreline response and coastal storm risk modeling applications. An increase in water depth may increase the potential for coastal flooding and allow larger storm waves to attack the shore.

The return period storm surge events can provide insight into the vulnerabilities of a given location through comparison with the existing topography. Table 2-3 provides peak storm surge heights by return period for St. Augustine Inlet, Florida. Storm surge levels versus frequency of occurrence presented in Table 2-3 were obtained from data compiled by the University of Florida for the Florida Department of Transportation (Sheppard and Miller, 2003).

Table 2-3. Peak Storm Tide Elevations.

Storm Return Period	Peak Storm Surge Height		
(years)	ft-NGVD29	ft-NAVD88	ft-MSL
10	3.6	2.5	1.8
20	5.4	4.3	3.6
50	9.6	8.5	7.8
100	12.3	11.2	10.5
200	14.5	13.4	12.7
500	16.9	15.8	15.1

FUTURE WITH-OUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The future without-project conditions of storm surge are similar to the existing conditions described above. As sea level in the study area rises in the future, storm surge will be occurring on top of that elevated water level. This will result in higher observed total water levels associated with storm surge events.

2.2.13 SEA LEVEL CHANGE

EXISTING CONDITIONS

It is anticipated that the global mean sea level will rise within the next 100 years. To incorporate the direct and indirect physical effects of projected future sea level change (SLC) on design, construction, operation, and maintenance of coastal projects, USACE has provided guidance in the form of Engineer Regulation, ER 1100-2-8162, and Engineer Technical Letter (ETL) 1100-2-1. Three estimates are required by the guidance; a baseline (or "low") estimate, which is based on historic sea level rise (SLR) and represents the minimum expected SLC, an intermediate estimate, and a high estimate representing the maximum expected SLC.

The study area is located between 30 and 45 miles from NOS gage #8720218 at Mayport, Florida. The historical sea level rise rate taken from this gage was determined to be 2.40 mm/year (0.0079 feet/year) (http://corpsclimate.us/ccaceslcurves.cfm). Given a project base year of 2020, a table of SLC rates was produced for each of the three required scenarios through the 50-year planning horizon and up to the year 2120. Additional detail on sea level change is provided in the Engineering Appendix.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

Figure 2-9 provides a graphic representation of the three levels of projected future SLC over a 100-year period. The project area can expect to see sea level rise 0.4 to 2.4 feet above its current position within the 50-year planning horizon, as predicted by the low and high SLC rates, respectively.

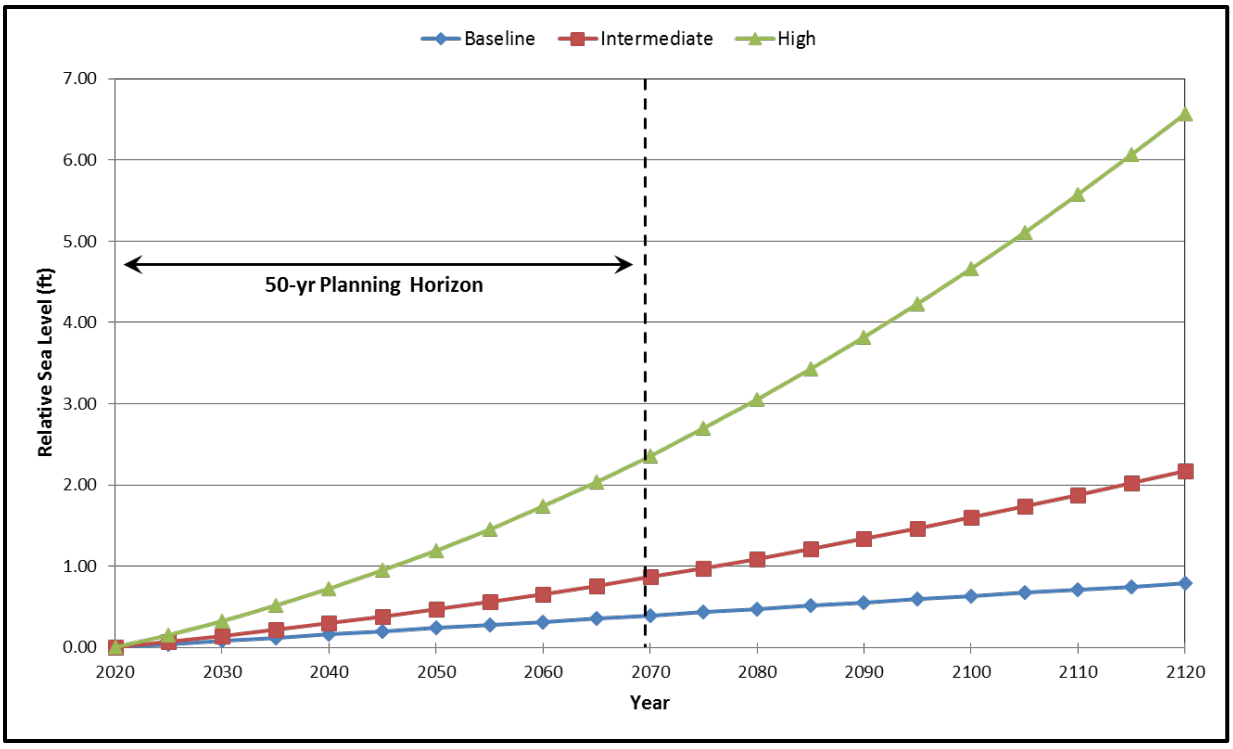


Figure 2-9. Relative Sea Level Change, St. Johns County, FL.

2.2.13.1 SHORELINE CHANGE RESULTING FROM SEA LEVEL RISE

An estimate of the rate of shoreline recession can be based on the local rate of SLC in some cases. With a change in sea level, the beach profile will attempt to reestablish the same bottom depths relative to the surface of the sea that existed prior to sea level change. That is, the natural profile will be translated upward and shoreward to maintain equilibrium. If the longshore littoral transport in and out of a given shoreline is equal, then the quantity of material required to reestablish the nearshore slope must be derived from erosion of the shore.

The above estimation is applicable to long straight sandy beaches with an uninterrupted supply of sand and should only be used for estimating long-term changes. Additional detail is given in the Engineering Appendix. Figure 2-10 provides an estimate of the potential shoreline changes within the project area attributable to projected changes in sea level.

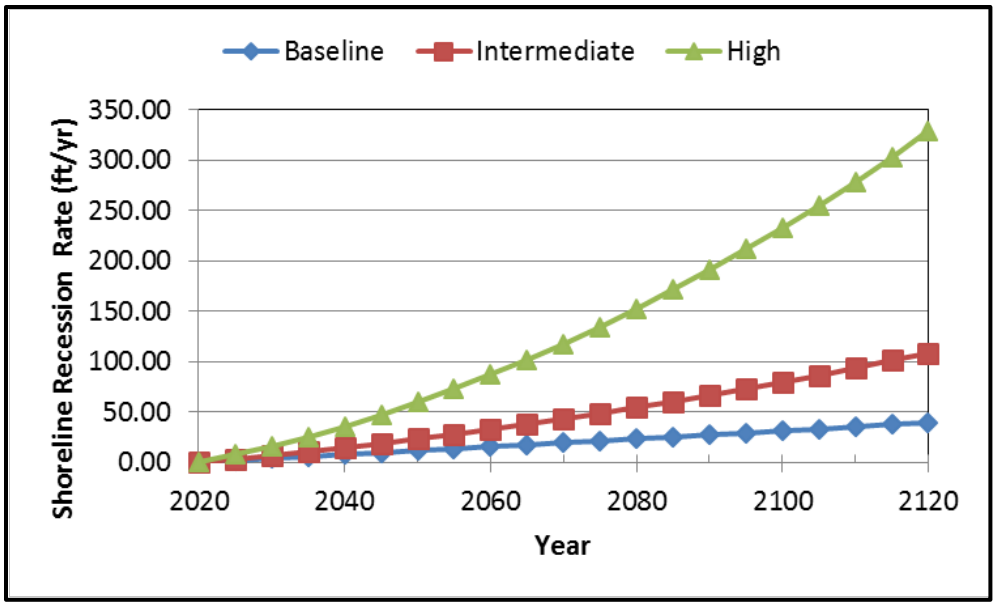


Figure 2-10. Estimated Shoreline Recession Rate Due to Sea Level Rise.

2.2.13.2 VOLUMETRIC CHANGE RESULTING FROM SEA LEVEL RISE

Engineering Manual (EM) 1110-2-3301 (USACE, 1995) gives guidance on how to calculate beach volume based on berm height, depth of closure, and translation of the shoreline (in this case, shoreline recession). Figure 2-11 provides an estimate of the shoreline volume loss as a result of the three SLR scenarios.

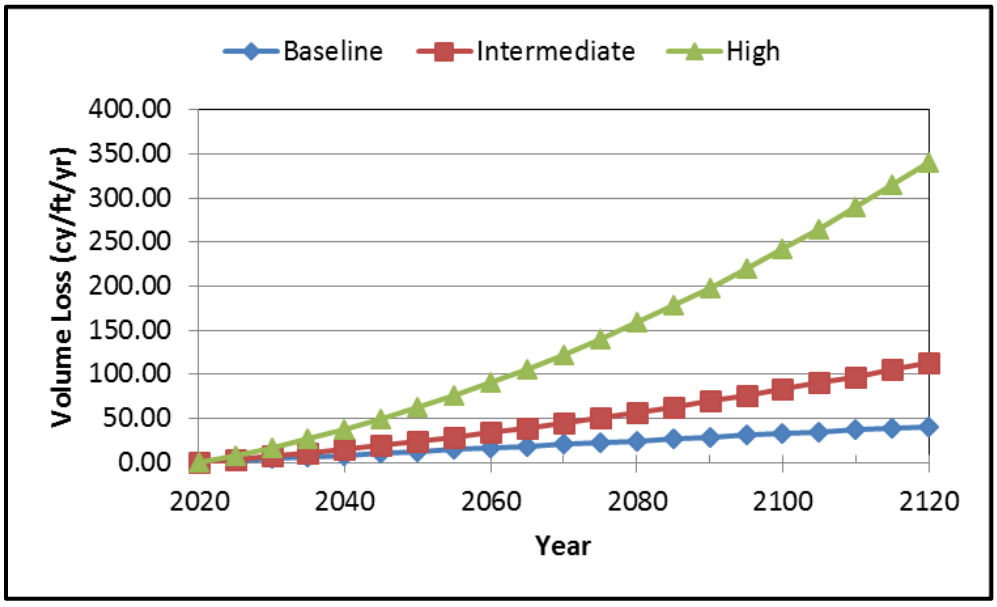


Figure 2-11. Estimated Volume Loss Due to Sea Level Rise.

2.2.13.3 INCORPORATION OF ER 1100-2-8162 AND ETL 1100-2-1: GUIDANCE FOR SEA LEVEL CHANGE

The SLC ETL 1100-2-1, supporting ER 1100-2-8162, suggests a tiered analysis to determine the risk of potential SLC and resulting incorporation into the plan formulation process. Incorporation of potential SLC into the USACE planning process will require active focus on risk-based scoping to define pertinent needs, opportunities, and the appropriate level of detail for conducting investigations. In particular, close attention is needed at the beginning of each study in order to screen planning/scoping decisions. The tiered analysis for SLC is incorporated into the six-step planning process used in this report. Mean Sea Level (MSL) is used as an elevation reference in this section of the report, as it is generally more intuitive for readers when describing changes to existing water elevations.

In order to evaluate SLC impacts to infrastructure, critical resources, and the population residing in the study area, a qualitative matrix was developed in Table 2-4. Resources evaluated in the matrix were based on those identified by the USACE Coastal Systems Portfolio Initiative (CSPI). CSPI describes the resource risk in a project area relative to the density of the resource, the population density that the resource serves, or in the case of environment, habitat, and recreation, the value placed on the resource. See http://navigation.usace.army.mil/CSPI for more information. The evaluation criteria shown in the table is from, *Technical Review of Coastal Projects: Storm Risk Management, Navigation and Ecosystem Restoration for Nation's Coastlines* (USACE, Spring 2012.)

The qualitative matrix shown in Table 2-4 evaluates the resources on which the study area depends. In addition to the CSPI evaluation criteria, Table 2-4 evaluates the vulnerability to resources from potential SLC, or SLR in the case of the study area. Averaging the "Vulnerability from SLR" to resources gives an average of 1.2, equating to a relatively low vulnerability of resources. This indicates that SLR is not a major contributor to overall resource vulnerability within the 50-year period of analysis.

Table 2-4. Qualitative Matrix describing vulnerability of resources from potential accelerations in sea level change.

Resource	Risk Rating from CSPI - Value or density of resource or dependent population (3=high, 2=med., 1=low, X=none present)	Description	Vulnerability from SLR (3=high, 2=med., 1=low, X=none present)	Description
Residential/commercial structures	2	Mostly residential (single-family and multi-family homes.) Most ground floor elevations of structures vary between 10.5 and 20.5 feet above existing Mean Sea Level (MSL) throughout the study area. Most ground floor elevations within the Tentatively Selected Plan (TSP) area are approximately 15.5 feet above existing MSL.	1	Projected high scenario SLC would not place Mean Sea Level (MSL) near infrastructure within the 50 year planning horizon and would increase the flood frequency very minimally. Typical surge experienced in the project area from large coastal storms is between 2.5 to 4.3 feet (10 and 20 year return period, respectively.) This indicates that SLR is not a major contributor to future damages over the 50 year planning horizon.
Environment and Habitat	3	Beach/dune habitat. Fairly narrow, steep beach backed by average 15.5 feet high dunes. Where no dune exists, seawalls of varying quality have been constructed.	2	Beach berm and dune system is located between 10.5 and 20.5 feet above MSL throughout the study area. Sub aerial habitat is located throughout this system.
Infrastructure (roads, water/sewer lines, boardwalks, navigation structures)	2	Water/sewer lines, septic tanks, seawalls and dune walkovers exist. State Road A1A is located between 10.5 and 20.5 feet above MSL throughout the study area. The road is located approximately 15.5 feet above MSL within the TSP area. Most other infrastructure would not be impacted until water level, including storm surge, reached above this point. The 10-year return period storm tide level is equal to 1.8 feet above MSL, including tide and effects from waves wave setup.	1	By the end of the 50 year planning horizon, State Road A1A remains adequately elevated above MSL under any SLC scenario. Other infrastructure located at, or above, this elevation is also adequately elevated. Wooden boardwalks (typically built over the dunes to allow beach access) have portions lower than this elevation and are more subject to damage. However, they are not high value, or critical, infrastructure.
Critical Facilities (police, fire, schools, hospitals, and nursing homes)	1	low density of critical facilities	1	Elevation of most critical facilities remains above MSL under any SLC scenario by the end of the 50-year planning horizon.
Evacuation Routes	3	State Road A1A is the main north/south evacuation route, located approximately 15.5 feet above MSL within the TSP area.	1	By the end of the 50 year planning horizon, State Road A1A remains adequately elevated above MSL under any SLC scenario. Even under the high SLC scenario, a 13-foot difference would remain between MSL and A1A within the TSP area.
Recreation	3	significant recreational use of beaches	1	Beach berm is between 10.5 and 20.5 feet above current MSL throughout the study area. Recreational use of beach is high around public access points.
		average =	**1.2**	**Low Vulnerability**

Overall, the initial analysis above indicates that the project area vulnerability to SLC is relatively low. A relatively low risk from SLC in the project area, combined with high uncertainty over potential accelerations in the rate of SLC, lead to an adaptive management strategy as shown in Figure 2-12.

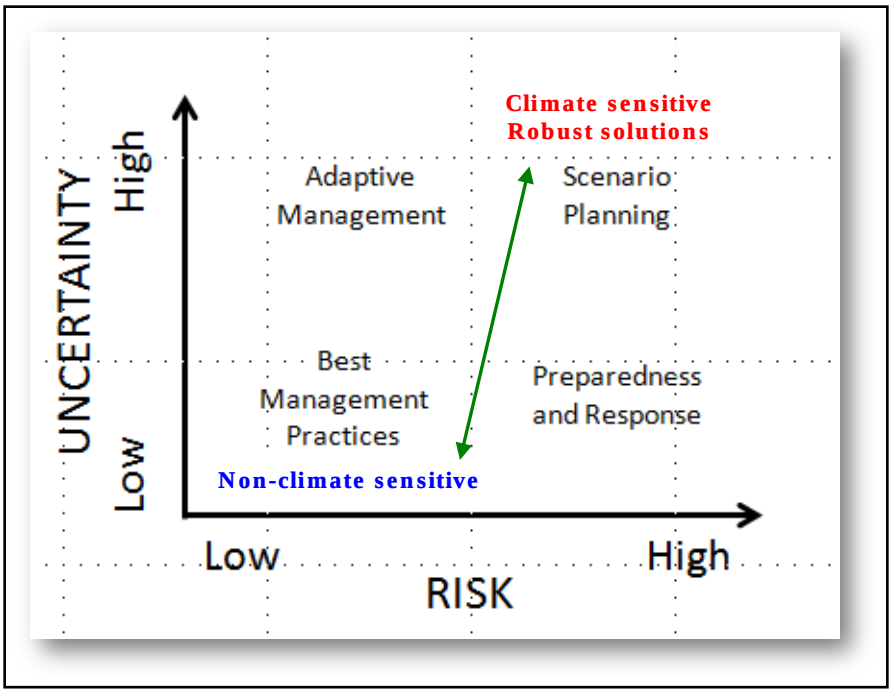


Figure 2-12. Consideration of risk and uncertainty in climate change related decision-making.

Elevations within the study area (Atlantic Ocean side of the island) are some of the highest on the barrier island, about 14.5 to 20.5 feet above Mean Sea Level (MSL). Elevations on the marsh side of the island are significantly lower. Although the marsh side of the island is not within the current study area, stakeholders should be aware of increased risk to infrastructure there as sea level rises. Cross-island profiles were taken at three points throughout the study area, shown in Table 2-5. As reflected in the table, the profiles of the island slope downward from the dune, located on the Atlantic Ocean, to the marsh side of the island where structures are generally located around 5.5 to 6.5 feet above current MSL. There may be other locations with lower elevations. However, these cross-island profiles represent the general topography within, and adjacent to, the study area.

Table 2-5. Key Elevations along Cross-Island Profiles.

	Ground elevations in feet (MSL)*			
R-monument of Profile	**Dune**	**State Road A1A**	**Atlantic Ocean-side Structures**	**Marsh-side Structures**
R-97	18.5	18.5	18.5	6.5
R-110	24.5	20.5	20.5	6.5
R-119	14.5	10.5	12.5	5.5

*elevations are approximate, based on 2015 bare-earth LiDAR given in NAVD88. Difference between NAVD88 and MSL on ocean side is -0.7 ft. Difference between NAVD88 and MSL on marsh side is -0.6 ft.

The island profile taken at R110 is shown in Figure 2-13. Marsh side areas of the island will likely be impacted by inundation more frequently than the ocean side as sea level rises, especially during extreme high tide events. In the study area, the majority of the oceanfront area is fronted by relatively high dunes as shown in Figure 2-13.

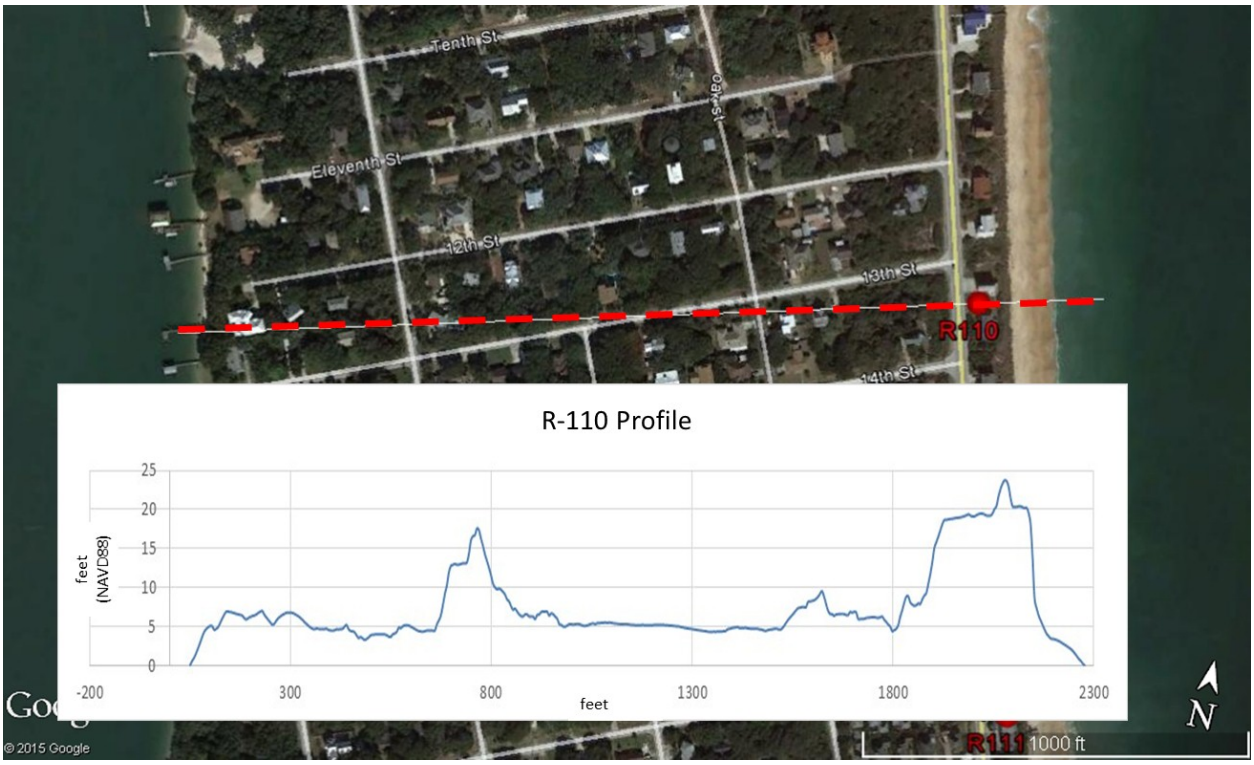


Figure 2-13. Cross-island profile taken at R110. Elevations are relative to NAVD88.

A key question, when assessing the vulnerability of the study area to SLC, is when critical thresholds will be crossed, if at all, by potential SLC. Throughout the study area, the dune crest height represents a critical threshold. The average dune height from Table 2-5 is 19 feet (MSL). SR A1A, and other infrastructure, is located slightly lower, on average, at 17 feet (MSL). Since the dune lies between the ocean and infrastructure, the dune height (19 feet) will be used as the ocean side critical elevation.

The maximum 50-year storm tide elevation in the study area is given as 7.8 feet MSL in Table 2-3. Water elevations during such storm events could reach the top of the dunes (19 feet MSL) once sea level increases by about 11.2 feet (7.8 feet storm tide + 11.2 feet sea level increase = 19 feet). This estimate does not take erosion of the dune height into consideration, which could occur over time. At the end of 50 years, sea level may increase by 2.4 feet under the high SLR scenario, significantly below the threshold of 11.2 feet.

ETL 1100-2-1 recommends that systems related to, but existing outside the study area, should also be evaluated for vulnerability to SLC. The marsh side of the island does not contain any critical infrastructure on which the study area depends, such as hospitals or emergency services. However, although the study area is not dependent on marsh side infrastructure, the marsh side of the island is potentially vulnerable to SLC. Infrastructure on the marsh side is generally built at, or above, 6 feet MSL as seen in Table 2-5. This side of the island is mainly affected by tides, not storm surge. Tidal range on the marsh side of the island is smaller than the ocean side.

Table 2-2 shows that Mean Higher High Water (MHHW) is equal to 2.4 feet MSL. Infrastructure could be periodically impacted once sea level increases by about 3.6 feet (2.4 feet + 3.6 feet sea level increase = 6 feet). At the end of 50 years, sea level may increase by 2.4 feet under the high SLR scenario, which is below the threshold of 3.6 feet. The high scenario is predicted to surpass this threshold in approximately 85 years after the base year, as seen in Figure 2-14. In such a case, infrastructure on the back side of the island could be impacted during higher high tide events, dependent on current and future construction to protect against elevated water levels such as seawalls and bulkheads.

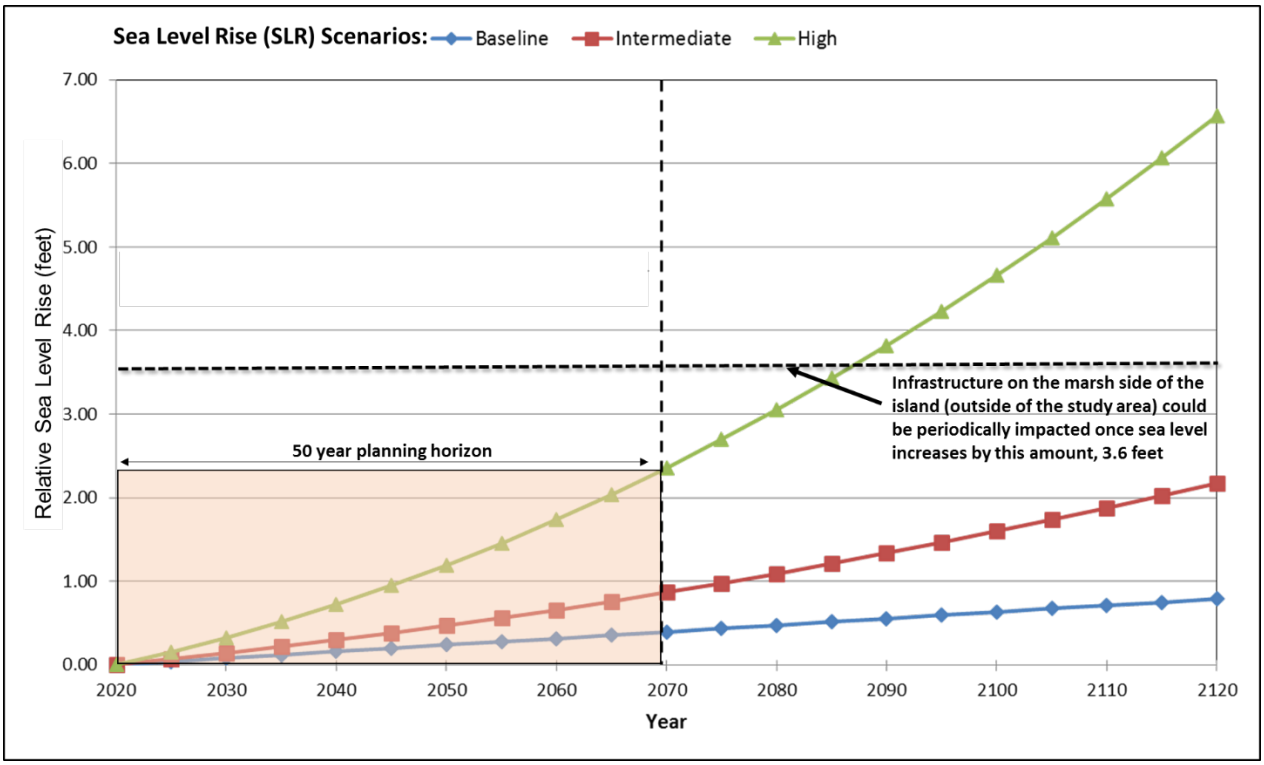
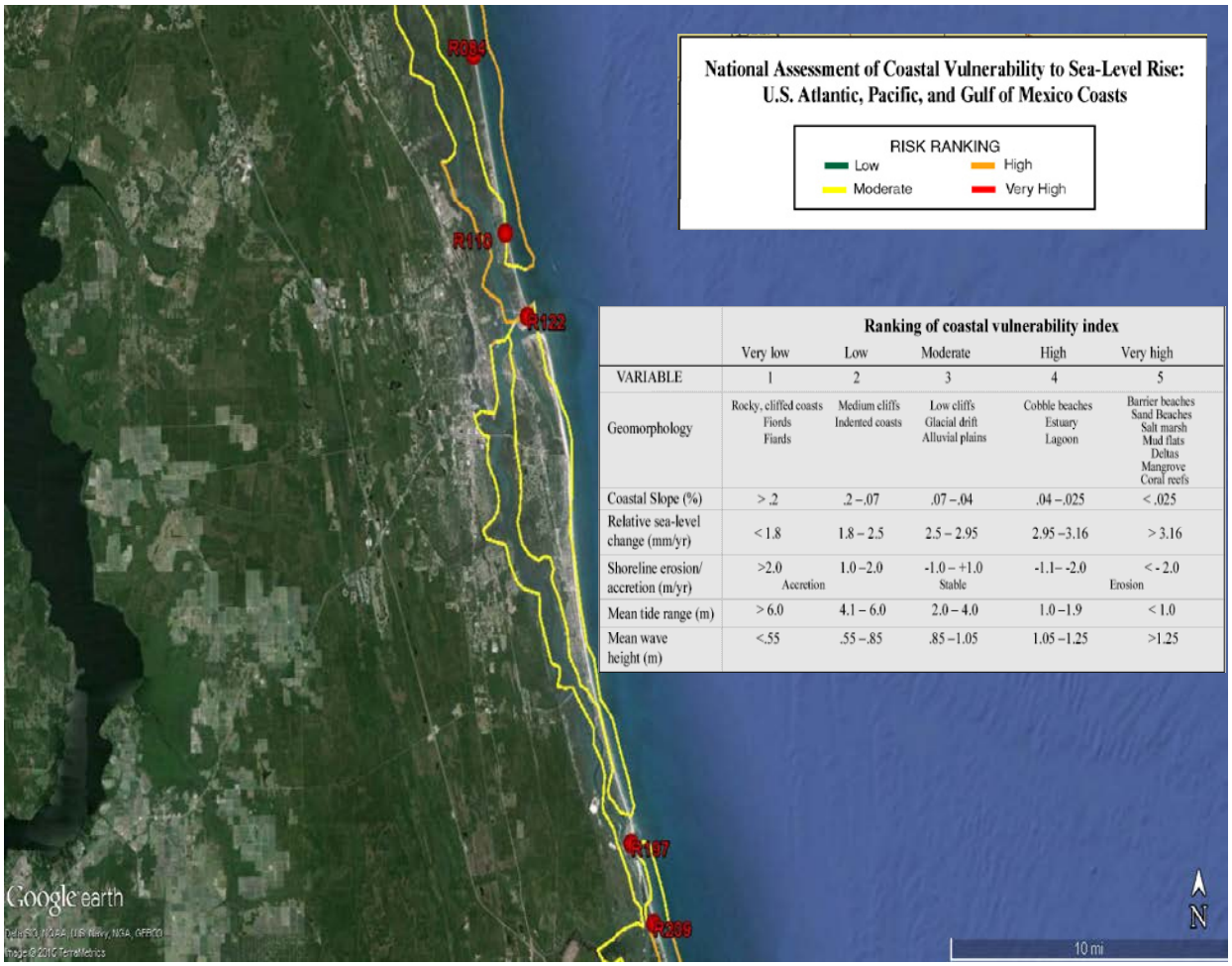


Figure 2-14. Threshold vulnerability on the marsh side of the island to relative sea level rise.

The existing Coastal Vulnerability Index (CVI) developed by the United States Geological Survey (USGS) is a useful indicator of a project area's natural vulnerability to SLC. Population, and infrastructure type, or density, are not parameters used in the assessment. The USGS used six input parameters to assess the CVI for geographic areas along the nation's shoreline. Parameters used include geomorphology, coastal slope, relative SLC, shoreline erosion/accretion, mean tide range, and mean wave height (USGS 2000). Figure 2-15 shows the CVI for the study area is rated as moderate to high based on the area being part of an erosional barrier island surrounded by sandy beaches and salt marsh.



	Ranking of coastal vulnerability index				
	Very low	Low	Moderate	High	Very high
VARIABLE	1	2	3	4	5
Geomorphology	Rocky, cliffed coasts Fiords Fiards	Medium cliffs Indented coasts	Low cliffs Glacial drift Alluvial plains	Cobble beaches Estuary Lagoon	Barrier beaches Sand Beaches Salt marsh Mud flats Deltas Mangrove Coral reefs
Coastal Slope (%)	> .2	.2 – .07	.07 – .04	.04 – .025	< .025
Relative sea-level change (mm/yr)	< 1.8	1.8 – 2.5	2.5 – 2.95	2.95 – 3.16	> 3.16
Shoreline erosion/ accretion (m/yr)	>2.0 Accretion	1.0 – 2.0	-1.0 – +1.0 Stable	-1.1 – -2.0	< - 2.0 Erosion
Mean tide range (m)	> 6.0	4.1 – 6.0	2.0 – 4.0	1.0 – 1.9	< 1.0
Mean wave height (m)	<.55	.55 – .85	.85 – 1.05	1.05 – 1.25	>1.25

Figure 2-15. USGS Coastal Vulnerability Index.

2.2.14 EFFECTS OF OTHER COASTAL STORM RISK MANAGEMENT (CSRM) AND NAVIGATION PROJECTS

EXISTING CONDITIONS

St. Augustine Harbor Federal Navigation Project is located adjacent to the southern end of the Vilano Beach reach. The harbor inlet is stabilized by a northern sand trap groin and southern jetty. Both of the structures act to impound material. Sediment transport around the tip of the north sand trap groin is visible in the form of nearshore shoaling in an area referred to alternately as Vilano Point, Vilano Shoal, or Porpoise Point. The inlet itself acts as an effective sediment sink, experiencing accretion in the channel, as well as the developing ebb and flood shoals. Throughout this report all of these accretional areas, including the shoals and inlet channel, are referred to as the, “inlet system.”

The ebb tide shoal of St. Augustine Inlet was used as a sand source for the initial beach nourishment of the St. Johns County Shore Protection Project (SPP) at St. Augustine Beach in 2001, as well as for subsequent nourishments. In 2012, portions of the inlet system, including the entrance channel, ebb shoal, and Vilano Shoal, were dredged as a sand source for renourishment of the project. These actions benefit the navigation mission by maintaining a navigable depth within the inlet. The Engineering Appendix offers additional information on the effects of adjacent projects.

Matanzas Inlet is not maintained for navigation. The inlet has a history of migrating to the south, but is now held in place by the south abutment of the SR A1A bridge over the inlet.

The IWW near Matanzas Inlet is subject to shoaling and must be regularly dredged to maintain navigation. Maintenance dredging of the channel is between 150,000 to 200,000 cubic yards per year (personal communication, FIND 2003). This material can be pumped into the dredged material management area, MSA SJ-1, until the 800,000 cubic yard capacity is reached. In 1999, approximately 765,000 cubic yards of material was pumped from MSA SJ-1 and the IWW onto the beach at Summer Haven. SJ-1 was last used in 2004, however in 2007 and 2011, the dredged material was pumped directly onto the beach at Summer Haven. This sand is fine grained with a low percentage of fine material (less than 5% passing a #200 sieve). A 2016 maintenance event is planned with approximately 400,000 cubic yards expected to be dredged and placed onto the beach at Summer Haven.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The future without-project conditions of other CSRM and navigation projects are similar to the existing conditions described above. The Federal navigation channel would continue to be used as a sand source for the authorized and previously constructed St. Johns County Shore Protection Project (SPP) at St. Augustine Beach. Inlets are dynamic features, and the shoreline morphology at the northern end of Anastasia State Park may change in the without-project condition. As will be described later in this report, the inlet system will be used as a sand source for the Recommended Plan.

2.2.15 PUBLIC ACCESS AND PARKING

EXISTING CONDITIONS

Federal participation in CSRM projects involving placement of sand is limited to shorelines open to public use. Guidance is provided in ER 1105-2-100 and ER 1165-2-130. Cost sharing for any recommended plan is based on shoreline ownership, use, and the availability of public access.

The South Ponte Vedra reach (R84-R104) contains only two signed public access points with parking, which significantly limits any Federal participation in a potential project. At the time of this writing, the non-federal sponsor does not intend to add public access or parking in the near future. The Vilano Beach reach (R104-R122) has signed public access at least every ½ mile with several, but not all, of the accesses having adequate public parking. The Summer Haven reach (R197-R209) contains no maintained public access

or signed public parking, severely limiting any Federal participation in a potential project. In the northern extent of the reach, unofficial public parking is available on the shoulder of Old SR A1A between the revetment and the road between R198 and R199. However, no signs indicate "public parking."

Figure 2-16 depicts signed public access and parking within the South Ponte Vedra Beach and Vilano Beach reaches. The green points are existing public access locations with free public parking recorded by FDEP and verified by USACE, Jacksonville District. Pink points indicate public accesses without parking.

Figure 2-16. Public access and parking within the South Ponte Vedra Beach and Vilano Beach Reaches.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE*)

Public access and parking are not expected to change between the existing and future without-project conditions.

2.3 NATURAL (GENERAL) ENVIRONMENT*

2.3.1 VEGETATION

EXISTING CONDITIONS

Coastal development has limited the dune system to relatively small portions of the three reaches. The intact dunes are dominated by a mixture of sea oats, beach pennywort, gaillardia, saltwort, sea rocket, railroad vine, prickly-pear cactus, and beach tea. In addition, a colony of the invasive exotic suckering Australian pine (*Casuarina glauca*) was located on Summer Haven beach at the southern terminus of the September 2008 breach. The majority of the three reaches are heavily developed, and the dune environment is degraded or non-existent. This is due to the construction of homes, hotels, restaurants, and condominiums, and to the continuing erosion of the beach and foredune. In these areas, there are landscape plantings that include native and exotic ornamental species. Finally, extensive expanses of salt marsh, dominated by cordgrass (*Spartina alterniflora*) and needle rush (*Juncus roemerianus*), occur inland of the three reaches.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE*)

Without the proposed project, the dune will continue to erode and eventually be eliminated, along with the associated dune vegetation, in the developed portions of the shoreline. Salt marsh vegetation will remain unchanged in the future without-project condition.

If an overwash or breach of the island were to occur in the Summer Haven reach, there could be a temporary negative impact on the marsh and seagrass habitat. Overwash is a natural dynamic of barrier islands as sea level rises. Marsh and seagrass habitats can tolerate a certain level of disturbance due to the dynamic nature of these environments. It would be expected that these habitats would recover on a relatively short timescale.

2.3.2 FISH AND WILDLIFE RESOURCES (OTHER THAN THREATENED AND ENDANGERED SPECIES)

EXISTING CONDITIONS

The biological communities found in the project area are well adapted to highly dynamic intertidal zones, and must cope with being aerially exposed during normal tidal cycles, as well as being subjected to the high energy of the ocean waves. These habitats can have low species diversity due to the harshness of the environmental conditions. However, animals that are able to successfully adapt to these dynamic

conditions are faced with very little competition from other organisms. Receding waves tend to wash amphipods (shrimp-like crustaceans) and isopods (small crustaceans such as woodlice) out of their burrows and suspend these organisms in the water column where they serve as an important food source for a variety of nearshore fish, including species among the snapper-grouper complex. A variety of polychaete worms that are also adapted to this highly dynamic and stressful environment can be found within the intertidal zone of the St. Johns County beaches. These intertidal organisms provide an important food source for foraging shore and wading birds, including least tern (*Sternula antillarum*), Wilson's plover (*Charadrius wilsonia*), black skimmer (*Rynchops niger*), and American oystercatcher (*Haematopus palliates*). The dominant invertebrate found along the shoreline of St. Johns County is the Atlantic coquina clam, *Donax variabilis*. Highly visible decapod crustaceans of the St. Johns County swash zone also include the ghost crab (*Ocypode quadrata*), mole crab (*Emerita talpoida*), and Atlantic fiddler crab (*Uca pugilator*). These organisms are highly motile, and burrow into the moist sand for refuge and to retard water evaporation from their bodies during aerial exposure. Coastal inlets provide migration routes for larvae entering nursery areas, and for sub-adults leaving nursery areas to mature and spawn offshore. Important species utilizing the St. Augustine Inlet and its ebb shoal include king mackerel (*Scomberomorus cavalla*), Atlantic Spanish mackerel (*Scomberomorus maculatus*), and cobia (*Rachycentron canadum*).

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

Species that utilize the beach environment may decrease in number due to continued erosion of the beach and dune system in the future without-project condition. No changes to fish and wildlife resources that reside below the swash zone would occur in the future without-project condition.

2.3.3 THREATENED AND ENDANGERED SPECIES

Threatened and endangered species that may occur in the project area and be affected by the proposed work are found in Table 2-6.

Table 2-6. Species protected under the Endangered Species Act that are located in the project area and that may be affected by the proposed project.

Common Name	Scientific Name	Federal Listing Status under ESA
Green Turtle	*Chelonia mydas*	Endangered
Loggerhead Turtle	*Caretta caretta*	Threatened
Leatherback Turtle	*Dermochelys coriacea*	Endangered
Kemp's Ridley Turtle	*Lepidochelys kempii*	Endangered
Hawksbill Turtle	*Eretmochelys imbricata*	Endangered
West Indian Manatee	*Trichechus manatus*	Endangered
Piping Plover	*Charadrius melodus*	Threatened
Red Knot	*Calidris canutus*	Threatened

Anastasia Island Beach Mouse	*Peromyscus polionotus phasma*	Endangered
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered
Sei Whale	*Balaenoptera borealis*	Endangered
Fin Whale	*Balaenoptera physalus*	Endangered
Humpback Whale	*Megaptera novaeangliae*	Endangered
Sperm Whale	*Physeter catadon macrocephalus*	Endangered

2.3.3.1 SEA TURTLES

EXISTING CONDITIONS

The loggerhead (*Caretta caretta*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), Kemp's ridley (*Lepidochelys kempii*), and hawksbill (*Eretmochelys imbricata*) sea turtles can occur within the project area. All of these species are federally endangered except the loggerhead, which is designated as threatened. Loggerheads, greens, and leatherbacks regularly nest within the project area. The nesting season in St. Johns County is between April 2 and October 24. Adult loggerhead females inhabit nearshore waters during the summer months between nesting attempts, typically laying three to six clutches in two week intervals. Sub-adults may use nearshore waters year-round for foraging.

The Florida Fish and Wildlife Conservation Commission manages the Statewide Nesting Beach Survey, which is a statewide program of sea turtle nesting surveys. The program reaches located in the study area are shown on **Figure 2-17**. Loggerhead nesting typically exceeds nesting by green and leatherback turtles. The study area has experienced an increase in loggerhead nesting since 2009, which has been observed statewide. Nesting data for the study area is provided in Table 2-7, Table 2-8, and Table 2-9.

The only sea turtle species for which U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) have designated critical habitat is the loggerhead. The project is located in designated loggerhead nearshore reproductive critical habitat (see Figure 2-18).

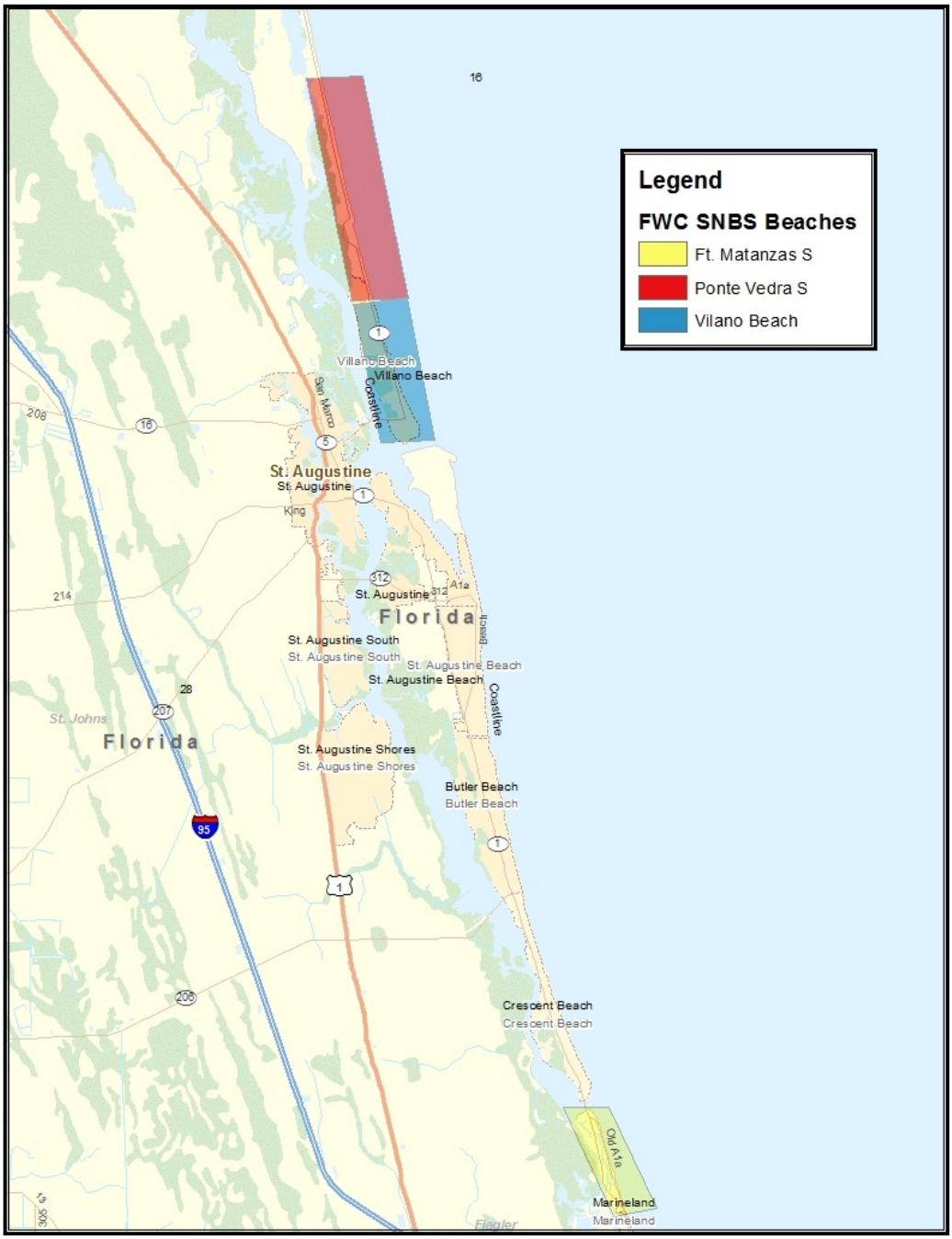


Figure 2-17. Map showing the location of the three Statewide Nesting Beach Survey (SNBS) reaches in the study area.

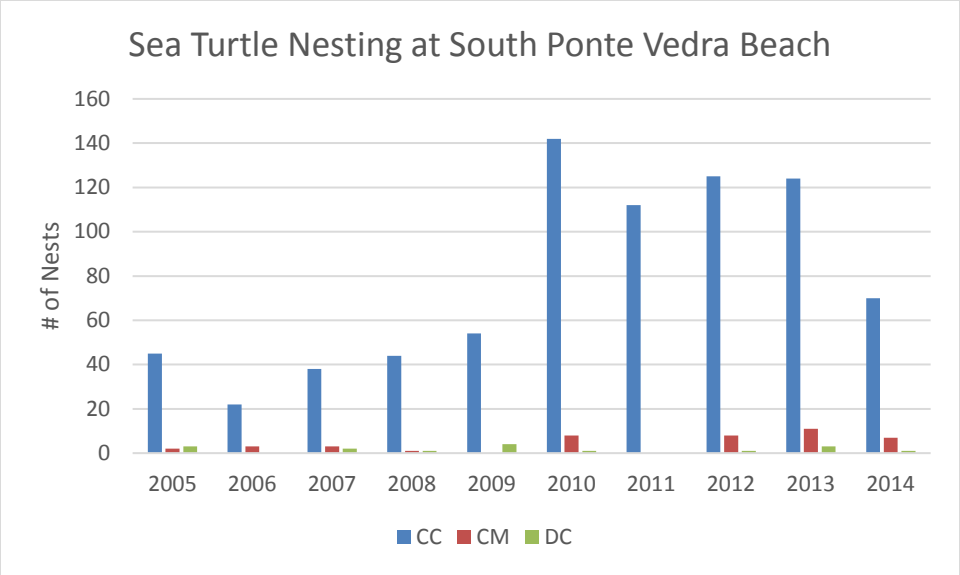


Table 2-7. Sea turtle nesting data for South Ponte Vedra Beach (identified as Ponte Vedra S according to the Statewide Nesting Beach Survey program) for loggerheads (CC), greens (CM), and leatherbacks (DC) from 2005 to 2014. Data obtained from the Florida Fish and Wildlife Conservation Commission.

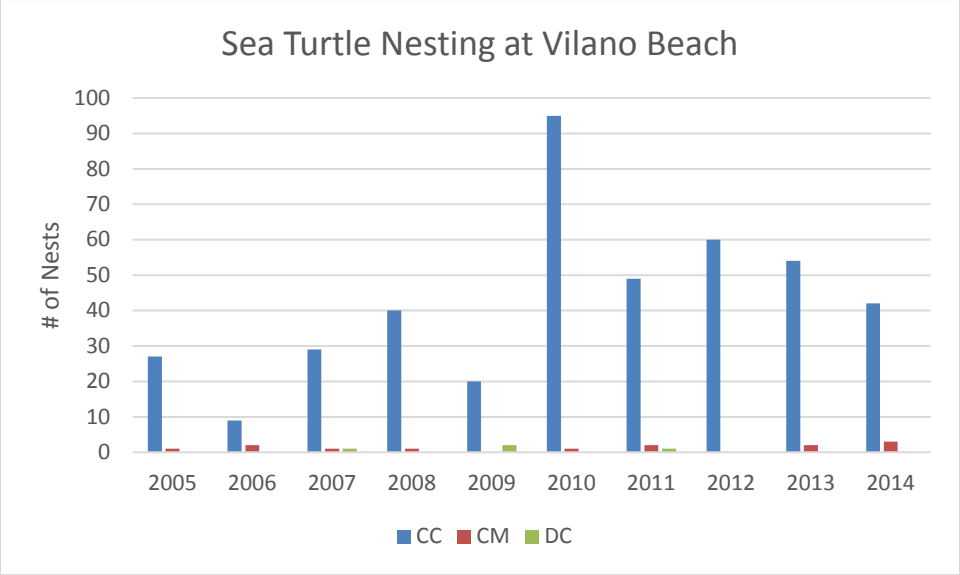


Table 2-8. Sea turtle nesting data for Vilano Beach for loggerheads (CC), greens (CM), and leatherbacks (DC) from 2005 to 2014. Data obtained from the Florida Fish and Wildlife Conservation Commission.

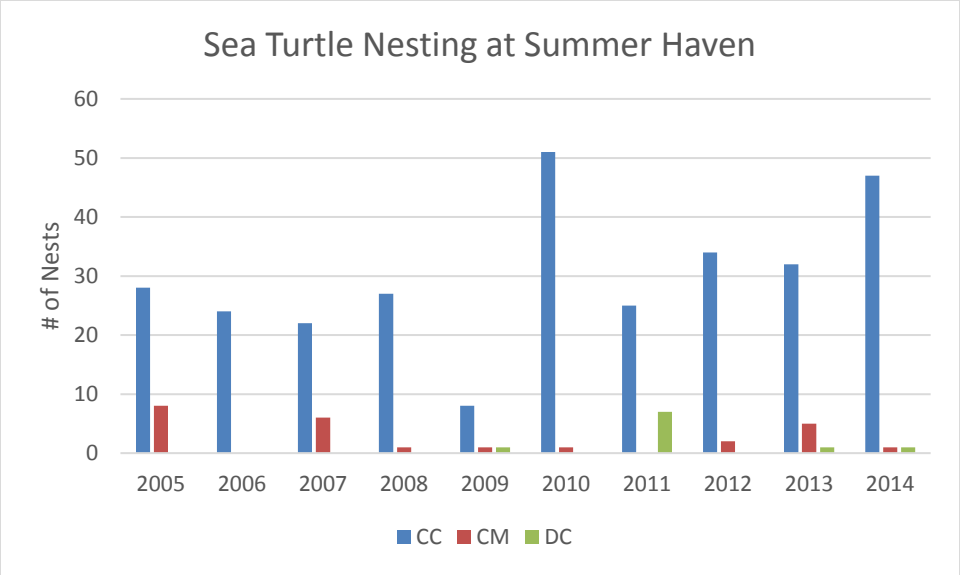


Table 2-9. Sea turtle nesting data for Summer Haven (identified as Ft. Matanzas South by the Statewide Nesting Beach Survey program) for loggerheads (CC), greens (CM), and leatherbacks (DC) from 2005 to 2014. Data obtained from the Florida Fish and Wildlife Conservation Commission.

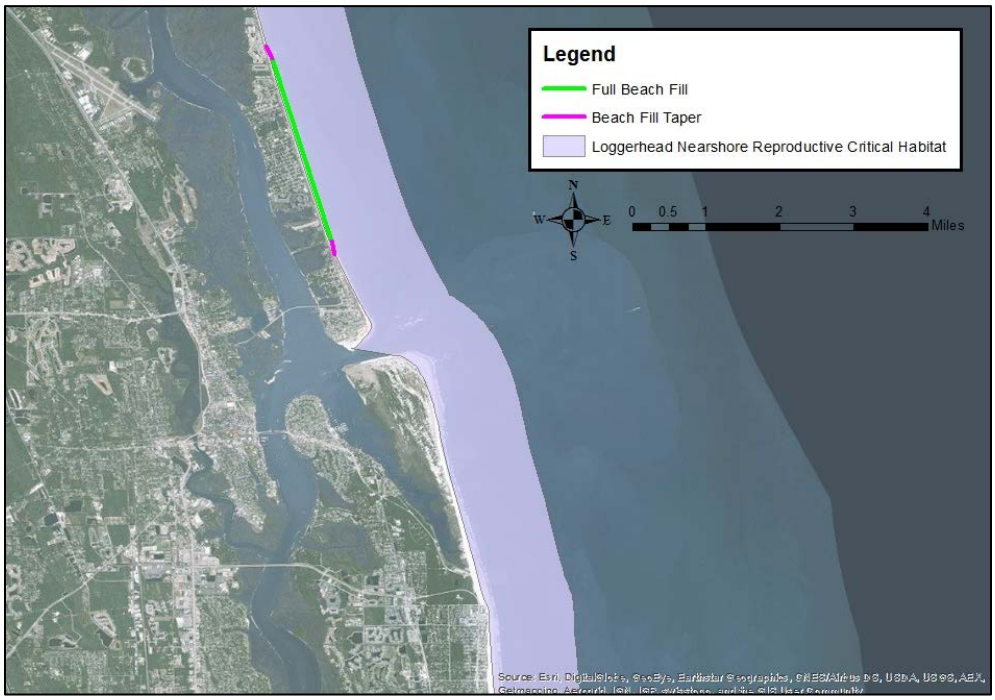


Figure 2-18. Location of loggerhead nearshore reproductive critical habitat in the project area.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

In the future without-project condition, it is projected that the beach will continue to erode. This will reduce the shoreline area available for nesting sea turtles. It will also increase turtle nest vulnerability to storm washout, as nests would be located closer to the Mean High Water (MHW) line. As adjacent shorelines are currently available for nesting, it is unknown whether the overall nesting would be affected. In addition to increased erosion, it is likely that the length of shoreline hardened by structures would increase. This could further decrease the area available for nesting sea turtles due to the fact that the hard structures constructed would likely be seawalls and revetments. Seawalls and revetments could negatively impact the width of beach available for nesting sea turtles.

2.3.3.2 WEST INDIAN MANATEE

EXISTING CONDITIONS

Manatees are found throughout St. Johns County, including the study area. They primarily use the IWW and the estuary to migrate and forage for food. The closest designated manatee critical habitat is located in the St. Johns River, approximately 30 miles north of the study area.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The future without-project conditions for the West Indian manatee are not expected to be different from the existing conditions described above.

2.3.3.3 PIPING PLOVER AND RED KNOT

EXISTING CONDITIONS

The *rufa* red knot (*Calidris canutus rufa*) is a medium-sized shorebird about 9 to 11 inches in length. The piping plover (*Charadrius melodus*) is a small shorebird about 6 to 7 inches in length. Both species are designated as threatened species under the Endangered Species Act, and they overwinter in Florida between November and April. Both the piping plover and the red knot prefer to forage in coastal habitats that include sand flats adjacent to inlets or passes, sandy mud flats along prograding spits (areas where the land rises with respect to the water level), ephemeral pools, and overwash areas. These substrate types have a richer infauna than the foreshore of high energy beaches and often attract large numbers of shorebirds.

While piping plover and red knot are known to occur in the North Florida area, they are more likely to be found either north of the study area in the GTMNERR or south of the study area at Matanzas Pass. The closest designated piping plover critical habitat is located north of the mouth of the St. Johns River, approximately 30 miles north of the study area. The USFWS has not yet designated critical habitat for the *rufa* red knot.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The continued erosion of the shoreline in the proposed placement area may reduce some habitat currently utilized by piping plover and red knot; however, the infrequent usage of these areas by these species suggests that the future without-project conditions would be similar to the existing conditions with respect to these species.

Allowing sediment to overtop the dune and create overwash fans in the Summer Haven reach would have a beneficial effect by enhancing habitat for piping plover and red knot.

2.3.3.4 ANASTASIA ISLAND BEACH MOUSE

The endangered Anastasia Island beach mouse (*Peromyscus polionotus phasma*) inhabits the primary and secondary dune systems within a 14.5 mile length of Anastasia Island and sections of the GTMNERR (Figure 2-19).

EXISTING CONDITIONS

The Anastasia Island beach mouse may have ranged from Florida's St. John's River in Duval County, south to Anastasia Island in St. Johns County. The beach mouse currently occurs on Anastasia Island, primarily on the north (Anastasia State Park) and south (Fort Matanzas National Monument) ends of the island. In 1992, mice from these two populations were reintroduced into suitable historical habitat between Ponte Vedra Beach and South Ponte Vedra Beach in north St. John's County at the GTMNERR. The reintroduced population is surviving, although in low numbers (USFWS, 2015). There is no evidence of beach mice utilizing the study reaches.

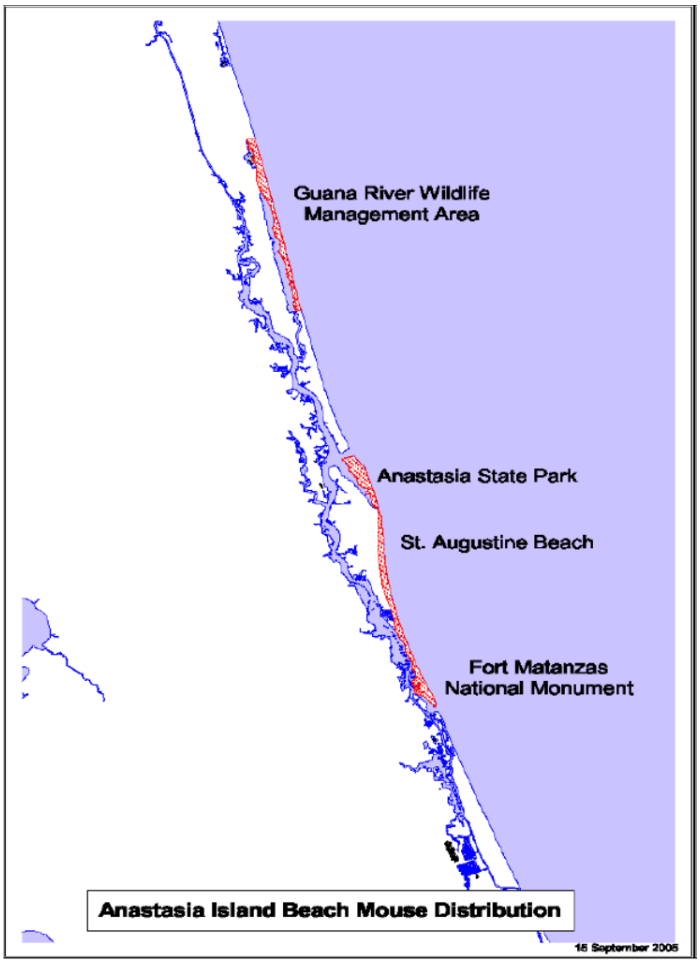


Figure 2-19. Location of Anastasia Island Beach Mouse habitat in the study area.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

Although not currently inhabited, potential beach mouse habitat is decreasing due to erosion in the study area. While there is a potential for beach mice to reoccupy this area if suitable habitat existed there, it is unlikely that the beach mouse will be significantly affected by the future without-project condition.

2.3.3.5 WHALES

EXISTING CONDITIONS

Five whale species listed as federally endangered occur in the Atlantic Ocean along the county's coastline during certain times of the year. These species include the 1) North Atlantic right whale (*Eubalaena glacialis*), 2) Sei Whale (*Balaenoptera borealis*), 3) Fin Whale (*Balaenoptera physalus*), 4) Humpback Whale (*Megaptera novaeangliae*), and 5) Sperm Whale (*Physeter catadon macrocephalus*). Portions of the offshore sand-source boundaries are located in North Atlantic right whale critical habitat.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The presence of whales in the study area is not likely to be altered from the existing conditions if the project were not constructed.

2.3.4 ESSENTIAL FISH HABITAT (EFH)

Waters and substrate within the project area have been identified as Essential Fish Habitat (EFH) by the South Atlantic Fishery Management Council (SAFMC; SAFMC 1998). EFH is defined as those waters and substrate necessary for fish to spawn, breed, feed, or grow to maturity. Pursuant to the 1999 Finding between USACE and NMFS, USACE's Notice of Availability of the draft EA initiated USACE's consultation under the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MSFCMA). NMFS provided comments on the draft EA on April 4, 2016, which are incorporated into this document. This section describes the existing conditions of the EFH in the project area, as well as the individual and cumulative impacts of the No Action Alternative. Section 5.2.5 describes the individual and cumulative impacts of the Recommended Plan and other reasonable alternatives. This NEPA document satisfies the coordination requirement for EFH under the MSFCMA (see also Section 6.13).

2.3.4.1 HABITAT AREAS OF PARTICULAR CONCERN

2.3.4.1.1 Coastal Migratory Pelagics

Areas which meet the criteria for Essential Fish Habitat-Habitat Areas of Particular Concern (EFH-HAPCs) include sandy shoals of Capes Lookout, Cape Fear, and Cape Hatteras from shore to the ends of the respective shoals, but shoreward of the Gulf Stream; The Point, The Ten-Fathom Ledge, and Big Rock (North Carolina); The Charleston Bump and Hurl Rocks (South Carolina); The Point off Jupiter Inlet (Florida); Phragmatopoma (worm reefs) reefs off the central east coast of Florida; nearshore hard bottom south of Cape Canaveral; The Hump off Islamorada, Florida; The Marathon Hump off Marathon, Florida; The "Wall" off of the Florida Keys; Pelagic Sargassum; and Atlantic coast estuaries with high numbers of Spanish mackerel and cobia based on abundance data from the Estuarine Living Marine Resources Program. Estuaries meeting this criteria for Spanish mackerel include Bogue Sound and New River, North Carolina; Bogue Sound, North Carolina (Adults May-September salinity >30 ppt); and New River, North Carolina (Adults May-October salinity >30 ppt). For Cobia; Broad River, South Carolina (Adults & juveniles May-July salinity >25ppt).

The project area is considered EFH for Coastal Migratory Pelagics, which include king mackerel (*Scomberomorus cavalla*), Atlantic Spanish mackerel (*Scomberomorus maculatus*), and cobia (*Rachycentron canadum*).

2.3.4.1.2 Tidal Inlets

The SAFMC designates tidal inlets (including their ebb and flood tide shoals) as EFH-HAPCs for penaeid shrimp and species within the snapper-grouper complex, as well as EFH for coastal migratory pelagic species. The ecological function of tidal inlets (including their ebb and flood tide shoals) is widely recognized for its contributions to spawning, egg and larval dispersal, juvenile recruitment, and as foraging habitat.

2.3.4.2 FISH UTILIZATION

The SAFMC has designated areas of vegetated and non-vegetated bottoms, live bottoms, and water columns within the study area as Essential Fish Habitat (EFH) in compliance with the MSFCMA, as amended by the Sustainable Fisheries Act of 1996. The Atlantic Ocean in the study area also provides essential forage, cover, and nursery habitats for other species that are commercially and recreationally important. Additional information for important species in the project area is included below.

Table 2-10. St Augustine Inlet Complex EFH Species/Management Units.

Species/Management Unit	Lifestage(s) Found at Location
Spinner Shark	ALL
Scalloped Hammerhead Shark	Neonate
Bonnethead Shark	Neonate, Adult
Lemon Shark	Juvenile, Neonate
Finetooth Shark	Juvenile, Adult
Nurse Shark	Adult, Juvenile
Tiger Shark	Neonate, Juvenile
Blacktip Shark	Neonate, Juvenile
Atlantic Sharpnose Shark	ALL
Coastal Migratory Pelagics	ALL
Blacknose Shark	ALL
Bull Shark	Adult
Dusky Shark	Neonate
White Shark	Juvenile
Snapper Grouper	ALL
Great Hammerhead Shark	ALL
Summer Flounder	Larvae, Juvenile, Adult
Penaeid Shrimp (Brown Shrimp, Pink Shrimp, White Shrimp)	ALL

Source: National Oceanic and Atmospheric Administration (NOAA) EFH Mapper tool (http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html).

Spinner Shark

The spinner shark (*Carcharhinus brevipinna*) is a common, coastal-pelagic, warm-temperate and tropical shark of the continental and insular shelves (Compagno, 1984). It is often seen in schools, leaping out of the water while spinning. It is a migratory species, but its patterns are poorly known. EFH for all lifecycles of the spinner shark exists in the St. Augustine Inlet system sand source area.

Scalloped Hammerhead Shark

The scalloped hammerhead (*Sphyrna lewini*) is a very common, large, schooling hammerhead of warm waters. It is the most common hammerhead in the tropics and is readily available in abundance to inshore artisanal and small commercial fisheries as well as offshore operations (Compagno, 1984). It migrates seasonally north-south along the eastern United States. Scalloped hammerhead sharks are widely distributed, but they are also dependent on discrete coastal nursery areas (Duncan et al., 2006). Neonate and Young-of-the-Year (YOY) would be more common within and near the St. Augustine Inlet during the summer months. EFH for all lifecycles of the scalloped hammerhead exists in the St. Augustine Inlet system sand source area.

Bonnethead Shark

The Bonnethead (*Sphyrna tiburo*) is a small hammerhead shark that inhabits shallow coastal waters where it frequents sandy or muddy bottoms. It is confined to the warm waters of the western hemisphere (Castro, 1983). Bonnethead sharks feed mainly on benthic prey such as crustaceans and mollusks. They do not appear to exhibit long distance migratory behavior and thus, little or no mixing of populations (Lombardi-Carlson, 2007). EFH for all lifecycles of the Bonnethead shark exists in the project area.

Lemon Shark

The lemon shark (*Negaprion brevirostris*) is common in the American tropics, inhabiting shallow coastal areas, especially around coral reefs. During migration, this species can be found in oceanic waters but tends to stay along the continental and insular shelves (Morgan, 2008). Lemon sharks are reported to use coastal mangroves as nursery habitats, although this is not well documented in the literature. EFH for all lifecycles of the Lemon shark exists in the project area.

Finetooth Shark

The Finetooth shark (*Carcharhinus isodon*) is a common inshore species of the western Atlantic. It ranges from North Carolina to Brazil. It is abundant along the southeastern United States and the Gulf of Mexico (Castro, 1983). Finetooth sharks generally prefer water temperatures reach 22°C (mid-May) and remain until water temperatures drop to 20°C (October). EFH for all lifecycles of the Finetooth shark exists in the project area.

Nurse Shark

The Nurse shark (Ginglymostoma cirratum) inhabits littoral waters in both sides of the tropical and subtropical Atlantic, ranging from tropical West Africa and the Cape Verde Islands in the east, and from Cape Hatteras, North Carolina to Brazil in the west. It is also found in the eastern Pacific, ranging from the Gulf of California to Panama and Ecuador (Bigelow and Schroeder, 1948). It is a shallow water species, often found lying motionless on the bottom under coral reefs or rocks. It often congregates in large numbers in shallow water (Castro, 1983; Pratt and Carrier, 2001). Generally, nurse sharks are not usually far ranging in their movements and most individuals spend their entire life cycle within a few hundred square kilometers (Carrier and Luer, 1990; Kohler et al., 1998). EFH for all lifecycles of the Nurse shark exists in the project area.

Tiger Shark

The Tiger shark (*Galeocerdo cuvier*) inhabits warm waters in both deep oceanic and shallow coastal regions (Castro, 1983). In the western North Atlantic Ocean, tiger sharks occur in coastal and offshore waters from approximately 40° to 0°N, and have been documented to make transoceanic migrations (Driggers et al., 2008). In the North Atlantic they are rarely encountered north of the Mid-Atlantic Bight (Skomal, 2007). A study by Heithaus et al. (2002) on tiger sharks in Australia showed they preferred shallow seagrass habitats, and this was influenced by prey availability, which is greater in shallow waters. The tiger shark is one of the larger species of sharks, reaching over 550 cm TL and over 900 kg. Its characteristic tiger-like markings and unique teeth make it one of the easiest sharks to identify. It is one of the most dangerous sharks and is believed to be responsible for many attacks on humans (Castro, 1983).

Blacktip Shark

The blacktip shark (*Carcharhinus limbatus*) is circumtropical in shallow coastal waters and offshore surface waters of the continental shelves. In the southeastern United States it ranges from Virginia to Florida and the Gulf of Mexico. The blacktip shark is a fast moving shark that is often seen at the surface, frequently leaping and spinning out of the water. It often forms large schools that migrate seasonally northsouth along the coast and exhibit a strong diel pattern in their aggregations thought to be related to predator avoidance or improved feeding efficiency (Heupel and Simpendorfer, 2005). EFH for all lifecycles of the Blacktip shark exists in the project area.

Atlantic Sharpnose Shark

The Atlantic sharpnose shark (*Rhizoprionodon terraenovae*) is a small coastal carcharhinid, inhabiting the waters of the northeast coast of North America. It is a common year-round resident along the coasts of South Carolina, Florida, and in the Gulf of Mexico and an abundant summer migrant off Virginia. Frequently, these sharks are found in schools of uniform size and sex (Castro, 1983). EFH for all lifecycles of the Atlantic sharpnose shark exists in the project area.

Coastal Migratory Pelagics

The St. Augustine Inlet is considered EFH for Coastal Migratory Pelagics, which include king mackerel (*Scomberomorus cavalla*), Atlantic Spanish mackerel (*Scomberomorus maculatus*), and cobia (*Rachycentron canadum*). The ecological function of tidal inlets (including their ebb and flood tide shoals) is widely recognized for its contributions to spawning, egg and larval dispersal, juvenile recruitment, and as foraging habitat.

Blacknose Shark

The blacknose shark (*Carcharhinus acronotus*) is a common coastal species that inhabits the western north Atlantic from North Carolina to southeast Brazil (Bigelow and Schroeder, 1948). It is very abundant in coastal waters from the Carolinas to Florida and the Gulf of Mexico during summer and fall (Castro, 1983). Schwartz (1984) hypothesized that there are two separate populations in the West Atlantic. EFH for all lifecycles of the blacknose shark exists in the project area.

Bull Shark

The bull shark (*Carcharhinus leucas*) is a large, shallow water shark that is cosmopolitan in warm seas and estuaries (Castro, 1983). It often enters fresh water, and may penetrate hundreds of kilometers upstream; bull sharks are the only shark species that is known to be physiologically capable of spending extended periods in freshwater (Thorson et al., 1973). EFH for all lifecycles of the bull shark exists in the project area.

Dusky Shark

The dusky shark (*Carcharhinus obscurus*) is common in warm and temperate continental waters throughout the world. It is a migratory species which moves north-south with the seasons. This is one of the larger species found from inshore waters to the outer reaches of continental shelves. It used to be important as a commercial species and a game fish, but is currently prohibited. The dusky shark is taken as bycatch in the swordfish and tuna fisheries. The dusky shark is one of the slowest growing requiem sharks and is often caught on both bottom and pelagic longlines, making it highly vulnerable to overfishing. Dusky sharks are currently prohibited and are a candidate for listing under the ESA. Neonate and adult life cycle stages are most likely to be found in the project area.

White Shark

The white shark (*Carcharodon carcharias*) is the largest of the lamnid, or mackerel, sharks. It is a poorly known apex predator found throughout temperate, subtropical, and tropical waters. Its presence is usually sporadic throughout its range, although there are a few localities (e.g., off California, Australia, and South Africa) where it is seasonally common. Large adults prey on seals and sea lions and are sometimes found around their rookeries. The white shark is also a scavenger of large dead whales. It has been described as the most voracious of the fish-like vertebrates and has been known to attack bathers,

divers, and even boats. EFH for juveniles is located in the project area; however, insufficient data exists for neonates and adults to identify EFH for those life stages.

Snapper Grouper

Essential fish habitat for snapper-grouper species includes coral reefs, live/hard bottom, submerged aquatic vegetation, artificial reefs and medium to high profile outcroppings on and around the shelf break zone from shore to at least 600 feet (but to at least 2000 feet for wreckfish) where the annual water temperature range is sufficiently warm to maintain adult populations of members of this largely tropical complex. EFH includes the spawning area in the water column above the adult habitat and the additional pelagic environment, including Sargassum, required for larval survival and growth up to and including settlement.

For specific life stages of estuarine dependent and nearshore snapper-grouper species, essential fish habitat includes areas inshore of the 100-foot contour, such as attached macroalgae; submerged rooted vascular plants (seagrasses); estuarine emergent vegetated wetlands (saltmarshes, brackish marsh); tidal creeks; estuarine scrub/shrub (mangrove fringe); oyster reefs and shell banks; unconsolidated bottom (soft sediments); artificial reefs; and coral reefs and live/hard bottom. EFH for snapper grouper exists in the project area.

Summer Flounder

Summer flounder (*Paralichthys dentatus*) are found in inshore and offshore waters from Nova Scotia, Canada to the east coast of Florida, and are most abundant in the Mid-Atlantic region from Cape Cod, Massachusetts to Cape Fear, North Carolina. Summer flounder usually begin to spawn at age two or three, at lengths of about 10 inches. Spawning occurs in the fall while the fish are moving offshore. Spawning migration is linked to sexual maturity, with the oldest and largest fish migrating first. As in their seasonal migrations, spawning summer flounder in the northern portion of the geographic range spawn and move offshore (depths of 120 to 600 feet) earlier than those in the southern part of the range. Larvae migrate to inshore coastal and estuarine areas from October to May. The larvae, or fry, move to bottom waters upon reaching the coast and spend their first year in bays and other inshore areas. At the end of their first year, some juveniles join the adult offshore migration. Adults spend most of their life on or near the sea bottom burrowing in the sandy substrate. Flounder lie in ambush and wait for their prey. They are quick and efficient predators with well-developed teeth allowing them to capture small fish, squid, sea worms, shrimp, and other crustaceans (ASMFC, 2016).

South Atlantic Shrimp

EFH for Penaeid Shrimp (Brown, Pink, Rock, and White shrimp) exists in the St. Augustine Inlet system and includes inshore estuarine nursery areas, offshore marine habitats used for spawning and growth to maturity, and all interconnecting water bodies as described in the Habitat Plan. Inshore nursery areas include tidal freshwater (palustrine), estuarine, and marine emergent wetlands (e.g., intertidal marshes); tidal palustrine forested areas; mangroves; tidal freshwater, estuarine, and marine submerged aquatic

vegetation (e.g., seagrass); and subtidal and intertidal non-vegetated flats. This applies from North Carolina through the Florida Keys.

South Atlantic Wahoo

The wahoo (*Acanthocybium solandri*) is an oceanic pelagic fish found worldwide in tropical and subtropical waters. In the western Atlantic wahoo are found from New York through Columbia including Bermuda, the Bahamas, the Gulf of Mexico, and the Caribbean. Wahoo are present throughout the Caribbean area, especially along the north coast of western Cuba where it is abundant during the winter (from FAO species guide; FAO, 1978). There is pronounced seasonal variation in abundance of wahoo. They are caught off North and South Carolina primarily during the spring and summer (April-June and July-September), off Florida's east coast year-round, off Puerto Rico and the U.S. Virgin Islands year-round with peak catches between September and March, in the Gulf of Mexico year-round, in the eastern Caribbean between December and June, and in Bermuda between April and September (SAFMC, 1998a). The wahoo spawning season extends from June through August, with peak spawning in June and July.

2.3.4.3 HARDGROUNDS

Hardgrounds provide substrate for benthic organisms, crevices where organisms can seek protection, and foraging habitat for a number of aquatic species. Hardgrounds can be of various types, artificial or natural, such as reefs, with high and/or low relief, and can be of any shape. Foster, Spurgeon, and Cheng (2000) note that "a long and relatively significant headland feature" extends from about R15 to R75. This feature is associated with submerged coquina and/or beachrock outcrops in the nearshore zone, which may contribute to the shell hash observed in the beach sediments in the South Ponte Vedra reach. Shell components in the sediments may possibly derive from active shellfish populations associated with the outcrop habitat.

The study area (R84 to R209) is located south of the headland feature that may have associated hardground features. While the shoreline adjacent to the headland feature has been relatively stable, the zone between the headland feature and St. Augustine Inlet has been progressively erosive from south to north. In 1994, a side-scan sonar survey was conducted over 2.7 square miles of nearshore substrate, to determine the presence and extent of hard bottom areas in the vicinity of the project. There were no distinguishable bottom features that could be classified as exposed hard bottom or outcrops. Based on core borings, it was determined that rock formations did not exist within the placement area. The existing geologic formation was covered with approximately 10-20 feet of sand (USFWS, 1994). No features such as hardbottoms or rock outcrops are located in the project's impact area (USACE, 1996).

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The presence of EFH in the study area is not likely to be altered from the existing conditions if the project were not constructed.

2.3.5 COASTAL BARRIER RESOURCES

In the 1970s and 1980s, Congress recognized that certain Federal actions and programs historically subsidized and encouraged development in coastal areas. To remove any Federal incentives to develop in these areas, Congress passed the Coastal Barrier Resources Act of 1982 (Public Law 97-348; CBRA). CBRA designated relatively undeveloped coastal areas along the Atlantic and Gulf of Mexico coasts of the United States as part of the John H. Chafee Coastal Barrier Resources System (CBRS), and made these areas ineligible for most new Federal expenditures and financial assistance. CBRA encourages the conservation of hurricane prone, biologically-rich coastal resources by restricting Federal expenditures that encourage development, such as Federal flood insurance. The CBRA includes both CBRS units and "Otherwise Protected Areas," which include lands already protected by a conservation easement or that are in public ownership. CBRS units can be developed, provided that private developers or other non-federal parties bear the full cost. The USFWS administers the CBRS program, and makes the final determination of a project's consistency with the CBRA.

EXISTING CONDITIONS

The project area includes two CBRS units and two Otherwise Protected Areas (OPAs) (Figure 2-20):

- Guana River Unit, FL-03P (Otherwise Protected Area)
- Usinas Beach Unit, P04A (CBRS unit)
- Conch Island Unit, P05 (CBRS unit)
- Conch Island Unit, P05P (Otherwise Protected Area)

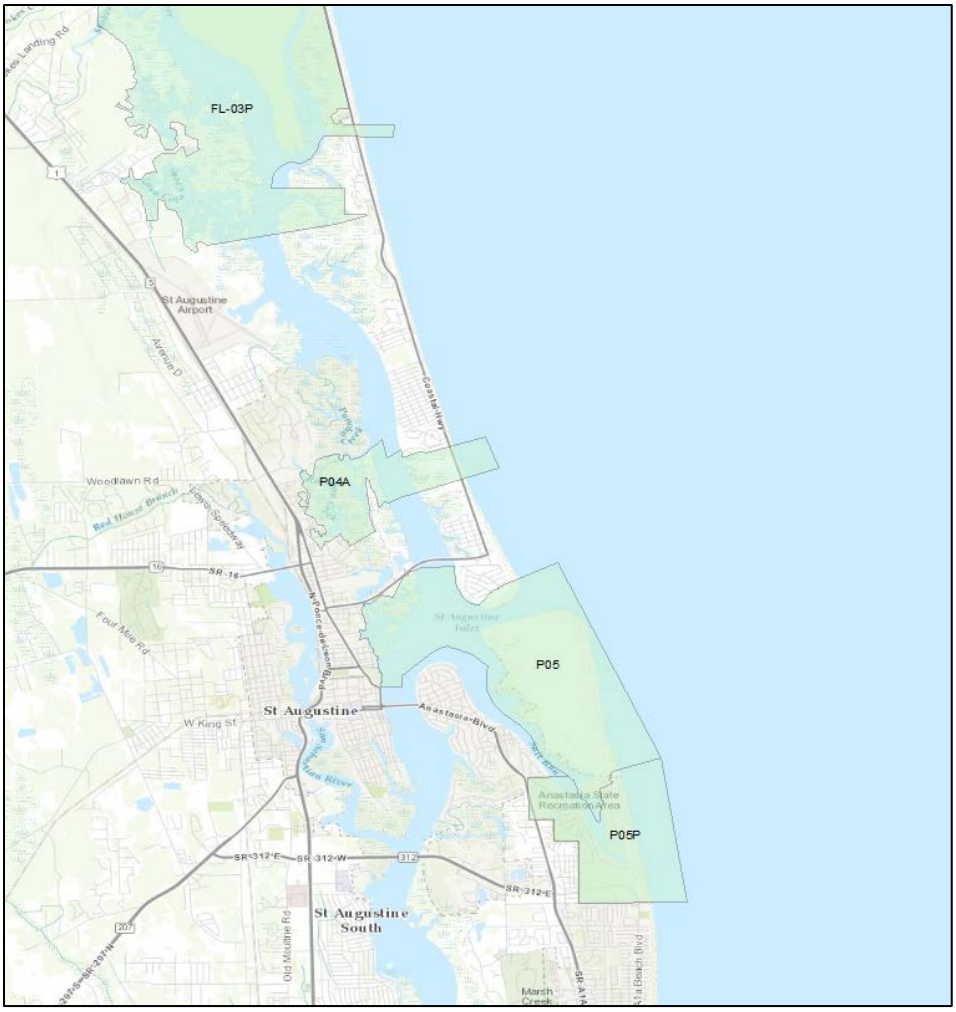


Figure 2-20. Location of Coastal Barrier Resource System (CBRS) units in the study area.

Portions of the Vilano Beach reach of the study area are within CBRS Unit P04A, Usinas Beach, while the southern portion of the Summer Haven reach lies within CBRS Unit P05A, Matanzas River (see Figure 2-20). The presence of CBRS units may limit federally-implementable alternatives, but not alternatives which could be carried out by the state or local sponsor. The effects of CBRA on plan formulation are discussed later in this report.

Portions of the South Ponte Vedra Beach reach lie within OPA FL-03P. The only Federal funding prohibition within OPAs is related to Federal flood insurance. The presence of this OPA will not constrain plan formulation.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

Increased erosion in the future without-project condition could decrease the habitat available to nesting sea turtles and to wintering piping plover and red knot. In less developed areas, a potential overwash could increase habitat for piping plover.

2.3.6 WATER QUALITY

EXISTING CONDITIONS

The project area is a sandy, high energy coastline. The beach is predominantly fine sand-size quartz with little shell fragments. Due to the high energy conditions found along the St. Johns County coastline, sand is continuously re-suspended in the water column with each breaking wave. This re-suspension of sediment results in generally highly turbid conditions in the nearshore region of the project area. The coastal waters in the area of the authorized work are designated by the State of Florida as Class III, which are classified as being suitable for recreation and for the propagation of fish and wildlife. Immediately adjacent to the South Ponte Vedra reach is the GTMNERR.

FDEP regulates water quality in Florida and requires stringent water quality monitoring during dredging and beach-fill operations. FDEP designates certain waters as Outstanding Florida Waters (OFW), which are waters designated worthy of special protection because of their natural attributes. The designation is intended to protect existing good water quality (see the FDEP website at http://www.dep.state.fl.us/WATER/wqssp/ofw.htm). The nearshore waters adjacent to the South Ponte Vedra Beach reach, the IWW, and the Guana River are classified as OFWs. In addition, the area south of the St. Augustine Inlet, the Anastasia State Recreation Area, is also classified as an OFW (see Figure 2-21).

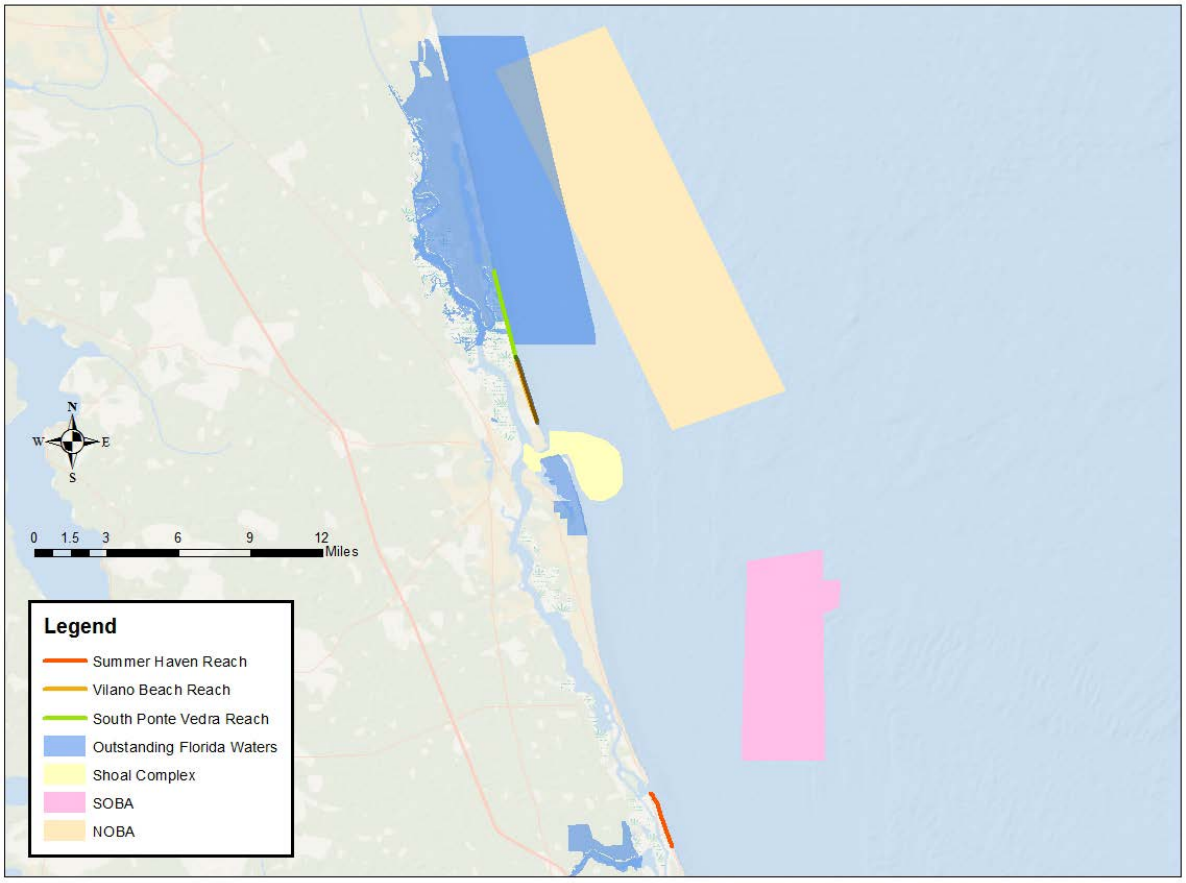


Figure 2-21. Location of OFWs in the Study Area.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The water quality in the study area is not likely to change from the existing conditions in the future without-project conditions.

2.3.7 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

EXISTING CONDITIONS

The coastline in the project area is located adjacent to predominantly residential and recreational areas. There are no known industrial activities in the immediate area. There are no known sources of hazardous or toxic wastes in the project area, and USACE is not aware of any records indicating these activities occurred in the project area in the past.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The presence/absence of hazardous or toxic wastes in the study area is not likely to change from the existing conditions in the future without-project conditions.

2.3.8 AIR QUALITY

EXISTING CONDITIONS

The urbanization of the City of St. Augustine and the popularity of the beaches contribute to a large number of motorized vehicles in the vicinity of the project area. However, air quality is generally good in the project area with respect to ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, and particulate matter (HomeFacts, 2016). Because of the sea breezes that are usually present along the St. Johns County shore, airborne pollutants are readily dispersed by the ocean-generated winds.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The air quality in the study area is not likely to change from the existing conditions in the future without-project conditions.

2.3.9 NOISE

EXISTING CONDITIONS

The project area is a favorite recreational spot for local residents of, as well as for the numerous tourists who visit the region. Additionally, St. Johns County beaches are a favorite spot for many residents of northeastern Florida. Because of the urbanization in the vicinity of the beaches and the popularity of the beaches, noise levels are usually slightly elevated during the tourist season and on most weekends.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

While the area may experience a decrease in tourist activity, noise levels in the study area are not likely to change significantly from the existing conditions in the future without-project conditions.

2.3.10 AESTHETIC RESOURCES

EXISTING CONDITIONS

Aesthetics found along most of the project area are typical of low-density, residential beach communities. The beach ecosystem includes a narrow beach berm and minimal intertidal area due to the extreme erosion experienced there since the early 1970s. Small portions of aesthetically valuable natural conditions remain, but even these areas experience overwash and erosion that has eliminated dune and saltmarsh vegetation. Most of the project area also includes some backdune naturalized areas with dune grasses, morning glory, and other native flowering groundcovers. There are a few commercial areas, but these generally lack dune features and native vegetation is absent. Previous efforts to restore dune habitats along St. Johns County beaches have been somewhat successful, and past maintenance efforts have greatly improved the aesthetics of the St. Johns County beaches.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The aesthetics of the study area is anticipated to decline in the future without-project condition due to increased erosion and the continued narrowing of the beach.

2.3.11 RECREATION RESOURCES

EXISTING CONDITIONS

The project area is a local favorite for county residents to spend much of their leisure time sunbathing, surfing, sailing, walking, and riding bicycles, in addition to a variety of other active and passive activities. The spring, summer, and fall months of the year are the most active times for recreational activities, with the summer months comprising the peak use period. During the winter months, the St. Johns County beaches have low recreational usage due to relatively low air and water temperatures (45-65°F and 56-61°F, respectively; NOAA 2015) and the frequency of northeast winds that produce strong waves and high tides.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The recreational usage of the study area are anticipated to decline in the future without-project condition due to increased erosion and the continued narrowing of the beach, which will make it less suitable for recreating.

2.3.12 NAVIGATION

EXISTING CONDITIONS

The St. Augustine Inlet is an improved tidal inlet connecting the San Sebastian River and the IWW Federal navigation channel to the Atlantic Ocean. Originally a natural inlet located south of its current location, the inlet was relocated in 1940 as part of the St. Augustine Harbor Navigation Project in response to public interests. Efforts to stabilize the inlet and improve navigation between 1941 and 1957 resulted in the construction of a north sand trap groin approximately 1,880 feet in length and a 3,695 foot south jetty. The authorized 16-foot inlet entrance channel is maintained at the best natural alignment, while the geographically fixed IWW channel is maintained at 12 feet deep.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The St. Augustine Inlet is currently maintained with the IWW Federal navigation channels, and will be maintained regardless of whether this project moves forward. Navigation conditions should not change for the St. Augustine Inlet from the existing conditions in the future without-project conditions.

In the Summer Haven reach, continued erosion in the future without-project condition could result in overwash or a possible breach of the island. Increased sediment due to overwash in the IWW would need to be addressed during a maintenance dredging event of that channel.

2.3.13 CULTURAL RESOURCES AND HISTORIC PROPERTIES

EXISTING CONDITIONS

The coastal areas of St Johns County have been a focal point of European maritime activity for over 450 years, and a source of prehistoric populations' lifeways for over 3,000 years. Subsequently, archaeological sites including shipwrecks, coastal infrastructure, prehistoric middens, and others types of sites constitute the cultural landscape of the coastal area.

The earliest recorded maritime activity in the vicinity dates to 1513 when Juan Ponce de León documented landfall at a latitude that coincides with modern day South Ponte Vedra Beach, where he named the landmass La Florida, claiming it as Spanish Territory. Following intensive Spanish explorations of the southeast, Spain initiated a formal settlement attempt here in 1565 under the leadership of Pedro Menéndez de Avilés. Menéndez' orders were to establish a garrison/colony with soldiers and colonists in La Florida preventing any further French advancement into Spanish lands. Colonizing efforts by Jean Ribault in Port Royal and the creation of Fort Caroline on the St. Johns River in 1564 by René de Laudonnière had forced King Philip II to initiate protective measures. Menendez, having failed to reach Fort Caroline before French reinforcements arrived, passed through the St. Augustine Inlet in September 1565, establishing a defensive position from which he successfully drove the French out. Located on a harbor with a sand bar across the entrance, the St Augustine settlement became the location of the longest, continuous European presence in the continental United States. The port town was almost entirely dependent upon maritime transportation until the railroad reached St Augustine after 1880.

Key in the development and defense of the city and garrison was its limited access at the St. Augustine Inlet. The inlet historically consisted of a series of shifting sand bars that permitted only shallower draft vessels to cross. Documented ship losses around the inlet are testament to the treacherous nature of these shoals; however, the sandbars also provided defense for the town by preventing large, foreign ships-of-war from entering the harbor. Today, the historic inlet channel has closed in due to the southward migration of the northern peninsula and only portions of it remain in the form of the Salt Run lagoon adjacent to Anastasia Island. The current inlet was created by USACE in 1940, when a land cut was made across the southern tip of Vilano Point. Historic maps suggest, however, that the current inlet location is in close proximity to the location of the inlet during the time Menendez first colonized Florida.

Considering the extensive, maritime-related history of the St Augustine region, much attention has been given to the archaeological and historical resources of the coastal areas. Archival research and cultural resource surveys have been conducted along the St. Johns County shoreline, portions of the IWW and along almost the entire shoal complex of the St. Augustine inlet. The majority of the surveys were conducted for USACE-related projects, while several were conducted by the St Augustine Lighthouse Archaeological Maritime Program (LAMP) for shipwreck research.

USACE surveyed all three reaches (South Ponte Vedra, Vilano, and Summer Haven) for the presence of cultural resources in 2010. Two archaeological sites (8SJ5442 and 8SJ7988) have been previously documented within the South Ponte Vedra and Vilano Beach reaches; however, both of these sites were assessed as isolated finds that were washed onto the beach after storm events. The Chainplate site (8SJ5442) was documented in 2007 and was composed of isolated shipwreck components originating from a wooden sailing ship. LAMP archaeologists documented and removed the items for conservation at that time. The Vilano Beach Rudder site (8SJ4988) was a 12-foot long, wooden rudder recovered in 2005 by the St. Johns County archaeologist and documented as probably belonging to a late nineteenth-century, wooden sailing vessel. The rudder was the only component identified on the beach at this location. Considering the high energy environment, materials buried within the beach are often exposed by storms only to be reburied, or are washed up onto the beach from further offshore. Further monitoring after storm events was recommended for both site locations. However, no materials were identified in either area during the USACE 2010 shoreline survey and none have been reported to LAMP or to the St. Johns County Archaeologist since the artifacts were recovered in 2005 and 2007 suggesting that the sources of these isolated artifacts lie submerged offshore. The only known offshore wreck north of the inlet is Compton's Wreck (8SJ3525), which is documented as a more modern wooden sailing vessel. Currently, there is insufficient information on the significance of this site, but the resource is located sufficiently offshore to be exempt from impacts during nearshore or beach placement.

In addition to the 2010 USACE survey, several archaeological assessments have been conducted along the Summer Haven reach, between range monuments R197 – R209. Several archaeological surveys have been conducted along this stretch of SR A1A as a result of bridge replacement and highway construction activities by the Florida Department of Transportation (FDOT). Three archaeological sites (8JS0046, 8SJ2527, and 8SJ4887) have been identified west of the proposed beach renourishment area and west of State Road A1A. All three sites were recorded as thick, multi-component shell middens with dominant Orange Period (4,000 – 2,500 BP) components. The Summer Haven site (8SJ0046), located at the northern end of the peninsula, was first recorded in the 1950s and contained human burials within the site, although no additional burials have been identified at the site since this time. Unfortunately, the majority of all three sites has been destroyed from canal excavations, residential development, and road construction and no portion of these sites were documented as being within the proposed renourishment area. The 2010 USACE survey did not identify any archaeological resources within the project area; however, monitoring of any staging and access routes closer to SR A1A for beach renourishment activities will be required by USACE in consultation with the Florida State Historic Preservation Officer (SHPO) and appropriate federally-recognized tribes in the event such activities are planned.

Just west of the project reaches is the SR A1A National Scenic and Historic Coastal Byway. Along the road on both the east and west sides spanning the entire project area are numerous historic structures, none of which are currently listed on the National Register of Historic Places (NRHP). While outside the project area, their presence should be noted as continued erosional forces may have long-term effects on such

resources; therefore, they are considered as part of the existing conditions. Of particular note is the group of historic residential structures comprising the community of Summer Haven. Dating from the 1890s through the 1930s, these structures may be potentially eligible for listing in the NRHP as a historic district, although such designation does not currently exist. Any proposed beach nourishment activities would serve to protect all historic resources near the project area along SR A1A from erosion.

The proposed sand sources for potential nourishment activities involve the use of the ebb, flood, and Vilano Point shoals around the St. Augustine Inlet. These areas have been surveyed intensively for cultural resources by USACE (DHR survey numbers: 1805, 5214, 5210, 6565, 17239, 17883, and 17947) for prior St Augustine Beach renourishment and maintenance dredging projects. Two shipwreck sites have been documented and several, potentially significant remote sensing targets have been identified within these areas. USACE, during consultation with the Florida SHPO, has agreed to maintain all buffers established for these resources (DHR file numbers 2009-06256, 2010-0839, and 2015-1661). Site 8SJ4889, the *Dixie Crystal*, is a historic shipwreck identified within the flood shoal and may be potentially eligible for inclusion in the NRHP. USACE has agreed with the Florida SHPO to maintain a150-foot buffer during dredging projects working near it to protect the resource. In addition, four targets were identified within the St. Augustine Inlet (targets SA-T-5, SA-OS-2, SA-OS-3, and SA-OS-4) that have a high potential for being significant resources, and each has a requirement for a 200-foot buffer around them for all dredging and maintenance activities (DHR File No 2010- 04838-A and 04838-B). Within the northern ebb shoal area lies site 8SJ4784 the North Shoals Vessel, a historic shrimp boat which sank trying to navigate the St. Augustine entrance channel. There is currently insufficient information to determine its eligibility for inclusion in the NRHP; however, USACE will protect the site through the use of buffers that will be determined through consultation with the SHPO. Currently, USACE is completing a cultural resource survey of previously un-surveyed portions of the shoal complex. Consultation for this survey is ongoing with the Florida SHPO and appropriate federally-recognized tribes. The consultation will be updated prior to project implementation. When finalized, 100% of the shoal complex will have been subject to cultural resource surveys.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

Continued erosion will eventually threaten cultural resources. As the shoreline recedes, resources will either be destroyed or hard structures will need to be constructed for their protection. As noted above, increased hardening is detrimental to the environment as a whole. Thus, continued shoreline erosion will create a cumulative negative effect on the environment.

2.3.14 NATIVE AMERICANS

EXISTING CONDITIONS

There is no known tribal or reservation land within the project area. However, Native American groups lived throughout this region in the past, and their decedents continue to live within the State of Florida

and throughout the United States. Prior consultation under Section 106 of the National Historic Preservation Act on various aspects of the project has not indicated any historic use, although it certainly remains possible. Consultation will be updated with both tribes in regards to project impacts.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

Selection of the No Action Alternative would have no adverse effect on Native American groups. As discussed above, portions of the project have been consulted upon with both federally-recognized tribes living in the region.

2.4 ECONOMIC ENVIRONMENT

EXISTING CONDITIONS

Information on the existing economic conditions along the St. Johns County study area coastline was collected for economic modeling purposes using Beach-fx. The information on the coastal assets detailed in this section was collected from mapping resources, site visits, and contractors.

2.4.1 DAMAGE ELEMENTS - STRUCTURE & CONTENTS VALUE

The following discussion includes structure and contents value for the South Ponte Vedra Beach and Vilano Beach reaches. As will be discussed later in this report, the Summer Haven reach was screened out of formulation due to a variety of reasons. As a result, only the two northern reaches were included in intermediate and final alternative analysis employing Beach-fx, and only those structure and content variables relevant to Beach-fx analysis are included here. Beach-fx is an event-driven life-cycle model that estimates damages and associated costs over a period of analysis based on storm probabilities, tidal cycle, tidal phase, beach morphology, and many other factors (Rogers et al., 2009). Damages to developed shorelines include damages to buildings, pools, patios, parking lots, roads, utilities, seawalls, revetments, bulkheads, etc., all classified as “damage elements.” Erosion of land resulting in the need to place backfill is also considered a damage. Economists, real estate specialists, and engineers have collected and compiled detailed information on damage elements within the study area including:

- 397 single-family residences
- 37 multi-family residences
- Commercial structures
- 251 dune walks
- SR A1A
- Several parking lots, gazebos, garages, pools, tennis courts, and bath houses

In total, attribute information for 817 separate damage elements was populated for economic modeling using Beach-fx. The proximity of these damage elements to the beach makes them potentially vulnerable to erosion, wave attack, and inundation.

Beach-fx handles economic considerations at the damage element level. These considerations include extent of damage, cost to rebuild, and time to rebuild. The construction and foundation type of each damage element was gathered from the St. Johns County property appraiser information and visual observations by USACE, Jacksonville District staff. First floor elevations of all the damage elements in the study area were surveyed. Real Estate professionals from Jacksonville District provided updated depreciated replacement costs for all of the damage elements in March 2015. An uncertainty of +/- 15% was assigned to these costs. The value of contents was assumed to be 50% of the structure value for all habitable structures per ER 1105-2-100. Non-habitable structures (dune walks, bathhouses, pools, etc.) had zero contents value.

2.4.2 STRUCTURE INVENTORY

The economic value of the existing structure inventory represents the depreciated replacement costs of damageable structures, and their associated contents, within the study area along the coastline. The damage element inventory includes 817 damageable structures with an overall estimated value of $268,000,000, with structure and content valuations of $188,000,000 and $80,000,000 respectively. Table 2-11 provides the distribution of structure and content values broken down by Beach-fx reach. Beach-fx reaches are 1,000-foot increment model reaches useful for developing study reaches into more manageable segments for analysis in Beach-fx. Their numbers approximate R-monument numbers. For instance, Beach-fx reach 100 spans the shoreline for 1,000 feet between R monuments 95.5 and 100.5. Beach-fx reaches are described with additional detail in the Economics Appendix.

Table 2-11. Distribution of Structures and Structure Value by Reach.

Distribution of Structures & Structure Value by Reach					
Beach-Fx Reach	**DE Count**	**Structure Value**	**Content Value**	**Total Value**	**% of Total Value**
84	8	$ 1,108,437	$ 376,268	$ 1,484,705	**1%**
85	20	$ 3,175,145	$ 1,275,190	$ 4,450,335	**2%**
86	20	$ 3,627,217	$ 1,469,831	$ 5,097,048	**2%**
90	27	$ 3,928,659	$ 1,603,997	$ 5,532,656	**2%**
91	22	$ 3,149,707	$ 1,233,206	$ 4,382,913	**2%**
92	15	$ 2,085,649	$ 816,325	$ 2,901,974	**1%**
93	28	$ 4,067,044	$ 1,681,022	$ 5,748,066	**2%**
87	32	$ 6,612,213	$ 2,861,777	$ 9,473,990	**4%**
88	22	$ 3,851,535	$ 1,641,533	$ 5,493,068	**2%**
89	28	$ 6,237,679	$ 2,715,902	$ 8,953,581	**3%**
94	8	$ 844,758	$ 140,214	$ 984,972	**0%**
95	19	$ 2,015,648	$ 584,794	$ 2,600,442	**1%**
96	26	$ 4,281,210	$ 1,761,098	$ 6,042,308	**2%**
97	20	$ 3,430,500	$ 1,383,555	$ 4,814,055	**2%**
98	61	$ 16,869,267	$ 7,846,416	$ 24,715,683	**9%**
100	46	$ 11,714,035	$ 5,313,803	$ 17,027,838	**6%**
101	25	$ 4,181,708	$ 1,711,544	$ 5,893,252	**2%**
102	8	$ 10,049,865	$ 4,680,000	$ 14,729,865	**5%**
103	12	$ 13,796,355	$ 6,419,700	$ 20,216,055	**8%**
104	22	$ 5,035,899	$ 2,181,137	$ 7,217,036	**3%**
105	15	$ 3,488,390	$ 1,350,185	$ 4,838,575	**2%**
106	20	$ 3,880,670	$ 1,665,604	$ 5,546,274	**2%**
107	30	$ 4,970,238	$ 2,068,742	$ 7,038,980	**3%**
108	11	$ 2,723,804	$ 1,074,022	$ 3,797,826	**1%**
109	15	$ 3,003,386	$ 862,898	$ 3,866,284	**1%**
110	18	$ 2,510,368	$ 888,944	$ 3,399,312	**1%**
111	31	$ 5,272,445	$ 2,241,253	$ 7,513,698	**3%**
112	22	$ 5,522,167	$ 2,198,746	$ 7,720,913	**3%**
114	16	$ 5,263,067	$ 2,141,249	$ 7,404,316	**3%**
115	11	$ 3,216,410	$ 1,287,180	$ 4,503,590	**2%**
116	12	$ 2,077,290	$ 655,080	$ 2,732,370	**1%**
117	10	$ 1,285,292	$ 360,946	$ 1,646,238	**1%**
118	36	$ 5,326,818	$ 2,186,154	$ 7,512,972	**3%**
119	33	$ 4,767,243	$ 2,059,374	$ 6,826,617	**3%**
120	36	$ 16,351,882	$ 7,684,346	$ 24,036,228	**9%**
121	19	$ 5,315,967	$ 2,575,266	$ 7,891,233	**3%**
122	13	$ 2,588,949	$ 1,279,362	$ 3,868,311	**1%**
Total	**817**	**$ 187,626,916**	**$ 80,276,658**	**$ 267,903,574**	**100%**

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

2.4.3 BEACH-FX MODEL SET-UP

The Economic Appendix provides a complete description of the Beach-fx model set-up and use. Data on historic storms, beach survey profiles, and private, commercial, and public structures within the project area are used as input to the Beach-fx model. The model is then used to estimate future damages resulting from hurricanes and coastal storms.

The future without-project damages are used as the base condition against which potential alternatives will be compared. The difference between with and without-project damages are used to determine project benefits.

2.4.4 BEACH-FX MODEL ASSUMPTIONS

- **Start Year:** The year in which the simulation begins is 2015
- **Base Year:** The year in which a Federal project would be constructed, and benefits would begin accruing, is 2020
- **Period of Analysis:** 50 years (2020 to 2070)
- **Discount Rate:** 3.125% FY2016 Federal Water Resources Discount Rate (though plan screening was completed at 3.125%, the annual costs and benefits of the Recommended Plan were recomputed at the FY17 discount rate of 2.875% in accordance with the expected Chief's Report signing date; refer to the Executive Summary).
- **Damage Functions:** Damage functions developed by the Institute for Water Resources (IWR), Coastal Storm Damage Workshop (CSDW), and Coastal Storm Damage Relationships Based on Expert Opinion Elicitation in 2002, were used.
- **Coastal Armor:**
  - Existing armor set at the lot level will protect the damage elements in that lot until failure is triggered. If the armor fails, structures will be subject to damages until the armor is rebuilt.
  - For lots without armor, state permit requirements for armor construction determine if a lot is able to be protected by armor, or not, once erosion reaches the seaward edge of the lot.
- **Number of Times Rebuilding Allowed:** The maximum number of structure rebuilds can be specified for damage elements. Based on the assumed likeliness that certain types of damage elements will eventually stop being rebuilt by property owners, the following are number of times that rebuilding is allowed for certain types of damage elements:
  - Dune Walks: 10x
  - All Other Damage Elements: 99x
- **Future value of structures:** The future structure inventory and values are the same as the existing condition. This conservative approach neglects any increase in value due to future development. Due to the uncertainty involved in projections of future development, using the existing inventory

is considered conservative for Florida where coastal development has historically increased in density and value.

2.4.5 BEACH-FX FUTURE WITHOUT-PROJECT DAMAGE RESULTS

Future without-project (FWOP) damages across the study area range between $46.8 and $149.8 M present value dollars.

- Structure Damage: Economic losses resulting from the structures situated along the coastline being exposed to wave attack, inundation, and erosion damages. Structure damages account for approximately 53.7% of the total FWOP damages.
- Contents Damage: The material items housed within the aforementioned structures (usually air conditioned and enclosed) that are potentially subject to damage. Content damages make up approximately 21.5% of the total FWOP damages.
- Coastal Armor Cost: Beach-fx provides the capability to estimate the costs incurred from measures likely to be taken to protect coastal assets and/or prevent erosion in the study area. Based on the existence of coastal armor units throughout the study area, Beach-fx was used to estimate the costs of erecting such measures throughout the period of analysis. Armor costs account for approximately 24.8% of the total FWOP damages.

Table 2-13 provides greater detail on the composition of the average FWOP damages by category and damage element type based on the *Iteration.csv* and *ReachYearlyDamagesByType.csv* model output files.

Table 2-12. Distribution of FWOP Damages by Category and Type.

DE Type	Average PV Structure Damage	Average PV Content Damage	Average PV Armor Costs	Total Average PV Damages & Costs	% of Total
COMM	$ 1,861,712	$ 930,865	$ -	**$ 2,792,576**	3%
GAZEBO	$ 608,711	$ -	$ -	**$ 608,711**	1%
MFR1	$ 2,250	$ 1,125	$ -	**$ 3,375**	0%
MFR2	$ 808,674	$ 404,337	$ -	**$ 1,213,010**	1%
MFR3	$ 135,699	$ 68,225	$ -	**$ 203,924**	0%
PARKINGLOT	$ 442,541	$ -	$ -	**$ 442,541**	0%
POOL	$ 88,565	$ -	$ -	**$ 88,565**	0%
ROAD2	$ 4,835,406	$ -	$ -	**$ 4,835,406**	5%
ROAD3	$ 1,687,213	$ -	$ -	**$ 1,687,213**	2%
SFR1	$ 13,295,051	$ 6,623,894	$ -	**$ 19,918,946**	21%
SFR2	$ 20,055,501	$ 10,009,045	$ -	**$ 30,064,546**	31%
SFR3	$ 5,793,992	$ 2,892,867	$ -	**$ 8,686,859**	9%
TENNIS	$ 734	$ -	$ -	**$ 734**	0%
WALK	$ 2,522,672	$ -	$ -	**$ 2,522,672**	3%
ARMOR COST	$ -	$ -	$ 24,063,881	**$ 24,063,881**	25%
Total	**$ 52,138,722**	**$ 20,930,358**	**$ 24,063,881**	**$ 97,132,960**	100%
% of Total	53.7%	21.5%	24.8%	100%	

2.4.5.1 SPATIAL DISTRIBUTION OF WITHOUT-PROJECT DAMAGES

There are several reaches, within the area modeled, where FWOP damages and armor costs are the greatest. The segment that includes model reaches 96 – 100 accounts for about 22% of the overall FWOP damages, and the segment that includes model reaches 111 – 116 accounts for about 30% of the overall FWOP damages. **Figure 2-22** illustrates the spatial distribution of erosion rate, existing structure value, and FWOP damages and costs by reach.

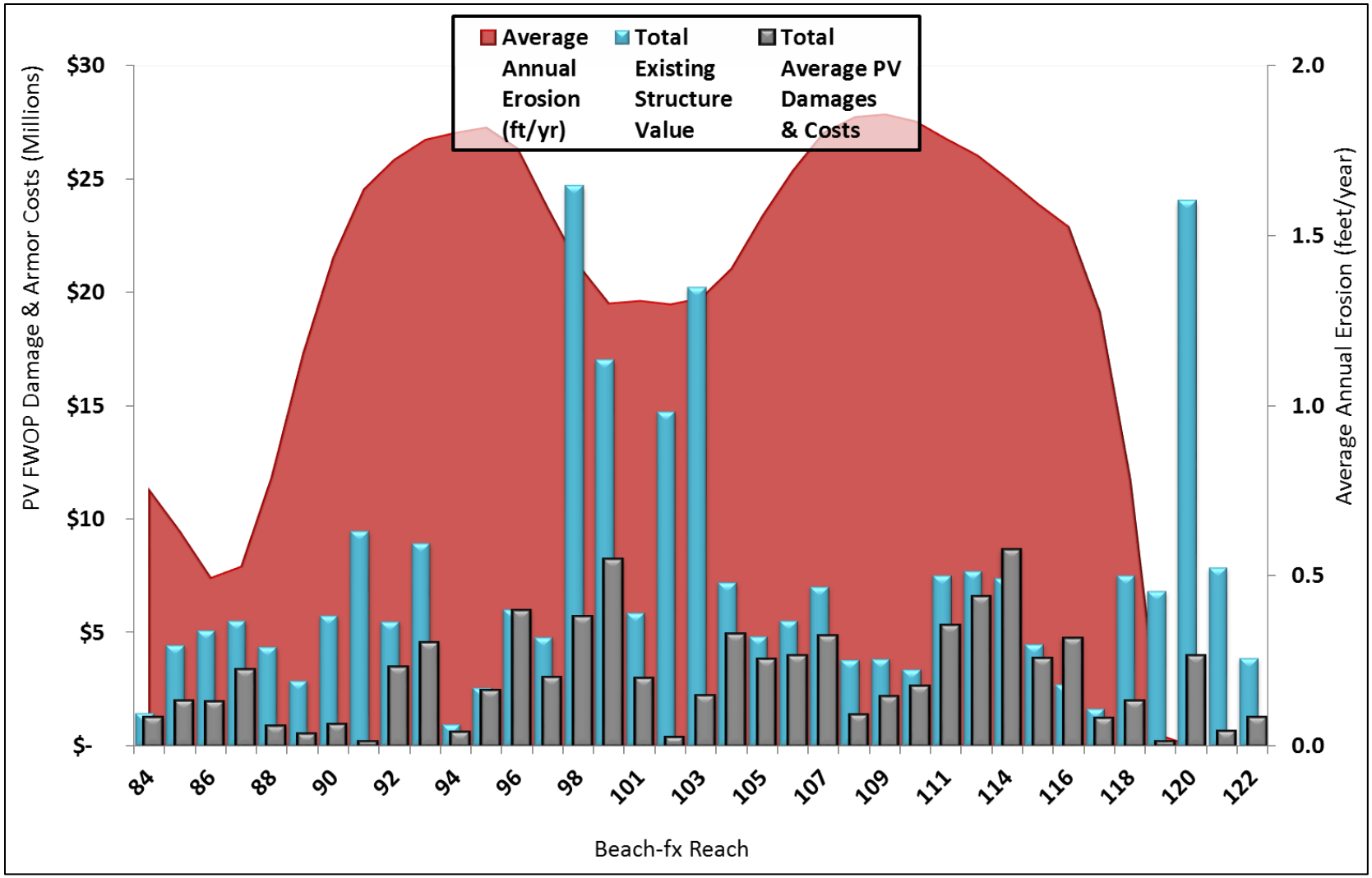


Figure 2-22. Spatial Distribution of Damages and Erosion Rates by Reach.

2.4.5.2 DAMAGE DISTRIBUTION BY DAMAGE DRIVING PARAMETER

Most of the FWOP damages and costs are attributable to erosion. The distribution of damages by driving parameter is as follows:

- Erosion: 99.56%
- Inundation: 0.13%
- Wave Attack: 0.32%

2.4.5.3 TEMPORAL DISTRIBUTION OF DAMAGES

Figure 2-23 illustrates the non-present value damages over time by Beach-fx reach. The timing of FWOP damages and armor costs varies across the model reaches. There is a great deal of variability in the amount of damages among the Beach-fx reaches. This is explained by the large number of variables, all of which the Beach-fx model takes into account. Variation between the reaches may result from the following:

- Density and amount of development
- Typical size and value of structures
- Typical distance between structures and mean-high water
- Size, shape, and location of the dunes, and coastal morphology
- Rate of erosion for each reach
- Amount and type of coastal armoring present
- Timing that property owners construct coastal armoring in the future

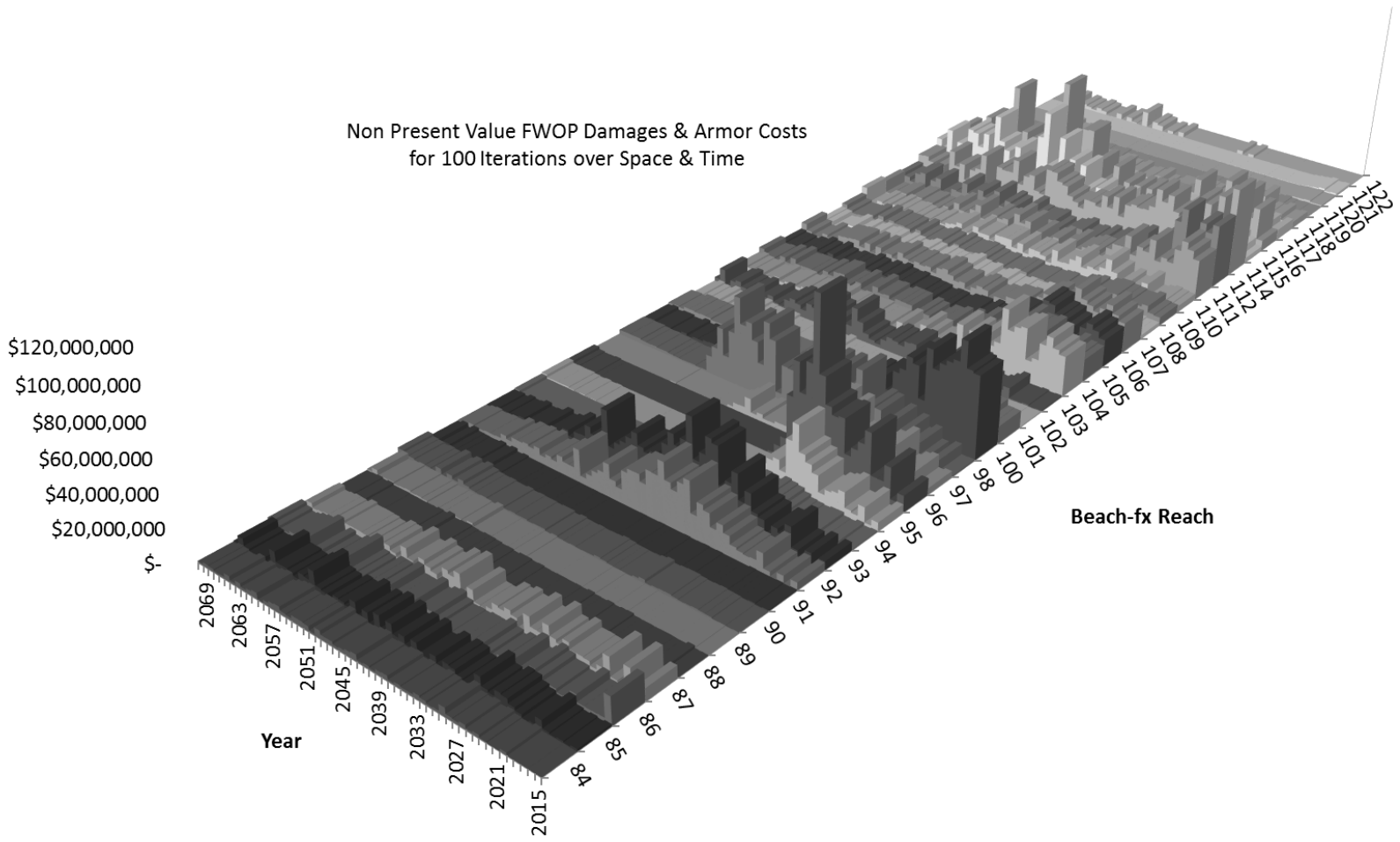


Figure 2-23. Non-Present Value FWOP Damages and Armor Costs over Space and Time.

2.4.5.4 FWOP DAMAGES IN ALTERNATIVE SEA LEVEL RISE (SLR) SCENARIOS

The FWOP condition was modeled for three Sea Level Rise (SLR) scenarios. ER 1110-2-8162 provides both a methodology, and a procedure, for determining a range of SLR estimates based on the local historic SLR rate, the construction (base) year of the project, and the design life of the project. The Beach-fx results presented above refer to the baseline scenario, which is based on the historic erosion rate. The results associated with the other two SLR scenarios are presented here.

Figure 2-24 provides an overall summary of FWOP average annual damage and armor costs in each SLR scenario. Combined structure and content damages increase by 22% from the base to intermediate scenarios, and 51% from the base to high scenarios. Armor costs increase by 57% from the base to intermediate scenarios, and 149% from the base to high scenarios. The total damage and armor costs increase by 31% from the base to intermediate scenarios, and 76% from the base to high scenarios. Erosion is the primary damage driver, accounting for about 99% of the FWOP damage and armor costs in the intermediate and high SLR scenarios. Additional detail on results from the SLR analysis is provided in the Economics Appendix.

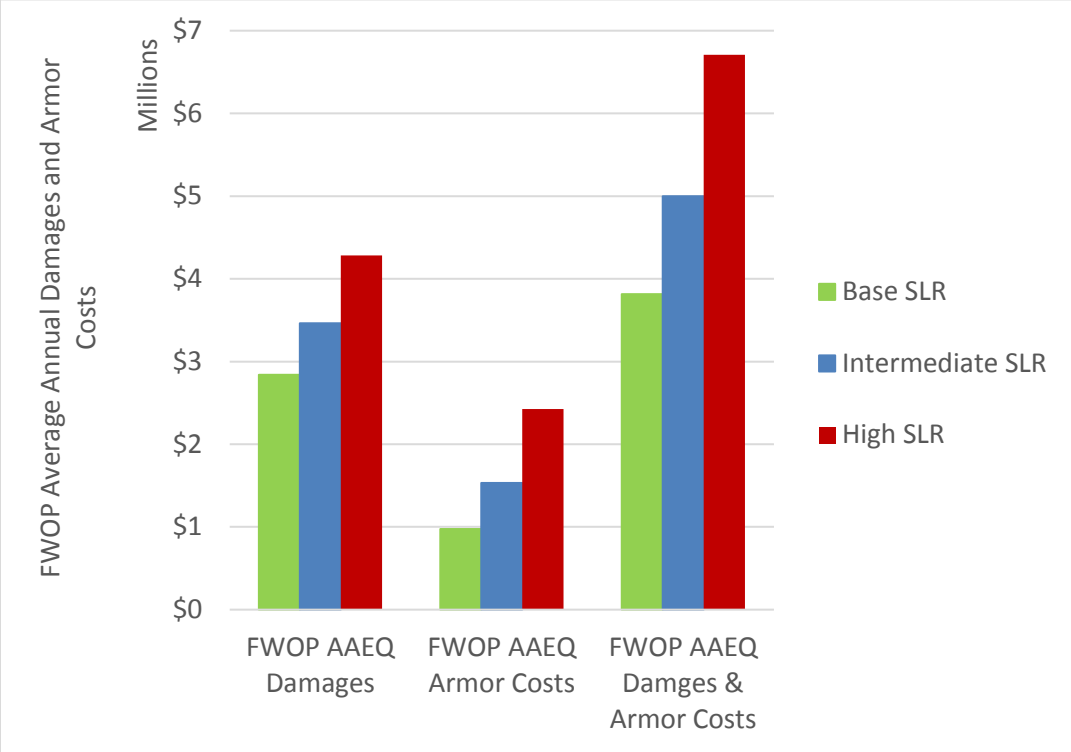


Figure 2-24. FWOP Average Annual Damage and Armor Costs for SLR.

2.4.5.5 FUTURE WITHOUT PROJECT CONDITION CONCLUSION

The following points summarize the FWOP conditions:

- Most of the FWOP damages are associated with single-family residences located along the shoreline.
- The majority of the damage and armoring is caused by erosion.
- Damages in the FWOP condition increase in the accelerated SLR scenarios.

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CHAPTER 3

PLAN FORMULATION

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3 PLAN FORMULATION

3.1 PLAN FORMULATION RATIONALE

Plan formulation is the process of developing alternative plans which meet the project-specific objectives while avoiding constraints.

The first step of plan formulation involves identifying all potential management measures for the given problems. A management measure is a structural or non-structural action that can be implemented at a specific geographic site to address one or more planning objectives.

An alternative plan is a set of one or more management measures functioning to address one or more objectives. Sometimes a plan consists of only one measure, but more often it's a combination of measures. Different alternative plans consist of different measures, or they combine the same measures in different ways, such as different dimensions, quantities, materials, locations, or implementation time frames. As the study evolves, favorable plans are reformulated to devise the most efficient, effective, complete, and acceptable plan.

Four accounts are established in the *Principles and Guidelines* (P&G 1983) to facilitate the evaluation of management measures and display the effects of alternative plans. The National Economic Development (NED) account displays the plan with the greatest net economic benefit consistent with protecting the nation's environment; the Environmental Quality (EQ) account displays non-monetary effects on ecological, cultural, and aesthetic resources including the positive and adverse effects of alternative plans; the Regional Economic Development (RED) account displays changes in the distribution of regional economic activity (e.g., income and employment); and the Other Social Effects (OSE) account displays plan effects on social aspects such as community impacts, health and safety, displacement, energy conservation, and others. The Federal *Principles and Guidelines* require that for Coastal Storm Risk Management (CSRM) projects, the NED plan is to be the selected plan unless an exception is granted. The NED plan must also be evaluated in consideration of the Principles and Guidelines criteria of completeness, effectiveness, efficiency, and acceptability. Each alternative plan is formulated in consideration of these four criteria.

3.2 SCOPING*

An initial scoping period for the project was conducted from August 17, 2005 through September 17, 2005. As the study progressed, USACE anticipated that an Environmental Impact Statement (EIS) might be required. A second scoping period was held from September 16, 2008 to October 16, 2008. A notice of intent to draft an EIS was published in the Federal Register on April 5, 2010. Subsequently, it became evident that no significant impacts to the human or natural environments were anticipated. USACE decided to initially prepare an Environmental Assessment (EA), rather than continue with the previous plans to draft an EIS. The draft EA and draft Finding of No Significant Impact (FONSI) were made available to the public for a 45-day public comment period from February 17, 2016 to April 4, 2016.

3.2.1 FEDERAL

3.2.2 AGENCY AND PUBLIC FEEDBACK

The most common concerns voiced in response to the scoping letters and comment periods included:

- Loss of land and property due to erosion
- Lack of protection from hurricanes
- Loss of recreational beach
- Concern over impacts to sea turtles and shore birds from renourishment
- Concern over impacts to benthic organisms from mining and fill
- Concern over protecting surfing spots and the revenue they generate
- Concern over wasting Federal tax dollars
- Too much time since the first studies without positive results
- Concern that revetments and seawalls harm sea turtle nesting

3.3 PROBLEMS AND OPPORTUNITIES*

A problem is an existing undesirable condition to be changed. An opportunity is a chance to create a future condition that is desirable. The difference between problems and opportunities is often indistinct, but in both cases a changed future condition is preferred. The purpose of this feasibility study is to develop an implementable and acceptable plan to improve the future condition and address specific problems and opportunities in the study area. Problems and opportunities to be addressed were identified in several ways. The study team reviewed previous studies by USACE

and other agencies and groups, as well as scoping letter comments received from local residents and stakeholders to identify current coastal risk related problems affecting the study area.

3.3.1 PROBLEMS

Problems within the study area include:

- Storm damages due to erosion, inundation, and waves threatening infrastructure
- Loss of natural habitat
- Shoreline erosion threatening recreational opportunities
- Shoreline erosion threatening hurricane evacuation route SR A1A
- Beach/dune interaction limited or eliminated

Erosion, both long term and storm induced, is the greatest problem in the study area. Loss of protective beach and dunes due to shoreline erosion threatens infrastructure, including SR A1A which is a major hurricane evacuation route for most of the study area and a National Scenic and Historic Coastal Byway. Erosion also threatens natural habitat and recreational opportunities. The study area has experienced long-term erosion. Some natural recovery occurs in the short-term, but the long-term trend is erosional.

Homeowners seeking to protect their property have constructed some erosion control measures, such as seawalls. These structures limit, or eliminate, the natural interaction where dunes feed sand to the eroded beach during storm events. Limiting this natural protective function makes infrastructure, and the environment adjacent to protected properties, more susceptible to storm damages. Multiple homes in the South Ponte Vedra Beach and Vilano Beach reaches received permits from the Florida Department of Environmental Protection (FDEP) to construct temporary seawalls. Sea level rise and coastal storms will continue to exacerbate the erosion pressures in the study area. Additional problems associated with the eroding shoreline include impacts to tourism and loss of recreational resources and habitat.

3.3.2 OPPORTUNITIES

Opportunities exist to:

- Protect/enhance habitat/environmental resources
- Maintain recreation
- Protect hurricane evacuation route (SR A1A)
- Protect/enhance beach/dune interaction
- Implement recommendations in the State of Florida's St. Augustine Inlet Management Plan to use the inlet as a sand source for beaches to the north of the inlet

There is an opportunity to reduce storm damage to infrastructure by implementing measures which control development in the project area and/or by engineering features which protect infrastructure. These are "management measures" and will be discussed in detail later in this chapter.

There is also the opportunity to preserve recreational opportunities that the current beach and dune systems provide in all reaches such as beach access, surfing, fishing, and wildlife viewing.

Coincident with some management measures like beach nourishment and dune creation are opportunities to protect and enhance natural habitat for sea turtles, etc., as well as protecting or enhancing the natural beach and dune interaction. The dunes act as a reservoir of sand. As they are eroded during storm events they feed sand to the beach and reduce potential erosion impacts to infrastructure. Measures that maintain this beach/dune interaction are preferable to those that would inhibit it, such as seawalls. While some natural functions, such as sea turtle nesting, may be disrupted around the time of construction activities, there is an opportunity for long-term benefit in preserving the beach habitat. Management measures requiring a source of sand for construction also provide an opportunity to implement part of the FDEP St. Augustine Inlet Management Plan which states that a portion of beach-compatible sand dredged from the inlet should be placed on beaches to the north of the inlet. This also represents the opportunity to implement a Regional Sediment Management (RSM) strategy where maintenance of the Federal inlet can be combined with a CSRM project, realizing significant cost savings to the Federal government and to the non-federal project sponsors.

3.4 CONSTRAINTS

3.4.1 PLANNING CONSTRAINTS

A constraint is a restriction that limits the extent of the planning process; it is a statement of effects that alternative plans should avoid. Constraints are designed to avoid undesirable changes between without and with project future conditions. The planning constraint for this study area is to avoid conflict with Federal regulations, as stated in Federal law, USACE regulations, and executive orders.

3.4.2 LOCAL CONSTRAINTS

Local and state laws, such as Florida State statutes, are not a constraint to NED formulation. However, they may be considered in the selection of a Locally Preferred Plan (LPP).

3.5 OBJECTIVES

3.5.1 FEDERAL OBJECTIVES

The Federal objective, as stated in The Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, established by the U.S. Water Resources Council on March 10, 1983 (P&G), is to contribute to national economic development (NED) consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. 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 study area and the rest of the nation.

The Federal objective does not seek to identify specific targets within objectives. For example, targeting a pre-defined storm frequency (100 year storm) relative to the storm damage reduction objective would be inappropriate. Rather, the planning process includes formulation of alternative plans to maximize benefits relative to costs.

3.5.1.1 PLANNING OBJECTIVES

The planning objectives are statements of the study purpose. Planning objectives are more specific than the Federal and non-federal objectives and reflect the problems and opportunities in the study area. Federal and non-federal objectives are discussed later in this chapter. An objective is developed to address each of the identified problems and opportunities while being consistent with the study authority and the USACE mission of coastal storm risk management. Planning objectives represent desired positive changes. The planning objectives for the study area would be attained within the 50-year period of analysis for the study, from 2020 through 2070. All of the objectives focus on activity within the three reaches of the study. The planning objectives are:

- Reduce storm damage to infrastructure, including SR A1A, a major hurricane evacuation route
- Maintain existing recreation (beach and nearshore)
- Maintain environmental quality for human and natural use, including natural protection provided by beach/dune interaction, air and water quality, habitat, and aesthetics

The goal of the feasibility study is to develop a range of alternative plans that balance the objectives and avoid conflicts or, where necessary, demonstrate the trade-offs between conflicting objectives; and enabling decisions to be made.

3.5.1.2 FEDERAL ENVIRONMENTAL OBJECTIVES

USACE strives to balance the environmental and developmental needs of the nation in full compliance with the National Environmental Policy Act (NEPA), and other authorities provided by Congress and the Executive Branch. Public participation is encouraged early in the planning process to define environmental problems and elicit public expression of needs and expectations. Significant environmental resources and values that would likely be impacted, favorably as well as adversely, by an alternative under consideration are identified early in the planning process. All plans are formulated to avoid, to the fullest extent practicable, any adverse impact on significant resources. Significant adverse impacts that cannot be avoided are mitigated as required by Section 906(d) of WRDA 1986. This feasibility study is an integrated document. Rather than having a separate NEPA document, it includes the Environmental Assessment (EA), which describes the environmental impacts of the recommended plan and summarizes compliance with Federal statutes and regulations.

3.5.1.3 ENVIRONMENTAL OPERATING PRINCIPLES

Consistent with NEPA, USACE has reaffirmed its commitment to the environment by formalizing a set of "Environmental Operating Principles" applicable to all its decision making and programs. These principles foster unity of purpose regarding environmental issues and ensure that conservation, environmental preservation, and restoration are considered in all USACE activities. Section 6.26 includes a discussion of the USACE Environmental Operating Principles and how the study addresses them.

3.5.1.4 CAMPAIGN PLAN OF THE U.S. ARMY CORPS OF ENGINEERS (USACE)

USACE Campaign Plan goals and objectives are derived, in part, from the Commander's intent, the Army Campaign Plan, and the Office of Management and Budget. The four goals, and their associated objectives, also build on prior strategic planning efforts. Each goal and objective is led by a USACE senior leader who manages and oversees actions to reach the goal and objective.

The successful achievement of the goals and objectives contained in the Campaign Plan are dependent on actions implemented by the entire USACE team. The implementing actions supporting each goal and objective are contained in the headquarters staff and Major Subordinate Command (MSC) implementation guidance for the Campaign Plan. The four goals of the Campaign Plan are:

Goal 1: Deliver innovative, resilient, and sustainable solutions to the Department of Defense (DoD) and the nation.

Goal 2: Deliver enduring and essential water resource solutions, utilizing effective transformation strategies.

Goal 3: Deliver support that responds to, recovers from, and mitigates disaster impacts to the nation.

Goal 4: Build resilient people, teams, systems, and processes to sustain a diverse culture of collaboration, innovation, and participation to shape and deliver strategic solutions.

These Campaign Plan goals, and associated objectives, will be addressed through the course of this feasibility study.

3.5.2 STATE AND LOCAL OBJECTIVES

The State of Florida is empowered by the Federal Coastal Zone Management Act (CZMA), and its implementing regulations at 15 CFR Part 930, to review Federal activities within or adjacent to its coastal zone, to comment on and concur with or object to a Federal agency's determination that the activity is consistent with the enforceable policies of the state's approved coastal management program. The Federal CZMA requires Federal activities to be consistent with a state's coastal zone program to the maximum extent practicable; it does not require compliance with a state's program. Florida's Coastal Zone Management Program was established under the Coastal Management Act of 1978 (Chapter 380.20, Florida Statutes) and approved by the Federal Coastal Zone Management office in 1981. Florida does not regulate its coastal zone through one comprehensive law, but rather through state statutes and administrative codes. Through Florida's comprehensive planning act, local governments are also given the opportunity to determine whether these activities are consistent with their goals and policies. FDEP is the lead state agency for the implementation of the CZMA.

The Beach and Shore Preservation Act (Chapter 161, Florida Statutes) is Florida's primary statute for developing and implementing the state's strategic beach management plan, regulating coastal construction seaward of the Mean High Water line, and regulating activities seaward of the coastal construction control lines. The act, administered by FDEP, was first passed in 1965 and has since been significantly amended. The objective of the Beach and Shore Preservation Act is to preserve and protect Florida's sandy beaches and adjacent beach and dune systems. FDEP strives to accomplish this objective with the following programs: Coastal Construction Control Lines, Joint Coastal Permit Program, Erosion Setbacks, Coastal Building Zone, Erosion Control Program, Erosion Control Line, and Inlet Management.

3.5.2.1 LOCAL COMPREHENSIVE PLANNING

The state's Local Government Comprehensive Planning Act of 1985 (Chapter 163) requires that all local governments prepare, adopt, and implement comprehensive plans that address community growth and development needs. It requires that local, regional, and state comprehensive plans be consistent with each other and requires coastal counties and cities to

include a "coastal management element" in their local plans. This section of the plan must be based on an inventory of the beach and dune system, existing coastal land uses, and an analysis of the effects of future land uses on coastal resources. Local governments must also address disaster mitigation and redevelopment, designation of coastal high-hazard areas, beach protection, and shoreline use.

The St. Johns County Beach Management Plan states that the county's central vision for its beaches provides for an equitable balance between dune and wildlife protection and amenities development for beach use and enjoyment, similar to those developed in Federal and state parks.

3.6 SUMMARY OF MANAGEMENT MEASURES

Management measures are specific structural or non-structural actions that would take place at geographical locations within the project areas. For this first iteration of evaluating measures, the entire project area was split into two geographical locations:

1) The South Ponte Vedra Beach and Vilano Beach reaches were grouped together due to their proximity and physical similarity.

2) The Summer Haven reach was evaluated separately due to its remote location relative to the rest of the study area and unique physical characteristics (e.g., limited number of houses).

3.6.1 IDENTIFICATION OF MANAGEMENT MEASURES

Management measures were selected to accomplish at least one planning objective. Both non-structural (NS) and structural (S) measures are included. All possible measures are considered, including those beyond the authority of USACE to implement.

NS-1: No Action. The no action plan is the continuation of existing conditions. Although this measure does not address any specific problems, it will provide a comparison to other measures. Information to describe this measure was collected during the inventory of existing conditions. The rate of shoreline change and current adjacent beach-fill and sand bypassing operations will be assumed to continue over the 50-year period of analysis. Present structures and replacement costs will be used into the future.

NS-2: Coastal Construction Control Line. A coastal construction control line (CCCL) that does not prohibit construction, but does provide stringent structural restrictions, has already been established by the State of Florida for all of the St. Johns County study area. This management measure provides for potential changes to the CCCL or building regulations that could be implemented by the State of Florida. Such changes could include moving the CCCL landward,

increasing the setback for construction, or increasing the standards for construction to reduce storm damages. The erosion of the shoreline would continue at the present rate, unabated by this measure.

NS-3: Moratorium on Construction. This management measure would not permit new construction in the area vulnerable to storm damages within the study area. As properties are damaged, reconstruction would not be permitted. The erosion of the shoreline would continue at the present rate, unabated by this measure. Although not a congressionally authorized activity, this measure could be implemented by state or local governments.

NS-4: Establish a No-Growth Program. This management measure would allow for existing structures and limited reconstruction following storm damage, but would not allow for an increased number of structures within the area vulnerable to storm damages adjacent to the study area. The erosion of the shoreline would continue at the present rate, unabated by this measure. Although not a congressionally authorized activity, this measure could be implemented by state or local governments.

NS-5: Relocation of Structures. This measure would allow the area to continue to erode and the land in this area would be lost. Structures vulnerable to storm damage in the study area would be identified, and where feasible, such structures would be moved further landward on their parcels to escape the vulnerable area.

NS-6: Flood Proofing of Structures. Flood proofing of existing structures, and regulation of flood plain and shorefront development, are management measures that state and local governments could implement. This measure would require changes to the building codes to further minimize flood damages associated with coastal storms. New construction, and substantial reconstruction, would be improved by new building code regulations. Existing structures could be improved through incentives and aid programs.

NS-7: Acquisition of Land and Structures. This measure would allow the shoreline to erode in the study area with a loss of land. Structures within the study area vulnerable to storm damage would be identified for acquisition. These structures would be demolished and natural areas would be restored. Such parcels would become public property, reducing the number of structures vulnerable to storm damages.

S-1: Seawalls. The construction of additional concrete seawalls, or improvements to and maintenance of, the existing bulkheads/seawalls would provide a significant degree of protection. The seawalls would be constructed at the seaward edge of the existing dune line. Existing seawalls may be demolished in favor of a new seawall to provide a seamless wall over the entire study area or select areas. This measure would stabilize the shoreline at the location of the bluff, allowing erosion to continue until the seawall becomes the water line. A concrete sheet pile wall

is proposed due to its stability in the salt environment and its ability to withstand wave action. Construction would entail excavation into the bluff to install tie-back features. The seawall must be of sufficient depth underground to withstand projected scour by wave action and will require rock protection at the bottom (toe) of the structure.

S-2: Revetments. Revetments have been placed on similar beaches to protect critically damaged or eroding areas. This measure would involve placement of large rock, designed to withstand the wave environment, along the existing dune line. The engineered structure would start at the elevation of the bluff to tie into existing elevations, and have a sloped profile. The structure would be imbedded under the beach elevation to a depth below expected scour and future erosion. In-place materials from the excavation would be used for backfill behind the structure. Along the shoreline, the revetment should be continuous to avoid erosional features at gaps and should include tie back features at the ends. Existing armor can either be incorporated into the structure, or demolished to provide a seamless structure.

S-3: Sand Covered Soft Structure. This management measure includes construction of a dune composed of geotextile sand-filled forms (typically tubes or bags) and covered with sand. This forms a sand dune with a structured core. Sand depth over the geotextile core would be maintained to an adequate depth to allow the dune to function as habitat and to not inhibit sea turtle nesting.

S-4: Beach Nourishment. This management measure includes initial construction of a beach-fill and future renourishments at regular intervals. Renourishment of the beach would be undertaken periodically to maintain the recreational and erosion control features within design dimensions. Dimensions of the beach-fill would be based on economic optimization of benefits provided, with consideration to cost, as well as the potential environmental impacts. Beach nourishment material is anticipated to be available in adequate quantities from offshore and/or from combinations of other sources such as navigation dredging, upland disposal areas, etc.

S-5: Groins. A series of groins in the problem area would help hold a beach in front of existing development and prevent further losses of land. The construction of groins would have to be supplemented with nourishment so that adjacent beaches would not be starved of sand. For this reason, groins are considered a method to help hold the fill in place and to reduce periodic nourishment requirements. The groins would be constructed of large size rock, designed to interlock together, and with a foundation that would avoid subsidence. The groins would be placed perpendicular to the shoreline and would extend from above the Mean High Water line out into shallow water. The length, orientation, and head of the structure (T-head or not) would be designed based on wave conditions, storms, and sediment transport. The beach-fill material would come from offshore and/or from in combinations of other sources such as navigation dredging, upland disposal areas, etc.

S-6: Submerged Artificial Reefs. This management measure would use the "perched beach concept" to limit the amount of underwater beach-fill and retain the dry beach for a longer period. Such construction would limit cross-shore losses of fill material. This would be accomplished by placement of a submerged artificial reef in shallow water with beach-fill material placed "perched" behind the reef structure. This measure may reduce initial nourishment (fill) quantities, reduce renourishment requirements, and offer mitigation for potential nearshore environmental impacts. The submerged artificial reef would be constructed out of large size rock with a foundation material to avoid subsidence. Typically, a structure perpendicular to the shore is constructed down-drift of the reef to stabilize fill. The beach-fill material would come from offshore and/or in combinations of other sources such as navigation dredging, upland disposal areas, etc.

S-7: Submerged Artificial Multi-purpose Reefs. This measure was chosen to fully account for the "maintain existing recreation (beach and nearshore)" objective. Multi-purpose reefs are intended to reduce wave energy by causing waves to break offshore over an artificial reef. The reef is designed to cause wave breaking in a form favorable for surfing and is constructed of material suitable for nearshore habitat. It is advisable to construct the reefs in combination with beach nourishment. A point of sand (or salient) typically forms in the wave shadow of the reef extending that portion of beach seaward. Sand that forms the salient would come from adjacent beaches. Pre-filling the project area with sand prior to, or with reef construction, would reduce adverse impacts to adjacent shorelines. Typically, these reefs are constructed of large, sand filled geotextile bags (or geotubes). Sand would come from offshore and/or in combinations of other sources such as navigation dredging, upland disposal areas, etc.

S-8: Nearshore Placement. Dredged material would be placed in the nearshore to dissipate wave energy, nourish the active profile, or placed as a combination of both. This method allows placement in water depths 15 feet and deeper. This management measure assumes that a portion of the sand placed in shallow water will move towards the beach under normal wave conditions. Over time, following construction, the sand bar will migrate towards the beach, attach to the beach, and shape into the normal equilibrium profile of the beach (thus adding material and enlarging the beach). The dredged material would come from offshore.

S-9: Breakwaters. The construction of breakwaters offshore along the St. Johns County study area is considered as a management measure to stabilize the existing beach. Such structures reduce the amount of wave energy reaching the shoreline behind them. As a result, the rate of annual erosion could decrease. The breakwaters would be constructed of large size rock with foundation materials to prevent subsidence. The breakwaters would be trapezoidal in profile and would be placed parallel to the shoreline in shallow water. The breakwaters would be constructed in segments separated from each other to prevent infilling between the existing beach and the

breakwaters. The elevation and length of each breakwater segment, and the distance between segments, would be designed using the wave and sediment transport characteristics of the reach.

S-10: Dunes and Vegetation. The presence of dunes is essential if a beach is to remain stable and able to accommodate the stress from unpredictable storms and extreme conditions of wind, wave, and elevated sea surfaces. Dunes maintain a sand repository that, during storms, provides sacrificial sand before structures would be damaged. The dune system provides a measure of public safety and property protection. Proper vegetation on dunes increases sand erosion resistance by binding the sand together via extensive root masses penetrating deep into the sand. Further, such vegetation promotes dune growth through its sand trapping action when significant wind action transports substantial quantities of sand. This measure would include placement of beach compatible material from upland, offshore, or other sources, in a dune feature adjacent to any existing dune. The top elevation of the constructed dune would tie into the existing dune. The front slope of the dune would be a function of the material grain size and construction equipment. Vegetation would be planted after placement of the dune material, as needed.

3.7 SCREENING OF MANAGEMENT MEASURES

3.7.1 PRELIMINARY SCREENING

In Table 3-1 management measures are evaluated by how they will individually meet planning objectives given planning constraints during a 50-year planning horizon within each geographic location, not necessarily across entire reaches. Seawalls, for example, would not necessarily be constructed down the entire length of the South Ponte Vedra Beach and Vilano Beach reaches. Rather the measure is evaluated to identify how constructing seawalls singularly, in select portions of the reaches, would meet planning objectives and constraints. Also, the overall effects of implementation are evaluated, not the shorter-term effects during construction of structural measures. This is especially relevant for beach nourishment, which typically includes periodic renourishment (reconstruction) of the beach over 50 years.

In addition to planning objectives and constraints, measures were also rated on their potential to meet the Four Accounts: National Economic Development (NED) includes damages prevented, emergency costs avoided, and other project costs; Environmental Quality (EQ) includes ecosystem value, water circulation, noise level changes, public facilities and services, aesthetic values, natural resources, air and water quality, cultural and historical preservation, and other factors covered by the National Environmental Policy Act (NEPA); Other Social Effects (OSE) includes security and preservation of life, health, and safety, community cohesion and growth, tax and property values, displacement of businesses, and public facilities; and Regional Economic Development (RED) includes the impact on local economy including local employment, income, and sales volume.

For the NED account, costs and benefits were not yet developed at this stage of plan formulation. The implementation of some measures, such as "Moratorium on Construction," would impact damage to future construction, but not damage to the existing inventory, which the NED calculation is based on for this study. These statements were entered in the matrix under the NED account and all measures given a "1" rating, which effectively negates the weight of this account. This ensures that no measures, which could potentially be part of a NED plan were screened out at this time as a result of the NED account. Rough costs versus Beach-fx damages were later used to screen measures carried forward from this stage.

The OSE account considers how measures impact life safety risk, especially as related to hurricanes and other significant storm events. The sponsor and state have an effective hurricane education, preparedness, and evacuation program. This results in most measures not having a significant difference between the with-project and future without-project condition (FWOP) as it is assumed most residents are prepared and would evacuate when necessary. As reflected in Table 3-1, structural measures could minimally improve life safety risk as a result of protecting hurricane evacuation route SR A1A. However, this analysis assumes that the majority of the population evacuates damage prone areas in adequate time to effectively reduce life safety risk.

It is important to note, that no alternatives were screened out due to their inability to meet the planning objective to "Maintain existing recreation (beach and nearshore)." USACE participates in single purpose projects formulated exclusively for coastal storm risk management, with economic benefits equal to or exceeding the costs, based solely on damage reduction benefits, or a combination of damage reduction benefits and recreation benefits. Under current policy, recreation must be incidental in the formulation process and may not be more than 50% of the total benefits required for justification (ER 1105-2-100, 3-4.b.(4)(a)).

The management measures were evaluated and rated in Table 3-1 for their potential to accomplish planning objectives given project constraints: 0 = does not meet criteria, 1 = partially meets criteria, and 2 = fully meets criteria. If the total rating equals a number greater than 8, the measure partially meets, at least, over half of the objectives and constraints, and is carried forward for further analysis. If the total rating is equal to or less than 8, the measure is not considered further. The final total rating should not be inferred to be a ranking of measures against one another. A measure's rating is only an indication of how likely it is to meet objectives given constraints, and therefore whether it is carried forward or not.

Management measures for the South Ponte Vedra Beach and Vilano Beach reaches were jointly screened due to their similarities and proximity to one another. The only significant difference between the reaches is the presence of the Coastal Barrier Resources System (CBRS) unit in the Vilano Beach reach. Federal law constrains Federal participation in a CBRS unit. Total ratings in Table 3-1 were significantly high or low enough that separate evaluation of the reaches was not

required. The only exception was evaluation of S-8 (Nearshore Placement). Presence of the CBRS unit caused this measure to not be carried forward for the Vilano Beach reach. However, the measure was carried forward for the South Ponte Vedra reach where no CBRS unit exists.

Table 3-1. Preliminary screening matrix.

South Ponte Vedra Beach and Vilano Beach Non-Structural Measures

	MEASURES	PROJECT OBJECTIVES			PROJECT CONSTRAINTS	FOUR ACCOUNTS					
	SOUTH PONTE VEDRA AND VILANO	Reduce Storm Damage to Infrastructure, Including SR A1A	Maintain Existing Recreation (Beach and Nearshore)	Maintain Environmental Quality Including Beach/Dune Interaction	Consistent with Federal Laws	National Economic Development (NED)	Environmental Quality	Other Social Effects	Regional Economic Development (RED)	Total	Measure Carried Forward (Yes/No)
	Nonstructural Measures (NS)										
NS-1	No-Action	No improvement	No impact to nearshore recreation. Loss of beach recreation.	Natural and artificial loss due to private shore protection measures.	Consistent with Federal law.	No project cost. No damages prevented.	Possible loss of dune habitat. Loss of turtle nesting habitat due to decreased beach/dune width and private shore protection measures. Minimal change to other factors.	Small life safety risk due to hurricane evacuation route damage. Moderate risk to loss of public facilities (parking, beach access, bathrooms). Negative effect on community cohesion due to perceived inequality.	Loss of property value and tax value. Loss of other revenue related to existing beach as long -term erosion continues.		
		0	1	0	2	1	1	0	0	5	Yes
NS-2	Coastal Construction Control Line	Increasing construction standards could decrease damage to future construction	No impact to nearshore recreation. Loss of beach recreation.	Natural and artificial loss due to private shore protection measures.	Implemented by state/local government and is consistent with Federal law.	Would impact future construction but not impact damages to existing inventory which NED calculation is based on for this study.	Possible loss of dune habitat. Loss of turtle nesting habitat due to decreased beach/dune width and private shore protection measures. Minimal change to other factors.	Small life safety risk due to hurricane evacuation route damage. Increased requirements/ restrictions on future construction are typically unfavorable.	Loss of property value and tax value. Loss of other revenue related to existing beach as long -term erosion continues.		
		1	1	0	2	1	1	0	0	6	No
NS-3	Moratorium on Construction	No improvement to damage of current construction but elimination of damage to future construction	No impact to nearshore recreation. Loss of beach recreation.	Natural and artificial loss due to private shore protection measures.	Implemented by state/local government and is consistent with Federal law.	Would impact future construction but not impact damages to existing inventory which NED calculation is based on for this study.	Possible loss of dune habitat. Loss of turtle nesting habitat due to decreased beach/dune width and private shore protection measures. Minimal change to other factors.	Small life safety risk due to hurricane evacuation route damage. Moderate risk to loss of public facilities (parking, beach access, bathrooms). Negative effect on community cohesion due to perceived inequality.	Loss of property value and tax value. Loss of other revenue related to existing beach as long term erosion continues.		
		1	1	0	2	1	1	0	0	6	No

Carried Forward | Eliminated | 2 Fully Meets Obj/Constraint | 1 Partially Meets Obj/Constraint | 0 Does Not Meet Obj/Constraint

South Ponte Vedra Beach and Vilano Beach Non-Structural Measures

	MEASURES	PROJECT OBJECTIVES			PROJECT CONSTRAINTS	FOUR ACCOUNTS					
	SOUTH PONTE VEDRA AND VILANO	Reduce Storm Damage to Infrastructure, Including SR A1A	Maintain Existing Recreation (Beach and Nearshore)	Maintain Environmental Quality Including Beach/Dune Interaction	Consistent with Federal Laws	National Economic Development (NED)	Environmental Quality	Other Social Effects	Regional Economic Development (RED)	Total	Measure Carried Forward (Yes/No)
	Nonstructural Measures (NS)										
NS-4	Establish a No-Growth Program	No improvement to damage of current construction but elimination of damage to future construction.	No impact to nearshore recreation. Loss of beach recreation.	Natural and artificial loss due to private shore protection measures.	Implemented by state/local government and is consistent with Federal law.	Would impact future construction but not impact damages to existing inventory which NED calculation is based on for this study.	Possible loss of dune habitat. Loss of turtle nesting habitat due to decreased beach/dune width and private shore protection measures. Minimal change to other factors.	Small life safety risk due to hurricane evacuation route damage. Loss of property value and tax value. Moderate risk to loss of public facilities (parking, beach access, bathrooms). Negative effect on community cohesion due to perceived inequality.	Loss of property value and tax value. Loss of other revenue related to existing beach as long-term erosion continues.		
		1	1	0	2	1	1	0	0	6	No
NS-5	Relocation of Structures	Relocating damageable elements would reduce damages.	No impact to nearshore recreation. Eventual narrowing of beach could cause loss of beach recreation.	Relocation could reduce private shore protection measures and maintain beach/dune interaction. Eventual narrowing of beach/dune system between ocean and A1A would limit or eliminate interaction	Consistent with Federal law.	Costs undetermined at this stage.	Eventual narrowing of beach/dune system between ocean and A1A would limit or eliminate habitat. No impact to nearshore habitat. Minimal change to other factors.	Small life safety risk due to hurricane evacuation route damage. Moderate risk to loss of public facilities (parking, beach access, bathrooms). Negative effect on community cohesion due to perceived inequality.	Loss of property value and tax value. Loss of other revenue related to existing beach as long -term erosion continues.		
		1	1	1	2	1	1	0	0	7	No
NS-6	Flood Proofing of Structures	Increasing construction standards could decrease damage to future construction	No impact to nearshore recreation. Loss of beach recreation.	Natural and artificial loss due to private shore protection measures.	Implemented by state/local government and is consistent with Federal law.	Costs undetermined at this stage.	Possible loss of dune habitat. Loss of turtle nesting habitat due to decreased beach/dune width and private shore protection measures. Minimal change to other factors.	Small life safety risk due to hurricane evacuation route damage. Increased requirements/ restrictions on future construction are typically unfavorable.	Loss of property value and tax value. Loss of other revenue related to existing beach as long -term erosion continues.		
		1	1	0	2	1	1	0	0	6	No
NS-7	Acquisition of Land and Structures	Removing damageable elements and conversion of property to natural area would maximize storm damage reduction.	No impact to nearshore recreation. Loss of beach recreation as beach/dune system narrows between A1A and ocean.	Eventual narrowing of beach/dune system between ocean and A1A would limit or eliminate interaction	Consistent with Federal law.	Costs undetermined at this stage.	Creation of natural area/habitat would improve environment. Loss of habitat as beach/dune system narrows between ocean and A1A.	Small life safety risk due to hurricane evacuation route damage. Moderate risk to loss of public facilities if parkland were created. Negative effect on community cohesion due to perceived inequality.	Minimal increase with creation of parkland and eco-tourism benefits.		
		2	1	1	2	1	1	0	1	9	Yes

Carried Forward | Eliminated | 2 Fully Meets Obj/Constraint | 1 Partially Meets Obj/Constraint | 0 Does Not Meet Obj/Constraint

South Ponte Vedra Beach and Vilano Beach Structural Measures

	MEASURES	PROJECT OBJECTIVES			PROJECT CONSTRAINTS	FOUR ACCOUNTS					
	SOUTH PONTE VEDRA AND VILANO	Reduce Storm Damage to Infrastructure, Including SR A1A	Maintain Existing Recreation (Beach and Nearshore)	Maintain Environmental Quality Including Beach/Dune Interaction	Consistent with Federal Laws	National Economic Development (NED)	Environmental Quality	Other Social Effects	Regional Economic Development (RED)	Total	Measure Carried Forward (Yes/No)
	Structural Measures (S)										
S-1	Seawalls	Would maximize storm damage reduction where constructed. However, adjacent properties could be made more vulnerable due to erosive effects of structures.	Potential loss of beach recreation fronting structures. Steepening of profile and/or wave reflection may effect nearshore recreation such as surfing.	Construction would eliminate beach/dune interaction. Interaction on properties adjacent to construction could be negatively affected.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Negative effects to sea turtle nesting habitat and wildlife habitat.	Likely supported by homeowners but little support from others.	No change.		
		1	1	0	1	1	0	1	0	5	No
S-2	Revetments	Would maximize storm damage reduction where constructed. However, adjacent properties could be made more vulnerable due to erosive effects of structures.	Sloped construction causes revetments to take up more beach width than seawalls. Potential loss of beach recreation fronting structures. Steepening of profile and/or wave reflection may effect nearshore recreation such as surfing.	Construction would eliminate beach/dune interaction. Interaction on properties adjacent to construction could be negatively affected.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Negative effects to sea turtle nesting habitat and wildlife habitat.	Likely supported by homeowners but little support from others.	No change.		
		1	1	0	1	1	0	1	0	5	No
S-3	Sand Covered Soft Structure	Would improve storm damage reduction.	Existing narrow beach may be maintained.	Beach/dune interaction would be maintained.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Environmental quality is highly dependent on maintaining sand coverage of structure. Without adequate coverage dune habitat and sea turtle nesting could be negatively impacted. No impact to nearshore habitat.	Improved life safety risk due to hurricane evacuation route protection. Protection of public facilities (parking, beach access, bathrooms).	Minimal increase to RED through improvement of tourism/beach economy. Protection of property value and tax value.		
		1	1	2	1	1	1	2	1	10	Yes

Carried Forward | Eliminated | 2 Fully Meets Obj/Constraint | 1 Partially Meets Obj/Constraint | 0 Does Not Meet Obj/Constraint

South Ponte Vedra Beach and Vilano Beach Structural Measures

	MEASURES	PROJECT OBJECTIVES			PROJECT CONSTRAINTS	FOUR ACCOUNTS					
	SOUTH PONTE VEDRA AND VILANO	Reduce Storm Damage to Infrastructure, Including SR A1A	Maintain Existing Recreation (Beach and Nearshore)	Maintain Environmental Quality Including Beach/Dune Interaction	Consistent with Federal Laws	National Economic Development (NED)	Environmental Quality	Other Social Effects	Regional Economic Development (RED)	Total	Measure Carried Forward (Yes/No)
	Structural Measures (S)										
S-4	Beach Nourishment	Continuous nourishment along constructible lengths of shoreline would maximize storm damage reduction.	Beach recreation would be maintained or improved. Nearshore recreation such as surfing and fishing could be impacted (negatively or positively) for a period of time after initial nourishment and periodic renourishments.	Beach/dune interaction would be maintained.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Empirical evidence indicates potential negative effects to benthic invertebrates and nearshore habitat are for short periods of time, with habitat recovering within one year. Positive impact to sea turtle nesting habitat.	Improved life safety risk due to hurricane evacuation route protection. Protection of public facilities (parking, beach access, bathrooms). Supported by majority of community.	Moderate increase to RED through improvement of tourism/ beach economy. Protection of property value and tax value.		
		2	1	2	1	1	1	2	2	12	Yes
S-5	Groins	In combination with beach nourishment, groins could be used at hotspots to stabilize fill and maximize storm damage reduction.	In combination with beach nourishment, beach recreation would be maintained. Nearshore recreation such as surfing and fishing could be impacted (negatively or positively) for a period of time after initial nourishment and periodic renourishments. Periodic renourishments should be reduced due to stabilization effects of groins.	Beach/dune interaction would be maintained.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Periodic renourishments could be reduced due to stabilizing effect of groins. Empirical evidence indicates potential negative effects to benthic invertebrates and nearshore habitat from beach nourishment are for short periods of time, with habitat recovering within one year. Positive impact to sea turtle nesting habitat. Possible entrapment hazard for hatchling sea turtles.	Improved life safety risk due to hurricane evacuation route protection. Protection of public facilities (parking, beach access, bathrooms). Supported by majority of community.	Moderate increase to RED through improvement of tourism/ beach economy. Protection of and tax value.		
		2	1	2	1	1	1	1	2	11	Yes
S-6	Submerged Artificial Reefs	Constructed in select locations, in combination with beach nourishment and a shore perpendicular structure, could maximize storm damage reduction.	In combination with beach nourishment and a shore perpendicular structure, beach recreation would be maintained. Nearshore recreation such as surfing and fishing could be impacted (negatively or positively) for a period of time after initial nourishment and periodic renourishments.	Beach/dune interaction would be maintained.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Reef has potential as nearshore habitat. Empirical evidence indicates potential negative effects to benthic invertebrates and nearshore habitat from beach nourishment are for short periods of time, with habitat recovering within one year. Positive impact to sea turtle nesting habitat.	Improved life safety risk due to hurricane evacuation route protection. Protection of public facilities (parking, beach access, bathrooms).	Moderate increase to RED through improvement of tourism/ beach economy. Protection of property value and tax value.		
		2	1	2	1	1	2	1	2	12	Yes

Carried Forward | Eliminated | 2 Fully Meets Obj/Constraint | 1 Partially Meets Obj/Constraint | 0 Does Not Meet Obj/Constraint

South Ponte Vedra Beach and Vilano Beach Structural Measures

	MEASURES	PROJECT OBJECTIVES			CONSTRAINTS	FOUR ACCOUNTS					
	SOUTH PONTE VEDRA AND VILANO	Reduce Storm Damage to Infrastructure, Including SR A1A	Maintain Existing Recreation (Beach and Nearshore)	Maintain Environmental Quality Including Beach/Dune Interaction	Consistent with Federal Laws	National Economic Development (NED)	Environmental Quality	Other Social Effects	Regional Economic Development (RED)	Total	Measure Carried Forward (Yes/No)
	Structural Measures (S)										
S-7	Submerged Artificial Multi-Purpose Reefs	Constructed in select locations in combination with beach nourishment, could maximize storm damage reduction.	In combination with beach nourishment, beach recreation would be maintained. Reef construction could maintain or improve nearshore recreation such as surfing, fishing, and diving. Reef could serve as mitigation for periodic beach nourishment impacts to nearshore recreation in other portions of the study area.	Beach/dune interaction would be maintained.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Reef has potential as nearshore habitat. Empirical evidence indicate potential negative effects to benthic invertebrates and nearshore habitat from beach nourishment are for short periods of time, with habitat recovering within one year. Positive impact to sea turtle nesting habitat.	Improved life safety risk due to hurricane evacuation route protection. Protection of public facilities (parking, beach access, bathrooms). May receive more support from environmental agencies.	Moderate increase to RED through improvement of tourism/beach economy. Protection of property value and tax value.		
		2	2	2	1	1	2	1	2	13	Yes
S-8 South Ponte Vedra	Nearshore Placement	Could provide moderate storm damage reduction dependent on migration of fill.	Beach recreation could be maintained or improved dependent on fill migration. Nearshore recreation such as surfing and fishing could be impacted (negatively or positively) for a period of time after initial placement and future periodic placements.	Beach/dune interaction would be maintained.	Consistent with Federal law.	Costs undetermined at this stage.	Empirical evidence indicates potential negative effects to benthic invertebrates and nearshore habitat are for short periods of time, with habitat recovering within one year. Volume of sand needed to provide significant benefits could have negative impact to sea turtle nesting habitat dependent on migration of fill.	Minimal improvement to life safety risk due to hurricane evacuation route protection. Minimal protection of public facilities (parking, beach access, bathrooms).	Minimal protection of property value and tax value.		
		1	1	2	2	1	0	1	1	9	Yes
S-8 Vilano	Nearshore Placement	Could provide moderate storm damage reduction dependent on migration of fill	Beach recreation could be maintained or improved dependent on fill migration. Nearshore recreation such as surfing and fishing could be impacted (negatively or positively) for a period of time after initial placement and future periodic placements.	Beach/dune interaction would be maintained	Supported by federal law except in CBRA zone.	Costs undetermined at this stage.	Empirical evidence indicates potential negative effects to benthic invertebrates and nearshore habitat are for short periods of time, with habitat recovering within one year. Volume of sand needed to provide significant benefits could have negative impact to sea turtle nesting habitat dependent on migration of fill.	Minimal improvement to life safety risk due to hurricane evacuation route protection. Minimal protection of public facilities (parking, beach access, bathrooms).	Minimal protection of property value and tax value.		
		1	1	2	1	1	0	1	1	8	No
S-9	Emergent Breakwaters	As a stand-alone measure, emergent breakwaters could improve storm damage reduction.	Beach recreation could be maintained. Nearshore recreation such as surfing could be negatively impacted.	Beach/dune interaction would be maintained.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Potential negative impacts to sea turtle nesting activities and hatchling entrapment.	Minimal improvement to life safety risk due to hurricane evacuation route protection. Minimal protection of public facilities (parking, beach access, bathrooms).	Minimal protection of property value and tax value.		
		1	1	2	1	1	1	1	1	9	Yes
S-10	Dunes and Vegetation	Could improve storm damage reduction as a stand-alone measure.	Beach recreation could be maintained. No impact to nearshore recreation.	Beach/dune interaction would be maintained or improved.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Dune creation improves dune habitat and potentially beach habitat for sea turtle nesting. No impact to nearshore habitat.	Minimal improvement to life safety risk due to hurricane evacuation route protection. Minimal protection of public facilities (parking, beach access, bathrooms).	Moderate increase to RED through improvement of tourism/beach economy. Moderate protection of property value and tax value.		
		1	1	2	1	1	2	1	2	11	Yes

Carried Forward | Eliminated | 2 Fully Meets Obj/Constraint | 1 Partially Meets Obj/Constraint | 0 Does Not Meet Obj/Constraint

Summer Haven Non-Structural Measures

	MEASURES	PROJECT OBJECTIVES			PROJECT CONSTRAINTS	FOUR ACCOUNTS					
	Summer Haven	Reduce Storm Damage to Infrastructure, Including SR A1A	Maintain Existing Recreation (Beach and Nearshore)	Maintain Environmental Quality Including Beach/Dune Interaction	Consistent with Federal Laws	National Economic Development (NED)	Environmental Quality	Other Social Effects	Regional Economic Development (RED)	Total	Measure Carried Forward (Yes/No)
	Nonstructural Measures (NS)										
NS-1	No-Action	No improvement	No impact to nearshore recreation. Loss of beach recreation.	No dune exists in northern, revetted portion. Minimal impact to beach/ dunes system in southern portion	Consistent with Federal law.	No project cost. No damages prevented.	Possible loss of dune habitat. Loss of turtle nesting habitat due to decreased beach/dune width and private shore protection measures. Minimal change to other factors.	Negative effect on community cohesion due to perceived inequality	Loss of property value and tax value. Loss of other revenue related to existing beach as long -term erosion continues.	5	Yes
		0	1	0	2	1	1	0	0		
NS-2	Coastal Construction Control Line	Increasing construction standards could decrease damage to future construction	No impact to nearshore recreation. Loss of beach recreation.	Natural and artificial loss due to private shore protection measures.	Implemented by state/local government and is consistent with Federal law.	Would impact future construction but not impact damages to existing inventory which NED calculation is based on for this study.	Possible loss of dune habitat. Loss of turtle nesting habitat due to decreased beach/dune width and private shore protection measures. Minimal change to other factors.	Increased requirements/restrictions on future construction are typically unfavorable.	Loss of property value tax value. Loss of other revenue related to existing beach as long term erosion continues.	6	No
		1	1	0	2	1	1	0	0		
NS-3	Moratorium on Construction	No improvement to damage of current construction but elimination of damage to future construction	No impact to nearshore recreation. Loss of beach recreation.	Some natural loss likely due to erosion. No artificial loss due to no anticipated shore protection measures in southern reach..	Implemented by state/local government and is consistent with Federal law.	Would impact future construction but not impact damages to existing inventory which NED calculation is based on for this study.	Possible loss of dune habitat. Loss of turtle nesting habitat due to decreased beach/dune width. Minimal change to other factors.	Loss of property value and tax value. Negative effect on community cohesion due to perceived inequality .	Loss of property value and tax value. Loss of other revenue related to existing beach as long -term erosion continues.	7	No
		1	1	1	2	1	1	0	0		
NS-4	Establish a No-Growth Program	No improvement to damage of current construction but elimination of damage to future construction	No impact to nearshore recreation. Loss of beach recreation.	Some natural loss likely due to erosion. No artificial loss due to no anticipated shore protection measures in southern reach.	Implemented by state/local government and is consistent with Federal law.	Would impact future construction but not damage to existing inventory which NED calculation is based on for this study.	Possible loss of dune habitat. Loss of turtle nesting habitat due to decreased beach/dune width. Minimal change to other factors.	Loss of property value and tax value. Negative effect on community cohesion due to perceived inequality .	Loss of property value and tax value. Loss of other revenue related to existing beach as long -term erosion continues.	7	No
		1	1	1	2	1	1	0	0		

Carried Forward | Eliminated | 2 Fully Meets Obj/Constraint | 1 Partially Meets Obj/Constraint | 0 Does Not Meet Obj/Constraint

Summer Haven Non-Structural Measures

	MEASURES	PROJECT OBJECTIVES			PROJECT CONSTRAINTS	FOUR ACCOUNTS					
	Summer Haven	Reduce Storm Damage to Infrastructure, Including SR A1A	Maintain Existing Recreation (Beach and Nearshore)	Maintain Environmental Quality Including Beach/Dune Interaction	Consistent with Federal Laws	National Economic Development (NED)	Environmental Quality	Other Social Effects	Regional Economic Development (RED)	Total	Measure Carried Forward (Yes/No)
	Nonstructural Measures (NS)										
NS-5	Relocation of Structures	Relocating damageable elements would reduce damages.	No impact to nearshore recreation. Eventual narrowing of beach could cause loss of beach recreation.	Relocation could reduce private shore protection measures in the southern reach and maintain beach/dune interaction. Eventual narrowing of beach/dune system between ocean and Old A1A would limit or eliminate interaction	Consistent with Federal law.	Costs undetermined at this stage.	Eventual narrowing of beach/dune system between ocean and Old A1A would limit or eliminate habitat. No impact to nearshore habitat. Minimal change to other factors.	Small life safety risk due to hurricane evacuation route damage. Moderate risk to loss of public facilities (parking, beach access, bathrooms). Negative effect on community cohesion due to perceived inequality.	Loss of property value and tax value. Loss of other revenue related to existing beach as long- term erosion continues.		
		1	1	1	2	1	1	0	0	7	No
NS-6	Flood Proofing of Structures	Increasing construction standards could decrease damage to future construction	No impact to nearshore recreation. Loss of beach recreation.	Natural and artificial loss due to private shore protection measures.	Implemented by state/local government and is consistent with Federal law.	Costs undetermined at this stage.	Possible loss of dune habitat. Loss of turtle nesting habitat due to decreased beach/dune width and private shore protection measures. Minimal change to other factors.	Increased requirements/restrictions on future construction are typically unfavorable.	Loss of property value and tax value. Loss of other revenue related to existing beach as long- term erosion continues.		
		1	1	0	2	1	1	0	0	6	No
NS-7	Acquisition of Land and Structures	Removing damageable elements and conversion of property to natural area would maximize storm damage reduction.	Creation of natural area/park would not impact beach or nearshore recreation. This assumes removal of Old A1A in southern reach.	Creation of natural area and removal of Old A1A would maintain beach/dune interaction.	Consistent with Federal law.	Costs undetermined at this stage.	Creation of natural area/habitat would improve environment.	Overall, public may view measure as beneficial to local interests.	Minimal increase with creation of parkland and eco-tourism benefits.		
		2	2	2	2	1	2	1	1	13	Yes

Carried Forward | Eliminated | 2 Fully Meets Obj/Constraint | 1 Partially Meets Obj/Constraint | 0 Does Not Meet Obj/Constraint

Summer Haven Structural Measures

	MEASURES	PROJECT OBJECTIVES			PROJECT CONSTRAINTS	FOUR ACCOUNTS					
	Summer Haven	Reduce Storm Damage to Infrastructure, Including SR A1A	Maintain Existing Recreation (Beach and Nearshore)	Maintain Environmental Quality Including Beach/Dune Interaction	Consistent with Federal Laws	National Economic Development (NED)	Environmental Quality	Other Social Effects	Regional Economic Development (RED)	Total	Measure Carried Forward (Yes/No)
	Structural Measures (S)										
S-1	Seawalls	Would maximize storm damage reduction where constructed. Structures exist to the north and south, therefore minimal effects to adjacent properties .	Potential loss of beach recreation fronting structures. Steepening of profile and/or wave reflection may effect nearshore recreation such as surfing.	Construction would eliminate beach/dune interaction. Beach/dune interaction on properties adjacent to construction could be negatively affected.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Negative effects to sea turtle nesting habitat in southern reach.	Likely supported by homeowners but little support from others.	No change.		
		2	1	0	1	1	0	1	0	6	No
S-2	Revetments	Would maximize storm damage reduction where constructed. Structures exist to the north and south, therefore minimal effects to adjacent properties .	Sloped construction causes revetments to take up more beach width than seawalls. Potential loss of beach recreation fronting structures. Steepening of profile and/or wave reflection may effect nearshore recreation such as surfing.	Construction would eliminate beach/dune interaction. Beach/dune interaction on properties adjacent to construction could be negatively affected.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Negative effects to sea turtle nesting habitat in southern reach.	Likely supported by homeowners but little support from others.	No change.		
		2	1	0	1	1	0	1	0	6	No
S-3	Sand Covered Soft Structure	Would improve storm damage reduction.	Existing narrow beach may be maintained.	Beach/dune interaction would be maintained.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Environmental quality is highly dependent on maintaining sand coverage of structure. Without adequate coverage dune habitat and sea turtle nesting could be negatively impacted. No impact to nearshore habitat.	Improved life safety risk due to hurricane evacuation route protection. Protection of public facilities (parking, beach access, bathrooms).	Minimal increase to RED through improvement of tourism/beach economy. Protection of property value and tax value.		
		1	1	2	1	1	1	2	1	10	Yes

Carried Forward | Eliminated | 2 Fully Meets Obj/Constraint | 1 Partially Meets Obj/Constraint | 0 Does Not Meet Obj/Constraint

Summer Haven Structural Measures

	MEASURES	PROJECT OBJECTIVES			PROJECT CONSTRAINTS	FOUR ACCOUNTS					
	Summer Haven	Reduce Storm Damage to Infrastructure, Including SR A1A	Maintain Existing Recreation (Beach and Nearshore)	Maintain Environmental Quality Including Beach/Dune Interaction	Consistent with Federal Laws	National Economic Development (NED)	Environmental Quality	Other Social Effects	Regional Economic Development (RED)	Total	Measure Carried Forward (Yes/No)
	Structural Measures (S)										
S-4	Beach Nourishment	Continuous nourishment along constructible lengths of shoreline would maximize storm damage reduction.	Beach recreation would be maintained or improved. Nearshore recreation such as surfing and fishing could be impacted (negatively or positively) for a period of time after initial nourishment and periodic renourishments.	Beach/dune interaction would be maintained in southern reach.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Empirical evidence indicate potential negative effects to benthic invertebrates and nearshore habitat are for short periods of time, with habitat recovering within one year. Positive impact to sea turtle nesting habitat.	Supported by homeowners.	Moderate increase to RED through improvement of tourism/beach economy. Minimal protection of property value and tax value in northern reach due to existing protection provided by revetment. Increased protection likely in southern reach.		
		2	1	2	1	1	1	1	2	11	Yes
S-5	Groins	In combination with beach nourishment, groins could be used at hotspots to stabilize fill and maximize storm damage reduction.	In combination with beach nourishment, beach recreation would be maintained. Nearshore recreation such as surfing and fishing could be impacted (negatively or positively) for a period of time after initial nourishment and periodic renourishments. Periodic renourishments should be reduced due to stabilization effects of groins.	Beach/dune interaction would be maintained in southern reach.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Periodic renourishments could be reduced due to stabilizing effect of groins. Empirical evidence indicate potential negative effects to benthic invertebrates and nearshore habitat from beach nourishment are for short periods of time, with habitat recovering within one year. Positive impact to sea turtle nesting habitat.	Supported by homeowners.	Moderate increase to RED through improvement of tourism/beach economy. Minimal protection of property value and tax value in northern reach due to existing protection provided by revetment. Increased protection likely in southern reach.		
		2	1	2	1	1	1	1	2	11	Yes

Carried Forward | Eliminated | 2 Fully Meets Obj/Constraint | 1 Partially Meets Obj/Constraint | 0 Does Not Meet Obj/Constraint

Summer Haven Structural Measures

	MEASURES	PROJECT OBJECTIVES			PROJECT CONSTRAINTS	FOUR ACCOUNTS					
	Summer Haven	Reduce Storm Damage to Infrastructure, Including SR A1A	Maintain Existing Recreation (Beach and Nearshore)	Maintain Environmental Quality Including Beach/Dune Interaction	Consistent with Federal Laws	National Economic Development (NED)	Environmental Quality	Other Social Effects	Regional Economic Development (RED)	Total	Measure Carried Forward (Yes/No)
	Structural Measures (S)										
S-6	Submerged Artificial Reefs	Constructed in select locations in combination with beach nourishment, could maximize storm damage reduction.	In combination with beach nourishment, beach recreation would be maintained. Nearshore recreation such as surfing and fishing could be impacted (negatively or positively) for a period of time after initial nourishment and periodic renourishments.	Beach/dune interaction would be maintained in southern reach.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Reef has potential as nearshore habitat. Empirical evidence indicate potential negative effects to benthic invertebrates and nearshore habitat from beach nourishment are for short periods of time, with habitat recovering within one year. Positive impact to sea turtle nesting habitat.	Supported by homeowners.	Moderate increase to RED through improvement of tourism/beach economy. Minimal protection of property value and tax value in northern reach due to existing protection provided by revetment. Increased protection likely in southern reach.	12	Yes
		2	1	2	1	1	2	1	2		
S-7	Submerged Artificial Multi-Purpose Reefs	Constructed in select locations in combination with beach nourishment, could maximize storm damage reduction.	In combination with beach nourishment, beach recreation would be maintained. Reef construction could maintain or improve nearshore recreation such as surfing, fishing, and diving. Reef could serve as mitigation for periodic beach nourishment impacts to nearshore recreation in other portions of the study area.	Beach/dune interaction would be maintained in southern reach.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Reef has potential as nearshore habitat. Empirical evidence indicate potential negative effects to benthic invertebrates and nearshore habitat from beach nourishment are periodic, with habitat recovering within one year. Positive impact to sea turtle nesting habitat.	Supported by homeowners.	Moderate increase to RED through improvement of tourism/beach economy.	13	Yes
		2	2	2	1	1	2	1	2		
S-8	Nearshore Placement	Could provide moderate storm damage reduction dependent on migration of fill.	Beach recreation could be maintained or improved dependent on fill migration. Nearshore recreation such as surfing and fishing could be impacted (negatively or positively) for a period of time after initial placement and future periodic placements.	Beach/dune interaction would be maintained in the southern reach.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Empirical evidence indicates potential negative effects to benthic invertebrates and nearshore habitat are for short periods of time, with habitat recovering within one year. Volume of sand needed to provide significant benefits could have negative impact to sea turtle nesting habitat dependent on migration of fill.	Supported by homeowners.	Dependent on fill migration to the dry beach, there could be a moderate increase to RED through improvement of tourism/beach economy. Minimal protection of property value and tax value in northern reach due to existing protection provided by revetment. Increased protection likely in southern reach.	8	No
		1	1	2	1	1	0	1	1		

Carried Forward | Eliminated | 2 Fully Meets Obj/Constraint | 1 Partially Meets Obj/Constraint | 0 Does Not Meet Obj/Constraint

Summer Haven Structural Measures

	MEASURES	PROJECT OBJECTIVES			PROJECT CONSTRAINTS	FOUR ACCOUNTS					
	Summer Haven	Reduce Storm Damage to Infrastructure, Including SR A1A	Maintain Existing Recreation (Beach and Nearshore)	Maintain Environmental Quality Including Beach/Dune Interaction	Consistent with Federal Laws	National Economic Development (NED)	Environmental Quality	Other Social Effects	Regional Economic Development (RED)	Total	Measure Carried Forward (Yes/No)
	Structural Measures (S)										
S-9	Emergent Breakwaters	As a stand-alone measure, emergent breakwaters could improve storm damage reduction.	Beach recreation could be maintained. Nearshore recreation such as surfing could be negatively impacted.	Beach/dune interaction would be maintained.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Potential negative impacts to sea turtle nesting activities and hatchling entrapment.	Minimal improvement to life safety risk due to hurricane evacuation route protection. Minimal protection of property value and tax value. Minimal protection of public facilities (parking, beach access, bathrooms).	No change.		
		1	1	2	1	1	1	1	0	8	No
S-10	Dunes and Vegetation	Could improve storm damage reduction as a stand-alone measure.	Beach recreation could be maintained. No impact to nearshore recreation.	Beach/dune interaction would be maintained or improved.	Supported by Federal law except in CBRA zone.	Costs undetermined at this stage.	Dune creation improves dune habitat and potentially beach habitat for sea turtle nesting. No impact to nearshore habitat.	Minimal improvement to life safety risk due to hurricane evacuation route protection. Minimal protection of property value and tax value. Minimal protection of public facilities (parking, beach access, bathrooms).	Moderate increase to RED through improvement of tourism/beach economy.		
		1	1	2	1	1	2	1	2	11	Yes

Carried Forward | Eliminated | 2 Fully Meets Obj/Constraint | 1 Partially Meets Obj/Constraint | 0 Does Not Meet Obj/Constraint

Management measures that were carried forward from this screening include:

Measures carried forward for South Ponte Vedra Beach and Vilano Beach reaches
NS-1: No Action
NS-7: Acquisition of Land and Structures
S-3: Sand Covered Soft Structure
S-4: Beach Nourishment
S-5: Groins
S-6: Submerged Artificial Reef
S-7: Submerged Artificial Multi-Purpose Reef
S-8: Nearshore Placement (for South Ponte Vedra Beach reach only)
S-9: Emergent Breakwaters
S-10: Dunes and Vegetation

Measures carried forward for Summer Haven reach
NS-1: No Action
NS-7: Acquisition of Land and Structures
S-3: Sand Covered Soft Structure
S-4: Beach Nourishment
S-5: Groins
S-6: Submerged Artificial Reef
S-7: Submerged Artificial Multi-Purpose Reef
S-10: Dunes and Vegetation

The measures carried forward were further discussed with the Project Development Team, the non-federal sponsor, and other stakeholders. In some cases, further analysis of a measure was not recommended, and the measure was eliminated. The following paragraphs discuss measures carried forward and their potential for development into alternatives. Rough Order Magnitude (ROM) costs for measures carried forward were developed and compared to FWOP damages from Beach-fx, as described later in this chapter. This comparison provides insight into where specific measures may be justified and which ones merit more in-depth analysis.

NS-7: Acquisition of Land and Structures. In the South Ponte Vedra Beach and Vilano Beach reaches, this measure will include buyout and demolition of the existing structures most susceptible to damage. For the Summer Haven reach, this measure would include buyout and demolition of existing structures in the southern portion of the reach south of the existing revetment.

S-3: Sand Covered Soft Structure. Such structures could be constructed in select areas of all three reaches, especially where infrastructure is particularly vulnerable during periods of beach narrowing. The vicinity of R114 in Vilano Beach is an area where the beach and dune have eroded close to homes and SR A1A during storm events. In their review of the screening matrix, FDEP stated that five similar structures

constructed in Brevard County, Florida, have been problematic, mainly due to the difficulty in maintaining appropriate sand cover over the structure. Sand-covered soft structures are likely to operate best in combination with beach nourishment.

S-4: Beach Nourishment. This is the most common type of structural measure constructed for large storm damage reduction projects in Florida. The Florida coastline is typically composed of straight sand beaches periodically interrupted by inlets and other man-made structures, but with few natural obstructions. This creates an environment where sediment transport patterns span large areas which the construction structures can easily interrupt. Because of this, constructing a beach system with natural storm damage reduction and habitat functions typically serves as the most effective and environmentally sound solution.

S-5: Groins: Groins are typically constructed to stabilize a sandy beach in isolated sections of shoreline with high erosion rates (hot spots). Constructing groins on long straight sections of sandy beach, such as South Ponte Vedra and Vilano beaches, can cause erosion to adjacent beaches downdrift of the sand transport flow. Although the R114 vicinity in Vilano Beach is considered a hotspot, other measures, such as beach nourishment, would be more likely to meet project objectives without causing downdrift impacts. Groins will not be evaluated in the South Ponte Vedra Beach or Vilano Beach reaches. However the Summer Haven reach could benefit from groins, especially if constructed near the southern end of the existing revetment where breaches have occurred. Previous beneficial use placements of sand dredged from navigation projects have eroded at very high rates from this area and could be stabilized with groins.

S-6: Submerged Artificial Reefs. Such a structure is typically constructed to protect isolated areas experiencing erosion and to prevent sand from eroding in the cross shore direction. Construction on a long straight beach such as South Ponte Vedra or Vilano beaches may cause negative impacts on adjacent beaches. The cost to construct structures the length of the study area would likely be excessive. There would also be significant difficulties with construction and maintenance since the structure would be located in the surf zone. Construction of these structures in Summer Haven could be evaluated further, however, material costs for construction would likely exceed those for other structures (such as groins) that could provide similar benefits. Due to these points, submerged artificial reefs are eliminated from further analysis.

S-7: Submerged Artificial Multi-Purpose Reefs. These structures are typically constructed along isolated areas of high erosion and particularly in order to mitigate for impacts to recreation (such as surfing) and/or habitat. Negative impacts, as described for S-6, may not be such a factor with these reefs since they are constructed in deeper water. The technology is relatively new compared to other structural measures. However, construction techniques are improving, which could lower costs and improve performance. Construction of such a measure would be best offshore of an erosional hotspot, such as in the R114 vicinity of Vilano Beach or offshore of the Summer Haven breach, just south of the constructed revetment.

S-8: Nearshore Placement (South Ponte Vedra Beach reach only). Typically, nearshore placement is conducted when a sand source's characteristics do not match the native beach and direct placement on

the beach (beach nourishment) is not possible for permitting reasons. For nearshore placement, material is placed in the nearshore where processes such as waves and currents can naturally sort finer material out and transport material suitable for the beach toward the shore. Preliminary investigations indicate that beach quality material is available for any potential project. Material of this quality would likely be more effective for storm damage reduction if placed as typical beach nourishment and not in the nearshore. Due to these considerations, nearshore placement is eliminated from further analysis.

S-9: Emergent Breakwaters. Emergent breakwaters would be constructed to minimize erosive forces, particularly waves, on the shoreline behind them. As a stand-alone measure, they can be effective at slowing erosion in isolated sections of shoreline with high erosion rates (hotspots). However, they may cause impacts to adjacent shorelines if constructed without beach nourishment, especially if constructed on long straight sections of sandy beach such as the South Ponte Vedra Beach and Vilano Beach reaches. In combination with beach nourishment, this measure could be effective in select areas such as the hotspot around R114 in Vilano Beach.

S-10: Dunes and Vegetation. Dunes are an integral component of the existing beach/dune system throughout the majority of the study area. Dunes protect against elevated water levels resulting from storm surge and are also a "reservoir" of sand, feeding the beach during erosive events. This measure would include nourishing the existing dune or creating a dune where one does not currently exist. The nourished dune would be vegetated, as needed, in order to stabilize the sand.

3.7.2 FORMULATION STRATEGY

Measures used singularly or in combination with others create alternatives, and varying scales of each create additional alternatives. For example, an alternative may be implementable for a portion of a reach, but not for an entire reach. Several alternatives of merit have resulted from combinations of management measures. These alternatives will undergo further analysis.

The purposes of the Coastal Barrier Resources Act (CBRA) include minimizing the loss of human life, wasteful expenditure of Federal revenues, and damage to fish, wildlife, and other natural resources associated with CBRS units. There are limits to Federal expenditures related to actions that could affect a unit. Due to the presence of a CBRS unit in the southern portion of the Summer Haven reach, and the revetment providing significant storm damage reduction to infrastructure in the northern portion, USACE will be limited in which alternatives it can implement. Due to the fact that a significant amount of shoreline within the CBRS unit is composed of undeveloped privately owned parcels, Federal expenditures for any alternative implementation would be prohibited by the CBRA due to the fact that such action could encourage development.

USACE will analyze structural alternatives only for the northern half of the Summer Haven reach, north of the CBRS unit. The only alternative analyzed in the southern half will be NS-7: Acquisition of Land and

Structures. The non-federal sponsor or state would not be as limited and may choose to implement other alternatives without Federal assistance.

There is also a CBRS unit located in the Vilano Beach reach that extends from just south of R114 to just south of R116, a distance of approximately 2,000 feet. Although no Federal expenditures are permitted in the unit that would be inconsistent with the purposes of the act, some alternatives may be implementable for the remainder of the reach. The location of the unit would allow for certain alternatives, such as beach nourishment, to be continuously implemented for justifiable lengths of the South Ponte Vedra Beach and Vilano Beach reaches, ending at the northern border of the CBRS unit. USFWS is amenable to beach nourishment next to a CBRS unit as long as natural sediment transport through the CBRS unit is not impeded. Further, placement can occur in a CBRS unit if the cost is incurred entirely by the non-federal sponsor.

Finally, the St. Augustine Inlet system is almost entirely located within a CBRS unit. The existing St. Augustine project currently obtains sand from this system, and the project has used this sand source for approximately 15 years. USACE initially coordinated with USFWS on the CBRS units in the project area on May 20, 2016, and provided additional information on the sand source location in a letter dated October 12, 2016. USFWS provided their determination that the use of the St. Augustine Inlet system as a sand source for this project was consistent with the purposes of the CBRA in a letter dated October 25, 2016.

Beach-fx modeling of the FWOP condition indicates very limited damages in the Vilano Beach reach from R117 through R122 at the St. Augustine Inlet. This indicates that it is highly unlikely any alternatives would provide a benefit justifying their cost to implement. Due to this, R117 – R122 of the Vilano Beach reach is eliminated from further analysis. Only the portion from R104 – R117 will be considered further.

<u>Alternatives for South Ponte Vedra Beach and Vilano Beach reaches</u>

- Acquisition of Land and Structures (NS-7)
- Beach nourishment (S-4)
- Dunes and vegetation (S-10)
- Beach nourishment (S-4) and sand covered soft structure (S-3)
- Beach nourishment (S-4) with emergent breakwaters (S-8)
- Beach nourishment (S-4) and multi-purpose artificial reef (S-7)

<u>Alternatives for Summer Haven reach</u>

In northern reach only, north of CBRS unit

- Beach nourishment (S-4)
- Beach nourishment (S-4) with multi-purpose artificial reef (S-7)
- Beach nourishment (S-4) with groin construction (S-5)

In southern reach only, within CBRS unit

- Acquisition of Land and Structures (NS-7)

As alternatives are developed, the alternative evaluation criteria of completeness, effectiveness, efficiency, and acceptability are considered. Completeness is satisfied by ensuring that the alternatives

include all activities to implement the plan. Effectiveness is determined by how the alternatives address the project problems. Efficiency is indicated by the cost effectiveness of a plan, which will be determined through the cost and benefit analysis. Acceptability is determined by evaluating the plan against local, state, and Federal law and policy, environmental constraints, and public willingness to support the plan.

Alternatives not meeting the criteria will be eliminated. Alternatives which meet the criteria will be carried forward as alternative plans.

3.8 ALTERNATIVES MILESTONE

The preliminary plan formulation and initial screening discussed in the sections above was undertaken prior to 2011, when study progress was put on hold due to funding constraints. With the advent of SMART Planning (Water Resources Reform and Development Act (WRRDA) 2014), the study received funding and was realigned in 2014 to meet the SMART Planning milestones, the first of which is the Alternatives Milestone, which was held in March 2015. As stated at the milestone meeting, the alternatives outlined above continued to be feasible for the South Ponte Vedra Beach and Vilano Beach reaches. Between 2011 and 2014, the non-federal sponsor continued efforts in the Summer Haven reach to buy out threatened properties within the CBRS unit and to not allow future development, thus furthering the NS-7 alternative discussed above without Federal assistance. Implementation of one of the structural measures discussed above is highly likely to have significant cost without providing much additional benefit. **With non-federal sponsor concurrence, the decision was made at the Alternatives Milestone to drop the Summer Haven Reach from further analysis based on the following:**

- Summer Haven is a geographically separate reach from the other two reaches and has extremely limited public access/parking.
- Major infrastructure such as SR A1A has already been relocated landward.
- There are a minimal number of structures in the southern portion of the reach.
- Structures in the northern portion of the reach are fronted by a revetment, reducing damage risk.
- Rebuilding of damaged structures is questionable given limited road access and damage susceptibility.
- The sponsor is purchasing properties when able and not allowing future development of the acquired properties.
- With the existing structural inventory growing smaller, it is highly likely that damages would not justify a 50-year CSRM project anywhere in the reach.
- Alternatives are also limited by the presence of a CBRS unit in three-quarters of the reach.

Although the Summer Haven Reach was screened out of further analysis in this Feasibility Study and Environmental Assessment (EA), additional coordination efforts were made to determine if other Federal agencies, such as the Federal Emergency Management Agency (FEMA), could provide assistance to the local sponsor in their ongoing efforts to acquire vulnerable structures and property and limit future construction within the reach. FEMA has provided past assistance by funding small berm construction (beach nourishment) following severe storms warranting Federal assistance. In addition, dredging of the

Intracoastal Waterway (IWW) in the vicinity of Matanzas Inlet typically results in the beneficial placement of dredged sand within the Summer Haven Reach.

3.9 SECONDARY SCREENING: SCREENING WITH ROUGH ORDER OF MAGNITUDE COSTS

Elimination of the Summer Haven Reach resulted in further development of the following alternatives for the South Ponte Vedra Beach and Vilano Beach reaches:

A. Buyout of Structures and Land Acquisition (NS-7)
B. Beach nourishment (S-4)
C. Dunes and vegetation (S-10)
D. Beach nourishment (S-4) with sand covered soft structure (S-3)
E. Beach nourishment (S-4) with emergent breakwaters (S-8)
F. Beach nourishment (S-4) with submerged multi-purpose artificial reef (S-7)

In order to screen these alternatives prior to modeling alternatives in Beach-fx, rough order of magnitude (ROM) cost estimates were developed for each of the alternatives. The ROM cost estimates were developed using information from similar historical projects. The estimates were based on implementing a measure along one mile of shoreline. It was assumed that it would not be feasible, or practical, to implement any alternatives along a stretch of shoreline less than one mile. These ROM costs were brought to present value (PV) based on maintenance assumptions over 50 years, and broken down to a cost per linear foot (LF) of shoreline, shown in Table 3-2.

The four accounts, National Economic Development (NED), Environmental Quality (EQ), Other Social Effects (OSE), and Regional Economic Development (RED) are also shown in Table 3-2 for comparison.

Table 3-2. Alternative Descriptions and Rough Order of Magnitude (ROM) Costs.

St John's County; Preliminary Alternative Cost Screening									
				Present Value (PV) of accumulated total cost	(PV) of accumulated cost per linear foot ($/LF)	Four Accounts			
Alternative	Description	Assumptions				National Economic Development (NED)	Environmental Quality (EQ)	Other Social Effects (OSE)	Regional Economic Development (RED)
A	Acquisition of land and structures	Estimates were made for reaches that had the greatest Future Without Project damages. Buying out structures and parcels in these reaches would equate to "managed retreat" of the most vulnerable reaches.	In addition to buy-out of structures, a $50,000 relocation allowance and $15,000 demolition cost per structure was assumed. Vacant parcels would also be bought out to prevent future development. Cost of vacant land is estimated at $3,600/linear foot of oceanfront footage plus $12,000 legal fees per vacant parcel.	This cost differs per reach due to differing estimated structure value, number of structures and number of vacant parcels per reach.	This cost differs per reach due to differing estimated structure value, number of structures and number of vacant parcels per reach.	Depending on the amount of damages reduces, net benefits will likely be lower than other alternatives due to high costs.	Conversion of developed land to undeveloped park, natural area, and habitat would improve environment. Loss of habitat would occur as beach/dune system narrows between ocean and SR A1A.	Small life safety risk improvement due to hurricane evacuation route damage. Increased requirements/restrictions on future construction are typically unfavorable.	Minimal increase with creation of parkland and potential eco-tourism benefits.
B	Beach nourishment	Includes the cost of nourishment with 120 cubic yards of sand per linear foot using an offshore sand source, approximately ten miles offshore.	The renourishment interval is seven years.	$34,945,011	$6,618	Net benefits are likely to be high compared to other alternatives depending on amount of damages reduced. Beach nourishment is an effective alternative for damage reduction on similar Florida shorelines.	Empirical evidence indicates potential negative effects to benthic invertebrates and nearshore habitat for short periods of time, with habitat recovering within one year. Positive impact to sea turtle nesting habitat.	Improved life safety risk due to hurricane evacuation route protection. Protection of public facilities (parking, beach access, bathrooms). Supported by majority of community.	Moderate increase through improvement of tourism/beach economy. Protection of property value and tax value.
C	Dunes and vegetation	15 cubic yards of sand per linear foot using an offshore sand source, approximately ten miles offshore.	Renourishment would be required every seven years.	$13,969,117	$2,646	Net benefits are likely to be high compared to other alternatives depending on amount of damages reduced. If dunes can prevent approximately the same amount of damages as beach nourishment, this alternative could provide the greatest net benefits given its lower cost.	Would push the entire beach profile seaward, only temporarily increasing berm width but maintaining dune width. Hence, there could be impacts from construction similar to beach nourishment. Positive impacts would include improvement of dune habitat and limited additional beach habitat for sea turtle nesting.	Minimal improvement to life safety risk due to hurricane evacuation route protection. Minimal protection of public facilities (parking, beach access, bathrooms).	Moderate increase through improvement of tourism/beach economy. Moderate protection of property value and tax value.
D	Beach nourishment with sand covered soft structure (Geotube)	Includes the cost of geotube core filled with sand plus an additional 9 cubic yards of sand per linear foot covering the filled geotube.	Also includes the cost of a full beach nourishment to keep geotube covered with sand. This is necessary to prevent exposure of the tube, which threatens turtle nesting and exposes the core to degradation from sunlight and vandalism. Renourishment interval is assumed to be seven years.	$39,933,581	$7,563	Net benefits are likely to be lower than other alternatives. Addition of a sand covered soft structure to beach nourishment may add additional cost without the addition of significant damage reduction.	Highly dependent on maintaining sand coverage of structure. Without adequate coverage, dune habitat and sea turtle nesting could be negatively impacted. Other benefits/impacts similar to Alternative 2, Beach Nourishment.	Improved life safety risk due to hurricane evacuation route protection. Protection of public facilities (parking, beach access, bathrooms).	Minimal increase through improvement of tourism/beach economy. Protection of property value and tax value.
E	Beach nourishment with emergent breakwater	Assumes that eight breakwaters would be required, per mile.	Assumes that periodic renourishment would be necessary every seven years. Renourishment costs are estimated at 75% cost of full beach nourishment alternative.	$75,419,880	$14,284	Net benefits will likely be lower than other alternatives, if not the lowest. The addition of breakwaters to beach nourishment may not add significant damage reduction while adding significant cost.	Potential negative impacts to sea turtle nesting and sea turtle hatchling entrapment. Other benefits/impacts similar to Alternative 2, Beach Nourishment.	Minimal improvement to life safety risk due to hurricane evacuation route protection. Minimal protection of public facilities (parking, beach access, bathrooms).	Minimal protection of property value and tax value.
F	Beach nourishment with submerged artificial multi-purpose reef	Assumes that two reefs per mile would be required.	Periodic renourishment would be necessary along with reef construction. Renourishment interval is seven years. Renourishment costs are estimated at 75% cost of full beach nourishment alternative. Also, it is assumed that the artificial reef would need to be rebuilt at year 15 and again in year 30.	$38,848,967	$7,358	Net benefits are likely to be lower than other alternatives. Addition of a multi-purpose reef to beach nourishment may add additional cost without the addition of significant damage reduction.	Potential to provide nearshore habitat. Other benefits/impacts similar to Alternative 2, Beach Nourishment.	Improved life safety risk due to hurricane evacuation route protection. Protection of public facilities (parking, beach access, bathrooms). May receive more support from environmental agencies and local special interest groups (surfers, fishermen, etc.)	Moderate increase through improvement of tourism/beach economy. Protection of property value and tax value.
FY2015 interest rate is 3.375%									
Basic cost assumption information data based on Level 3 ROM Cost Report provided to the PDT on 9/1/15									
The "per linear foot" estimate includes all associated costs (mobilization, demobilization, inspections, monitoring during construction, etc.)									

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A project's benefit-to-cost ratio (BCR) must be greater than 1.0 in order for an alternative to be justified and implementable (i.e., the benefits must be greater than the costs). Benefits equal damages prevented, or the difference between the FWOP damages and damages resulting after implementation of an alternative (with-project damages). At this point in the study, damages are used as a proxy for benefits. Using the value of FWOP damages as a substitute for the benefits will overestimate the benefit provided by any alternative since this assumes that 100% of damages have been averted. Therefore if the ROM cost of an alternative is equal to, or less than, the FWOP damages, the Benefit-to-Cost Ratio (BCR) can be assumed to approximate 1, and the measure may be justified. Figure 3-1 displays the ROM costs per linear foot of alternatives, in addition to the FWOP Beach-fx damages along the shoreline for each of the three SLR scenarios. Wherever damages were far below an alternative's ROM cost, it was assumed that the measure would not be justified along that shoreline length and the alternative was screened out. Where damages are near or above ROM costs along a stretch of shoreline of sufficient length for an alternative to be realistically implemented, it was assumed that the alternative could be justified and was carried forward. This comparison not only helps in screening, but it also serves to scale alternatives that are carried forward, illustrating the shoreline lengths that may have enough FWOP damages to justify implementation of a project.

The cost of an alternative's implementation may vary depending on the SLR scenario used for design. Because of this, it is important to note that there is uncertainty around future costs, and alternatives with costs just above projected damages should not be screened out prematurely. Beach nourishment, for example, will have a higher cost for higher SLR scenarios because more sand or shorter renourishment intervals would be required. Other alternatives may have the same implementation cost for any scenario.

In Figure 3-1, FWOP damages are shown for each Beach-fx reach throughout the South Ponte Vedra Beach and Vilano Beach reaches. On the horizontal axis, R84 is the northernmost reach and R122 is the furthest southern reach, adjacent to St. Augustine Inlet. The damages include both damages to infrastructure (roads and houses), as well as costs for replacing and constructing armor as it is damaged or triggered in the Beach-fx model. Straight horizontal lines are the ROM costs for alternatives listed in Table 3-2.

Figure 3-1 also shows where Federal cost sharing in an alternative would be limited due to the presence of a CBRA zone and, in the case of an alternative requiring placement of sand on the dune or beach, limited public access and parking.

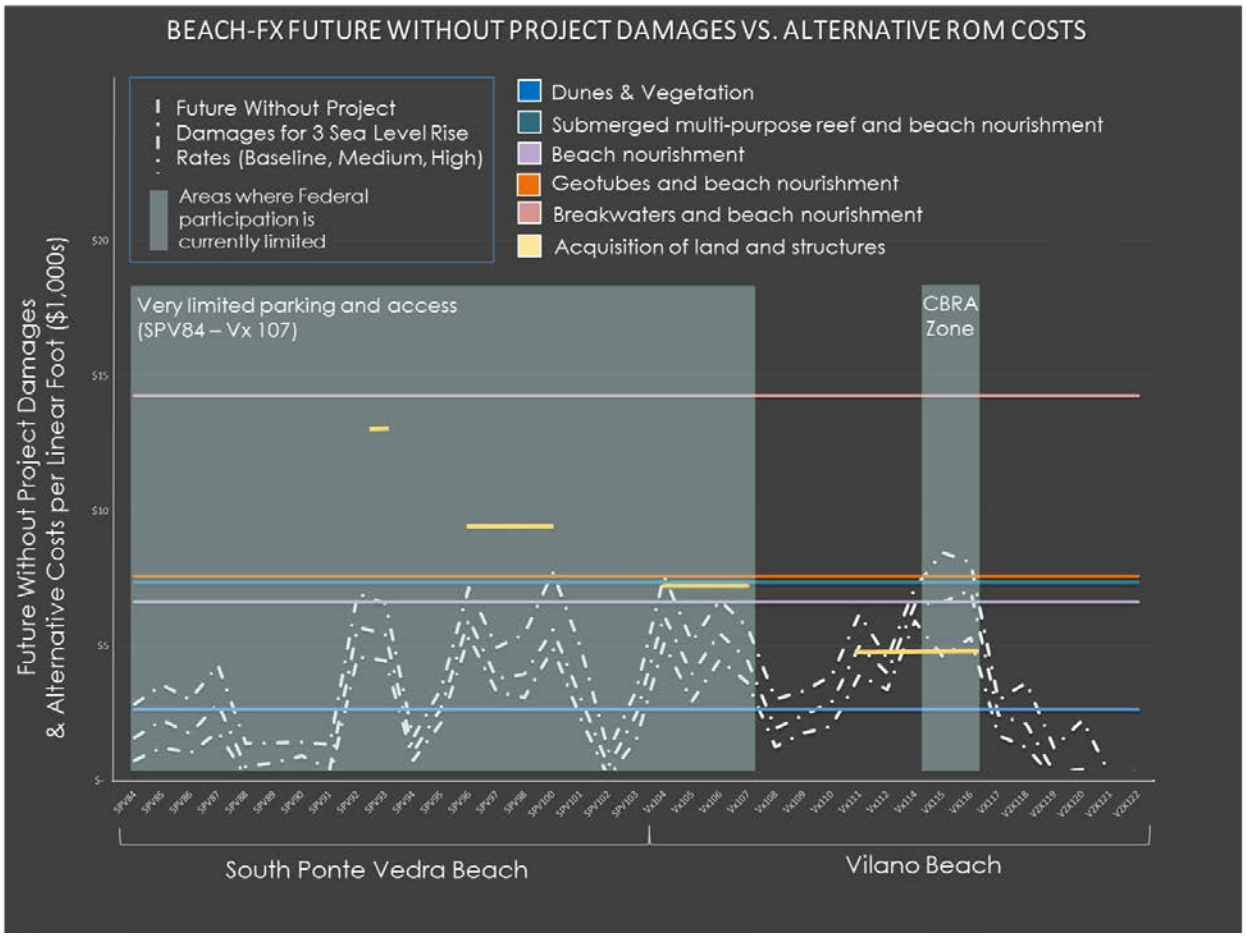

Figure 3-1. Beach-fx Future Without-Project Damages vs. Alternative ROM Costs.

This step resulted in the following alternatives being carried forward for modeling in Beach-fx:

- Acquisition of land and structures in Beach-fx reaches 111 to 116 (Vilano Beach)
- Dunes and vegetation in Beach-fx reaches 92-101 (South Ponte Vedra) and 104-116 (Vilano Beach)
- Beach nourishment in Beach-fx reaches 92-101 (South Ponte Vedra) and 104-116 (Vilano Beach)

For Beach-fx modeling and evaluation of alternatives, the acquisition of land and structures alternative already had an adequate cost estimate. The two other alternatives were developed further for specific application in the designated reaches and more detailed cost estimates were prepared. Descriptions of the alternatives are as follows:

Acquisition of Land and Structures: This alternative would allow the shoreline to erode in the study area with a loss of land. Parcels, both developed and undeveloped, vulnerable to storm damage would be bought, and structures would be demolished. Parcels would be managed by the non-federal sponsor, remaining undeveloped into the future and reducing future storm damages.

Dunes and Vegetation: This alternative would include placement of beach compatible material in a dune feature adjacent to the existing bluff. The top elevation of the dune would tie into the bluff. Initial engineering modeling indicated that the existing dune elevations, when combined with berm and/or dune extension, provide sufficient protection. Therefore, no additional elevation is included in further alternative analysis. The front slope of the dune would be a function of the material grain size and construction equipment. Vegetation would be planted, after placement of the dune material, where needed. Preliminary engineering design work concluded that the most feasible plan for dunes and vegetation would have the following characteristics:

- Extension from the existing seaward face of the dune or existing armor (revetment/seawall).
- Construction such that the dune, and beach profile out to the depth of closure, will extend approximately 10 to 20 feet seaward from its existing location and the dune elevation will as closely as possible match the elevation of the existing dune elevation.
- Construction such that a berm feature will extend seaward from its existing location above the water line to account for the volume of material needed to fill the submerged portion of the beach profile extension.
- Periodic reconstruction of the dune and beach profile extension.
- Construction using a dredge to transport material from a sand source.

Beach Nourishment: This measure includes initial construction of beach-fill and future renourishments at regular intervals. The design berm elevation for the project area is +8.0 ft-NAVD88, which is approximately at the natural berm elevation. Restricting the design berm elevation to the natural berm elevation minimizes scarping of the beach, which hinders beach access by nesting sea turtles and can pose safety problems for recreational beach use. Other reasons for following the natural berm elevation are related to storm damage reduction. A berm constructed at a lower elevation would increase the probability of overtopping by storm surge, thereby offering less protection to upland development and/or existing dunes. A higher berm elevation could result in backshore flooding due to excessive rainfall or wave/surge overtopping. A higher berm may also be more susceptible to wind-induced erosion.

Preliminary engineering design work, and economic analysis, suggested that the plan for beach nourishment would have the following characteristics:

- Maintaining the existing dune feature and extension of the berm feature from the existing seaward toe of the dune or existing armor (revetment/seawall)
- Construction such that the berm will extend approximately 20 to 100 feet seaward from its existing location and the berm elevation will as closely as possible match the elevation of the existing berm elevation
- Periodic reconstruction of the berm extension and occasional reconstruction of the dune feature

Figure 3-2 shows profile views of the beach nourishment, dunes and vegetation, and a combination of both alternatives.

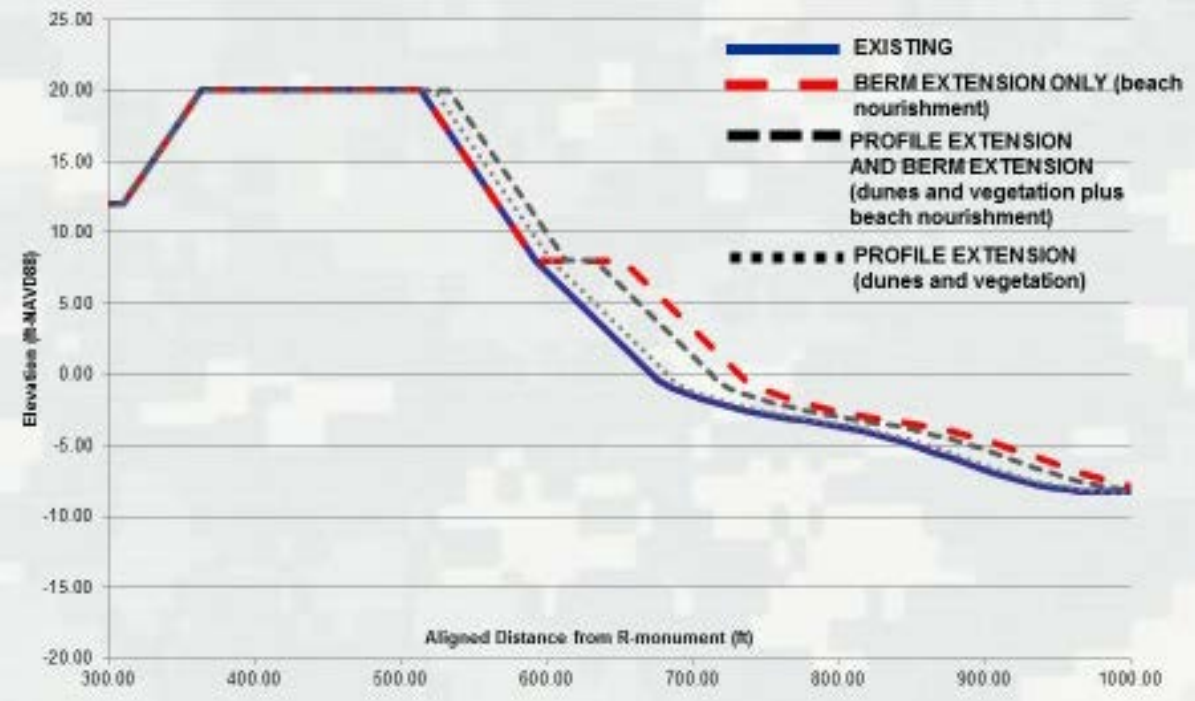

Figure 3-2. Profile view of dunes and vegetation and beach nourishment combinations.

3.9.1 FINAL SCREENING: FUTURE WITH PROJECT MODELING IN BEACH-FX

The non-structural alternative of Acquisition of Land and Structures in Beach-fx reaches 111 to 116 was modeled in Beach-fx by starting with a copy of the FWOP model setup, then deactivating all of the damage elements that were to be bought out and setting all of the lots to be bought out as unable to be armored. The Future With-Project (FWP) damages were compared to the FWOP damages to determine the benefits of this alternative over 50 years. This alternative only prevents 28% of the FWOP damages in reaches 111 to 116. Most of the FWOP damages in this area are associated with SR A1A and future armoring costs to protect the road. The alternative does nothing to prevent these damages. USACE, Jacksonville District Real Estate estimated the cost of this alternative to be $30,226,584. The results showed that this alternative would not be economically justified, with a BCR of 0.45.

Additionally, the alternative did not meet the efficiency criterion and only partially meets the effectiveness criterion of the Principles and Guidelines (P&G) screening criteria:

- Effectiveness: The alternative partially meets this criteria. Buyout does not alleviate damages to SR A1A, only to structures being bought out.
- Efficiency: The alternative is not efficient, as reflected in the BCR being less than one.

The dune and beach nourishment alternatives were set up to be modeled in Beach-fx for any combination of 0, 10, or 20 foot dune and profile extensions (dunes and vegetation) along with 0, 20, 40, 60, 80, or 100- foot berm extensions (beach nourishment). Initial results indicated that no alternative with only a dune and profile extension resulted in a BCR greater than one. Furthermore, the original plan was to use an offshore sand source located within the Northern Offshore Borrow Area (NOBA). This source is located approximately 10 miles from the study area; using this distant source resulted in low BCRs. The FDEP's Inlet Management Plan for St. Augustine Inlet directs that a portion of sand dredged from the inlet should be placed on beaches north of the inlet. Formulation of further alternatives then focused on use of the inlet system as a sand source. Since the inlet is approximately four miles from the study area, nourishment costs are less and the BCR improved. Table 3-3 shows all alternative combinations resulting in a BCR of one or greater using the inlet system as the sand source. More information on Beach-fx inputs and results for alternative formulation is provided in the Economic Appendix.

Table 3-3. Results Summary for Beach-fx Future With-Project Modeling (discount rate of 3.125%).

Alternative Number	Dune and Profile Extension* (ft)	Berm Extension** (ft)	Shoreline Extent (Beach-fx Reaches)	Project Length (miles)	Average Nourishment Interval (years)	Average Annual Project Cost	Average Annual Project Benefits	Benefit to Cost Ratio	Average Annual Project Net Benefits
1	0	100	104 to 116	2.6	16	$ 1,650,000	$ 1,823,000	1.10	$ 173,000
2	10	80	104 to 116	2.6	16	$ 1,584,000	$ 1,759,000	1.11	$ 175,000
3	0	80	104 to 116	2.6	15	$ 1,512,000	$ 1,777,000	1.18	$ 265,000
4	10	60	104 to 116	2.6	13	$ 1,508,000	$ 1,850,000	1.23	$ 342,000
5	0	60	92 to 116	4.8	16	$ 2,435,000	$ 2,797,000	1.15	$ 362,000
6	**0**	**60**	**104 to 116**	**2.6**	**12**	$ 1,435,000	$ 1,845,000	**1.29**	**$ 410,000**
7	10	40	104 to 116	2.6	12	$ 1,408,000	$ 1,689,000	1.20	$ 281,000
8	0	40	92 to 116	4.8	11	$ 2,276,000	$ 2,679,000	1.18	$ 403,000
9	0	40	104 to 116	2.6	10	$ 1,380,000	$ 1,647,000	1.19	$ 267,000
10	20	20	92 to 116	4.8	12	$ 2,376,000	$ 2,526,000	1.06	$ 150,000
11	20	20	104 to 116	2.6	10	$ 1,405,000	$ 1,514,000	1.08	$ 109,000
12	10	20	92 to 116	4.8	9	$ 2,323,000	$ 2,329,000	1.00	$ 6,000
13	10	20	104 to 116	2.6	9	$ 1,380,000	$ 1,417,000	1.03	$ 37,000

Notes:
Values based on 30 iteration runs, preliminary cost estimates, and only include structure, content, & armor damage.
Table is sorted by length of horizantal seaward dune and berm extension from greatest to least.
*Value indicates the horizantal seaward extension of the dune and entire profile (feet). At a minimum, the 2015 dune profile is maintained.
**Value indicates the horizantal seaward extension of the berm (feet) in addition to the dune and profile extension.

Alternative 6 results in the greatest net benefits. This alternative includes a 60-foot berm extension and maintenance of the 2015 dune position, but no extension of the dune and profile.

Table 3-3 includes alternatives that cover portions of both the South Ponte Vedra Beach and Vilano Beach reaches. As noted elsewhere in this report, the South Ponte Vedra Beach reach contains very limited public access and parking. Continued coordination with the sponsor on this issue resulted in the determination that no additional public access would be added to the reach prior to initial construction of any potential project. Additionally, the reach is separable from the Vilano Beach reach, meaning that no construction of a project in the South Ponte Vedra Beach reach has no impact on project performance in the Vilano Beach reach. **These factors resulted in screening out of the South Ponte Vedra Beach reach from further formulation.**

Screening out of the South Ponte Vedra Beach reach resulted in consideration of alternatives from Beach-fx reaches 104 through 116 in the final array. The top two alternatives covering these reaches were run in Beach-fx using 100 iteration simulations. The results of these simulations were used to determine the NED Plan. The results of the alternative comparison are presented in Table 3-4. The NED Plan is the plan with a BCR greater than one which maximizes net benefits. The NED Plan is Alternative 6 from Beach-fx reaches 104 - 116. As shown in Table 3-3, Alternative 6 is bracketed by a larger alternative, #3, and a smaller alternative, #9, demonstrating that a larger or smaller project would not result in greater net

benefits and that the NED Plan is the optimal size alternative. Additional detail on NED selection is provided in the Economics Appendix.

Table 3-4. Average Annual Benefits and Costs for Final Array of Alternatives (discount rate of 3.125%)

Alternative Number	Dune and Profile Extension* (ft)	Berm Extension** (ft)	Shoreline Extent (Beach-fx Reaches)	Average Annual Benefits ($)	Average Annual Costs ($)	BCR	Average Annual Net Benefits ($)
6	0	60	104 to 116	$ 1,733,000	$ 1,392,000	1.25	$ 341,000
4	10	60	104 to 116	$ 1,763,000	$ 1,466,000	1.20	$ 297,000
Values based on 100 iteration runs, preliminary cost estimates, and only include structure, content, & armor damage							
*Value indicates the norizontal seaward extension of the dune and entire profile (feet). At a minimum, the 2015 dune profile is maintained.							
**Value indicates the horizontal seaward extension of the berm (feet) in addition to the dune and profile extension.							

3.10 THE RECOMMENDED PLAN

Typically, the NED plan becomes the Recommended Plan unless the non-federal sponsor opts to pursue a Locally Preferred Plan (LPP) which differs from the NED plan. An LPP is subject to the requirements described in ER 1105-2-100. The option of selecting an LPP was coordinated with the local sponsor, who opted not to pursue an LPP. The NED plan therefore is the Recommended Plan.

Alternative 6 is the Recommended Plan. The economic results presented in this section reflect the costs in the Total Project Cost Summary (TPCS) found in Appendix B – Cost Engineering and Risk Analysis. Therefore the results presented here will differ slightly from the values presented in previous sections.

The Beach-fx model results describing the physical performance of the Recommended Plan will not change from the simulation run for the final array of alternatives. These results are independent of the project costs. The physical performance results most relevant to the economic analysis are the nourishment volumes and the timing of nourishment events.

The average initial construction volume over 100 Beach-fx iterations is 1,310,000 cubic yards. The average volume of individual future periodic nourishments over 100 iterations is 866,000 cubic yards.

Beach-fx reaches correspond, approximately, with FDEP R monuments. The shoreline extent of the Recommended Plan (Alternative 6), from Beach-fx reaches 104 to 116, corresponds to a shoreline length spanning from R monuments R103.5 to R116.5. A detailed description of the Recommended Plan is included in the next chapter.

3.10.1 INCREMENTAL JUSTIFICATION OF THE RECOMMENDED PLAN

ER 1105-2-100 Appendix E, E-3 c (2) defines a "separable element" as, "…any part of a project which has separately assigned benefits and costs, and which can be implemented as a separate action (at a later date or as a separate project). Separable elements so considered are similar to the planning concept of

last added increments, with the added idea of separation or detachment of the increment from the whole." "Separable elements usually must be incrementally justified."

Incremental analysis has been incorporated throughout plan formulation. The original study reaches, South Ponte Vedra Beach, Vilano Beach (R104 – R117), Vilano Beach (R117 – R122), and Summer Haven were designated based on geography, erosion rates, and the ability to be constructed as separable elements. As described earlier in this report R117 – R122 of the Vilano Beach reach was screened out due to the limited potential for justification. The Summer Haven reach was screened out for similar reasons. Figure 3-1 then screened and scaled potential alternatives, further refining the incremental analysis within the separable reaches. Finally, the South Ponte Vedra Beach reach was screened out, supported in part by the fact that it was separable from the Vilano Beach reach. Further formulation of the Recommended Plan then proceeded for the justifiable shoreline length.

On a long straight sandy coast like the Recommended Plan area, it is assumed that a project of less than approximately one mile of shoreline length would not be implemented as a separate action or project. Therefore the Recommended Plan area was divided into three separable elements of roughly one mile, as shown in Table 3-5.

Table 3-5. Incremental Analysis of the Recommended Plan (discount rate of 3.125%).

JUSTIFICATION OF SEPARABLE ELEMENTS (AVERAGE ANNUAL TERMS)				
Model Reaches	Capped Benefits Per Separable Element	Certified Placement Cost Per Separable Element	Capped Net Benefits Per Separable Element	Approx Length of Separable Elements (miles)
104-107	$ 737,000	$ 317,000	$ 420,000	0.8
108-111	$ 527,000	$ 344,000	$ 183,000	0.8
112-116	$ 1,053,000	$ 449,000	$ 604,000	1

As shown in Table 3-5, each separable element has positive net benefits, demonstrating that each is incrementally justified. Figure 3-3 presents the same data with the blue line indicating that net benefits remain positive across all three elements.

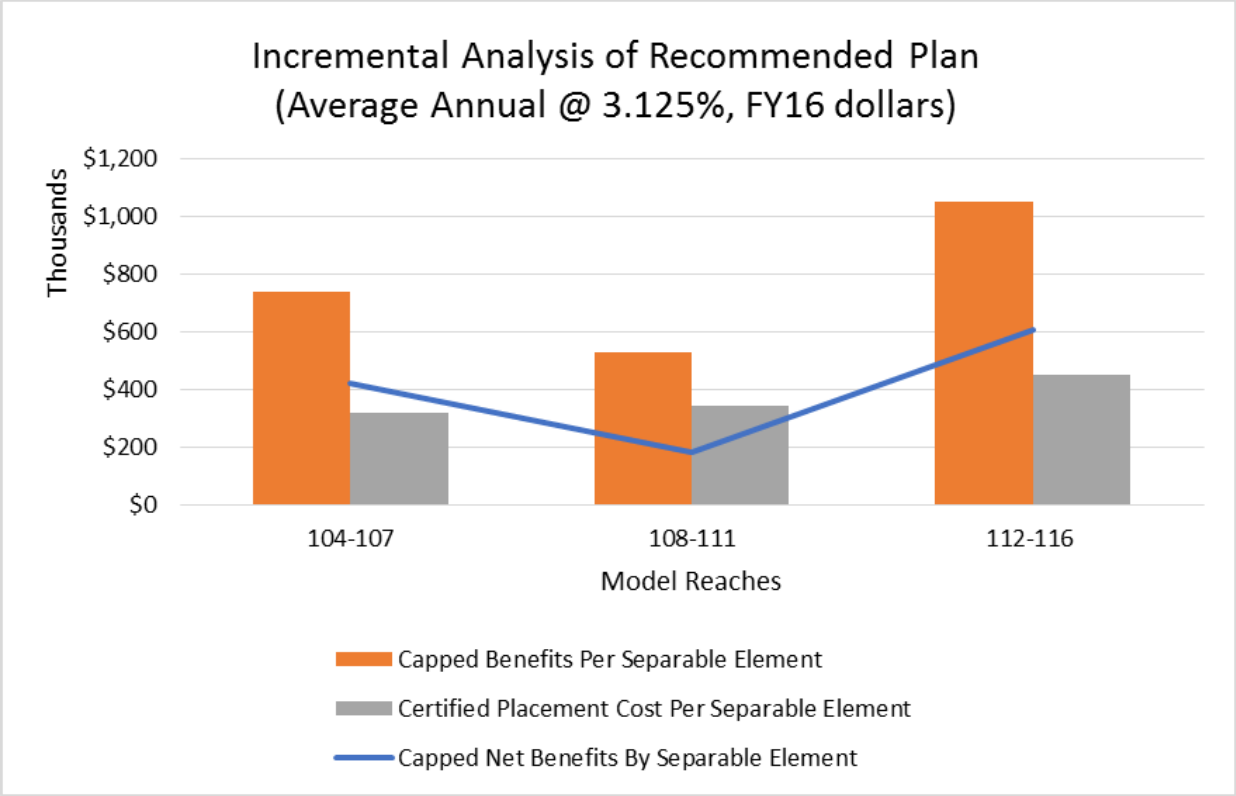

Figure 3-3. Incremental analysis of the Recommended Plan. Calculation includes primary storm damage reduction benefits and incidental recreation benefits capped at 50% of total benefits needed for justification.

CHAPTER 4
RECOMMENDED PLAN

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4 RECOMMENDED PLAN

The Recommended Plan will provide Coastal Storm Risk Management (CSRM) to a number of residences and commercial structures, including 105 single-family residences, 9 multi-family residences, and 5 commercial structures.

The Recommended Plan will also reduce damages to a key piece of critical infrastructure, SR A1A, increasing the accessibility of the Recommended Plan area and uninterrupted ingress/egress of emergency vehicles and affected population during storm events, as well as the daily traffic count of up to 14,000 vehicles per day (http://www2.dot.state.fl.us/floridatrafficonline/viewer.html).

According to the 2010 census, there are approximately 2,500 residents within the Recommended Plan area, and this population increases periodically throughout the year due to tourism. Notably, tourism can increase the population during summer months when the Recommended Plan area is most susceptible to hurricanes.

- **Description:** The Recommended Plan is Alternative 6, which includes construction of a 60- foot equilibrated berm extension from R103.5 to R116.5 along 2.6 miles of shoreline. The project template will include a dune feature that reflects the average 2015 dune position. Maximum length tapers of one thousand feet will extend from the northern and southern ends of the berm extension, connecting the extension to the existing shoreline. The addition of tapers results in sand placement from R102.5 to R117.5 along 3 miles of shoreline. A dredge will be used to fill the template with sand from the St. Augustine Inlet system, including the ebb, flood, Vilano Point shoals, and the Federal navigation channel and any associated shoals.
- **Average # Nourishment Events:** 1 initial construction event, 3 periodic nourishment events
- **Average Volume of Initial Construction**: 1,310,000 cubic yards
- **Average Volume of Each Periodic Nourishment**: 866,000 cubic yards
- **Average Periodic Nourishment Interval**: 12 years
- **Initial Construction Duration**: approximately 3.3 months

4.1 PROJECT DESIGN

The project design can be described by three factors; the dimensions of the dune, dimensions of the berm, and shoreline slopes.

4.1.1 PROJECT DUNE

Existing dune elevations in the Recommended Plan area are between +14 and 20 feet NAVD88, generally increasing moving from south to north. Evaluation of the design alternatives has shown that the existing elevations, when combined with berm and/or dune extension, provide sufficient protection. Therefore, no additional elevation is included in the selected design plan.

Table 4-1. Generalized Dune Characteristics of the Recommended Plan Area.

R monuments	Dune Height (ft-NAVD88)	Dune Width (ft)
R100 to R111	20	150
R112 to R114	20	30
R115 to R117	14	110

Within the area encompassed by the Recommended Plan, the average dune width ranges between 110 feet and 150 feet, with the exception of the R112 to R114 area, which is only 30 feet wide (Table 4-1). Although the Recommended Plan does not include widening the existing dune, any erosion of material from the existing idealized dune template (i.e., the 2015 generalized profile) will be replaced during nourishment events. Therefore, the existing 2015 idealized dune template will be restored accordingly during initial construction and periodic nourishment of the project and is noted as an important feature of the project.

4.1.2 PROJECT BERM

The design berm elevation for the project area is +8.0 feet NAVD88, which is approximately at the natural berm elevation. Restricting the design berm elevation to the natural berm elevation minimizes scarping of the beach, which hinders beach access by nesting sea turtles and can pose safety problems for recreational beach use. Other reasons for following the natural berm elevation are related to storm damage reduction. A berm constructed at a lower elevation would increase the probability of overtopping by storm surge, thereby offering less protection to upland development and/or existing dunes. A higher berm elevation could result in backshore flooding due to excessive rainfall or wave/surge overtopping. A higher berm may also be more susceptible to wind-induced erosion.

The Recommended Plan includes a 60-foot extension of the +8 foot NAVD88 contour, sloping 1V:10H to the 0.0 foot NAVD88 contour, and a 60-foot extension of the existing subaqueous (below water) profile. Figure 4-1 shows a typical existing idealized profile and nourishment template. Following construction and equilibration of the profile, the beach dimensions are expected to approximate the idealized profile. Tapers of a maximum length of one thousand feet will extend from the northern and southern ends of the berm extension, connecting the extension to the existing shoreline.

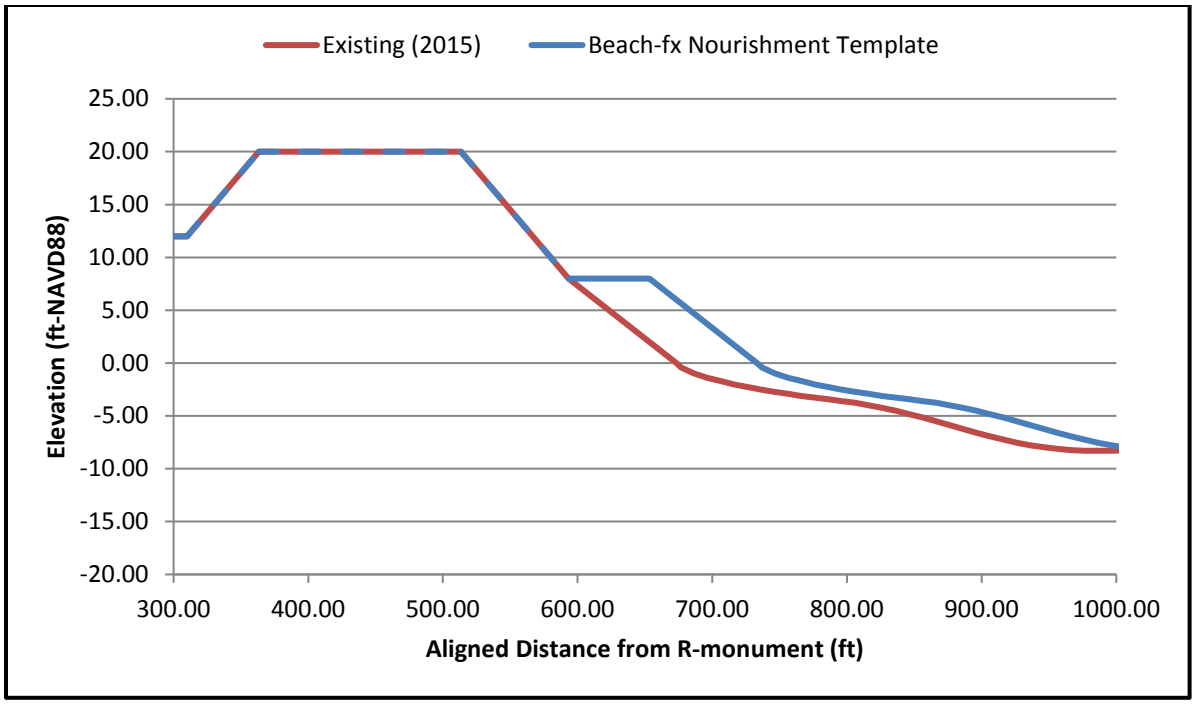

Figure 4-1. Typical Existing Idealized Profile and Nourishment Template.

4.1.3 PROJECT BEACH SLOPES

After waves adjust and sort the placed sand, the sand is expected to settle into an equilibrium beach slope, similar to the native beach. The native beach slopes in the area of the Recommended Plan vary between 1V:5H (1 vertical foot for every 5 horizontal feet) to 1V:10H at the dune, between 1V:9.09H and 1V:10H along the berm to the water's edge, and are round 1V:50H from the water's edge to -12 foot NAVD88. The estimate of the slope of the material after adjustment is based on averaging the beach profile slopes of the native beach from the mean low water datum to the approximate location of the 12-foot depth contour. Since sand from the sand source was determined to be a near match to the gradation of the existing beach, it is expected that the placed sand will equilibrate to a shape similar to the existing profile.

It is unnecessary and impractical to artificially grade beach slopes below the low water elevation since they will be shaped by wave action. For this reason, the front slope of the sand placed at the time of construction may differ from that of the natural profile. The final slope of the placed sand depends on the characteristics of the sand and the wave climate in the project area. With steep initial slopes, the sand will quickly adjust to the natural slopes.

4.1.4 PROJECT VOLUMES

The average initial construction volume over 100 Beach-fx iterations is 1,310,000 cubic yards. The average volume of individual future periodic nourishments over 100 iterations is 866,000 cubic yards. These are average volumes based on Beach-fx modeling. The Engineering Appendix includes detailed description on how these averages are reached and the variability that can be expected.

4.1.5 PROJECT CONSTRUCTION

The Recommended Plan includes a 60-foot berm extension from the +8.0 foot NAVD88 2015 contour out to the depth of closure between R monuments 103.5 and 116.5. Tapers of a maximum length of one thousand feet will extend from the northern and southern ends of the berm extension, connecting the extension to the existing shoreline, resulting in a maximum length of placement between R monuments R102.5 and R117.5. The +8.0 foot NAVD88 2015 contour includes perturbations due to the natural undulations of the shoreline, as well as shoreline armoring (revetments) in select locations, but overall is rather smooth and straight. It will be necessary during the project engineering and design (PED) phase to establish a smooth, relatively straight, base construction line that will allow the project to perform as predicted during the Beach-*fx* shoreline analysis. The location of the +8.0 foot NAVD88 2015 contour serves as the basis for creating the baseline which will be tailored to provide the approximate amount of material predicted for initial construction by Beach-*fx*.

As previously discussed, the front slope of the beach-fill placed at the time of construction, or future renourishment, may differ from that of the natural profile. This reflects the capabilities of the construction equipment that will be used to build the shore protection project. Within the first year or two after placement of the beach-fill, the construction profile will be reshaped by waves into an equilibrium profile, causing the berm to retreat to a position more characteristic of the project design template.

4.1.6 RENOURISHMENT EVENTS

As stated, the Recommended Plan includes a 60-foot berm extension and maintenance of the existing (2015) idealized dune. The existing beach is therefore the minimum acceptable profile.

Traditionally, in CSRM studies, a fixed renourishment interval is defined and optimized for the 50-year period of Federal participation. In Beach-fx, rather than having a fixed renourishment interval, renourishment events are triggered when specific criteria are met. The triggers were set up to simulate a point at which the berm extension erodes to at least half its equilibrated width in at least one reach, and a minimum volume of 750,000 cubic yards has eroded from the entire project template. Based on these parameters, the average time interval between nourishment events over all 100 iterations is 12 years. In reality, this interval could vary significantly depending on erosion and storm events. More information about the renourishment triggers is provided in the Engineering Appendix.

Planning of renourishment events will be based on performance of the project. A survey of the project area (such as a monitoring or post-storm survey) will be analyzed to determine if berm erosion is progressing as expected. Volume changes between the latest survey, the design template, and the construction template will be calculated. If the project has lost sufficient volume due to storms, a renourishment may be necessary. Beach-fx has been used to determine the average renourishment interval of 12 years. It should be emphasized that this is an average and the need to renourish the project could occur before, or after, this period depending on storm events. The Engineering Appendix provides additional detail on renourishment triggers.

The average volume of individual future periodic nourishments over 100 iterations is 866,000 cubic yards. With an average time interval of 12 years, the nourishment years would be 2020 for initial construction, followed by the following years for periodic nourishment: 2032, 2044, and 2056. An additional volume of sand will be placed in 2056 to carry the project throughout its period of Federal participation. It would be uneconomical to plan for a periodic nourishment in 2068 with only two years left in the period of Federal participation.

4.1.7 PROJECT MONITORING

Physical monitoring of the recommended project is necessary to assess project performance and to ensure that project functionality is maintained throughout the 50-year period of Federal participation in the project. The monitoring plan will be directed primarily toward accomplishing systematic measurements of the beach profile shape. Profile surveys should provide accurate assessments of dune and beach-fill volumes and a basis for assessing post-construction dune and beach-fill adjustments, as well as variation in the profile shape due to seasonal changes and storms. Monitoring will play a vital role in determining if project renourishment is necessary. Post-construction monitoring activities include topographic and bathymetric surveys of the placement area and adjacent areas on an annual basis for 3 years following construction and then biannually until the next construction event. Other monitoring efforts include bathymetric surveying of the sand source, which will be done as part of the pre-construction engineering and design (PED) phase prior to each nourishment. Measured wind, wave, and water level information will be obtained from the best available existing data sources. This data will be applied in support of previously discussed monitoring efforts. It will also be used to periodically assess the state of sea level rise and to determine if reassessment of the project volumes and/or renourishment intervals is required.

4.1.8 OPERATIONS AND MAINTENANCE CONSIDERATIONS

33 U.S. Code § 426e (Federal aid in protection of shores) states, "When in the opinion of the Chief of Engineers the most suitable and economical remedial measures would be provided by periodic beach nourishment, the term "construction" may be construed for the purposes of sections 426e to 426h–1 of

this title to include the deposit of sand fill at suitable intervals of time to furnish sand supply to project shores for a length of time specified by the Chief of Engineers." By this provision, periodic nourishment is considered construction and not maintenance, and therefore is cost shared. The Recommended Plan involves initial construction and periodic nourishment, and is technically "beach nourishment." Physical (topographic and bathymetric) and environmental surveys supporting beach nourishment are cost-shared activities included in the total project cost. The operations, maintenance, repair, rehabilitation, and replacement (OMRR&R) anticipated for this project includes any necessary long-term topographic and bathymetric surveys (different from those supporting beach nourishment activities) of the placement area and adjacent areas, and a monitoring report on an annual basis for 3 years following construction and then biannually until the next construction event. Other OMRR&R items may include revegetating the dune as needed between nourishment activities (per Policy Guidance Letter No. 27 (11/17/92)), scarp repair, and beach tilling. The operations and maintenance will also include the items of local cooperation. These items entail publicizing floodplain information, ensuring continued conditions of public ownership and use of the shore, performing surveillance of the beach, and any specific directions prescribed by the government. Based on the size and scope of the Recommended Plan and the cost of similar activities for similar projects, the annual costs for OMRR&R are estimated to be $35,000 per year.

Operations and maintenance is borne 100% by the non-federal sponsor and is detailed in the Project Partnership Agreement (PPA). An Operations and Maintenance Manual will be completed by USACE and provided to the sponsor following completion of initial construction.

4.2 RECOMMENDED PLAN SAND SOURCE

As plan formulation proceeded, it was determined that the available offshore sand sources were too far from the Recommended Plan project area to be cost effective. Use of navigation channels and inlet material had been discussed, and these sources are closer to the project area than offshore sand sources and therefore more cost effective. During a Value Engineering (VE) analysis, discussion of sand sources focused on the St. Augustine Inlet system, including the ebb, flood, and Vilano Point shoals, as well as the Federal navigation channel. These sources are projected to be cost effective and able to provide the needed volume of sediment to both the Recommended Plan and the ongoing Federal coastal storm risk management project at St. Augustine Beach without negatively impacting the inlet system.

The Recommended Plan will require approximately 5,640,000 cubic yards of sand over a 50-year period. The FDEP "Final Order Adopting St. Augustine Inlet Management Implementation Plan," directs that strategies should be implemented to:

1. Continue to transfer sediment from the inlet system to the adjacent beaches, meeting a bypassing objective of 278,000 cubic yards per year, as determined by the Inlet Sink Analysis, provided in the document, *Regional Sediment Budget for St. Augustine Inlet and St. Johns County, FL, 1998/1999-2010* (USACE, 2012). The material obtained from the inlet system shall be distributed to the adjacent Atlantic Ocean-fronting beaches, with a placement ratio of approximately one third of material placement to the north and two thirds of material placement to the south.

2. Inlet sand transfer material shall be placed in designated critically eroded areas to the north or south of the inlet between R84 and R152, St. Johns County, in accordance with Implementation Strategy #1.
3. Inlet dredge material may be obtained from the Federal navigation channel, the intracoastal waterway channel, and encroaching flood shoals adjacent to the Federal channel, including the Porpoise [Vilano] Point borrow area, for placement in accordance with Implementation Strategies #1 and #2.

The Recommended Plan area is to the north of St. Augustine Inlet, between R102.5 and R117.5. As detailed in the Geotechnical Appendix, there is adequate beach quality sand (meeting FDEP permitting requirements for beach placement) to meet the estimated sand needs of the Recommended Plan. Currently, there is approximately 6.5 million cubic yards of compatible sand available within the inlet system. This volume is more than adequate to meet the initial construction volume. The periodic nourishment volume is 866,000 cubic yards every 12 years. The inlet management plan states that the bypassing objective is 278,000 cubic yards per year, of which one third should go to beaches to the north. One third of the bypassing objective is 92,666 cubic yards per year. Over 12 years, 1.1 million cubic yards would be available to meet the 866,000 cubic yard need for a periodic nourishment event.

Use of the inlet system would implement a Regional Sediment Management (RSM) strategy where maintenance of Federal navigation features can be combined with a Federal CSRM project, realizing significant cost savings. It would be ideal if construction of the Recommended Plan could be coordinated with future construction of the already authorized and constructed Federal Shore Protection Project at St. Augustine Beach, south of the inlet. Such a strategy would realize significant cost savings and minimize potential environmental impacts from multiple dredge mobilizations, as outlined in the Engineer Research and Development Center (ERDC) 2016 technical report, *Regional Sediment Management Strategies for the Vicinity of St. Augustine Inlet, St. Johns County, Florida,* ERDC/CHL TR-16-12.

The existing Federal Shore Protection Project at St. Augustine Beach uses a hydraulic dredge to acquire sand from the St. Augustine Inlet system, and the Recommended Plan could potentially use the same dredge. Dredging of the Federal navigation channel through St. Augustine inlet also typically uses a hydraulic dredge. Therefore three Federal projects in the same vicinity could potentially use the same plant for construction or maintenance. Each time construction or maintenance of the projects could be combined would result in minimization of environmental impacts and a cost savings of at least $4,000,000 by combining three separate dredge mobilization into one.

The existing St. Augustine Project has an average periodic nourishment interval of every five years. The Recommended Plan has an average periodic nourishment interval of twelve years. Since the given intervals are average it is likely that the periodic renourishments, or initial construction of the Recommended Plan, could coincide.

Use of the inlet system as the Recommended Plan's sand source is similar to any project's dependency on a sand source within state waters and subject to applicable regulation. The inlet system lies within CBRS Unit P05, and its use as a sand source for the Recommended Plan has been coordinated with the U.S. Fish

and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), and the state, as documented elsewhere in this report. Given this coordination and the agencies' concurrence that the intended use is acceptable and beneficial to the coastal system, there is low risk that the source will become unusable in the future and another sand source will be required.

4.3 SEA LEVEL RISE CONSIDERATIONS

An important question about the Recommended Plan is its performance under different Sea Level Change scenarios. As discussed earlier in this report, the study area is experiencing Sea Level Rise (SLR). Each of the SLR scenarios described earlier are considered equally likely to occur. Therefore, if the project does not perform, then it cannot be considered a completely effective plan. Table 4-2 shows the average BCRs and net benefits of the Recommended Plan under the three SLR scenarios.

Table 4-2. Recommended Plan Benefits and Costs (AAEQ@2.875%) for different SLR scenarios.

SLR Scenario	AAEQ Benefits	AAEQ Costs	BCR	Net AAEQ Benefits
Base SLR	$ 1,683,000	$ 1,719,000	0.98	$ (37,000)
Intermediate SLR	$ 2,221,000	$ 1,996,000	1.11	$ 225,000
High SLR	$ 2,694,000	$ 2,593,000	1.04	$ 100,000

*Based on 100 iteration runs and only include structure, content, and armor damage.

As shown in Table 4-2, though the average benefits of the project increase in the SLR scenarios, the average costs also increase. The costs increase because renourishment is triggered more frequently. Thus, the project performance (in terms of the benefit-cost ratio) is relatively constant throughout the SLR scenarios. Overall, these results suggest that the Recommended Plan is effective in all three simulated SLR scenarios.

4.4 LAND LOSS AND RECREATION BENEFITS

In outlining the process and procedures to be used in the evaluation of CSRM projects, ER-1105-2-100 mentions the inclusion of land loss due to erosion, stating that such damages should be computed as the market value of the average annual area expected to be lost. Prevention of land loss is a component of primary storm damage reduction benefits but is not computed within the Beach-fx model. Thus, calculation of land loss benefits must be completed outside of the model and added to the structure and contents damage and armor costs benefits to obtain the total storm damage reduction benefits of the project.

Following the guidance provided, two key pieces of information are needed to calculate the land loss benefits of a CSRM project: (1) the square footage of land lost each year, and (2) the market value of land in the project footprint. The Economics Appendix provides detail on how the square footage of land loss each year was calculated. As the second component of the land loss benefits calculation, ER 1105-2-100

instructs that nearshore land values be used to estimate the value of land lost. The USACE, Jacksonville District Real Estate Department estimated a nearshore land value of $14.00 per square foot for the St Johns Study Area.

Using the analysis technique described, the total present value of land loss benefits over the 50-year period of Federal participation is estimated at $7,314,000, or $278,000 in average annual terms (2.875% discount rate).

According to ER-1105-2-100, incidental recreation benefits can be calculated for CSRM projects. While recreation benefits cannot make up more than 50% of the total benefits needed for project justification, the guidance states, "if the criterion for participation is met, then all recreation benefits are included in the benefit to cost analysis."

Additionally, ER-1105-2-100 specifies that benefits arising from recreation opportunities created by a project be measured in terms of willingness to pay. As described in the Economics Appendix, the unit day value (UDV) method was used to calculate the incidental recreation benefit provided by the Recommended Plan, resulting in an estimated total present value of recreation benefits of $18,224,000 or $692,000 average annual terms (2.875% discount rate). Table 4-3 provides a summary of the NED Plan with land loss and recreation benefits added, expressed in average annual equivalent terms.

Table 4-3. Economic Summary.

Economic Summary	Primary Storm Damage Reduction Benefits	Primary Storm Damage Reduction + Incidental Recreation Benefits
Price Level	FY17	FY17
FY17 Water Resources Discount Rate	2.875%	2.875%
Average Annual Structure & Contents Damage & Armor Costs Benefits	$1,683,000	$1,683,000
Average Annual Land Loss Benefits	$278,000	$ 278,000
Average Annual Incidental Recreation Benefits	$ -	$ 692,000
Average Annual Total Benefits	$1,961,000	$ 2,653,000
Average Annual Costs	$2,031,000	$2,031,000
Average Annual Net Benefits	**($70,000)**	**$622,000**
Benefit Cost Ratio	**0.97**	**1.3**

The total BCR, including CSRM, land loss, and incidental recreation benefits for the Recommended Plan, is equal to 1.3.

4.5 RECOMMENDED PLAN BENEFITS TO HURRICANE EVACUATION ROUTE SR A1A

As described elsewhere in this report, SR A1A is designated as a National Scenic and Historic Coastal Byway, is the only evacuation route for the region, and is a major north-south thoroughfare for the area. After the 2008 hurricane season, areas of the dune were eroded to within five feet of SR A1A in portions of the Vilano Beach reach around R115, within the southern-half of the Recommended Plan area. If SR A1A were to be breached in this location, any north/south access of emergency vehicles to affected areas, as well as any evacuating population, would be cut off. SR A1A is the evacuation route for approximately 6,000 residents on the barrier island. As shown in Figure 4-2, there are no other north/south roads in this vicinity. The Recommended Plan reduces the risk of damage to SR A1A and maintains its use as the only evacuation route, ingress/egress for emergency vehicles, as well as maintaining a corridor for the resident population to return once conditions are safe.

Figure 4-2: R115 vicinity, where past storms have eroded beach and dunes to within five feet of SR A1A. Damage to SR A1A in this area would significantly slow north/south ingress/egress for evacuating populations and emergency response vehicles. Breaching of SR A1A in this vicinity would completely cut off north/south transport as there is no other north/south route.

4.6 COMPLIANCE WITH EXECUTIVE ORDER (EO) 11988

EO 11988 requires Federal agencies to avoid, to the extent possible, the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities."

The Water Resources Council Floodplain Management Guidelines for implementation of EO 11988, as referenced in USACE ER 1165-2-26, require an eight-step process that agencies should carry out as part of their decision-making on projects that have potential impacts to, or within, the floodplain. The eight steps reflect the decision-making process required in Section 2(a) of the EO. The eight steps and responses to them are summarized below.

1. Determine if a proposed action is in the base floodplain; the area which has a one percent or greater chance of flooding in any given year.

Yes, the Recommended Plan footprint is within the base floodplain. However, this project reduces damages caused by erosion, and flooding (or inundation) does not cause significant future without-project damages.

2. If the action is in the base floodplain, identify and evaluate practicable alternatives to the action, or to location of the action, in the base floodplain.

This document has evaluated alternatives in earlier sections. Practicable measures and alternatives were formulated and evaluated, including non-structural measures such as acquisition of land and structures.

3. If the action must be in the floodplain, advise the general public in the affected area and obtain their views and comments.

Scoping letters were sent to all abutting property owners, and Federal and state agencies on August 17th, 2005, and on September 16, 2008, in fulfillment of NEPA requirements. Views and comments were received from residents, the FDEP, the Florida Fish & Wildlife Conservation Commission (FWC), the State Historic Preservation Office (SHPO), and NMFS.

4. Identify beneficial and adverse impacts due to the action and any expected losses of natural and beneficial flood plain values. Where actions proposed to be located outside the base floodplain will affect the base floodplain, impacts resulting from these actions should also be identified.

Potential impacts associated with the Recommended Plan are summarized in Chapters 3, 4, and 7 of this report. The project will not alter or impact natural or beneficial floodplain values.

5. If the action is likely to induce development in the base floodplain, determine if a practicable non-floodplain alternative for the development exists.

The project will not encourage development in the floodplain. Development is expected to continue whether or not the action is taken, as demonstrated by coastal development around the State of Florida in areas both with, and without, constructed Federal CSRM projects. The project provides benefits for existing development. The project will not change the base floodplain. Practicable measures and alternatives were formulated and evaluated earlier in this report, including non-structural measures such as acquisition of land and structures.

6. As part of the planning process under the Principles and Guidelines, determine viable methods to minimize any adverse impacts of the action, including any likely induced development for which there is no practicable alternative, and methods to restore and preserve the natural and beneficial flood plain values. This should include reevaluation of the "no action" alternative.

The project will not induce development in the floodplain, and the project will not impact the natural or beneficial floodplain values. Management measures and alternatives, including the No Action alternative, were evaluated and discussed earlier in this report.

7. If the final determination is made that no practicable alternative exists to locating the action in the floodplain, advise the general public in the affected area of the findings.

The Draft Feasibility Study and Environmental Assessment (EA) was released for public review on February 5, 2016. Comments received, and responses to the comments, have been incorporated into the report.

8. Recommend the plan most responsive to the planning objectives established by the study and consistent with the requirements of the Executive Order.

The Recommended Plan is the most responsive to all of the study objectives and is consistent with the requirements of EO 11988. This project reduces damages caused by erosion, and flooding (or inundation) does not cause significant future without-project damages.

4.7 FEDERAL IMPLEMENTATION RESPONSIBILITIES

USACE is responsible for budgeting for the Federal share of future Federal construction projects. Federal funding is subject to budgetary constraints inherent in the formation of the national civil works budget in a given fiscal year. USACE would perform the necessary preconstruction engineering and design (PED) needed prior to construction. USACE would meet requirements for the use of Federal lands at the borrow area, obtain water quality certification, coordinate with the state as required by the CZMA, and construct the project. Cost sharing of PED, initial construction, and periodic nourishment will be in accordance with WRDA 1986, as amended, subject to the availability of appropriations.

4.8 NON-FEDERAL IMPLEMENTATION RESPONSIBILITIES

The non-federal sponsor for the CSRM project will be St. Johns County. The non-federal project sponsor would provide an up-front cash contribution for initial construction costs of the proposed project. The amount of the non-federal up-front cash contribution would be based on cost-sharing principles reflecting shoreline use, ownership, and public access in existence at the time of construction. The non-federal sponsor shall provide the entire cost of all material placed on or seaward of private undeveloped lands and developed private lands (which are inaccessible to the public). The non-federal sponsor shall provide lands, easements, and rights-of-way and bear a portion of the administrative costs associated with land requirements. The non-federal project sponsor will be responsible for all costs of operation, maintenance, repair, rehabilitation, and replacement of project features. Section 402 of the 1986 Water Resources Development Act (33 USC 701b-12) as amended by Section 14 of the 1988 Water Resources Development Act, states that "Before construction of any project for local flood protection or any project for hurricane or storm damage reduction, that involves Federal assistance from the Secretary, the non-federal interests shall agree to participate in and comply with applicable Federal floodplain management and flood insurance programs." The non-federal sponsor and communities must be enrolled in, and in compliance with, the National Flood Insurance Program (NFIP) to receive Federal funding for a recommended storm damage reduction project. St. Johns County is enrolled in, and in compliance with, the NFIP.

4.9 RECOMMENDED PLAN COST SHARING

Cost-sharing percentages are based on ownership and use of parcels landward of where the full 60-foot equilibrated berm extension and 2015 dune feature will be placed. Parcels landward of the 1,000 foot tapers are not used to calculate cost sharing, but construction of the tapers will be cost shared in the calculated amount. For full Federal cost sharing, public access with adequate parking (or another way for the public to reach access, such as a public bus or beach shuttle) must be provided every ½ mile. Figure 4-3 includes public access and parking locations for the Recommended Plan area and depicts the shoreline lengths that are covered by adequate public access and parking.

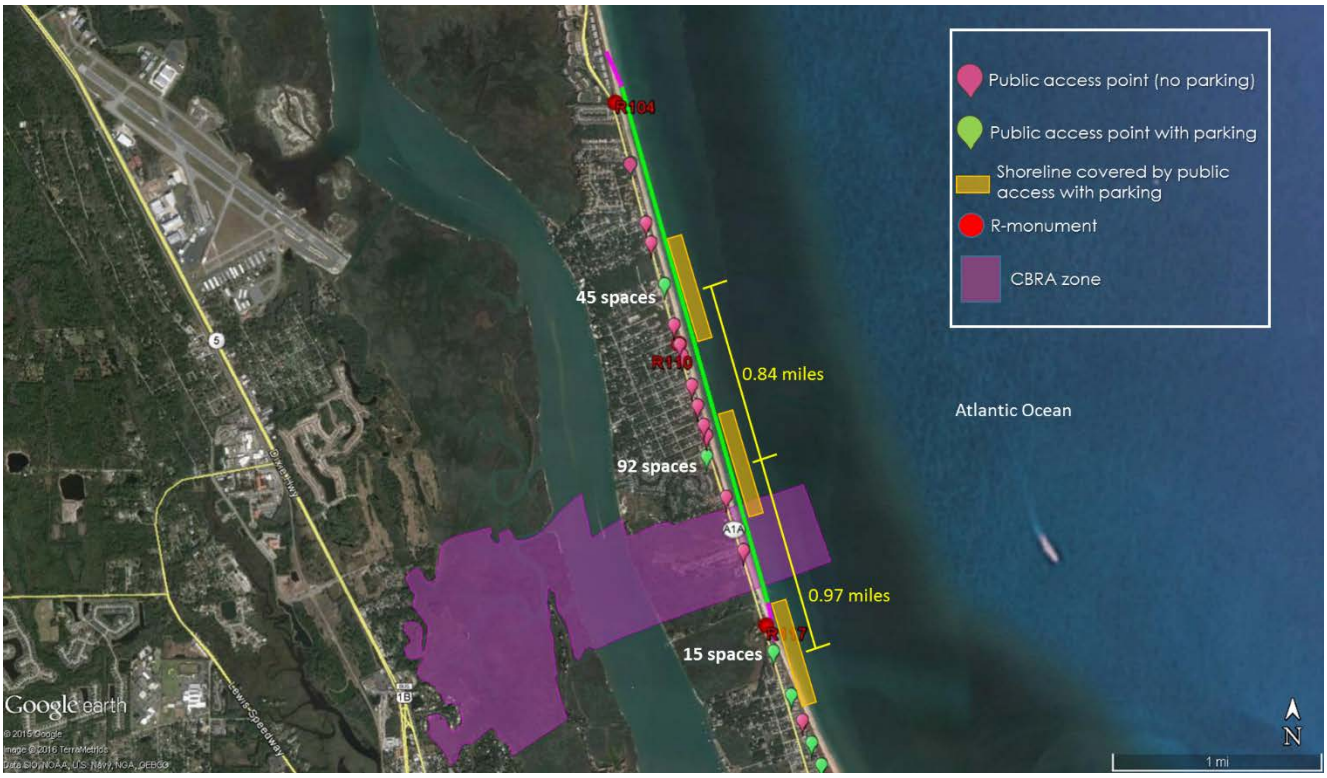

Figure 4-3. Public Access and Parking within the Recommended Plan Area.

The current cost share estimates are based on policy guidance provided by ER 1105-2-100, Appendix E and ER 1165-2-130. Cost sharing for this project is determined by section 103(c)(5)of WRDA 1986, which establishes a 65/35 cost share for CSRM. To provide for other than the cost sharing established in section 103, statutory language directing a different cost sharing percentage would have been required. The WRDA of 1999 changed the cost sharing policy previously provided by WRDA 1986 by setting the non-federal share of periodic nourishment carried out after January 1, 2003 to 50% for projects authorized for construction after December 31st, 1999. Table 4-4 shows the Federal and non-federal cost sharing for the Recommended Plan. Additional detail on how percentages were calculated is given in Appendix F. Changes to shoreline ownership and use prior to construction could change the stated cost sharing percentages. Cost sharing for initial construction is 23.0% Federal / 77.0% non-federal. Cost sharing for periodic nourishments is 17.7% Federal / 82.3% non-federal.

Table 4-4. Recommended Plan Cost Sharing.

	INITIAL CONSTRUCTION				PERIODIC NOURISHMENT*		
Shore Ownership and Project Purpose (as defined in ER 1105-2-100)	Maximum Level of Federal Participation in Construction Costs	Shoreline Length (feet)	Shoreline Length x Federal Participation %	Shoreline Length x non-Federal Participation %	% of Federal Participation for Periodic Nourishment	Shoreline Length x Federal Participation %	Shoreline Length x non-Federal Participation %
I. Federally Owned	100%	0	0	0	100%	0	0
II. Publicly and Privately Owned, Protection Results in Public Benefits							
A. Coastal Storm Risk Management (CSRM) on Developed Lands (Public/Private)	65%	3,835	2,493	1,342	50%	1,918	1,918
B. CSRM on Undeveloped Public Lands **	65%	948	616	332	50%	474	474
C. CSRM on Undeveloped Private Lands	0%	603	0	603	0%	0	603
III. Privately Owned, Use Limited to Private Interests (No public access within 1/4 mile)	0%	5,922	0	5,922	0%	0	5,922
IV. CBRA Zone	0%	2,190	0	2,190	0%	0	2,190
	Total Distance:	13,498	3,109	10,389	Total Distance:	2,392	11,107
	Cost Shares:		23.0%	77.0%	Cost Shares:	17.7%	82.3%

4.10 RECOMMENDED PLAN COSTS

The Recommended Plan total project cost, including contingency, is $78,417,000, as shown in Table 4-5 (FY17 price levels). The Cost Appendix provides additional detail.

Table 4-5. Recommended Plan Cost Summary (Project First Cost) (FY17 Price Levels).

	Cost Summary (Project First Costs) (FY17 Price Levels)			
	St. Johns County, FL CSRM Project			
	R102.5 - R117.5 (total placement area, including tapers)			
		INITIAL CONSTRUCTION		PERIODIC NOURISHMENT
WBS	**Item**	**Total Item Cost**		**Total Item Cost**
017	Mob/Demob	$3,052,000		$9,147,000
017	Beach Fill	$10,110,000		$21,138,000
017	Associated General Items	$254,000		$597,000
	Subtotal	$13,416,000		$30,882,000
01	Real Estate			
01	- lands and damages	$0		$0
01	- administrative	$2,514,000		$0
	- Federal admin.	$1,571,000		$0
	- non-federal admin.	$943,000		$0
30	PED	$1,203,000		$4,884,000
31	Construction Management	$1,096,000		$2,574,000
017	Dune vegetation	$1,009,000		$3,027,000
30	Post-Project Monitoring	$164,000		$493,000
	Subtotal	$5,986,000		$10,978,000
	Contingency (28%)	$5,432,000		$11,721,000
	Total	**$24,834,000**		**$53,583,000**
	Total Project Cost for 50 year period of Federal participation = $78,417,000			

Table 4-6 displays cost sharing for the Recommended Plan.

Table 4-6. Recommended Plan Cost Sharing (Project First Cost) (FY17 Price Levels).

St. Johns County, FL CSRM Project					
Summary of Project Cost Sharing (Project First Costs) (FY17 Price Levels)					
R102.5 - R117.5 (total placement area, including tapers)					
Initial Construction					
Item	Federal Cost Share	Federal Cost	Non-federal Cost Share	Non-federal Cost	Project First Cost
Coastal Storm Risk Management Costs	23.0%	$5,712,000	77.0%	$19,122,000	$24,834,000
Non-federal LERRD Contribution*	0.0%	$0	100.0%	$943,000	
Non-federal Cash Contribution				$18,179,000	
Periodic Nourishment					
Periodic Nourishment	17.7%	$9,484,000	82.3%	$44,099,000	$53,583,000
Initial Construction + Periodic Nourishment					
Final Project Cost Share and Cost (50 years)	-	$15,196,000	-	$63,221,000	$78,417,000
* Includes non-federal admin costs only					
NOTE: Dollar values are rounded					

4.11 HURRICANE MATTHEW (2016) EROSION IMPACT ANALYSIS

Hurricane Matthew, a strong category 3 hurricane, impacted northeast Florida from October 6th through 8th, 2016. The storm caused structural damage and dune erosion throughout the Recommended Plan area as shown in Figure 4-4, Figure 4-5, and Figure 4-6. An evaluation was completed to determine if the volume of sand eroded by Hurricane Matthew was significant enough to warrant reanalysis of the Recommended Plan.

Figure 4-4. Hurricane Matthew damage in the vicinity of R114 on Oct. 8, 2016. Note erosion of sand below house. Image courtesy of Florida Department of Environmental Protection.

Figure 4-5. Hurricane Matthew damage in the vicinity of R116 on Oct. 8, 2016. Note top of vinyl sheet pile seawall emerging from sand in foreground and dune scarping and erosion below pile-supported homes. Image courtesy of Florida Department of Environmental Protection.

Figure 4-6. Hurricane Matthew damage in the vicinity of R116 on Oct. 10, 2016. Note debris from destroyed dune walkovers and other structures. Note dune scarping and erosion below house. Image courtesy of Florida Department of Environmental Protection.

For the evaluation, pre and post-storm LIDAR data collected by USACE was compared. Figure 4-7 includes pre and post-storm profiles showing the dune erosion experienced at R111, near the middle of the recommended plan area. Along the recommended plan shoreline approximately 165,000 cubic yards was eroded from the dune as a result of Hurricane Matthew. Erosional losses to the berm were minimal, as the sand eroded from the dune was spread out over the berm and nearshore area. The portions of the berm that did erode are expected to experience natural recovery in the months following the storm. However, natural recovery of dunes can take a very long time.

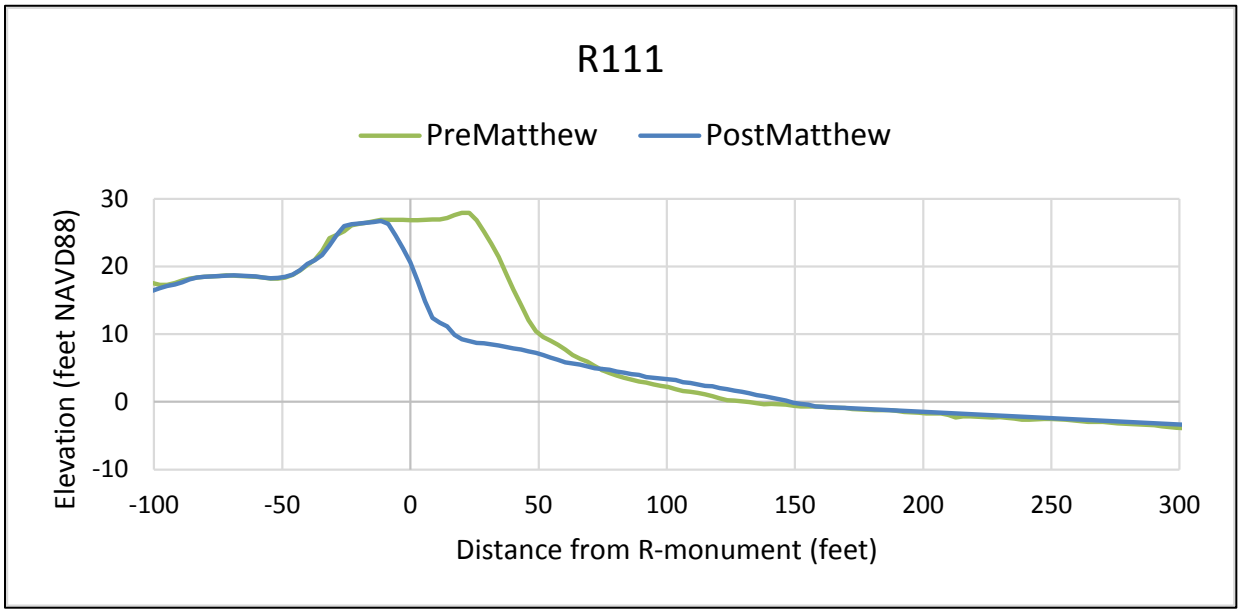

Figure 4-7. Pre and Post-Storm LIDAR Profiles at R111.

This result indicates that approximately 165,000 cubic yards of additional sand could be needed for initial construction in 2020. This volume is a relatively small amount and does not take into account any natural recovery of the dune that could occur prior to 2020. Furthermore, to understand how this volume compares to the Recommended Plan's initial construction volume of 1,310,000 cubic yards, it is important to consider the probabilistic nature of Beach-*fx*.

Each complete Beach-*fx* model run consists of 100 iterations, with each iteration representing the 50-year planning horizon for the project. Each iteration, therefore, has a unique volume requirement for initial construction. Based on the Recommended Plan modeling, a range of volumes was determined for each initial construction event. The average initial construction volume modeled in Beach-*fx* is 1,310,000 cubic yards with a standard deviation of 189,000 cubic yards. The estimated 165,000 cubic yards of additional volume needed for initial construction as a result of Hurricane Matthew's impact is within the standard deviation for the initial construction volume. The range of volumes for initial construction are shown in Table A-21 of the Engineering Appendix.

Regarding potential cost impacts, quantity estimates are the primary cost risk driver identified in the cost schedule risk analysis, and the potential 13% increase in initial construction volume caused by Hurricane Matthew is covered by the 28% cost contingency for the Recommended Plan. In conclusion, the erosion impacts of Hurricane Matthew are included in the risk and uncertainty used to develop the Recommended Plan and re-analysis is not recommended.

4.12 FINANCIAL ANALYSIS OF NON-FEDERAL SPONSOR'S CAPABILITIES

A financial analysis is required for any plan being considered for USACE implementation that involves non-federal cost sharing. The ultimate purpose of the financial analysis is to ensure that the non-federal sponsor understands the financial commitment involved and has reasonable plans for meeting that commitment. By memorandum dated April 24, 2007, the Assistant Secretary of the Army (Civil Works), granted approval of the self-certification of the non-federal sponsors for their ability to pay the non-federal share of projects. The self-certification is required prior to submission of the Project Partnership Agreement, typically during the PED phase of the project. Included with the self-certification, the financial analysis shall include the non-federal sponsor's statement of financial capability, the non-federal sponsor's financing plan, and an assessment of the sponsor's financial capability.

4.13 VIEWS OF NON-FEDERAL SPONSOR

St. Johns County is the non-federal sponsor for the Recommended Plan. They have been an integral part of the Project Delivery Team (PDT) from the conception of the project. At each step of the process, St. Johns County has contributed to the available information, participated in the formulation, and reviewed the products. St. Johns County supports the Recommended Plan.

CHAPTER 5

EFFECTS OF THE RECOMMENDED PLAN

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5 EFFECTS OF THE RECOMMENDED PLAN*

The effects of the Recommended Plan will include effects resulting from the use of the offshore sand sources identified in Section 2.2.5. The sand source is not included in the Recommended Plan; however, effects of the sand mining are discussed in the event that offshore sand may be sought as a borrow source in the future if economically justified.

5.1 GENERAL ENVIRONMENTAL EFFECTS*

The environmental effects associated with the Recommended Plan are primarily temporary in nature, and most affected resources would return to pre-construction conditions either immediately after dredging (with respect to resources such as aesthetics and noise) or within one or two years (with respect to sea turtle nesting and benthic resources). However, dredging inlets and altering the shoreline has the potential to change how sediment transport occurs regionally. The use of the St. Augustine Inlet was extensively studied, and the FDEP Inlet Management Plan supports the usage of the inlet system as identified in the Recommended Plan.

5.2 NATURAL (GENERAL) ENVIRONMENT*

This section is the scientific and analytic basis for the comparisons of the alternatives. Section 2 includes the effects resulting from the "no action alternative," or the "future without-project conditions (FWOP)." The following section includes anticipated changes to the existing environment including direct, indirect, and cumulative effects as a result of the Recommended Plan, or the "future with-project conditions."

5.2.1 GENERAL CONDITIONS

5.2.1.1 ST. AUGUSTINE INLET

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

Since the St. Augustine Inlet is currently maintained at a depth of 16 feet, the future with-project condition will not change the inlet. USACE modeled the sediment transport patterns in the ebb shoal of the inlet, and dredging the ebb shoal in the quantities proposed in the Recommended Plan will not increase shoaling rates associated with the inlet. The material from the inlet system will be distributed to the beaches north and south of the inlet in accordance with the FDEP Inlet Management Plan, which corresponds to the volumes outlined in the Recommended Plan.

If the offshore sand sources are used, there may be increased shoaling in the St. Augustine Inlet due to the increased volume of material in the sediment budget. However, the inlet will continue to be maintained as part of the Federal inlet and Intracoastal Waterway (IWW) projects. Therefore, no significant changes to the inlet are expected to occur.

5.2.1.2 SOUTH PONTE VEDRA AND VILANO BEACH

The Recommended Plan includes beach placement at the full template width from R103.5 to R116.5. There are 1,000 foot tapers at each end, extending the area of beach placement to approximately R102.5 to R117.5. This placement area extends slightly into the South Ponte Vedra study reach; however, the majority of the South Ponte Vedra reach will not be affected by the Recommended Plan. Vilano Beach will be entirely affected by the Recommended Plan.

5.2.1.3 SUMMER HAVEN BEACH

The Recommended Plan does not affect Summer Haven Beach. Without beach placement, the beach and dune systems in the Summer Haven Beach study reach will continue to erode.

5.2.2 VEGETATION

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

The project will plant dune vegetation on the reconstructed frontal dune to stabilize the dune slopes as part of the initial construction. Sea oats will be the primary species planted, and the costs were based on sea oats planted on nine-inch centers along 30 feet of dune slope for the length of the project. Although the costs were based on planting sea oats, the project will attempt to incorporate other native coastal species in the project planting plan to create a diverse habitat based on their commercial availability. Other potential species to be included in the planting plan include gulfhairawn muhly (*Muhlenbergia filipes*), bluestem (*Schizachyrium scoparium, S. maritimum*, or *S. littorale*), seashore dropseed (*Sporobolus virginicus*), beach sunflower (*Helianthus debilis*), beach morningglory (*Ipomoea imperati*), and bayhops (*Ipomoea pes-caprae*).

After dune vegetation is established, additional vegetation will naturally recruit following future periodic nourishments and will be planted as needed. This increase would be seen regardless of the sand source; inlet system or offshore sand source.

5.2.3 FISH AND WILDLIFE RESOURCES (OTHER THAN THREATENED AND ENDANGERED SPECIES)

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

The dredging activity may attract some seabirds to the dredge area. Activities, such as oil exploration, have been shown to attract large numbers of seabirds, possibly because of an increase in food availability as bottom sediments are stirred up by drilling, potentially resulting in an algal bloom, and attracting species preyed on by seabirds (Tasker et al. 1986; Herron Baird 1990). Similar processes may occur during the initial stages of sand dredging. In addition, some species groups, notably gulls, are attracted by increases in shipping activity, especially at the low speeds associated with dredging (Garthe and Hüppop 1999; Skov and Durinck 2001; Christensen et al. 2003). Vision has been shown to be an important component in the foraging activity of a number of seabird species (Essink 1999; Garthe et al. 2000; Gaston

2004; Thaxter et al. 2010). As a result, water clarity may play an important role in the foraging success of these, and other, species. Changes to water clarity resulting from the re-suspension of sediments during dredging operations would negatively affect the foraging capabilities of some species. However, turbidity would only be increased in the vicinity of the dredging and placement operations. In addition, the impact of increases in turbidity is likely to be dependent, both in scale and spatial extent, on initial background levels (Cook 2010). Water quality would quickly return to pre-dredging conditions upon completion of construction. Other than these effects, migratory birds would be minimally affected by dredging activities.

Although benthic organisms would be temporarily impacted at the beach placement site and at the sand source locations (including both the inlet system and the offshore sand source locations), recovery of the benthic community is expected to occur with normal seasonal recruitment patterns. Suitable foraging areas exist outside of the project area to prevent significant impacts to both shorebirds and fish species foraging on the benthic species impacted in the nearshore environment and at the ebb shoal. If construction occurs during the summer months, USACE would implement its migratory bird protection measures that include daily surveys for shorebird nesting activities. If nests were found, a buffer zone of at least 300 feet would be established around each nest. No significant adverse impacts to migratory birds are anticipated with the migratory bird protection measures in effect. Some opportunistic foraging during placement is expected by both fish and bird species. Other wildlife utilizing the dredging and placement sites would be temporarily displaced during construction.

If the offshore sand source were used, the impacts to fish and wildlife species other than those protected under the Endangered Species Act will be similar to those effects identified for the use of the inlet system.

5.2.4 THREATENED AND ENDANGERED SPECIES

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

With the implementation of the protective measures listed in this section, USACE has determined that the Recommended Plan may affect, but is not likely to adversely affect, sea turtles in the water (may affect if a hopper dredge is used), manatees, piping plover, red knot, or whales. The Conservation Measures outlined in the 1991 National Marine Fisheries Service (NMFS) South Atlantic Division Regional Biological Opinion (SARBO; revised 1995 and 1997), the 2013 U.S. Fish and Wildlife Service (USFWS) Piping Plover Programmatic Biological Opinion (P3BO), and the 2015 USFWS Statewide Programmatic Biological Opinion (SPBO) will be adhered to for these species as appropriate. In addition, USACE has determined that the presence of a dredge in the nearshore waters and pipeline on the beach could temporarily impact the physical or biological features (PBF) and primary constituent elements (PCE) of loggerhead critical habitat unit LOGG-N-14 during construction. Hatchling egress from the water's edge to open water, and nesting female transit back and forth between the open water and the nesting beach during nesting season, could be hindered by the presence of the dredge and pipeline. However, the construction phase would typically last three to four months, approximately every 10-12 years (erosion due to storms could require more frequent events), and the daily construction activity would occur within only a small area at

a time (approximately 500 linear feet per day). In addition, the SARBO includes conditions that minimize incidental take of turtles. Finally, the placement of sand may increase sea turtle nesting habitat if the placed sand is highly compatible (i.e., grain size, shape, color, etc.) with naturally occurring beach sediments in the area, and compaction and escarpment remediation measures are incorporated into the project (i.e., the project complies with the terms and conditions of the SPBO). Therefore, USACE has determined that the project will not destroy or adversely modify loggerhead critical habitat.

5.2.4.1 SEA TURTLE NESTING HABITAT

Beach placement may occur year-round; however, construction during the winter months would lessen the impact on nesting and hatchling turtles. The Florida Fish and Wildlife Conservation Commission (FWC) noted in their comments on the draft EA that sand placement between May 1 and October 31 could interfere with nesting or hatchling turtles. As the construction is anticipated to take three to four months, restricting sand placement to November through April could substantially increase construction costs, as competition would be limited by the dredge companies available to perform the work. However, USACE will take the recommendations to conduct the work outside of nesting season into consideration. If construction occurs during nesting season, sea turtle nests will be relocated by trained monitors to an appropriate location outside of the construction area. Additional measures to protect sea turtles and their nesting habitat can be found in the USFWS Statewide Programmatic Biological Opinion (2011; revised in 2015); however, a summary of these is found below:

- Only beach compatible material containing no more than 5% fine material passing a #230 sieve would be placed on the beach.
- Daily sea turtle nest monitoring and relocation would be required. Only nests that would be affected by construction activities would be relocated to a nearby self-release beach site in a secure setting where artificial lighting would not interfere with hatchling orientation.
- Sand compaction and escarpment monitoring would occur post placement.
- Staging areas for construction equipment would be located off the beach to the maximum extent practicable.
- Direct lighting of the beach and nearshore waters would be minimized through reduction, shielding, lowering, and appropriate placement to avoid excessive illumination of the water's surface and nesting beach while meeting all U.S. Coast Guard, EM 385-1-1, and Occupational Safety and Health Administration (OSHA) requirements.

The Recommended Plan will help to maintain the dune feature that may be important as a cue for nesting green turtles. In addition, it will ensure that approximately 3.15 acres of nesting habitat are maintained that might otherwise be lost due to coastal armoring and erosion.

5.2.4.2 LOGGERHEAD CRITICAL NEARSHORE REPRODUCTIVE HABITAT

The proposed placement area is located in designated loggerhead Nearshore Reproductive Critical Habitat Unit LOGG-N-14. The Primary Constituent Elements (PCEs) for Nearshore Reproductive Habitat include waters off the highest density nesting beaches, waters free from obstructions or artificial lighting to allow

ingress/egress of turtles, and waters with minimal manmade structures to promote predators and to disrupt wave patterns.

In the designation of Critical Nearshore Reproductive Habitat, NMFS indicates that dredging and disposal activities may "affect habitat conditions for efficient passage of hatchlings or females by creating barriers or dramatically altering the slope of the beach approach." Dredging of the inlet system sand source will be located far enough away from nesting beaches to avoid impacting nesting and hatchling turtles, and will be at dredging depths shallow enough to avoid modifying wave energy reaching the shoreline. Dredging of the inlet system sand sources, or of the proposed offshore sand sources, would not "dramatically" alter the slope of the "beach approach" or disrupt wave patterns that would impact nesting female or hatchling ingress or egress to/from the beach. Additionally, in the final ruling for critical habitat, NMFS responded to a commenter that, "neither beach nourishment nor the dredging of sand from offshore borrow sites are expected to be significantly impacted by the critical habitat designation as proposed."

Placement of sediment on the beach requires the use of a pipeline to convey the material from the dredge to the placement site. The pipeline typically includes floating and submerged components and approaches perpendicular to the beach. Though the pipeline will be located within the nearshore reproductive habitat, a pipeline located along the sea floor would not be an obstruction to ingressing/egressing sea turtles and would not affect the PCE's that support nearshore reproductive habitat. Dredging and placement of beach-compatible sediment will not result in barriers or dramatic altering of the slope of the beach approach for nesting females because of the relatively fast equilibration of the constructed profile. The constructed profile immediately begins to equilibrate to the more natural equilibrium profile as the waves redistribute sediment along and cross-shore to the equilibration toe of fill. The beach profile will extend into the Nearshore Reproductive Habitat; however, the slope will quickly adjust and would not block or otherwise impede passage of hatchlings or females. Additionally, in the Final Rule for Nesting Beaches Critical Habitat, USFWS states that processes that "mimic these natural processes" (e.g., beach nourishment) are an important component of the physical and biological features of these high density nesting beaches. Since Critical Nearshore Reproductive Habitat is tied to the locations of these high nesting density beaches and beach nourishment projects can be essential to maintaining the long term nesting densities on highly erosive beaches, beach nourishment is not likely to adversely modify Critical Nearshore Reproductive Habitat.

Lighting on-board dredges and associated ancillary equipment/vessels is required for safe and efficient operations at night. Lighting associated with beach nourishment dredging is a temporary occurrence. However, while dredging sand sources, all lighting aboard dredges, support vessels, etc. operating within three nautical miles of sea turtle nesting beaches are limited to the minimal lighting necessary to comply with U.S. Coast Guard and/or OSHA requirements. All nonessential lighting on the dredge and supporting equipment/vessels shall be minimized through reduction, shielding, lowering, and appropriate placement of lights to minimize illumination of the water to reduce potential disorientation effects on female sea turtles approaching the nesting beaches and sea turtle hatchlings making their way seaward from their natal beaches. Through the implementation of minimum lighting requirements on board dredges and

associated ancillary equipment, the PCEs that support Nearshore Reproductive Habitat will not be affected.

5.2.4.2.1 Sea Turtle Protective Measures

To minimize potential adverse impacts to sea turtles, the following measures would be implemented:

- The contractor would instruct all personnel associated with the project of the potential presence of these species and of the need to avoid collisions with sea turtles. All construction personnel would be responsible for observing water-related activities for their presence.
- The contractor would advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles, which are protected under the Endangered Species Act of 1973.
- Siltation barriers would be made of material in which a sea turtle cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment.
- All vessels associated with the construction project would operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels would preferentially follow deep-water routes (e.g., marked channels) whenever possible.
- If a sea turtle is seen within 100 yards of the active daily construction/disposal operation or vessel movement, all appropriate precautions would be implemented to ensure its protection. These precautions would include cessation of operation of any moving equipment closer than 50 feet of a sea turtle. Operation of any mechanical construction equipment would cease immediately if a sea turtle is seen within a 50-foot radius of the equipment. Activities would not resume until the protected species has departed the project area of its own volition.
- Any collision with and/or injury to a sea turtle would be reported immediately to the NMFS Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

5.2.4.3 WEST INDIAN MANATEE AND WHALES

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

Standard protective measures would be taken during placement activities to ensure the safety of manatees and whales. These measures are recommended by both the USFWS and NMFS as part of the 2015 USFWS SPBO (for manatees) and the 1991 NMFS SARBO (revised in 1995 and 1997; for whales). To make the contractor and his personnel aware of the potential presence of these species in the project area, their endangered status, and the need for precautionary measures, the contract specifications would include the following standard manatee and whale protection clauses:

- The contractor would instruct all personnel associated with construction activities about the potential presence of manatees and whales in the area and the need to avoid collisions with them.

- If siltation barriers are used, they shall be made of material in which manatees and whales cannot become entangled, are properly secured, and are regularly monitored to avoid manatee entrapment. Barriers must not block entry to or exit from essential habitat.
- If a manatee were sighted within 100 yards of the project area, all appropriate precautions would be implemented by the contractor to ensure protection of the manatee. These precautions would include the operation of all moving equipment no closer than 50 feet of a manatee. If a manatee were closer than 50 feet to moving equipment or the project area, the equipment would be shut down and all placement activities would cease to ensure protection of the manatee. Placement activities would not resume until the manatee has departed the project area.
- The vessel operators shall maintain a 500-yard buffer between the vessel and any whale.
- All vessels associated with the project would operate at 'no wake' speeds at all times while in shallow waters or channels where the draft of the boat provides less than three feet clearance from the bottom. Boats used to transport personnel would be shallow draft vessels, preferably of the light-displacement category, where navigational safety permits. Vessels transporting personnel between the landing and any workboat would follow routes of deep water to the greatest possible extent. Shore crews would use upland road access if available.
- Mooring bumpers would be placed on all large vessels wherever and whenever there is a potential for manatees to be crushed between two moored vessels. The bumpers would provide a minimum stand-off distance of four feet.
- All personnel would be advised that there are civil and criminal penalties for harming, harassing, or killing manatees and whales, which are protected under the Endangered Species Act and the Marine Mammal Protection Act (discussed further in Section 6).

5.2.4.4 PIPING PLOVER AND RED KNOT

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

As the placement area associated with the Recommended Plan is not optimal habitat for piping plover or red knot, effects (both adverse and beneficial) are minimal. Beach placement of material would temporarily impact wintering piping plover and red knot due to displacement from their foraging and roosting habitat. In addition, the benthic invertebrates on which these species feed will be affected by the placement of sand. Recovery of the benthic infauna should occur with normal seasonal recruitment patterns. During pump-out of the dredged material, there may be some opportunistic feeding at the placement area by shorebirds, including piping plover and red knot.

5.2.4.5 ANASTASIA ISLAND BEACH MOUSE (AIBM)

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

Although AIBM have not been trapped within the GTMNERR since 2006 and are not likely to be affected by the beach placement activities, the following conditions for the AIBM from the SPBO would be followed.

- Beach mouse habitat would be avoided when selecting sites for equipment, pipes, vehicle storage and staging to the maximum extent practicable.
- All construction activity would remain at least 5 to 10 feet seaward of the toe of the dune or 10% of the beach width seaward of the dune toe in areas of occupied beach mouse habitat.
- Existing beach access points shall be used for vehicle and equipment beach access to the maximum extent possible. These access points shall be delineated by post and rope or other suitable material to ensure vehicles and equipment transport stay within the access corridor. The topography at the access points shall be fully restored to preconstruction conditions following project completion. Parking areas for construction crews shall be located as close as possible to the work sites, but outside of vegetated dune areas to minimize impacts to existing habitat and transporting workers along the beachfront.
- If needed, personnel would trap any pipeline access corridor through beach mouse habitat for five days prior to pipeline placement and removal.

5.2.5 ESSENTIAL FISH HABITAT (EFH)

Pursuant to the 1999 Finding between USACE and NMFS, USACE's Notice of Availability of the draft EA initiated USACE's consultation under the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MSFCMA). Section 2.3.4 describes the Existing Conditions of the EFH in the project area, as well as the individual and cumulative impacts of the No Action Alternative. This Section describes the individual and cumulative impacts of the Recommended Plan and other reasonable alternatives. This NEPA document satisfies the coordination requirement for EFH under the MSFCMA (also see Section 6.13).

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

Placement of dredged material on the beach could directly and indirectly impact approximately 15,500 feet of ocean high salinity surf zone. Long-term adverse impacts (i.e. suppression of re-colonization of the infaunal community) are not anticipated if nourishment events are spaced more than five years apart. In addition, material placed will be beach-quality sediment similar in composition to the existing beach sediments. Beach placement is anticipated to take three to four months, and migrating larvae and/or juvenile fish could be subject to project-related elevated turbidity and suspended sediment levels during that time period. In their comments dated April 4, 2016, NMFS provided the following conservation recommendations: 1) best management practices restricting the time of year for dredging to reduce impacts to EFH and vulnerable life stages of federally managed fishery species, and (2) development of a scientifically supported rationale and monitoring program to assess impacts of beach disposal (nourishment) to benthic shoreline communities. USACE responded to NMFS' comments on December 28, 2016 (see Appendix G-3). The first recommendation to time dredging for the fall and winter months, when taken in combination with recommendations to avoid impacts to sea turtle nesting, limits construction to only a few months during the spring. USACE will consider this window and the development of a monitoring program as funding and scheduling allow. The headland feature discussed in Section 2.3.4 is located over five miles north of the proposed location of sand placement in the

Recommended Plan (R102.5 to R117.5). Since the direction of longshore sediment transport in this region is north to south, any potential rock outcrops located north of sand placement are unlikely to experience coverage by placed sand as it equilibrates.

5.2.6 COASTAL BARRIER RESOURCES

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

The Federal government will not cost-share in the sand placement within Unit P04A (Usinas Beach). The proposed project does not include the construction of structures that would require Federal Flood Insurance. Although sand will be removed from Unit P05, the project will not result in effects that are contrary to the purposes of CBRA. Therefore, the Recommended Plan will not affect the Units P04A or P05 (Conch Island) with respect to the goals of CBRA. The USFWS found the project to be consistent with the purposes of CBRA in a letter dated October 25, 2016. Please see also Section 2.3.5 and Section 6.15.

5.2.7 WATER QUALITY

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

The primary anticipated change in water quality at the beach placement site would be a temporary increase in turbidity. According to the State of Florida's Class III water quality standards, turbidity levels during placement of dredged material are not to exceed 29 nephelometric turbidity units (NTUs) above background levels at the edge of normally a 150-meter mixing zone, which would be the standard for the dredge and beach placement areas. Portions of the placement area are in close proximity to the Guana River Marsh Aquatic Preserve (approximately 0.5 miles), and the St. Augustine Inlet system adjacent to the Anastasia State Recreation Area. As both of these areas are classified as Outstanding Florida Waters (OFWs), increased turbidity levels at the OFWs that are a result of the dredging and placement activities at the project site cannot exceed 0 NTUs above background levels unless a variance is obtained from FDEP. In order to comply with these standards, turbidity will be monitored according to state protocols during the proposed beach placement work. If at any time the turbidity standards are exceeded, the activities causing the violation would temporarily cease.

5.2.8 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

As mentioned in Section 2.3.7, there are no known sources of hazardous or toxic wastes in the project area, and USACE is not aware of any records indicating these activities occurred in the project area in the past. Therefore, USACE does not anticipate that dredging in any of the proposed sand source locations would encounter hazardous, toxic, or radioactive wastes. USACE includes in all project specifications the procedures and protective measures to be taken should munitions be encountered during dredging operations.

5.2.9 AIR QUALITY

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

The proposed action may result in small, localized, temporary increases in concentrations of nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), volatile organic compounds (VOC), and particulate matter (PM). Emissions associated with the dredge plant would be the largest contribution to the inventory. Projected emissions from the dredge plant and other associated construction activities would not adversely impact air quality given the anticipated relatively low level of emissions and the likelihood for prevailing offshore winds. With the proposed action, the criteria pollutant levels should be well within the national ambient air quality standards. Short term impacts from dredge emissions and other construction equipment associated with the Recommended Plan would not significantly impact air quality. No air quality permits would be required.

Since the placement area and the preferred sand source (the inlet system sand sources) are located in an attainment area, there is no requirement to prepare a conformity determination pursuant to the General Conformity Regulations (58 FR 63214). The criteria pollutants, including ozone, are estimated herein for planning purposes only. The offshore sand sources are located in Federal Outer Continental Shelf waters where the attainment status is unclassified. There is no provision for any classification in the Clean Air Act for waters outside of the boundaries of state waters.

The Council on Environmental Quality (CEQ) issued final guidance in August 2016 on Greenhouse Gases and Climate Change, specifically related to their impacts in reviews conducted under the National Environmental Policy Act (available online athttps://ceq.doe.gov/guidance/ceq_guidance_nepa-ghg-climate_final_guidance.html). The analysis in this section is provided pursuant to this guidance. To ensure that the analysis conducted in this section is as conservative as possible, the emissions from the project are compared to the *de minimus* standard set by U.S. Environmental Protection Agency (EPA) for air quality in St. Johns County. Comparing the project emissions to the *de minimus* is the simplest method and is the best first look at effects of emissions. The *de minimis* standards are located at http://epa.gov/airquality/genconform/deminimis.html.

Direct emissions from the Recommended Plan involving dredging of the inlet system sand sources and placement of sand for the period of Federal participation would be confined to exhaust emissions of dredging, transport, and construction equipment. Criteria air pollutant emissions were estimated for the Recommended Plan using estimates of power requirements, duration of operations, and emission factors for the various equipment types. Multiplying horsepower rating, activity rating factor (percent of total power), and operating time yields the energy used. The energy used multiplied by an engine-specific emission factor yields the emission estimate. Operational data from the 2005 Duval County nourishment cycle and the Wilmington District's Brunswick County shore protection project were used to estimate power requirements and duration of the proposed hopper dredging activity. Additionally, the Lake Worth Inlet Feasibility Study air quality analysis was used to prepare the estimate of using a cutterhead dredge.

The following types of equipment were included in the analysis:

- Hopper Dredge
- Cutterhead Dredge
- Tow Vessel
- Spreader/ Grater (Bulldozer)
- Spreader/ Grater (Front-end loader)
- Booster Pump
- Crew/ Survey Vessel
- Crane Barge/Hauler
- Tug Boats (2)

The horsepower of each piece of equipment, the hours each piece of equipment would be used each day, and the fuel consumed by that piece of equipment over a 24-hour period were determined. Additional information such as the anticipated contract duration and actual working days of each component was also determined.

Certain assumptions were made for each piece of dredging, construction, and support equipment regarding the number of hours a day that equipment would be used. These factors were utilized in the overall emissions calculations.

- Dredging vessels were assumed to be operating 24-hours a day, which does not account for downtime due to maintenance, refueling and repositioning.
- For sand placement operations using a hopper dredge, the beach-based equipment used to spread the sand and arrange the pipeline, and the booster itself were assumed to be operating approximately 5 hours a day.
- The crew boat/survey vessel was assumed to operate up to 5 hours a day.
- The two tug boats and crane barge would be used to mobilize and de-mobilize the pipeline into the selected corridor, and it is expected that the work will occur for 12 hours a day for up to 14 days.
- As actual contractor equipment is unavailable (a contract has not been awarded and USACE generally does not dictate the type of equipment a contractor may use), where a range of input values into the assessment was available, the value which would result in a “worst-case” analysis was chosen.

The daily values for each equipment type were then applied to each component of the Recommended Plan. The emissions values for the components were summed to compare against the EPA National Emissions Inventory for St. Johns County to determine the impact to air quality.

Table 5-1. Equipment Horsepower, Estimated Daily Working Hours and Resultant Fuel Consumption.

Equipment Type	Horse Power	Hours worked per day	Fuel Consumption/day (gals)
Hopper Dredge (1)	6,500	24	7,030
Cutterhead Dredge (1)	1,256	24	1,546^
Tow Vessel (1)	400^	24	321.6^
Spreader/ Grater (Bulldozer) (2)	250	5	46.8^
Spreader/ Grater (Front-end loader) (1)	250	5	23.4^
Booster Pump (1)	13,000	5	144^
Crew/ Survey Vessel (1)	100	5	200
Crane Barge/hauler (1)	175	12	31^
Tug Boats (2)	400^	12	321.6^
Equipment Type	**Horse Power**	**Hours worked per day**	**Fuel Consumption/day (gals)**
Hopper Dredge	6,500	24	7,030
Cutterhead Dredge	1,256	24	1,546^
Tow Vessel	400^	24	321.6^
Spreader/ Grater (Bulldozer) (2)	250	5	46.8^
Spreader/ Grater (Front-end loader)	250	5	23.4^
Booster Pump	13,000	5	144^
Crew/ Survey Vessel	100	5	200
Crane Barge/hauler	175	12	31^
Tug Boats (2)	400^	12	321.6^

^ Anderson, 2008

Table 5-2. Duration of Each Event.

Year	Event	Construction Duration (Days)
2020	Initial Construction	98
2032	Beach Renourishment (1)	77
2044	Beach Renourishment (2)	77
2056	Beach Renourishment (3)	77
2068	Beach Renourishment (4)	77

All dredging, turning, steaming, and pumpout were assumed to occur in state waters. Emission factors for the diesel engines on the dredges, barge, tugboats were obtained from EPA's *Compilation of Air Pollutant Emissions Factors, AP-42, Volume 1* (2002). Emission factors for tiered equipment used in beach construction were derived from NONROAD Model (5a) estimates. Total component emissions of nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), volatile organic compounds (VOC), and

particulate matter (PM) are presented broken out on a per year basis for comparison with the per year *de minimus* standards.

Table 5-3. National De Minimus Annual Tons for an Area in Attainment Maintenance.

	CO	NOx	$PM_{2.5}$	PM_{10}	SOx	VOC
de minimus Annual Tons	100	100	100	100	100	100

Table 5-4. Emissions Totals (Tons/Year).

Construction Year	Duration (Months)	CO	NOx	$PM_{2.5}$	PM_{10}	SOx	VOC
2020	3.21	22.50	145.83	3.33	3.33	25.00	2.50
2032	2.52	17.66	114.48	2.61	2.61	19.63	1.96
2044	2.52	17.66	114.48	2.61	2.61	19.63	1.96
2056	2.52	17.66	114.48	2.61	2.61	19.63	1.96
2068	2.52	17.66	114.48	2.61	2.61	19.63	1.96

To date, EPA has not established CO^2 emission standards for temporary mobile emission sources, nor for equipment used in construction projects (e.g., dump trucks, cranes, and front end loaders). However, USACE calculated CO^2 emissions for each year of the project, which are reported below.

Table 5-5. CO2 Emissions (Lbs/Year).

Construction Year	Emissions of Carbon Dioxide using a Hopper Dredge (Lbs/Year)	Emissions of Carbon Dioxide using a Cutterhead (Lbs/Year)
2020	15,587,880	5,058,214
2032	12,247,620	3,974,311
2044	12,247,620	3,974,311
2056	12,247,620	3,974,311
2068	12,247,620	3,974,311

One opportunity to decrease emissions would be to construct this project at the same time as other projects in this region, including maintenance of the IWW, maintenance of the St. Augustine Inlet, and renourishment of St. Augustine Beach. Not only would combining these projects result in cost savings, but it would reduce greenhouse gas emissions by requiring the dredge and associated equipment to mobilize only once to the project site.

5.2.10 NOISE

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

Dredging noise can affect marine mammals, sea turtles, and fishes. Possible effects of dredging noise can vary depending on a variety of internal and external factors, and can be divided into masking (obscuring sounds of interest by the production of interfering sounds, generally at similar frequencies), response, discomfort, hearing loss, and injury (MALSF, 2009). Deeper water operations may propagate sound over greater distances than those in confined nearshore areas (Hildebrandt, 2004).

Dredging to extract sand produces broadband and continuous sound, mainly at lower frequencies. The little available data indicates that dredging is not as noisy as seismic surveys, pile driving, and sonar; however, it is louder than most shipping, operating, offshore wind turbines, and drilling (MALSF, 2009). Noise associated with dredging activities can be placed into five categories:

1. **Collection noise** – The noise generated from the collection of material from the sea-floor; for example, the scraping of the buckets on a bucket ladder dredge or the operation of the drag head. This noise is dependent on the structure of the sea floor and the type of dredge used.
2. **Pump noise** – The noise from the pump driving the suction through the pipe.
3. **Transport noise** – The noise of the material being lifted from the sea floor to the dredge and pumped through a pipeline to the beach. For trailing suction hopper and cutter suction dredges, this would be the noise of the material as it passes up the suction pipe. For clamshell dredges, it would be the sound of the crane dropping/lifting the bucket.
4. **Deposition noise** – This noise is associated with the placement of the material within the barge or hopper.
5. **Ship/machinery noise** – The noise associated with the dredging ship itself. For stationary dredges, the primary source will be the onboard machinery. Mobile dredges will also have propeller and thruster noise (MALSF, 2009).

Field investigations have been undertaken to characterize underwater sounds typical of bucket, hydraulic cutterhead, and hopper dredging operations (Dickerson et al., 2001). Preliminary findings indicate that cutterhead dredging operations are relatively quiet as compared to other dredging operations in aquatic environments. Bucket dredges create a more complex spectrum of sounds, very different than either cutterhead or hopper dredges. Hopper dredges produce somewhat more intense sounds similar to those generated by vessels of comparable size. Hopper dredge noises consist of a combination of sounds emitted from two relatively continuous sources: engine and propeller noise similar to that of large commercial vessels, and sounds of dragheads moving in contact with the substrate.

Reported source levels for dredging operations range from 160 to 180 dB re 1 uPa @ 1 m for 1/3 octave bands with peak intensity between 50 and 500 Hz (Greene and Moore, 1995). The intensity, periodicity, and spectra of emitted sounds differ greatly among dredge types. Components of underwater sounds produced by each type are influenced by a host of factors including substrate type, geomorphology of the

waterway, site-specific hydrodynamic conditions, equipment maintenance status, and skill of the dredge plant operator (Dickerson et al., 2001).

Noise generated by the dredge may minimally impact those living on the beaches during project construction, but will likely not be too noticeable over ambient noise of wind and waves. Noise generated on the beaches by equipment placing the dredged material will be relatively low level, and will be of a short duration (construction period of approximately three to four months). Construction equipment such as booster pumps will be properly maintained to minimize effects of noise. Once dredging and beach placement have concluded, noise levels will drop back to background levels for the beach area. Since the increases to the current level of noise as a result of this project will be localized and minor, there will only be a temporary reduction in aesthetics and no expectation of adverse effects to the environment as a result of construction-related noise.

5.2.11 AESTHETIC RESOURCES

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

The aesthetics of the beach placement area would be temporarily adversely impacted during construction due to the presence of construction equipment on the beach. In the longer term, the beach aesthetics will be improved over the previously eroded shoreline with the construction of a more natural beach. Aesthetics of the sand source locations would also experience temporary adverse impacts due to the presence of dredge equipment during construction.

5.2.12 RECREATION RESOURCES

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

Recreational use of the beach, including sunbathing and surfing, would be temporarily disrupted for up to several months during construction due to the presence of construction equipment on the beach. In addition, recreational use of the inlet system and the offshore sand sources (e.g., boating, kayaking, and windsurfing) would be temporarily adversely affected by the dredging operations.

Recreational usage in the future with-project condition would be improved over the long-term due to the availability of a wider beach face.

5.2.13 NAVIGATION

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

Temporary impacts to vessel traffic could occur due to the presence of dredge equipment in St. Augustine Inlet during construction. If the inlet system is used as a sand source, the shoaling rate is not anticipated to increase in the inlet. However, an offshore sand source may cause additional shoaling in the inlet system due to the material added to the sediment budget in the region.

5.2.14 CULTURAL RESOURCES AND HISTORIC PROPERTIES

As discussed in the Section 2: Existing Conditions and Future Without-Project Conditions portion of this document, substantial cultural resources work and investigations have been conducted throughout various portions of the project area. Consultation is ongoing with the Florida State Historic Preservation Officer (SHPO) and appropriate federally-recognized tribes. Prior to project implementation, consultation and any required resources surveys will be finalized in accordance with Section 106 of the National Historic Preservation Act for all proposed alternatives.

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

The Recommended Plan would see shoreline impacts occurring between FDEP R Monuments R102.5 and R117.5. USACE surveyed this shoreline area for cultural resources in 2010 and did not identify any archaeological sites. As discussed in Section 2, this area includes the Chainplate Site (SJ5442) documented in 2007 which was composed of isolated shipwreck components washed onto the shoreline from a storm event. Identified materials were removed for conservation by St. Augustine Lighthouse Archaeological Maritime Program (LAMP) archaeologists at that time. Another site documented in the project area that was an isolated find recovered from the beach after a storm event is site 8SJ4988 the Vilano Beach Rudder Site. The 12-foot long, wooden rudder was recovered in 2005 by the St. Johns County archaeologist and was recorded as probably belonging to a late nineteenth-century, wooden sailing vessel. The rudder was the only component identified on the beach in this location. Further monitoring after storm events was recommended for both site locations. However, no materials were identified in either area during the USACE 2010 shoreline survey and none have been reported to LAMP or to the St. Johns County Archaeologist since the artifacts were recovered in 2005 and 2007 suggesting that the sources of these isolated artifacts lie submerged offshore. No further resources were identified in the renourishment area that would be affected by this recommended plan.

The proposed sand source for the selected plan would involve the use of the ebb, flood, and Vilano Point shoals around the St. Augustine Inlet. These areas have been surveyed intensively for cultural resources by USACE and known resources have been identified within these areas. During consultation with the Florida SHPO, USACE agreed to maintain all buffers established for these resources. Site 8SJ4889, the *Dixie Crystal*, is a historic shipwreck identified within the flood shoal and may be potentially eligible for inclusion in the National Register of Historic Places. A 150-foot buffer was agreed upon during consultation with the Florida SHPO for dredging projects working near it to protect the resource. In addition, four targets were identified within the St. Augustine Inlet (targets SA-T-5, SA-OS-2, SA-OS-3, and SA-OS-4) that have a high potential for being significant resources, and each has a requirement for a 200-foot buffer around them for all dredging and maintenance activities. Within the northern ebb shoal area lies site 8SJ4784 the North Shoals Vessel, a historic shrimp boat which sank trying to navigate the St. Augustine entrance channel. There is currently insufficient information to determine its eligibility for inclusion in the NRHP; however USACE will protect the site through the use of buffers that will be determined through consultation. Currently, USACE is completing a cultural resource survey of previously un-surveyed portions of the shoal complex. Consultation for this survey is ongoing with the Florida SHPO and

appropriate federally-recognized tribes. The consultation will be updated prior to project implementation. When finalized, 100% of the shoal complex will have been subject to cultural resource surveys. USACE does not expect any effects to historic properties contingent on use of buffers within the sand source areas for identified resources and targets. Consultation under Section 106 of the National Historic Preservation Act is ongoing and will be completed prior to project implementation. The project will maintain a fortuitous find policy that will halt use of an area should any resources be identified during maintenance dredging.

5.2.15 NATIVE AMERICANS

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

As part of the development of this project, consultation is ongoing between USACE and the two federally-recognized tribes within the immediate area of potential effect. As discussed in Chapter 3, there are no known Native American properties within the project area and the project should not have any effects to Native Americans. However, consultation with both federally-recognized tribes within the region is ongoing and will be updated upon further consultation on this project. Archaeological sites near the project area are discussed in the Cultural Resources section of this report. Once consultation is complete, additional updates may be needed.

5.2.16 NATURAL OR DEPLETABLE RESOURCES

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

Sand is a natural and depletable resource. However, the use of the material from the navigation channel serves two purposes: shoreline protection and enhanced navigation. As discussed in Section 4.1, the use of the inlet system would implement a Regional Sediment Management strategy where the material from the navigation project is beneficially used to nourish the adjacent beaches.

5.2.17 CUMULATIVE IMPACTS

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

Cumulative impacts are defined in 40 CFR 1508.7 as those effects that result from:

> *…the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.*

Material from the inlet system is currently used for the St. Augustine Beach CSRM project, which is expected to continue into the future. No other future beach nourishment, either public or private, are anticipated to occur in this region. Without a Federal beach nourishment project, it is expected that private property owners would begin armoring their properties individually with hard structures such as seawalls and revetments.

Table 5-6 summarizes the impact of cumulative impacts resulting from actions identified to occur in the past, present, and reasonably foreseeable future. Summaries of the impacts to sand resources, protected species, and water quality, are provided to discuss how they would be directly or indirectly impacted by the proposed action and its alternatives. The table also illustrates the with-project and the FWOP condition (the difference being the incremental impact of the project). Please also see Section 2.2.14 for additional information about the effects of other Federal projects in the project area.

Table 5-6. Cumulative Impacts.

	Past (cumulative impacts due to Past Actions)	Present (cumulative impacts due to Present Actions)	Future without-project (cumulative impacts anticipated)	Future with Proposed Action (cumulative impacts anticipated)
Sand Resources	St. Augustine Inlet was created in the mid-1900s, and maintenance dredging of the Inlet and the IWW has occurred since that time. Material has been removed from the St. Augustine Inlet system has been used for the Federal shore protection project at St. Augustine Beach since the 1990s	offshore sand resources are not within an economic distance of the study site for use; shoal sediments at St. Augustine Inlet are abundant as sediment accumulates from alongshore transport	Material from navigational channels will continue to be periodically dredged, and the material will be placed on downdrift beaches; seawalls may be required to protect upland structures in the project area; future beach placement constructed by local entities would likely also use the shoal system, as offshore resources are not economically feasible	Sediments eroding from north of St. Augustine Inlet will be deposited into the inlet system; approximately 1/3 of the sediment in the system will be dredged and placed north of the Inlet
Protected Species	more abundant and widespread prior to development	erosion causing continued decline in habitat	Increased erosion in the future without-project condition will cause beach habitat to continue to shrink	individuals may be affected by dredging and placement activities; coastal habitat is sustained for life of project
Water Quality	Pristine prior to development; increasing recreational usage, and the development of the City of St. Augustine may have caused some decline in water quality	some degradation due to anthropogenic actions such as navigation through the inlet	no change to present condition; no known projects in the vicinity that may occur in the future and cause a decline in water quality	temporary increases in local turbidity due to construction; no long-term change

5.2.18 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

5.2.18.1 IRREVERSIBLE

An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. One example of an irreversible commitment might be the mining of a mineral resource. The use of sand from the proposed sand sources would temporarily deplete the suitable sand reserves in the short term, but they are expected to reestablish following dredging as outlined in the FDEP "Final Order Adopting St. Augustine Inlet Management Implementation Plan."

5.2.18.2 IRRETRIEVABLE

An irretrievable commitment of resources is one in which, due to decisions to mandate the resource for another purpose, opportunities to use or enjoy the resources as they presently exist are lost for a period of time. An example of an irretrievable loss might be where a type of vegetation is lost due to road construction. As littoral drift restores the sand volumes in the inlet system over time, the dredging alternatives would not result in an irretrievable commitment of resources.

5.2.19 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

FUTURE WITH-PROJECT (RECOMMENDED PLAN)

Species of relatively non-motile infaunal invertebrates that inhabit the dredge areas will unavoidably be lost during dredging. Species of motile epifaunal invertebrates inhabit the inlet system. Motile organisms such as fish and crabs should be able to escape the area during construction. Many of those species that are not able to escape the construction area are expected to recolonize after project completion from adjacent similar habitat.

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CHAPTER 6

ENVIRONMENTAL COMPLIANCE

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6 COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS*

This chapter discusses the status of coordination and compliance of the Recommended Plan with environmental requirements. Additionally, the Recommended Plan's applicability to the USACE environmental operating principles is addressed.

6.1 NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (NEPA)

This report documents the effects of this project and serves as the Environmental Assessment (EA). It was made available for public review and comment for a 45-day period from February 17 through April 4, 2016. The public coordination and environmental assessment complies with the intent of the National Environmental Policy Act (NEPA). The project is in compliance with the National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4321, *et seq*. P.L. 91-190.

6.1.1 SCOPING AND ISSUES

An initial scoping period for the project was conducted from August 17, 2005 through September 17, 2005. The National Oceanic and Atmospheric Administration (NOAA) responded to the scoping letter with concerns about the essential fish habitat (EFH) in the nearshore waters of the study area and requested that an EFH assessment be prepared as part of the study. This assessment is included in Sections 2.3.4 and 5.2.5 of this report. The Florida Department of Environmental Protection (FDEP) coordinated a review of the scoping letter and proposed project with the appropriate state agencies. Their comments were incorporated into the drafting of this report. The scoping letter also drew a response from one concerned citizen who owned property in the area.

As the study progressed, USACE anticipated that an Environmental Impact Statement (EIS) would be required. A second scoping period was held from September 16, 2008 to October 16, 2008. Responses were received from the Environmental Protection Agency (EPA), the Florida Department of State's Division of Historical Resources, the Seminole Nation of Oklahoma, and several landowners in the study area. A notice of intent to draft an EIS was published in the Federal Register on April 5, 2010.

Subsequently, it became evident that no significant impacts to the human or natural environments were anticipated. USACE decided to initially prepare an EA, rather than continue with the previous plans to draft an EIS. The draft EA and draft Finding of No Significant Impact (FONSI) was made available to the public for a 45-day public comment period from February 17, 2016 to April 4, 2016.

All correspondence associated with the NEPA scoping process is included in Appendix G-3, NEPA Correspondence.

6.1.2 AGENCY COORDINATION AND COOPERATING AGENCIES

This proposed project has been coordinated with the following agencies: U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), U.S. Environmental Protection Agency (EPA), Florida State Clearinghouse, Florida State Historic Preservation Officer (SHPO), and the Florida Department of Environmental Protection (FDEP). The FDEP, Bureau of Beaches and Coastal Systems, NMFS Habitat Conservation Division, and the Bureau of Ocean and Energy Management (BOEM) have all accepted USACE's invitations to participate as cooperating agencies in this study. These agencies were involved in the study during the plan formulation process to ensure that the Recommended Plan was consistent with their policies. BOEM's role in the study was limited following the selection of the Recommended Plan, which did not involve Outer Continental Shelf (OCS) resources. Correspondence with all Federal and state agencies is included in Appendix G-3.

6.1.3 LIST OF RECIPIENTS

A Notice of the Availability of the Draft EA and Draft FONSI was mailed to those listed in Appendix G-4, NEPA Mailing List on February 17, 2016. The document was also made available on USACE's website at http://www.saj.usace.army.mil/About/DivisionsOffices/Planning/EnvironmentalBranch/EnvironmentalDocuments.aspx#St_Johns.

6.1.4 COMMENTS RECEIVED AND RESPONSE

Comments received as a result of the public review of the draft EA are included in Appendix G, and are addressed in this document as appropriate.

6.2 ENDANGERED SPECIES ACT OF 1973

This project falls under the scope of the November 25, 1991 South Atlantic Regional Biological Opinion (SARBO; as amended in 1995 and 1997) for federally-listed marine species. USACE reinitiated consultation with NOAA Fisheries under the SARBO, which is ongoing. NOAA Fisheries provided guidance that projects found to be consistent with the SARBO as reinitiated for loggerhead critical habitat should not consult separately while consultation is ongoing for the programmatic opinion (R. Sweeney, email correspondence dated November 18, 2015). Therefore, no additional coordination is required with NOAA Fisheries for these species.

USACE has determined that the sand placement activities associated with this project fall within the scope of the USFWS SPBO (2011), as amended in 2015, and the P^3BO (2013). The USFWS provided their comments on the project and their concurrence that the SPBO was appropriate to apply to the project in a letter dated December 22, 2016. The project is in compliance with the Endangered Species Act.

This project is in compliance with the Endangered Species Act of 1973, as amended, 16 U.S.C. 1531, *et seq*. P.L. 93-205.

6.3 FISH AND WILDLIFE COORDINATION ACT OF 1958

Coordination with USFWS under the Fish & Wildlife Coordination Act of 1958 was conducted concurrently with the USFWS review of the project under the Endangered Species Act, and was initiated in a letter dated May 20, 2016. USFWS provided their comments and determination in a letter dated December 22, 2016. This project is in full compliance with the act.

6.4 NATIONAL HISTORIC PRESERVATION ACT OF 1966 (*INTER ALIA*)

The Proposed Action is in compliance with Section 106 of the National Historic Preservation Act, as amended (PL89-665). As part of the requirements and consultation process contained within the National Historic Preservation Act implementing regulations of 36 CFR Part 800, this project is also in compliance through ongoing consultation with the Archaeological and Historic Preservation Act, as amended (PL93-29), Archeological Resources Protection Act (Public Law 96-95), American Indian Religious Freedom Act (Public Law 95-341), Native American Graves Protection and Repatriation Act (NAGPRA), Executive Order 11593, 13007, and 13175, the Presidential Memo of 1994 on Government to Government Relations and appropriate Florida Statutes. Consultation with the Florida SHPO, appropriate federally-recognized tribes, and other interested parties has been initiated and is ongoing. No construction work will begin prior to completion of consultation. The Proposed Action will be in compliance with the goals of this act upon completion of coordination as stated above.

6.5 CLEAN WATER ACT OF 1972

A Section 401 water quality certification application will be submitted to FDEP, and USACE will obtain this certification prior to construction. All state water quality requirements would be met, and the USACE will ensure that turbidity standards in OFWs adjacent to the project area are met. A Section 404(b) evaluation is included in this report as Appendix G-1. The project is in compliance with this act.

6.6 CLEAN AIR ACT OF 1972

The short-term impacts from construction equipment associated with the project would not significantly impact air quality. No air quality permits would be required for this project. St. Johns County is designated as an attainment area for federal air quality standards under the Clean Air Act. Because the project is located within an attainment area, EPA's General Conformity Rule to implement Section 176(c) of the Clean Air Act does not apply and a conformity determination is not required.

6.7 COASTAL ZONE MANAGEMENT ACT OF 1972

The Florida State Clearinghouse coordinated a review of the project in response to USACE's scoping letter dated August 17, 2005. Based on the information contained in the scoping notice and comments provided by their reviewing agencies, the state had no objections to the proposed activities. However, the state provided several comments in their letter dated October 14, 2005. FDEP staff noted that the project would require state water quality certification in the form of a Joint Coastal Permit. They did not object to investigating the offshore borrow areas, but expressed concern about the use of the ebb shoal. They suggested that further investigation of the nearshore area adjacent to Vilano Beach be conducted for the presence of hardbottom communities. Finally, they discouraged the use of structural alternatives. Please see Appendix G-3 for the FDEP comments, which will be addressed primarily during the FDEP permit process.

A Federal consistency determination in accordance with 15 CFR 930 Subpart C is included in this report as Appendix G-2. USACE has determined that the project is consistent with the Florida Coastal Management Plan (FCMP) concerning acquisition of Water Quality Certifications and other state authorizations. The Draft EA and Section 404 (b)(1) Evaluation have been submitted to the state in lieu of a summary of environmental impacts to show consistency with the FCMP.

The state's final concurrence of the project's consistency with the FCMP will be determined during the environmental permitting process, in accordance with the 2006 Interagency Coordination Agreement. USACE has no indication that FDEP will not concur with our determination. At this time, this project is in compliance with this act.

6.8 FARMLAND PROTECTION POLICY ACT OF 1981

No prime or unique farmland would be impacted by implementation of this project. This act is not applicable to the project.

6.9 WILD AND SCENIC RIVER ACT OF 1968

No designated Wild and Scenic river reaches would be affected by project related activities. This project is in compliance with this act.

6.10 MARINE MAMMAL PROTECTION ACT OF 1972

USACE does not anticipate the take of any marine mammal during any activities associated with the project. Should a hopper dredge be utilized, a trained, government-certified sea turtle and marine mammal observer will be stationed on the dredge during all water-related construction activities. Appropriate actions will be taken to avoid adverse effects to listed and protected marine mammal species during project construction. Therefore, this project is in compliance with this act.

6.11 ESTUARY PROTECTION ACT OF 1968

In the Estuary Protection Act of 1968, Congress declared that "many estuaries in the United States are rich in a variety of natural, commercial, and other resources, including environmental natural beauty, and are of immediate and potential value to the present and future generations of Americans." This act is intended to protect, conserve, and restore estuaries in balance with developing them to further the growth and development of the Nation. There are no estuaries of national significance located in the study area; therefore, this project is consistent with the purposes of this act.

6.12 FEDERAL WATER PROJECT RECREATION ACT

The principles of the Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1 (12), *et seq*. P.L. 89-72, do not apply to this project.

6.13 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976

Pursuant to the 1999 Finding between USACE and NMFS, USACE's Notice of Availability of the draft EA initiated USACE's consultation under the MSFCMA. NMFS provided initial comments on September 13, 2005, in response to USACE's request for scoping comments (August 17, 2005). NMFS requested that any NEPA document associated with the project include an EFH assessment, and noted the importance of the nearshore waters in the study area as foraging habitat for federally managed fishery resources. NMFS provided comments on the draft EA on April 4, 2016, and USACE responded to their recommendations on December 28, 2016 (see Appendix G-3). The project is in compliance with the act.

6.14 SUBMERGED LANDS ACT OF 1953

The project would occur on submerged lands of the State of Florida. The project is being coordinated with the state, and is in compliance with the act.

6.15 COASTAL BARRIER RESOURCES ACT AND COASTAL BARRIER IMPROVEMENT ACT OF 1990

The Coastal Barrier Resources Act (CBRA) and the Coastal Barrier Improvement Act of 1990 (CBIA) limit federally-subsidized development within the CBRS units to limit the loss of human life and natural resources by discouraging development in high risk areas, to reduce wasteful expenditures of Federal resources, and to protect the natural resources associated with coastal barriers. CBRA provides development goals for undeveloped coastal property held in public ownership, including wildlife refuges, parks, and other lands set aside for conservation ("otherwise protected areas," or OPAs). These public lands are excluded from most of the CBRA restrictions, although they are prohibited from receiving Federal Flood Insurance for new structures.

Federal monies can be spent within the CBRS units for certain activities, including, but not limited to, (1) projects for the study, management, protection, and enhancement of fish and wildlife resources and habitats; (2) establishment and operation and maintenance of navigation aids; (3) projects funded under the Land and Water Conservation Fund Act of 1965; (4) scientific research; (5) assistance for emergency actions essential to saving lives and the protection of property and the public health and safety, if preferred pursuant to the Disaster Relief Emergency Assistance Act and the National Flood Insurance Act and are necessary to alleviate the emergency; (6) maintenance, repair, or reconstruction, but not expansion, of publically owned or publically operated roads, structures, or facilities; (7) non-structural projects for shoreline stabilization that are designed to mimic, enhance, or restore a natural stabilization system; (8) any use or facility necessary for the exploration, extraction, or transportation of energy resources; (9) maintenance or construction of improvements of existing Federal navigation channels, including the disposal of dredge materials related to such projects; and (10) military activities essential to national security.

USACE coordinated with USFWS concerning the CBRS units in the project area to confirm that the project is in compliance with the act on May 20, 2016. This consultation focused on the beach placement area, and the USFWS provided confirmation that beach placement pursuant to the Recommended Plan was consistent with the purposes of the CBRA. The USACE consulted further with the USFWS on October 12, 2016, specifically to address the use of the St. Augustine Inlet system as a sand source for the project. The USFWS provided confirmation in a letter dated October 25, 2016, that the removal of sediment from CBRS Unit P05 (Conch Island Unit) for placement pursuant to the Recommended Plan was consistent with the purposes of CBRA. This project is in compliance with this act.

6.16 RIVERS AND HARBORS ACT OF 1899

The proposed work would temporarily obstruct navigable waters of the United States. The proposed action will be subject to the public notice, public hearing, and other evaluations normally conducted for activities subject to the act. The project is in compliance with this act.

6.17 ANADROMOUS FISH CONSERVATION ACT

This act authorizes the Secretaries of the Interior and Commerce to enter into cooperative agreements with the States and other non-federal interests for conservation, development, and enhancement of anadromous fish and to contribute up to 50% as the Federal share of the cost of carrying out such agreements. As this project is not receiving funding for these purposes, this act does not apply.

6.18 MIGRATORY BIRD TREATY ACT AND MIGRATORY BIRD CONSERVATION ACT

Migratory birds would be minimally affected by dredging at the proposed sand source locations. The USACE will include our standard migratory bird protection requirements in the project plans and

specifications and will require the contractor to abide by those requirements. Renourishment activities at the beach placement site will be monitored at dawn or dusk daily during the nesting season to protect nesting migratory birds. If nesting activities occur within the construction area, appropriate buffers will be placed around nests to ensure their protection. The project is in compliance with these acts.

6.19 MARINE PROTECTION, RESEARCH AND SANCTUARIES ACT (OCEAN DUMPING ACT)

The term "dumping" as defined in the act (33 U.S.C. 1402) does not apply to the disposal of material for beach nourishment or to the placement of material for a purpose other than disposal (i.e. placement of rock material as an artificial reef or the construction of artificial reefs as mitigation). Therefore, the Marine Protection, Research, and Sanctuaries Act does not apply to this project. The disposal activities addressed in this EA have been evaluated under Section 404 of the Clean Water Act (see Appendix A).

6.20 UNIFORM RELOCATION ASSISTANCE AND REAL PROPERTY ACQUISITION POLICIES ACT OF 1970.

The purpose of PL 91-646 is to ensure that owners of real property to be acquired for Federal and federally-assisted projects are treated fairly and consistently and that persons displaced as a direct result of such acquisition will not suffer disproportionate injuries as a result of projects designed for the benefit of the public as a whole.

While one of the alternatives considered during plan formulation included the acquisition of real property, this is not part of the Recommended Plan. Therefore, this project does not involve any real property acquisition or displacement of property owners or tenants. Therefore, this act is not relevant to this project.

6.21 EXECUTIVE ORDER (EO) 11990, PROTECTION OF WETLANDS

No wetlands would be affected by project activities. This project is in compliance with the goals of this Executive Order.

6.22 E.O 11988, FLOOD PLAIN MANAGEMENT

To comply with EO 11988, the policy of USACE is to formulate projects that, to the extent possible, avoid or minimize adverse effects associated with the use of the floodplain and avoid inducing development in the floodplain unless there is no practicable alternative. No activities associated with this project are located within a floodplain, which is defined by EO 11988 as an “area which has a one percent or greater chance of flooding in any given year.” The project is located within the Coastal High Hazard Area (CHHA), as defined by EO 11988 as an “area subject to inundation by one-percent-annual chance of flood, extending from offshore to the inland limit of a primary frontal dune along an open coast and any other

area subject to high velocity wave action from storms." The project shoreline is significantly developed, and further development is anticipated to be minimal.

CSRM projects are inherently located in coastal areas, and are often located in CHHAs based on the problems the project is seeking to alleviate. The primary objective of the St. Johns County CSRM Project is to reduce infrastructure damage. There is no practicable alternative that could be located outside of the CHHA that would achieve this objective.

For the reasons stated above, the project is in compliance with EO 11988, Floodplain Management.

6.23 E.O. 12898, ENVIRONMENTAL JUSTICE

On February 11, 1994, the President of the United States issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. The Executive Order mandates that each federal agency make environmental justice part of the agency mission and to address, as appropriate, disproportionately high and adverse human health or environmental effects of the programs and policies on minority and low-income populations.

Any potential adverse effects of the proposed action would be more likely to affect those of higher socioeconomic status, such as large watercraft owners or those living in the coastal area surrounding the project. The beneficial effect of a wider, more sustainable beach at South Ponte Vedra Beach and Vilano Beach would benefit all members of the public who are able to obtain transportation to access the beach. The storm damage reduction benefits are primarily benefitting the landowners in this area. There are no disproportionate adverse impacts to minority or low income populations resulting from the implementation of the project.

6.24 E.O. 13045, DISPARATE RISKS INVOLVING CHILDREN

On April 21, 1997, the President of the United States issued Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*. The Executive Order mandates that each Federal agency make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children and ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.

As the proposed action does not affect children disproportionately from other members of the population, the proposed action would not increase any environmental health or safety risks to children.

6.25 E.O. 13112, INVASIVE SPECIES

The proposed action will require the mobilization of dredge equipment from other geographical regions. Dredge equipment has the potential to transport species from one region to another, introducing them to new habitats where they are able to out-compete native species. The benefits of the proposed project

outweigh the risks associated with the very slight potential for introducing non-native species to this region. The action takes place primarily in Atlantic Ocean waters, minimizing risk to more sheltered coastal habitats.

6.26 ENVIRONMENTAL OPERATING PRINCIPLES

1. Foster sustainability as a way of life throughout the organization.

The Recommended Plan prioritizes the use of material from the inlet system that is already in the sediment system. This prevents the need from dredging offshore, previously undisturbed sediments.

2. Proactively consider environmental consequences of all USACE activities and act accordingly.

The integration of the EA into the feasibility study requires all members of the Project Delivery Team to acknowledge the impact that the proposed project will have on the environment. This helps to ensure the project is designed with the environment in mind.

3. Create mutually supporting economic and environmentally sustainable solutions.

The use of the inlet system in the Recommended Plan incorporates RSM strategies, which inherently incorporate outcomes that are economically and environmentally preferable.

4. Continue to meet our corporate responsibility and accountability under the law for activities undertaken by USACE, which may impact human and natural environments.

This document includes all information necessary to document how the project meets USACE's corporate responsibility and accountability requirements for actions that may impact human and natural environments.

5. Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.

The project biologist is involved throughout the study process to ensure that environmental considerations are taken into account for the life of the project.

6. Leverage scientific, economic and social knowledge to understand the environmental context and effects of USACE actions in a collaborative manner.

The entire Project Delivery Team understands the need to consider the environment during its decision-making process.

7. Employ an open, transparent process that respects views of individuals and groups interested in USACE activites.

The actions taken to involve the public, resource agencies, and NGOs who may be interested in the project are outlined in Section 6.1.

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CHAPTER 7

Recommendation

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7 RECOMMENDATION

I have given consideration to all significant aspects in the overall public interest including engineering feasibility, economic, social, cost and risk analysis, and environmental effects. The Recommended Plan described in this final report provides the optimum solution for coastal storm risk management benefits within the study area that can be developed with the framework of the formulation concepts. Implementation of the St. Johns County, Florida Coastal Storm Risk Management (CSRM) Project is recommended at this time, with such modification as in the discretion of the Commander, Headquarters, U.S. Army Corps of Engineers (HQUSACE), may be advisable.

The Recommended Plan, shown in Figure 7-1, is the National Economic Development (NED) Plan including beach and dune nourishment within the Vilano Beach reach and a small portion of the South Ponte Vedra Beach reach. The design includes construction of a 60-foot equilibrated berm extension from the +8.0 foot 1988 North Atlantic Vertical Datum (NAVD88) contour between the R monuments R103.5 and R116.5 along 2.6 miles of shoreline. The project template will include a dune feature varying in height between +14.0 to +20.0 feet NAVD88, reflecting the average 2015 dune position. Tapers of a maximum length of one thousand feet will extend from the northern and southern ends of the berm extension, connecting the extension to the existing shoreline. The addition of tapers results in sand placement from R102.5 to R117.5 along 3 miles of shoreline.

Figure 7-1. Recommended Plan.

The Recommended Plan will reduce coastal risk and damage to infrastructure as well as a critical hurricane evacuation route for the area, SR A1A. The Project First Costs are $78,417,000 (FY17 price levels) over 50 years. Initial construction will be cost shared at 23% Federal and 77% non-federal. Periodic nourishments will be cost shared at 17.7% Federal and 82.3% non-federal. The average annual net benefits for the Recommended Plan are $622,000 and benefit cost ratio (BCR) is 1.3 to 1.

In addition to the NED benefits associated with reducing damages to infrastructure, the Recommended Plan will also have non-monetary benefits for environmental quality and other social effects. Construction of the identified Recommended Plan will use the St. Augustine Inlet system as a sand source. Use of this source will provide considerable value to the nation since a Federal navigation channel is within the system and an ongoing Federal CSRM project is located south of the inlet. One construction event could effectively accomplish all three Federal projects with one dredge mobilization, saving considerable funds over the 50-year period of Federal participation in the Recommended Plan, as well as avoid environmental impact risks related to multiple dredging events.

Initial construction will require approximately 1,310,000 cubic yards of sand, and each periodic nourishment event will require approximately 866,000 cubic yards from the inlet system. The renourishment interval is expected to be approximately 12 years, equaling three renourishment events in addition to initial construction over the 50-year period of Federal participation.

7.1 ITEMS OF LOCAL COOPERATION

Recommendations for provision of Federal participation in the Recommended Plan described in this report would require the project sponsor to enter into a written Project Partnership Agreement (PPA), as required by Section 221 of Public Law 91-611, as amended, to provide local cooperation satisfactory to the Secretary of the Army. Such local cooperation shall include:

a. Per WRDA 1986, as amended, provide 35% of initial project costs assigned to hurricane and storm damage reduction, plus 100% of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits; and 50% of periodic nourishment costs assigned to hurricane and storm damage reduction, plus 100% of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits and as further specified below:

    1) Enter into an agreement that provides, prior to construction, 35% of design costs;
    2) Provide all lands, easements, and rights-of-way, and perform or ensure the performance of any relocations determined by the Federal Government to be necessary for the initial construction, periodic nourishment, and operation and maintenance of the project;
    3) Provide, during construction, any additional amounts as are necessary to make their total contribution equal to 35% of initial project costs assigned to hurricane and storm damage reduction, plus 100% of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits; and 50% of periodic nourishment costs assigned to hurricane and storm damage reduction, plus 100% of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits;

b. For so long as the project remains authorized, operate, maintain, and repair the completed project, or functional portion of the project, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and state laws and regulations, and any specific directions prescribed by the Federal Government;

c. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-federal sponsor, now or hereafter, owns or controls for access to the project for the purpose of inspecting, operating, maintaining, repairing, replacing, rehabilitating, or completing the project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Federal Government shall relieve the non-federal sponsor of responsibility to meet the non-federal sponsor's obligations, or to preclude the Federal Government from pursuing any other remedy at law or equity to ensure faithful performance;

d. Hold and save the United States free from all damages arising from the initial construction, periodic nourishment, mitigation, operation, maintenance, repair, replacement, and rehabilitation of the project and any project related betterments, except for damages due to the fault or negligence of the United States or its contractors;

e. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

f. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended, 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the initial construction, periodic nourishment, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-federal sponsor with prior specific written direction, in which case the non-federal sponsor shall perform such investigations in accordance with such written direction;

g. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the initial construction, periodic nourishment, operation, or maintenance of the project;

h. Agree that the non-federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, and repair the project in a manner that will not cause liability to arise under CERCLA;

i. If applicable, comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100 17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for the initial construction, periodic nourishment, operation, and maintenance of the project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

j. Comply with all applicable Federal and state laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600 7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army," and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c *et seq.*);

k. Provide the non-federal share of that portion of the costs of data recovery activities associated with historic preservation that are in excess of 1% of the total amount authorized to be appropriated for the project in accordance with the cost sharing provisions of the agreement;

l. Participate in and comply with applicable Federal floodplain management and flood insurance programs;

m. Do not use Federal funds to meet the non-federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized;

n. Prescribe and enforce regulations to prevent obstruction of or encroachment on the project that would reduce the level of protection it affords or that would hinder future periodic nourishment and/or the operation and maintenance of the project;

o. Not less than once each year inform affected interests of the extent of protection afforded by the project;

p. Publicize floodplain information in the area concerned, provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the floodplain, and adopt such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

q. For so long as the project remains authorized, the non-federal sponsor shall ensure continued conditions of public ownership and use of the shore upon which the amount of Federal participation is based;

r. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms;

s. Recognize and support the requirements of Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project, or separable element thereof, until the non-federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

t. At least twice annually, and after storm events, perform surveillance of the beach to determine losses of nourishment material from the project design section and provide the results of such surveillance to the Federal government; and

u. Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires the non-federal sponsor to participate in and comply with applicable Federal floodplain management and flood insurance programs, prepare a floodplain management plan within one year after the date of signing the project partnership agreement (PPA), and implement the plan no later than one year after project construction is complete.

7.2 DISCLAIMER

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to higher authority as proposals for project modification and/or implementation funding. The recommendations herein for provision of a coastal storm risk management project for St. Johns County, Florida do not include any provisions for work which would result in any new Federal expenditures or financial assistance prohibited by the Coastal Barrier Resources Act (Public Law 97-348); nor were funds obligated in past years for this project for purposes prohibited by this act.

7.3 CERTIFICATION OF PUBLIC ACCESSIBILITY

As part of the obligations established in the project partnership agreement (PPA) for the St. Johns County, Florida, Coastal Storm Risk Management (CSRM) Project, the non-federal sponsor shall assure continued conditions of public ownership and public use of the shore upon which Federal participation is based during the economic life of the project. The non-federal sponsor shall also provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms. In the

determination of the Federal interest in cost sharing, Federal participation was limited to areas where public beach access and adequate parking are available. For shoreline reaches farther than ¼ mile from public access with adequate parking, Federal participation was not provided. The maximum Federal participation allowable for each land use category is applied for cost sharing. I therefore conclude that there is reasonable public availability of the project beaches in all areas where Federal participation is provided.

Jason A. Kirk, P.E.
Colonel, U. S. Army
District Commander

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CHAPTER 8

List of Preparers

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8 LIST OF PREPARERS*

8.1 PREPARERS

This Feasibility Study with integrated Draft Environmental Assessment was prepared by the following U.S. Army Corps of Engineers personnel:

Matt Schrader, P.E.	Coastal Engineer
Aubree G. Hershorin, Ph.D.	Ecologist
Dan Hughes, Ph.D.	Archeologist

8.2 REVIEWERS

This report was reviewed by the following personnel:

Paul DeMarco	Biologist
Brandon Burch	Project Manager

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CHAPTER 9

References and Index

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9 REFERENCES AND INDEX*

9.1 REFERENCES

Atlantic States Marine Fisheries Commission. 2016. Summer Flounder: Life History. Available online at http://www.asmfc.org/species/summer-flounder.

Carrier, J.C. and Luer, C.A., 1990. Growth rates in the nurse shark, *Ginglymostoma cirratum*. *Copeia*, pp.686-692.

Castro, J.I. 1983. The sharks of North American waters. Texas A&M University Press, College Station: 180pp.

Christensen, T.K., Clausager, I. & Petersen, I.K. 2003. Base-line investigations of birds in relation to an offshore wind farm at Horns Rev, and results from the year of construction. NERI Report.

Compagno, L.J.V. 1984. FAO Species Catalog Vol.4, Part 1 and 2: Sharks of the world: An annotated and illustrated catalogue of shark species known to date. FAO Fish. Synop. 125. FAO, Rome, Italy

Cook, A.S.C.P. and N.H.K. Burton. 2010. A review of the potential impacts of marine aggregate extraction on seabirds. Marine Environment Protection Fund Project 09/P130. Marine Aggregate Levy Sustainability Fund. Available online at http://www.bto.org/sites/default/files/shared_documents/publications/research-reports/2010/rr563.pdf.

Dickerson, C., Reine, K.J., and Clarke, D.G. 2001. Characterization of underwater sounds produced by bucket dredging operations, DOER Technical Notes Collection (ERDC TNDOER-E14), U.S. Army Engineer Research and Development Center, Vicksburg, MS. www.wes.army.mil/el/dots/doer.

Driggers III, W.B., Ingram Jr, G.W., Grace, M.A., Gledhill, C.T., Henwood, T.A., Horton, C.N. and Jones, C.M., 2008. Pupping areas and mortality rates of young tiger sharks Galeocerdo cuvier in the western North Atlantic Ocean. *Aquatic Biology*, *2*(2), pp.161-170.

Duncan, K.M., A.P. Martin, B.W. Bowen, and H.G. De Couet. 2006. Global phylogeography of the scalloped hammerhead shark (*Sphyrna lewini*). Molecular Ecology 15(8):2239-2251.

Essink, Karel. 1999. Ecological effects of dumping of dredged sediments; options for management. Journal of Coastal Conservation 5: 69-80.

Foster, Emmett R., Darren L. Spurgeon, and Jenny Cheng. 2000. Shoreline Change Rate Estimates: St. Johns County, June 2000. Florida Department of Environmental Protection, Office of Beaches and Coastal Systems. Report No. BCS-00-03. Available online at ftp://ftp.dep.state.fl.us/pub/water/beaches/HSSD/reports/stjsre.pdf.

Garthe, S. and O. Hüppop. 1999. Effect of ship speed on seabird counts in areas supporting commercial fisheries. Journal of Field Ornithology, 70: 28-32.

Garthe, S., Benvenuti, S. and Montevecchi, W. A. 2000. Pursuit diving in northern gannets feeding on capelin. Proceedings of the Royal Society of London: Series B, 267, 1717-1722.

Gaston, A. J. 2004. Seabirds a natural history. Helm, London.

Greene, C.R.J. and S.E. Moore. 1995. Man-made noise. Pp 101-158 in Marine Mammals and Noise. W.J. Richardson, C.R.J. Greene, C.I. Malme and D.H. Thomson (ed.), Academic Press, San Diego.

Hall, Wes. 2000. Archaeological Diver Identification and Evaluation of Twelve Potentially Significant Submerged Targets in St. Augustine Inlet, St. Johns County, Florida. Contract No. DACW17-98-M-0200. Submitted to U.S. Army Corps of Engineers, Jacksonville District by Mid-Atlantic Technology and Environmental Research, Inc. May 27, 2000.

Heithaus, M.R. and Dill, L.M., 2002. Food availability and tiger shark predation risk influence bottlenose dolphin habitat use. *Ecology*, *83*(2), pp.480-491.

Herron Baird, P. 1990. Concentrations of seabirds at oil-drilling rigs. Condor, 92: 768-771.

Heupel, M.R. and Simpfendorfer, C.A., 2005. Quantitative analysis of aggregation behavior in juvenile blacktip sharks. *Marine Biology*, *147*(5), pp.1239-1249.

Hildebrand, J. 2004. Sources of anthropogenic sound in the marine environment. In E. Vos and R.R. Reeves (eds.) Report of an International Workshop: Policy on Sound and Marine Mammals, 28–30 September 2004, London, England 23 December 2005. U.S. Marine Mammal Commission, London, England.

HomeFacts. 2016. St. Augustine, FL Air Quality Information. Accessed online at http://www.homefacts.com/airquality/Florida/St.-Johns-County/St.-Augustine.html.

Lombardi-Carlson, L.A., 2007. Life history traits of bonnethead sharks, Sphyrna tiburo, from the eastern Gulf of Mexico. *SEDAR13*, pp.1-7.

Marine Aggregate Levy Sustainability Fund (MALSF). 2009. A generic investigation into noise profiles of marine dredging in relation to the acoustic sensitivity of the marine fauna in UK waters with particular emphasis on aggregate dredging: PHASE I Scoping and review of key issues. MEPF Ref No: MEPF 08/P21. Cefas contract report C3312. Accessed online at http://www.cefas.co.uk/media/462318/mepf-08p21%20final%20report%20published .pdf.

Morgan, Alexia. 2008. Lemon shark biological profile. Florida Museum of Natural History. Available at http://www.flmnh.ufl.edu/fish/discover/species-profiles/negaprion-brevirostris.

NMFS. 2006. Final Consolidated Atlantic Highly Migratory Species Fishery Management Plan. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Sustainable Fisheries, Highly Migratory Species Management Division, Silver Spring, MD. Public Document. pp. 1600.

NOAA, 1991. Regional biological opinion for Southeastern hopper dredging. November 15, 1991 (revised August 25, 1995, and September 5, 1997). Available online at http://sero.nmfs.noaa.gov/protected_resources/section_7/freq_biop/index.html.

NOAA, 2015. Water Temperature Table of the Southern Atlantic Coast. Accessed online on November 13, 2015 at https://www.nodc.noaa.gov/dsdt/cwtg/all_meanT.html.

Pratt, H.L., Jr., and J.C. Carrier. 2001. A review of elasmobranch reproductive behavior with a case study on the nurse shark, *Ginglymostoma cirratum.* Environmental Biology of Fishes 60:157-188.

Rogers, Cory M., Kristine A. Jacobson, and Mark Gravens. 2009. Beach-fx User's Manual: Version 1.0 Report No. ERDC/CHL SR-09-6. Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory 3909 Halls Ferry Road, Vicksburg, MS 39180-6199. 262 pages. Available online at http://acwc.sdp.sirsi.net/client/search/asset/1000110.

Skomal, G.B., 2007. Shark nursery areas in the coastal waters of Massachusetts. In *American Fisheries Society Symposium* (Vol. 50, p. 17). American Fisheries Society.

Skov, H. and J. Durinck. 2001. Seabird attraction to fishing vessels is a local process. Marine Ecology Progress Series, 214: 289-298.

SAFMC (South Atlantic Fishery Management Council). 1998. Final Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans of the South Atlantic Region. Including a Final Environmental Impact Statement/Supplemental Environmental Impact Statement, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, Charleston, S.C. 136 pages.

Tasker, M. L., P. Hope-Jones, T. Dixon, and A. Wallis. 1986. Seabirds associated with oil production platforms in the North Sea. Ringing and Migration, 7: 7-14.

Thaxter, C.B., Wanless, S., Daunt, F., Harris, M.P., Benvenuti, S., Watanuki, Y., Gremillet, D. & Hamer, K. C. 2010. Influence of wing loading on the trade-off between pursuit-diving and flight in Common Guillemots and Razorbills. Journal of Experimental Biology, 213, 1018-1025.

U.S. Climate Data. 2015. Average Monthly Climate, Jacksonville Beach – Florida. Accessed online on November 13, 2015 at http://www.usclimatedata.com/climate/florida/united-states/3179.

U.S. Fish and Wildlife Service. 2011. Statewide programmatic biological opinion. Revised March 13, 2015. Available online at http://www.saj.usace.army.mil/About/Divisions-Offices/Planning/Environmental-Branch/Environmental-Documents/.

U.S. Fish and Wildlife Service. 2013. Piping plover programmatic biological opinion. Available online at http://www.saj.usace.army.mil/About/Divisions-Offices/Planning/Environmental-Branch/Environmental-Documents/.

U.S. Fish and Wildlife Service. 2015. Species Account/Biologue: Anastasia Island Beach Mouse. Information available online at http://www.fws.gov/northflorida/species-accounts/beach-mice-2005.htm.

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