# Manatee County, Florida Shore Protection Project – Anna Maria Island

Manatee County, Florida

DRAFT

# Engineering Documentation Report (EDR)

## Dune Resilience

U.S. Army Corps of Engineers
Jacksonville District
August 2020

# EXECUTIVE SUMMARY

The purpose of this Engineering Documentation Report (EDR) is to document how the Manatee County, Florida Shore Protection Project (SPP) can be adapted in order to increase project resilience, with project-specific recommendations for incorporating design refinements within the existing project authority. This EDR is an implementation document to supplement 1991 Manatee County, Florida SPP General Design Memorandum, which is the most recent decision document for the project. This EDR was prepared in accordance with Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works Projects, 31 August 1999.

General dune-related design refinements applicable to beach nourishment projects were considered for implementation to increase project resilience. Design refinements considered include the incorporation of enhancements to support dune stability. Dune enhancements include sand placement, vegetation, sand fencing, modifications to pedestrian and vehicle accesses, and storm water outfall pipes.

The design refinements recommended to increase resilience for the Manatee County SPP include dune incorporation and vehicle access modifications. These design changes are considered to be minor as they do not increase the total volume of sand to be placed over the period of Federal participation or Total Project Cost. The one time dune design refinements recommended by this EDR will be implemented with funding provided under the Bipartisan Budget Act of 2018 (BBA-18) which are not applied towards the project Section 902 limit. This EDR demonstrates that these design refinements are consistent with the project purposes. Recommendations were considered in accordance with guidance contained in Engineering and Construction Bulletin (ECB) 2018-2, Implementation of Resilience Principles in the Engineering & Construction Community of Practice, 25 January 2008. The USACE principles of resilience – Prepare, Absorb, Recover and Adapt (PARA) were applied in support of risk-informed decision making, and the Director of Civil Works Memorandums dated 21 June 2017 and 3 May 2018, to operationalize risk-informed decision making.

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# PERTINENT DATA

**Table 1** provides a tabular summary comparing key project data for the status quo implementation of the existing authorized project and for implementation of the project with recommended dune design refinements to increase resilience. The project remains economically justified and there is only a small decrease in the remaining benefit to remaining cost ratio (RBRCR) with the implementation of the recommended dune design refinements. Potential life-cycle cost savings and additional benefits that could be realized from increased project resilience are not accounted for in the economic analysis.

*Table 1: Pertinent Data Comparison*

| Pertinent Data | Existing Authorized Project | EDR Recommendation Implementation |
|---|---|---|
| ***General:*** | | |
| Project Purpose | SPP | SPP |
| End of Federal Participation | 2042 | 2042 |
| ***Physical Data*** | | |
| *Project Length | 4.2 miles | 4.2 miles |
| Design Berm Width | 75 ft | 75 ft |
| **Design Berm Elevation | 6.0 ft MLW (4.8 ft NAVD88) | 6.0 ft MLW (4.8 ft NAVD88) |
| Planned Periodic Nourishment Volume | 612,000 cy | 612,000 cy |
| Planned Periodic Nourishment Interval | 9 yr | 9 yr |
| Dune Crest Width | n/a | 10 ft |
| Dune Elevation | n/a | 8 ft NAVD 88 |
| Dune Slope | n/a | 1V:3H |
| *One Time Dune Design Refinements* | | |
| Volume | n/a | 4,025 cy |
| Dune Vegetation | n/a | 44,785 $ft^2$ |
| Rope and Post Fencing | n/a | 320 ft |
| **Financial Data:** | | |
| FY20 Interest Rate | 2.750% | 2.750% |
| Dune Feature Costs (FY20) | $0 | $1,169,500 |
| ***AAEQ Costs (FY20) | $987,046 | $1,006,778 |
| ****AAEQ Benefits (w/Rec, FY20) | $14,528,000 | $14,528,000 |
| RBCR | 14.7 | 14.4 |

* The authorized project provides for future nourishment of the entire length of Anna Maria Island (7.5 mile total length) as needed and justified.
**The 1973 Chief's Report authorized a berm elevation of 6.0 ft MLW. This elevation was changed in the 1991 General Design Memorandum (and draft 2000 Limited Re-evaluation Report) to 5 ft NGVD29, which was believed to be approximately equivalent to 6.0 ft MLW. This conversion was discovered to be incorrect and future nourishments should use 6.0 ft MLW as the appropriate berm elevation.
***Potential life-cycle cost savings and additional benefits that could be realized from increased project resilience are not accounted for in the economic analysis.
**** Incidental recreation is $961,000, AAEQ net benefits without recreation is $12.5M and the BCR is 13.5 as is shown in **Table 9-3**

# INTRODUCTION

The resilience of the Anna Maria Island segment of the Manatee County, Florida Shore Protection Project (Manatee County SPP) can be increased through the adaptation of project specific recommendations in accordance with the U.S. Army Corps of Engineers (USACE) principles of resilience found in Engineering Construction Bulletin (ECB) 2018-2. In general, the incorporation of dunes into the Federal project can increase the project's resilience due to the critical role that the dunes play in reducing damage to the project and infrastructure. The following sections describe the resilience principles and their application to beach systems, along with the changing understanding of dunes and how they provide resilience to the project.

## RESILIENCE PRINCIPLES

ECB 2018-2*, Implementation of Resilience Principles in the Engineering & Construction Community of Practice*, provides the policy and guidance for applying the USACE principles of resilience. In general, USACE defines resilience as the ability to anticipate, prepare for and adapt to changing conditions; and withstand, respond to and recover from disruptions. This ECB reflects this general definition and supports the application of a more project-specific definition of resilience as the capacity of a component, unit, or system to withstand occasional large overloads (for a definite duration of time) that cause minimal permanent deformation, damage, or cumulative degradation and then recover (within a specified time) its original state and function after the overloading event.

The 2016 Resilience Initiative Roadmap established that resilience will be implemented USACE-wide through the application of the PARA principles and in support of risk-informed decision making. To apply resilience at the project or system level, an evaluation should be performed using the PARA principles during pre-construction designs, engineering during construction designs, and/or during repair/rehabilitation designs as frequently as needed based on engineering judgment and reflective of project complexity and assessed risk.

In order to apply resilience to an authorized beach nourishment project it is important to understand how the project specific definition of resilience and PARA principles described in ECB 2018-2 apply to this type of project and beach systems, which include a dune, berm, and submerged profile. **Table 2** and **Table 3** break down the resilience terminology and how it relates to beach nourishment.

*Table 2: Applicability of PARA Principles to Beach Nourishment*

| ECB 2018-2 PARA Principles | PARA Principles relative to beach nourishment projects |
|---|---|
| The **Prepare** principle should be used to consider measures that reduce risks or costs under loading conditions beyond those required by technical standards | **Preparing** for the future needs of the recommended plan, initial project construction and periodic nourishments are planned to manage coastal risk over the period of Federal participation. |
| The **Absorb** principle should be used to identify cost effective measures to limit damage to, or loss of function of, a project component or system due to both acute and chronic loading conditions, including conditions beyond those used for the design. This principle can also be used as an opportunity to consider adding system component robustness, redundancy, and increased reliability. | The beach system **absorbs** impacts of erosion, inundation, and wave attack in order to reduce impacts to valuable upland infrastructure. |
| The **Recover** principle should be used to identify cost effective measures that allow for rapid repair or function restoration of a project component or system. | Periodic nourishments and natural recovery of the beach system following storms **recover** functionality of the dune and beach system. The integrated nature of dunes and berms is an essential component of beach system recovery. |
| The **Adapt** principle should be used to identify cost effective modifications to a project component or system that will maintain or improve future performance based on lessons learned from a specific loading condition or loadings associated with changed conditions. | Since beach nourishment projects are constructed of sand and are "soft" features, the project design can be **adapted** for future periodic nourishment as the beach system evolves and project monitoring improves understanding of a project's performance. |

*Table 3: Applicability ECB 2018-2 Project Specific Resilience Definition to Beach Nourishment*

| ECB 2018-2 Project Specific Definition of Resilience | Resilience relative to beach nourishment projects |
|---|---|
| *Capacity of a **component, unit, or system** to withstand occasional **large overloads** (for a definite duration of time) that cause **minimal permanent deformation, damage, or cumulative degradation** and then essentially recover (within a specified time) its **original state and function** after the overloading event.* | |
| component, unit, or system | Project components include design template dimensions and advanced fill volume. The beach system includes dunes, dry beach berm, submerged profiles & sand bars. |
| large overloads | Large (low frequency) tropical and extratropical storm events. |
| minimal permanent deformation, damage, or cumulative degradation | Impacts from large storm events causing significant erosion to the project's advanced fill and design template which reduce a project's ability to reduce storm damage. |
| original state and function | The fully constructed project design template and advanced fill dimensions which function to reduce coastal storm over the period of Federal participation. |

## DUNE CONSIDERATIONS FOR EXISTING SAJ BEACH NOURISHMENT PROJECT DESIGNS

The United States Army Corps of Engineers (USACE) Jacksonville District (SAJ), in partnership with local sponsors, have been implementing beach nourishment projects in Florida since 1969. The initial project designs for many of these projects were developed from the 1960's through the 1980's. The majority of these projects were designed to control beach erosion and prevent the landward retreat of the shoreline that would cause property and infrastructure damage. This is in contrast to more recent projects, where the projects are meant to reduce damages to not only erosion but also flooding and wave attack. The general understanding at the time was that that the best way to address the problem of landward erosion was to build a wider beach berm. Dunes were considered in the plan formulation process for these project, but typically were eliminated from consideration. This is because dunes were thought to only reduce storm surge flooding and vertical erosion which were not considered to be significant problems along the coast in most project areas. Beach recreation was also an important consideration in the development of these projects. The general understanding at the time was that wider beach berms would increase recreational opportunities while dunes would take up beach space that could otherwise provide recreational value. The following excerpts from USACE Beach Erosion Control Studies demonstrate how dunes and vegetation for dune stabilization were considered at the time these projects were being formulated.

*"Stabilization of the beaches and adjacent dunes with vegetation is, for the most part, not applicable in the present situation. Dunes will not be constructed and beach grassing would be unsightly, unnecessary, and deprive the area of a recreational beach."* – 1979 Feasibility Report for Beach Erosion Control, St. Johns County, Florida

*"Hurricane surge protection in the form of a sand dune was eliminated from consideration as the populated areas are of sufficient elevation to withstand such a surge" … "Although effective in stabilizing dunes, the grasses natural to the area are ineffective in preventing erosion in the local high energy wave climate."* – 1985 Feasibility Report and EIS, Beach Erosion Control for Nassau County, Florida

## INCREASING RESILIENCE FOR EXISTING SAJ BEACH NOURISHMENT PROJECT DESIGNS

It is now recognized that dunes are integral components of a beach system and play a critical role in reducing damages to the project and infrastructure. The following excerpts from the Hurricane Sandy Coastal Projects Performance Evaluation Study and the New Jersey Sea Grant Consortium Dune Manual demonstrate the importance of dunes and how they can increase resilience on beach nourishment projects.

*"Dunes can significantly contribute to the volumes of sediment available for redistribution along the shoreline during a storm, reducing the potential for undermining and exposure of land-based infrastructure, and impeding the landward reach of storm tides."* – 2013 Hurricane Sandy Coastal Projects Performance Evaluation Study.

*"Dunes can provide protection for a relatively small volume of sand both on the ocean and bay shorelines. Conventionally, dunes should be constructed along with a protective beach. At the time of construction, dunes should be actively vegetated to reduce loss from wind-blown sand transport and increase their resistance to erosion."* – 2013 Hurricane Sandy Coastal Projects Performance Evaluation Study.

*"Coastal sand dunes act as reservoirs of sand that help the beach maintain its equilibrium and preserve the ability of the beach to respond naturally to storm events. Beaches evolve during a storm by taking on a more dissipative state that causes waves to break farther offshore, reducing the wave energy near the shoreline. During this transition, the beach slope is reduced and one or more sand bars may form. The bars are formed as sand is transported offshore during the peak of the storm and is deposited near the region of most intense wave breaking. During smaller storms, the waves don't reach the base of the dune, and the erosion is limited to the beach face (berm) itself. The dunes only become active during moderate to large storms when the dissipation created by the bars is insufficient to prevent the waves from attacking the base of the dune. As a dune erodes, it releases a portion of its built-up reservoir of sand into the littoral system, where it contributes to bar formation and the development of a more dissipative profile, ultimately reducing damage to inland infrastructure. Larger dunes can withstand more wave activity and therefore provide more protection to areas behind them. In the simplest terms, the sand stored in a dune buys time and provides protection from severe storms."* – 2016 New Jersey Sea Grant Consortium Dune Manual.

**Figure 1** illustrates the interaction between the dune, berm, and submerged profile during storm events.

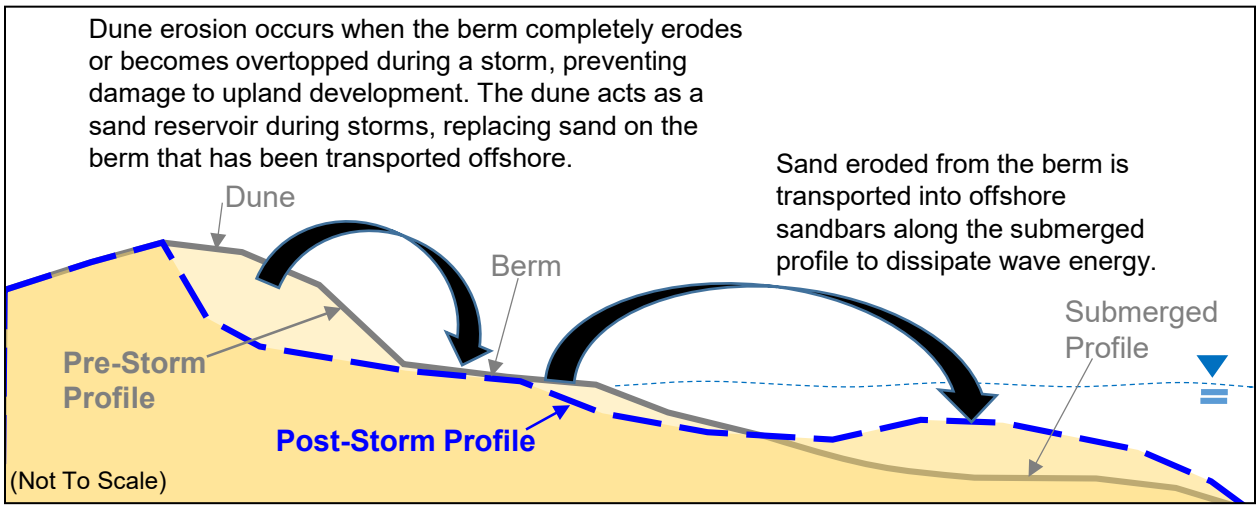



*Figure 1: Beach Profile Storm Response*

Based on the definition of resilience and PARA principles described in ECB 2018-2, it is possible to apply design refinements for increased resilience to authorized beach nourishment projects. These project design refinements can be implemented when they are permitted by project authorities and do not significantly increase total life cycle cost. Project resilience can be increased through various means including;

- addition of dunes to the authorized design template,
- adaptation of the shape/configuration of the advance fill to incorporate a dune,
- addition of vegetation and sand fencing,
- modification of pedestrian and vehicle access points, and modifications around storm water outfall pipes.

**Figure 2** shows how the advanced fill placement on a typical nourishment project could be adapted to include a dune with the same total advanced fill volume. The resilience profile shown in **Figure 3** theoretically demonstrates how a dune increases project resilience based on the volume of sand available to maintain the project's authorized design intent to reduce damage to upland infrastructure between nourishment events.

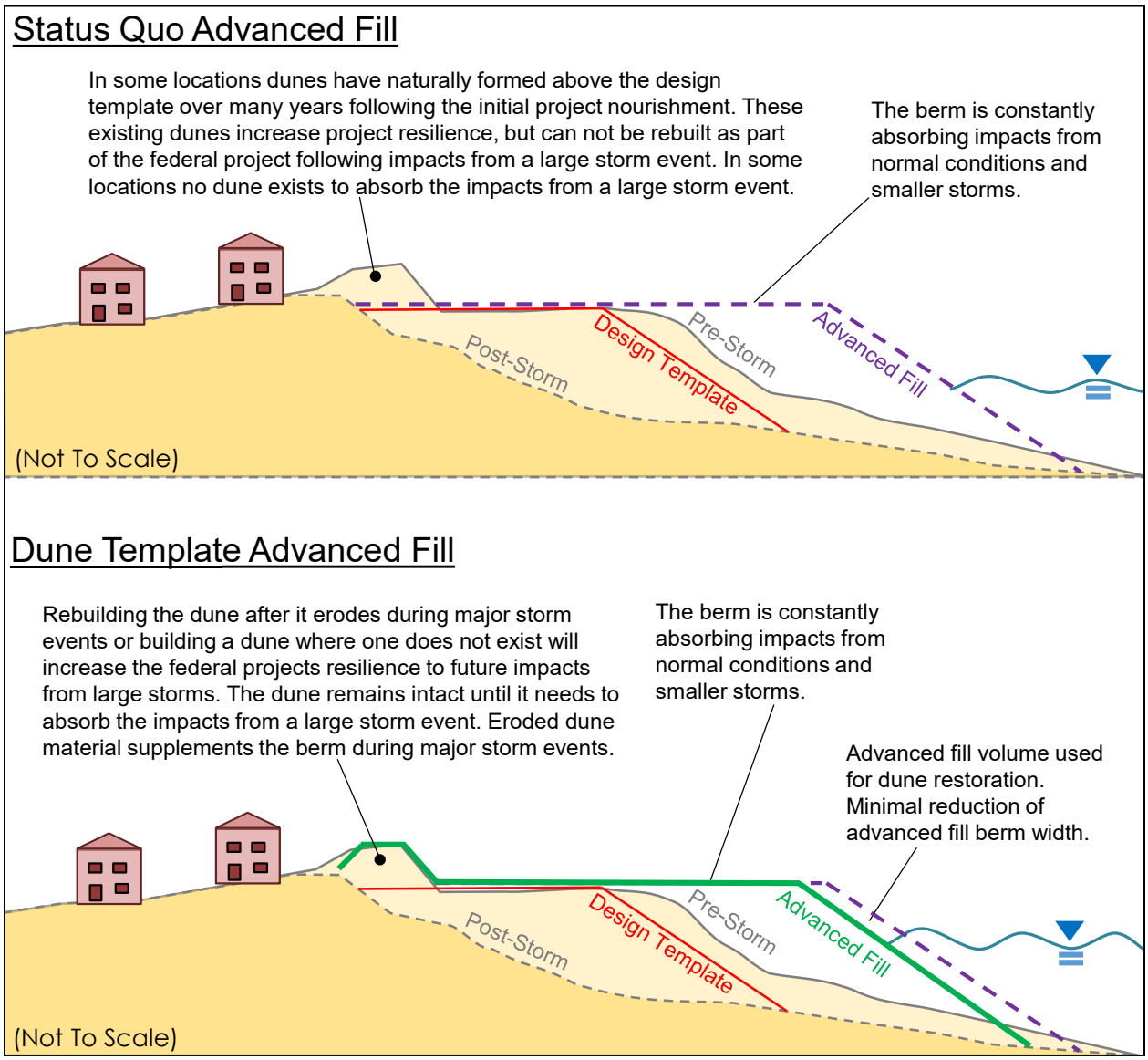
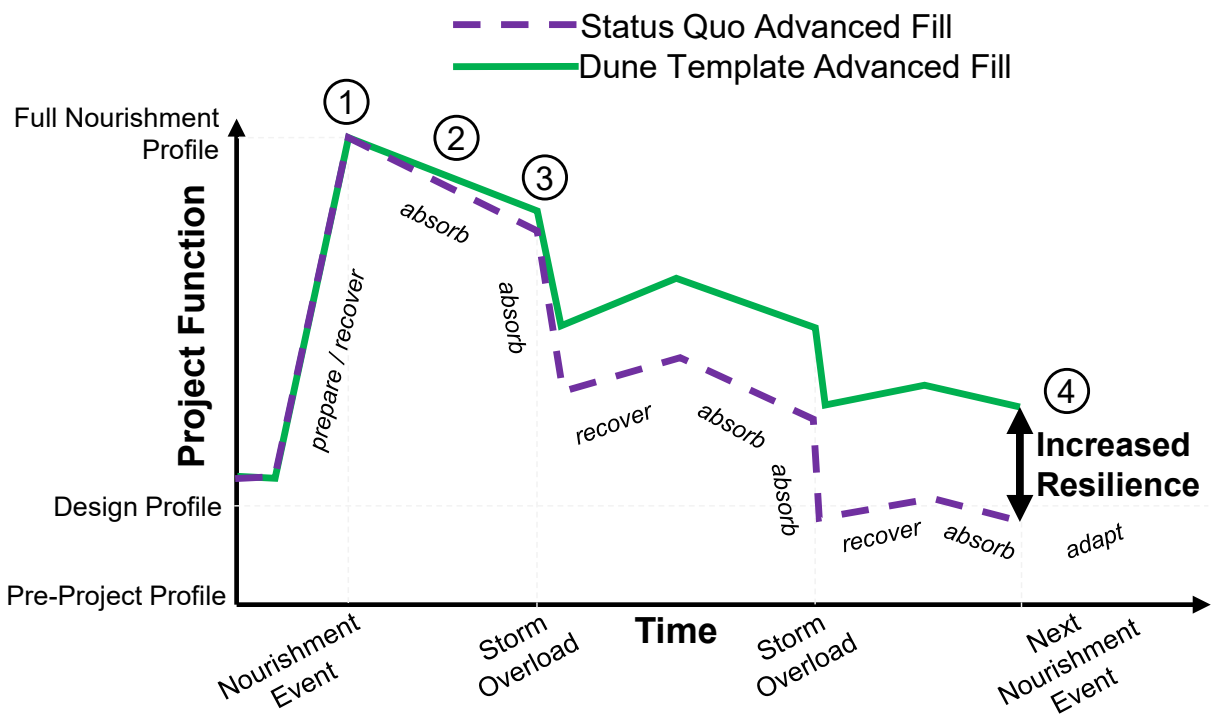



*Figure 2: Adapted advanced fill nourishment template to include a dune*




1. Nourishment of the full construction template (design template & advanced fill volume) in order to **prepare** for future erosion and to **recover** storm damage reduction function that was lost following the previous nourishment.
2. The dune template nourishment loses less function under normal conditions than the status quo berm nourishment because the dune remains untouched while the berm is constantly changing and being eroded as it **absorbs** impact from normal conditions and smaller storms. The dune also captures wind-blown sand losses from the project berm; whereas those loses are not captured but lost to the upland without a dune.
3. The dune template nourishment is able to better **absorb** the impacts of large storms that overload the system than the status quo berm nourishment because as the dune erodes it releases sand into the berm, allowing the beach to continue to function. The dune also prevents loss of beach material into the upland through a breach, by reducing the chance of a breach occurring during a major storm.
4. At the end of the nourishment cycle the dune template nourishment will likely require less volume for next nourishment or the next nourishment could be delayed until it's needed which would reduce project costs. The design for the next nourishment can be **adapted** as needed.

*Figure 3: Resilience profile demonstrating how a dune contributes to increased resilience*

# 1 STATUS OF PROJECT AUTHORIZATION

The Manatee County, Florida Shore Protection Project (SPP) was authorized by Section 201 of the Flood Control Act of 1965 (Public Law (PL) 89-298[1]) dated 27 October 27 1965, as amended by Section 131 of the Water Resources Development Act (WRDA) of 1976 (PL 94-587) and Section 206 of WRDA 1992 (PL 102-580). Resolutions approving the project under the provisions of Section 201 of Public Law 89-298 were adopted by the Senate Public Works Committee on 20 November 1975. The Chief of Engineers authorized the SPP for Manatee County, Florida on 19 December 1975.

The authorized project purpose includes both beach erosion control (BEC) and hurricane protection (HP). After initial authorization the project name changed from BEC to Shore Protection Project (SPP), which is the name referenced in the most recent decision documents and the name that will be utilized throughout this report. A project description is included in Section 4 of this document. The project is also described in Senate Document No. 93-37, 93rd Congress, 1st Session.

# 2 ITEMS OF LOCAL COOPERATION AND THE PROJECT COOPERATION AGREEMENT

The agreement governing initial construction and periodic nourishment of this project is the Local Cooperation Agreement (LCA) between the Department of the Army and Manatee County, Florida for Construction of the Manatee County Florida Shore Protection Project dated 4 August 1992. The most recent agreement governing periodic nourishment of this project is the Project Partnership Agreement (PPA) dated 22 November 2019. Article II of this agreement lists the obligations of the Government and local sponsor. A new or amended PPA will be needed for construction of the dune features recommended by this report.

The non-Federal sponsor, Manatee County, Florida, is responsible for lands, easements, rights-of-way, relocations, and disposal areas required for the Project. The sponsor operates and maintains the Project, performs required hydrographic and environmental monitoring and compliance activities, and provides and maintains necessary access roads, parking areas and other public use facilities open and available to all on equal terms. The sponsor has fulfilled all of their non-Federal responsibilities to date in accordance with the LCA. Copies of the monitoring reports are available upon request from the non-Federal sponsor.

# 3 PREVIOUS INVESTIGATIONS

## 3.1 1948 BEACH EROSION STUDY CHIEFS REPORT

This cooperative study for beach erosion control at Anna Maria and Longboat Keys was compiled by the USACE in 1947 and a report was published as House Document 760, 80th Congress, 2nd Session. This report was “unfavorable” to recommending a Federal project due to the absence of publicly owned shorefront property in the problem area at that time.

[1] Earlier decision documents incorrectly referenced the Flood Control Act of 1965 as PL 98-298.

## 3.2 1973 Chiefs Report

The purpose of this report was to survey the gulf and Tampa Bay shorelines of Manatee County to determine the need for providing beach erosion control and hurricane protection. There has been no authorizing legislation subsequent to the initial legislation (PL 89-298). This report recommended that the "most practicable plan" would involve artificial placement of fill to form a protective and recreational beach for three physically separate problem areas. It was concluded that improvements considered for those three areas are economically justified, but Federal participation was only warranted for the gulf shore of Anna Maria Key. The two areas where Federal participation was not carried forward were the Tampa Bay shoreline of Anna Maria Key and Longboat Key. Hurricane protection measures were determined to be not economically feasible for the gulf shores of Manatee County due to the infrequency of severe tide-producing hurricanes in the area, and cost protective measures were high in comparison. The recommendation stated that the Federal project be adopted for beach erosion control along 3.2 miles of gulf shore providing a 50 ft berm at 6 ft above MLW.

## 3.3 1979 General Design Memorandum Phase I

This report recommended several changes to the authorized plan. First, the addition of 0.3 miles of fill to the original 3.2 mile restoration seaward of Holmes and Bradenton beach. Second, the recommendation of a 2,000 ft fill and a low profile rubble mound groin along the northernmost gulf shoreline of the city of Anna Maria. Third, the changes in cost and interest rate, updating costs to 1978 price levels and interest rate of "6 5/8" percent. Fourth is change from benefits to reflect daily beach usage by types instead of annual usage. Lastly, the "hold and save" clause contained in the items of local cooperation was changed as specified by Section 9 of PL 95-251.

## 3.4 1980 General Design Memorandum Phase II

This report proposed to restore a portion of shoreline along the city of Anna Maria that had been severely eroded, the northernmost 0.4 miles (2,000 ft) of Anna Maria Key. From 1940 until 1970 the area was in a state of accretion, but switched to a very rapid erosional spot due to the onshore movement of sand and subsequent accretion immediately south of the localized erosion area. A protective recreational beach along this 2,000 ft stretch of shoreline was designed to have a 50 ft berm at an elevation of 6 ft MLW (4.8 ft NAVD 88) with an approximate seaward slope of 1V:15H to elevation 0.0 MLW. The slope was designed to then change to 1V:30H to existing bottom.

## 3.5 1991 General Design Memorandum

In this report the initial restoration length of shoreline increased from 3.2 miles to 4.2 miles, and berm width increased from 50 ft to 75 ft. The problem area increased from the authorization in 1975 due to continued erosion and the negative impacts of subtropical storm of 1982, Hurricane Elena of 1985, and tropical storm Juan of 1985. The advance nourishment volume increased from 322,000 to 510,000 cy which was a result of placement of nine years advance nourishment instead of five, which increased due to economic considerations. Overfill decreased from 123,000 to 102,000 cy, and the total initial fill requirement increased from 940,000 to 2.2 million cy.

## 3.6 1991 Post Authorization Change Report

This report summarized the scope, cost, benefits, design, cost allocation and environmental changes for the Manatee County, Florida SPP. The detailed planning and engineering for construction of the project are contained in the 1991 GDM, and changes were authorized in PL 102-580. The recommended plan in

this report modified the authorized project to increase the length of the initial restoration to 4.2 miles. The problem area increased from the authorization in 1975 due to continued erosion and the negative impacts of subtropical storm of 1982, Hurricane Elena of August to September 1985, and tropical storm Juan of October 1985.

### 3.7 2000 Draft Limited Reevaluation Report

This report was prepared by Coastal Planning & Engineering, Inc. and summarizes the draft results of detailed engineering, environmental and economic analysis related to the first periodic renourishment the Manatee County SPP. This report recommended increasing the periodic nourishment interval to 10 years and the advanced fill volume to 982,100 cy due to seaward accretion of the beach since construction in 1992. This report is mentioned in later reports for the Manatee County SPP (detailed below) but was not approved and adopted by the USACE.

### 3.8 2005 Project Information Report

This report was prepared in response to the severe 2004 hurricane season (Hurricanes Charley, Frances, Ivan and Jeanne). Emergency nourishment began in 2005 to rehabilitate the project using 100 percent Flood Control and Coastal Emergency (FCCE) funds. During completion of the 2005 emergency beach renourishment, inclement weather conditions caused the contractor to cease operation, and the contract was cancelled for convenience. The original contract (using FCCE funds only) was for the placement of 409,000 cy of material. The final volume of sand placed (after inclement weather caused the contractor to cease operation and the contract was cancelled for convenience) was 212,922 cy, less than the original FCCE placement amount.

### 3.9 2013 Project Information Report

This report was prepared in response to Tropical Storm Debby and Hurricane Isaac, which adversely affected the Southwest Gulf Coast of Florida, including Manatee County. This PIR recommended reconstruction of the full construction template, using 1,144,100 cy, to restore the project to pre-storm conditions using FCCE funding. A total of 888,000 cy of material was placed along 4.2 miles from R-12 southward to R-33 including the 0.5 mile taper to R-36 to renourish the beach.

## 4 Project Description

The Manatee County, Florida Shore Protection Project was initially constructed pursuant to Section 201 of the Flood Control Act of 1965 (Public Law 89-298). The authorized project includes the entire 7.5 mile Gulf shoreline of Anna Maria Island. The initial project provided for restoration of 3.2 miles of beach to an elevation of 6.0 feet above mean low water with a 50-foot berm width and a natural slope seaward as would be shaped by wave action. The General Design Memorandum of September 1991 and subsequent 1991 Post Authorization Change Notification Report recommended an increase in project length to 4.2 miles with another 0.5 mile taper and an increase in berm width from 50 to 75 feet. The project fill limits extend from R-12 to R-33.4, including a 0.5 mile taper extending to R-36. The taper is part of the Federal project, but is part of the locally preferred plan and is not cost shared by the Federal Government. **Figure 4-1** shows the project limits.

**Table 4-1** shows the conversions for the vertical datums within the project area (at NOAA Tide Station #8726243, Anna Maria Outside, FL). **Figure 4-2** shows the typical cross section of the design and construction template, as well as the typical location of the Erosion Control Line (ECL). The ECL represents the pre-initial project mean high water contour (MHW), which delineates private and State of Florida lands within the project area and is the existing landward extent of the project. The acquisition of additional lands is limited within the analysis conducted in this EDR as dictated by guidance provided in the CESAD-PD Memorandum dated 30 January 2019, which indicates that the landward extent of the resiliency refinements proposed within this EDR is the ECL for all parcels that do not have an existing private easement.

*Table 4-1: Vertical Datum Conversions for Manatee County SPP*

| Datums | Elevations (FT) |
|---|---|
| Mean Higher High Water (MHHW) | 2.26 |
| Mean High Water (MHW) | 1.96 |
| Mean Tide Level (MTL) | 1.17 |
| Mean Sea Level (MSL) | 1.19 |
| Mean Low Water (MLW) | 0.38 |
| Mean Lower Low Water (MLLW) | 0.00 |
| North American Vertical Datum 1988 (NAVD) | 1.62 |
| National Geodetic Vertical Datum 1929 (NGVD29) | 0.62* |

*NGVD29 value not available from NOAA Station and was obtained using NOAA's VDatum tool.

Initial construction for the project was completed March 1993 and placed approximately 2.3 million cy of material along Anna Maria Island. **Table 4-2** lists the nourishment events in the Manatee County SPP. In addition to nourishment events listed in the table, navigation maintenance dredging material from Longboat Pass is routinely placed on the southern end of Anna Maria Island. This sand source is "shared" with Longboat Key and typically results in placement of roughly 75,000 to 150,000 cy on Anna Maria Island every 6 to 8 years.

*Table 4-2: Project Area Placement Events*

| Year | Volume (cy) | Project | Description |
|---|---|---|---|
| 1993 | 2,320,000 | SPP Initial Construction | R-12 to R-36 |
| 2002 | 1,900,000 | Non-Federal<br>SPP (Renourishment) | R-7 to R-10<br>R-12 to R-36 |
| 2006 | 213,000 | SPP (FCCE) | R-12 to R-28 |
| 2011 | 24,709 | Non-Federal | R-7 to R-10 |
| 2011 | 195,000 | Non-Federal | R-36 to R-41.3 |
| 2014 | 888,000 | FCCE (FCCE) | R-12 to R-36 |
| 2014 | 260,000 | Non-Federal | R-33 to R-40.7 |
| 2020 (Planned) | 815,000* | SPP (FCCE) | R-12 to R-36 |
| 2020 (Planned) | 235,000* | Non-Federal | R-33 to R-40.7 |
| * Volumes are estimated and based on planned renourishment volume calculations | | | |

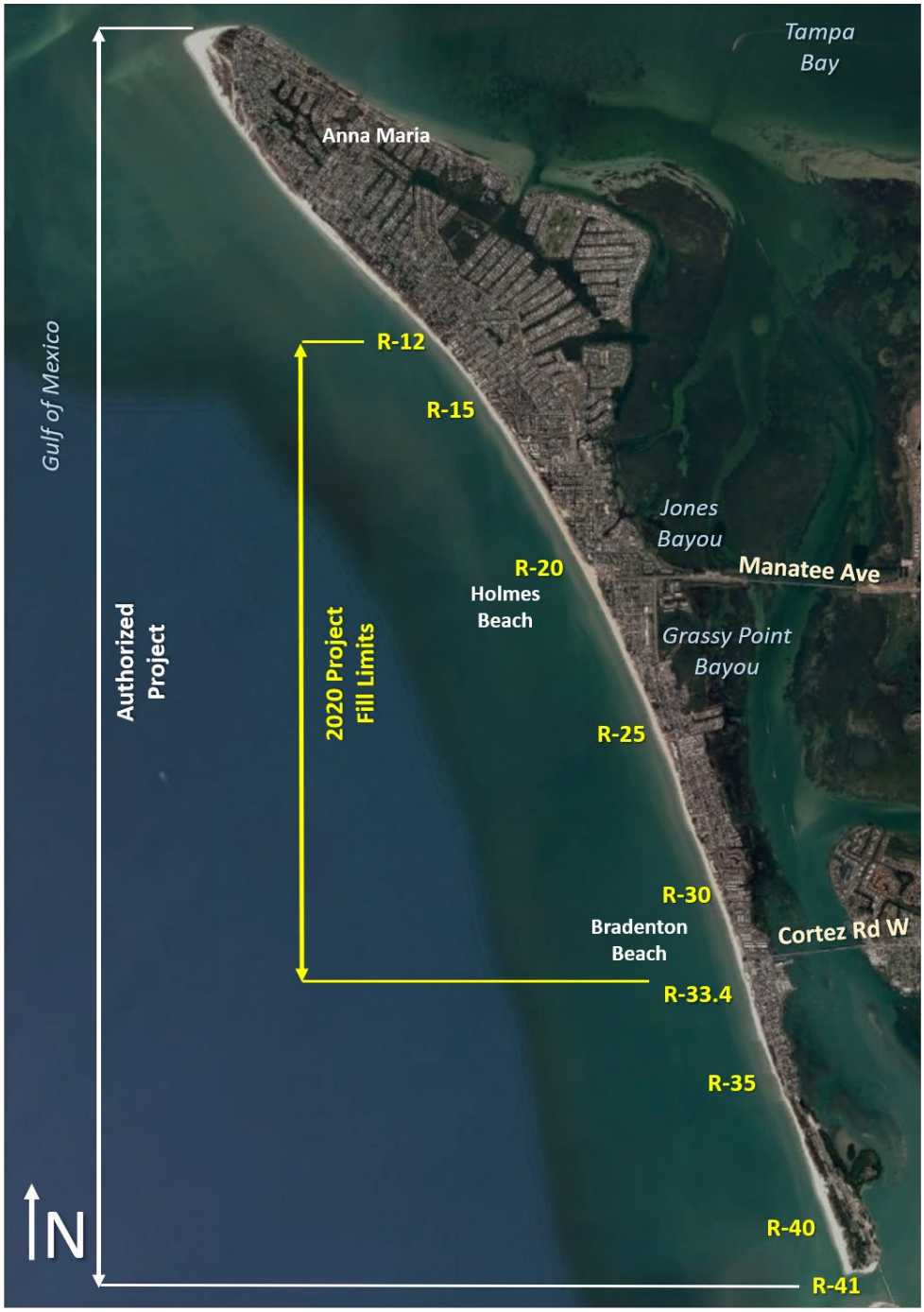



*Figure 4-1: Authorized Project Limits*

## 4.1 Typical Project Conditions

The Manatee County, Florida SPP Anna Maria Island Segment (R-12 to R-33 with a taper to R-36) has large portions of naturally-occurring, vegetated dunes along the majority of the project. From R-12 to R-27 the vegetated portion of the beach is 40 to 70 ft wide. South of R-27, the vegetated dunes are narrower (30-50 ft wide). The dune crest along the length of the project is typically 10 to 15 ft wide at an elevation of 8 ft NAVD88.

Throughout the project footprint there are scattered areas where dunes have not formed and, therefore, gaps exist in the dune system. There are 19 of these gaps in the dunes. The largest gap is approximately 1,000 ft long and is located at Manatee Public Beach (R-20 to R-21). The remaining 18 gaps are each less than 500 ft wide.

**Figure 4-2** shows recent typical beach conditions at profile R-20. This profile is representative of the general conditions of the beach in the project area. Also included in the figure is the USACE authorized design template and the projected 2020 construction template. The figure shows the typical conditions of the beach within the project area between 2015 and 2019.

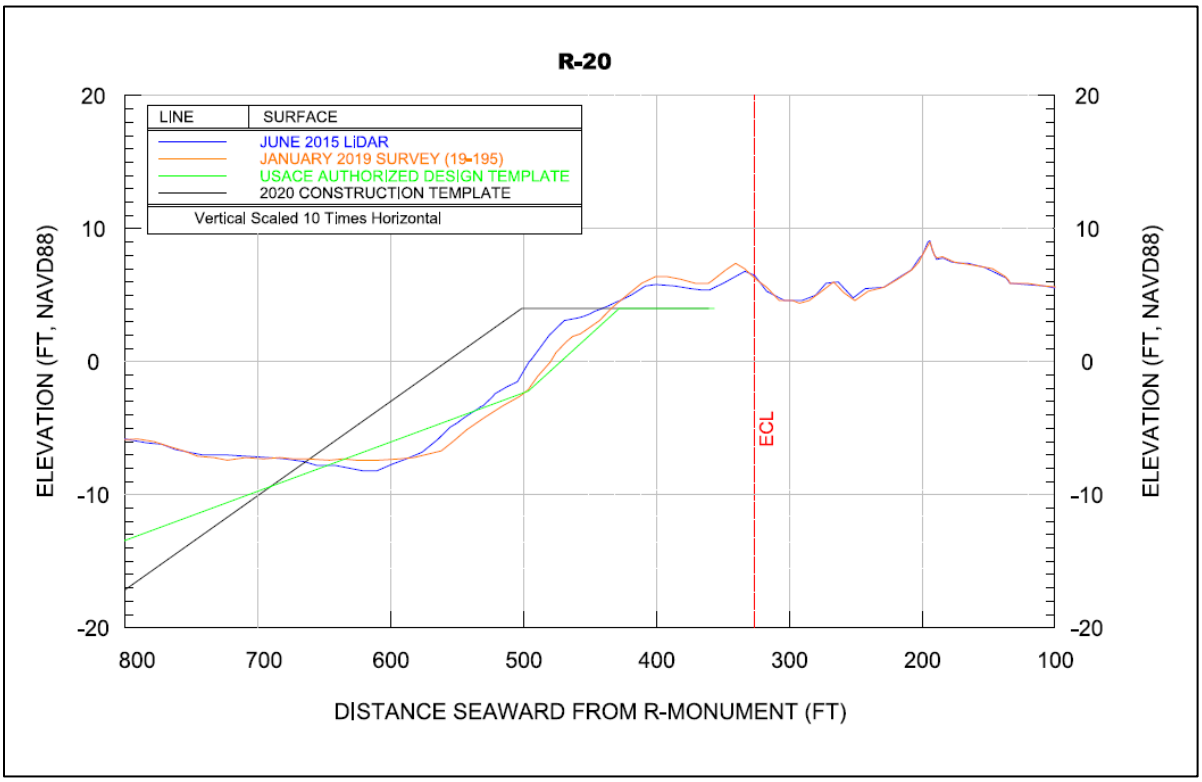



*Figure 4-2: Beach Profiles at R-20 from 2015-2019*

# 5 DESIGN CHANGES CONSIDERED

The following are general dune-related design changes that can be considered on any project of this type. **Table 5-1** outlines the specific circumstances of the Manatee County, Florida SPP with respect to each of these items. Several design refinements that can increase project resiliency were considered, including the incorporation of dunes and additional dune enhancements to support dune stability. Dune enhancements include vegetation, sand fencing, pedestrian access, vehicle access, and storm water outfall pipes. These design refinements could be added or modified as standalone design changes or could be implemented in conjunction with dune construction.

**1) Dune Incorporation:** This consists of incorporating a dune template as part of the project in future nourishment events. The dune construction template may adopt the dimensions of existing dunes, modify the dimensions of existing dunes, or add a new dune where dunes do not currently exist within the existing project footprint. The dune construction template will be considered part of the project's construction template and the volume of material to construct the dune will be considered part of the project's advanced fill volume as shown in **Figure 2**. The authorized design template on which benefits are based will not be changed by dune construction nor will the authorized advanced fill volume associated with future periodic nourishments be changed. For future periodic nourishments, the same volume of advanced fill would be placed such that a portion of that volume may be placed in the dune. Where existing dunes are incorporated as advanced fill, the total advanced fill volume will not change and the berm width will be reduced minimally to account for the volume placed in the dune. Potential sand sources will comply with State of Florida statutes and meet all applicable criteria based on consultation with FDEP.

**2) Vegetation:** Planting vegetation helps to anchor sand dunes and promotes dune growth. The roots and stems of sea oats and other native coastal plants trap wind-blown sand. As the sand piles up around the plants, new roots develop on the recently buried stems while new stems emerge from the sand's surface. This traps even more sand and grows the dune. In general vegetation should be planted on all newly constructed dunes.

**3) Sand Fencing:** An additional way to enhance dune growth is through the installation of sand fencing. Sand fencing is a relatively low cost option that works similarly to dune vegetation to help support sand dune growth by trapping and collecting wind driven sand.

**4) Pedestrian Access Modifications:** Pedestrian access modifications could include signage encouraging beachgoers to stay off dunes and to use designated access points, rope fencing to keep people out of the dunes, or constructing dune walkovers to allow beach access without impacting the dune. These measures prevent dune vegetation, and the dune itself, from being trampled and degraded by foot traffic which could reduce the function of the dune.

**5) Vehicle Access Modifications:** Vehicle access modifications could include changing the angle at which the vehicle access cuts through the dune so that during a storm the gap through the dune would erode in on itself. Mats or ramps could be used to allow vehicles to drive over the dune and prevent the degradation of the dunes in these area. Sand stockpile areas could be designated for filling in the dune gaps when a storm is approaching.

**6) Modifications at Storm Water Outfalls:** Areas where storm water outfall pipes intersect dunes and release storm water onto the project footprint could be modified with revetment sections or the pipes could be re-routed in order to prevent degradation of the dune in these areas caused by outfall scour.

*Table 5-1: Project Specific Dune Design Refinements Considerations*

| Design Change | Project Specific Considerations |
|---|---|
| No Action | No change to the existing project |
| Dune Incorporation | Dunes have not been directly constructed as part of the SPP, however dunes have formed naturally within the project footprint and enhance the erosion control and hurricane protection benefits of the SPP. Incorporating dunes as part of the SPP would allow for reconstruction of the dunes following a significant storm event; thus immediately enhancing the projects ability to control erosion. |
| Vegetation | Dune vegetation is well established along the existing dune in the project area. As such, existing dune areas generally do not currently require dune vegetation planting. However, future dune construction should include planting of native dune vegetation |
| Sand Fencing | In the absence of dune construction, sand fencing could be strategically placed to help trap sand in small dune gaps such as at dune walk throughs. Sand fencing could also be used to direct foot traffic through designated pedestrian beach accesses. |
| Pedestrian Access Modifications | There are 47 public pedestrian access points in the project area. These accesses are footpaths that cut directly through the existing dune. The footpaths could result in degradation of the dune over time at these locations. These locations could benefit from sand fencing placed in a manner that would guide foot traffic on a dedicated path and collect windblown sand in the vicinity of the footpath. |
| Vehicle Access Modifications | There are 5 vehicle beach access points in the project area. These access points currently consist of a gap through the dune that is vulnerable to backside dune erosion due to waves and surge that penetrate the access. |
| Modifications at Storm Water Outfalls | There are no outfall pipes affecting dunes in the project area. |

# 6 RECOMMENDED DESIGN CHANGES

The design changes considered for increasing the resilience of the Manatee County SPP, Anna Maria Island Segment, are listed below:

1) Dune Incorporation
2) Vehicle Access Modifications
3) Pedestrian Access Modifications

The evaluation of design refinements and subsequent recommendations are described in more detail in the following sections. Recommended design changes are based on the considerations in **Table 5-1** as well as consistency with guidance provided in ECB 2018-2, Director of Civil Works' Memorandums dated 21 June 2017 and 3 May 2018, and ER 1105-2-100, Planning Guidance Notebook.

## 6.1 DUNE INCORPORATION

The USACE recommends incorporating dunes along portions of the Manatee County, Florida SPP, Anna Maria Island Segment. The dimensions of the proposed dune template are displayed in **Table 6-1**. The USACE does not recommended incorporating dunes along the entire length of the project due to policy constraints limiting dune incorporation to the limits of the project area. The Manatee County SPP, Anna Maria Island Segment has a landward boundary of the ECL and there are no existing easements on private property landward of the ECL for this project. As a result, Federal construction of dunes must occur seaward of the ECL. There are some portions of the project where there is insufficient berm width seaward of the ECL to support dune incorporation and, as a result, there is no dune incorporation recommended in these areas (exceptions are described below when discussing closing gaps in the dunes). The dune provides an additional stockpile of material that is normally untouched by the erosional effects of typical tidal and wave action. During storm conditions, the stockpile will erode into the berm which will maintain the berm width and reduce landward erosion during major storms, as described in **Figure 1**.

The proposed dune template for the Manatee County, Florida SPP is based off the natural characteristics of the existing dunes and available berm footprint. The proposed dune crest elevation is 8 ft NAVD88with a dune crest width of 10 ft wide, and the slopes are 1 Vertical (V):3 Horizontal (H) on both the seaward and landward face of the dune. **Figure 6-1** displays a cross-section of the typical dune template for the Anna Maria Island Segment and shows the proposed template compared to the existing dunes at R-20 based on the January 2019 survey.

The template provided in **Figure 6-1** is the proposed template to be incorporated into the SPP, however this template is not a final design. The final design for this project will be developed during the Preliminary Engineering and Design phase (PED) of the Project to account for existing project conditions and engineering judgment. The final designs are not anticipated to vary greatly from the templates presented herein.

*Table 6-1: Anna Maria Island Segment Dune Dimensions*

| Start | End | Crest Height (ft NAVD88) | Crest Width (ft) | Slopes |
|---|---|---|---|---|
| R-13 | R-15 | No Dune Recommended | | |
| R-15 | R-21.7 | 8 | 10 | 1V:3H |
| R-21.7 | R-21.8 | No Dune Recommended | | |
| R-21.8 | R-22.5 | 8 | 10 | 1V:3H |
| R-22.5 | R-23.7 | No Dune Recommended | | |
| R-23.7 | R-24.9 | 8 | 10 | 1V:3H |
| R-24.9 | R-25.3 | No Dune Recommended | | |
| R-25.3 | R-26.4 | 8 | 10 | 1V:3H |
| R-26.4 | R-28.3 | No Dune Recommended | | |
| R-28.3 | R-30.2 | 8 | 10 | 1V:3H |
| R-30.2 | R-31 | No Dune Recommended | | |
| R-31 | R-31.5 | 8 | 10 | 1V:3H |
| R-31.5 | R-32.2 | No Dune Recommended | | |
| R-32.2 | R-32.4 | 8 | 10 | 1V:3H |
| R-32.2 | R-36 | No Dune Recommended | | |

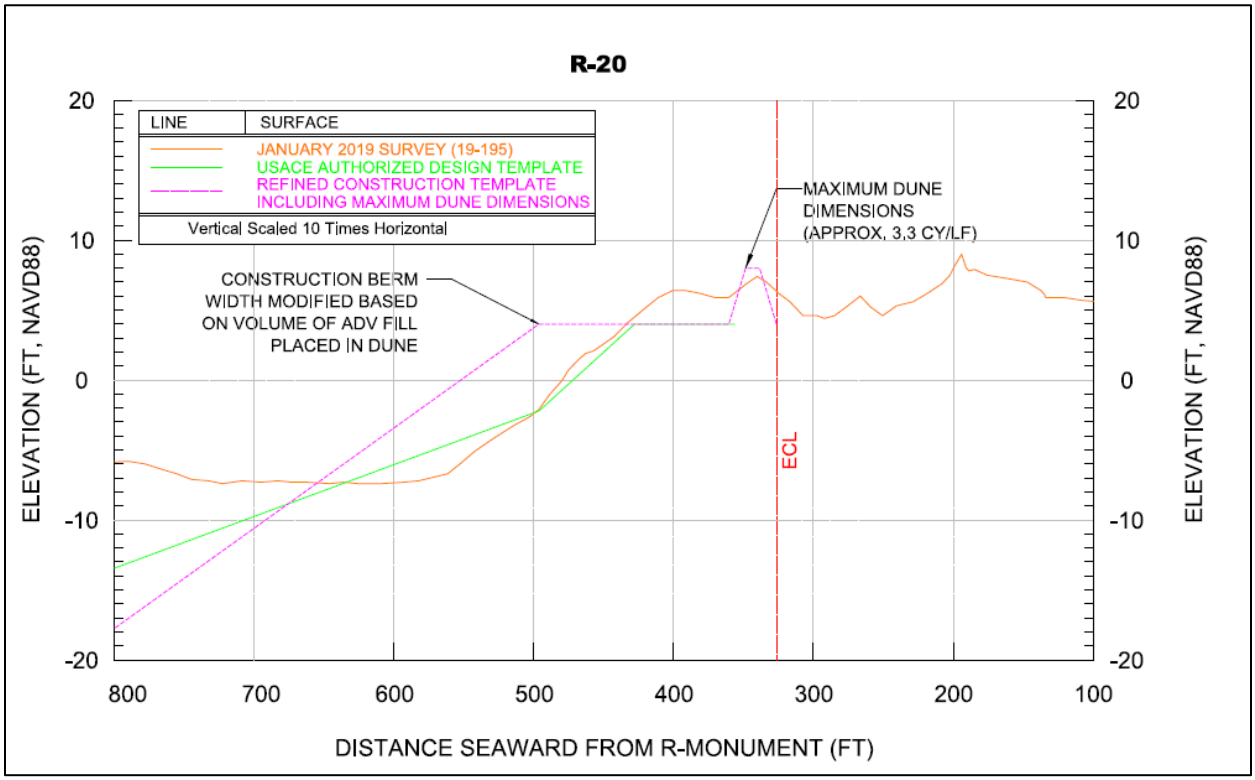



*Figure 6-1: Example of Anna Maria Island Segment Dune Template at R-20*

In addition to incorporating the existing dunes into the Project, the USACE also considered gaps in the existing dunes that reduce project resilience. There are 19 locations within the project area with gaps in the dunes. Within the limitations of this EDR, the USACE recommends closing 9 of these gaps fully and 1 one the gaps partially using dune construction with the same dune dimensions of the proposed dune in **Table 6-1**.

The largest of these dune gaps is at Manatee Public Beach (Holmes Beach, between R-20 and R-21). The gap in the dunes in this location is approximately 1,000 ft long and is part of a public recreational area with trees, picnic tables, volleyball courts, and a café. The local sponsor indicated in a meeting on 29 July 2020 that they would only support partial closure of this gap in the dunes. In order to increase the project resilience as much as possible, a dune closure of 250 ft on the north side of the gap is recommended. The location of the recommended partial closure is shown in **Figure 6-2**. In order to place the dune behind the ECL in this location, it would require the acquisition of a certification of land use for parcel #7384200059 from Manatee County. It is not possible to place the dune template seaward of the ECL in this location because a dune in this area would be vulnerable to erosional losses during typical wave conditions compared to the adjacent natural dune position, which is more landward and less likely to be impacted by waves. By incorporating the existing dune landward of the ECL, it promotes project resilience and allows the reservoir of sand to be in place for a large storm.

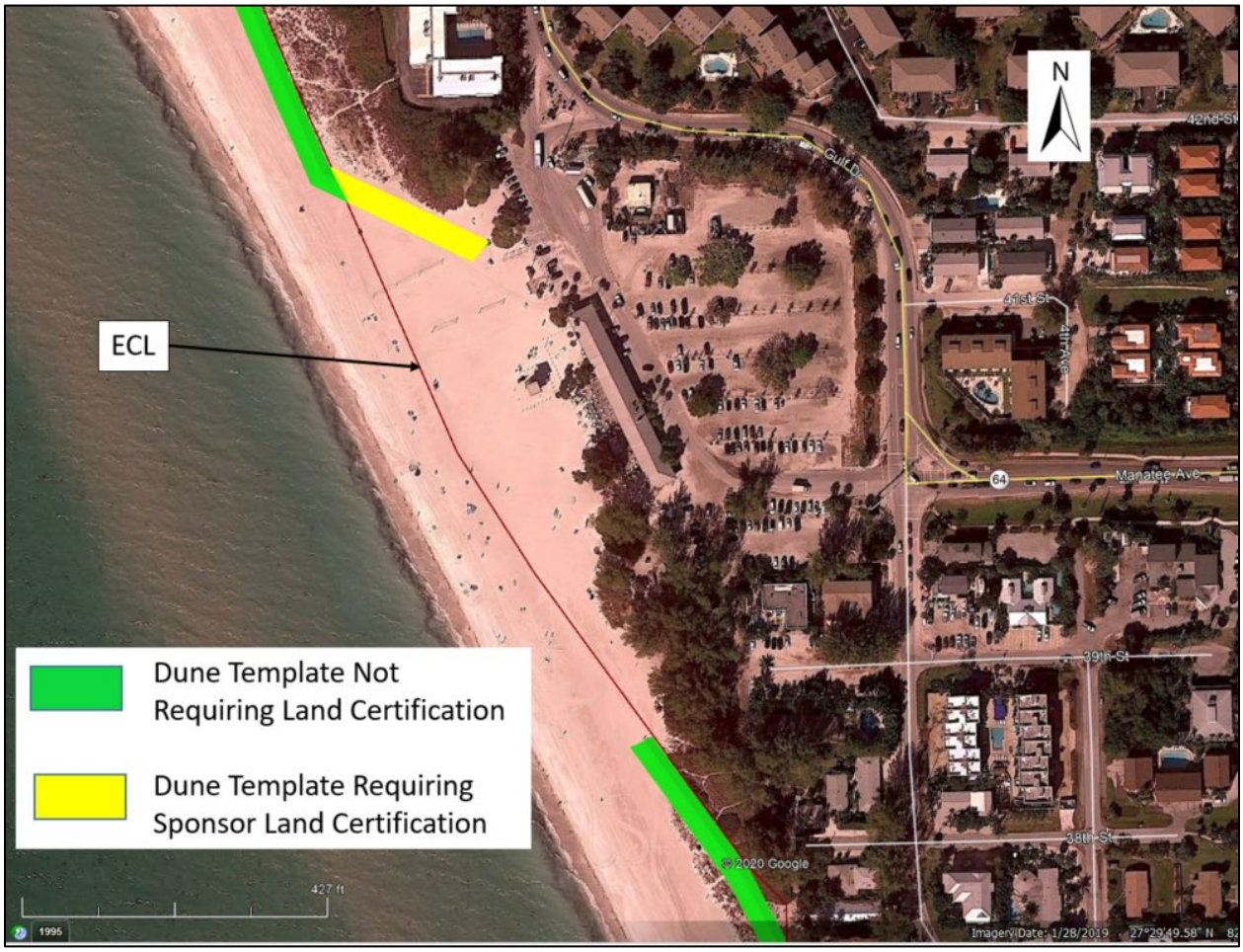



*Figure 6-2: Proposed Modifications at the Dune Gap at Manatee Public Beach*

There are 19 total dune gaps in the project area. The locations of these gaps is shown in **Table 6-2**. The USACE recommends closing the gaps using dune construction at all of these locations to increase the resiliency of the project but within the constraints of this EDR, only 9 of the gaps can be closed (in addition to the partial closure of the Manatee Public Beach gap described above). These gaps are highlighted in the table. These 9 gaps can be closed with the recommended dune template described in **Table 6-1** in order to increase the resiliency of the project by making the adjacent dunes less susceptible to erosion due to flanking. The 9 gaps in the dunes that the USACE recommends closing as part of this EDR range from 60 to 225 ft long. An additional, incidental benefit to adding a dune in these locations is making the project more resilient to inundation from elevated water levels, such as storm surge and wave run-up. These gaps will be closed seaward of the ECL and, as a result, do not require any land certification. It would be similarly beneficial for the other gaps in the dunes to also be closed, but these cannot be done within the constraints of the EDR.

*Table 6-2: Locations of Dune Gaps*

| No. | Location | Length of Gap (ft) | Structures or Sand | Gap Closed by Proposed Dune (Yes or No)? |
|---|---|---|---|---|
| 1 | R-13 | 200 | Sand | No |
| 2 | R-14 | 220 | Sand | No |
| 3 | R-14.5 | 90 | Sand | No |
| 4 | R-17.2 | 150 | Sand | Yes |
| 5 | R-20.4 (Manatee Public Beach) | 1,000 | Private concrete patio | Yes |
| 6 | R-21.8 | 100 | Sand | No |
| 7 | R-22 | 100 | Sand | Yes |
| 8 | R-23.2 | 150 | Sand | No |
| 9 | R-24 | 70 | Sand | Yes |
| 10 | R-24.7 | 60 | Sand | Yes |
| 11 | R-24.9 | 75 | Sand | Yes |
| 12 | R-25.4 | 80 | Sand | Yes |
| 13 | R-26.3 | 225 | Private concrete parking lot | Yes |
| 14 | R-27.1 | 100 | Private concrete patio | No |
| 15 | R-28.3 | 150 | Seawall | No |
| 16 | R-28.7 | 70 | Sand | Yes |
| 17 | R-29.2 | 100 | Sand | Yes |
| 18 | R-30.8 | 500 | Sand | No |
| 19 | R-32.7 | 150 | Sand | No |
| | Total | 3,590 | | |

***Highlighted rows indicate gaps that USACE recommends closing within constraints of EDR**

## 6.2 Vehicle Access Points

Vehicle access points that create gaps in the dunes are more susceptible to erosion and landward material losses that reduce project resilience. There are five vehicular access points in the Manatee County SPP, Anna Maria Island Segment area:

1. 67th Street R-14.3
2. 46th Street R-19
3. Manatee Public Beach R-20.5
4. 30th Street R-24
5. 3rd Street South R-33.1

The location of the vehicle accesses can be seen in **Figure 6-8** and **Figure 6-9**. The proposed changes to the five vehicle access points include angling accesses, narrowing accesses and converting them to pedestrian-only access. These proposed changes to the vehicle accesses are general recommendations and do not constitute full designs. The specific designs for these recommendations may change during the PED phase based on the existing conditions at the time of design and engineering judgment.

Structural alternatives such as wooden vehicle ramps, seawalls, and gates that close during storm events were considered during the analysis but ultimately rejected. Wooden vehicle ramps are more costly than any of the modifications proposed in this EDR and would require a greater level of design than what is intended within the scope of this EDR. These structures are also typically less aesthetically pleasing compared to the natural appeal of vegetated dunes and repair costs would likely be more expensive than the other alternatives, both of which are concerns of the local sponsor. Gates to close during storm events are also not desirable because they require frequent maintenance to ensure that they are functioning properly, especially in a marine environment. Seawalls used to close gaps in the dune were also rejected because they would only provide inundation protection benefits and would also require a greater level of design than what is intended within the scope of this EDR. The purpose of this SPP is erosion control and, according to CESAD-PD Memorandum dated 20 January 2019, “modifications that change the nature of an existing project’s benefits will only be considered if the change is minor and incidental”. The modifications proposed in this EDR may have the benefit of providing inundation protection to the SPP but this benefit will be incidental. The primary benefits will be to increase the project’s resiliency to erosion by providing reserves of sand higher on the beach profile and by preventing flanking and backside erosion of the existing dune.

### 6.2.1 67th Street

The northernmost vehicle access point in the project area is located at 67th Street (R-14.3). This vehicle access is approximately 15 ft wide and has an elevation of approximately 7 ft NAVD88 based on the 2015 Light Detection and Ranging (LiDAR) survey. This access is perpendicular to the shoreline, which is the least desirable method of access because it provides minimal resistance to waves and surge (Wootton, 2016). Waves and surge that penetrate the access can flank the existing, adjacent dune and cause scouring to the backside of the dune, which can lead to failure of larger sections of dune. In order to make the access less susceptible to direct wave impacts, the USACE recommends angling the access using sand placement and dune vegetation planting, as seen in **Figure 6-3**. While not as effective as closing the access, angling the access can cause some of the wave energy to be deflected by the dune and vegetation instead of penetrating directly through the access point.

*Figure 6-3: Proposed Modifications at the 67th Street Vehicle Access*

### 6.2.2 46th Street

The second vehicle access point in the project area is located at 46th Street (R-19). The access is at the end of 46th Street and is angled slightly to the south. The access is approximately 15 ft wide at an elevation of 7 ft NAVD88. While the access is already slightly angled, the USACE recommends creating a more pronounced angle for the access (**Figure 6-4**) using sand placement and dune vegetation. Angling the access can further aid against direct wave penetration, which can flank the dune and cause scouring on the backside.

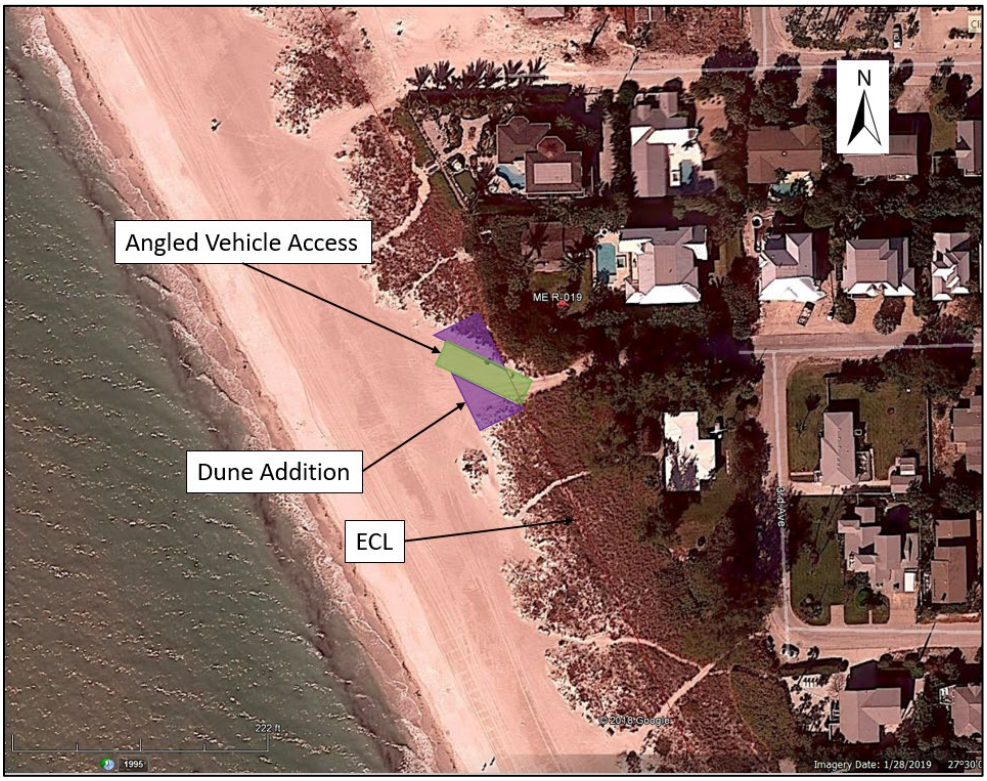



*Figure 6-4: Proposed Modifications at the 46th Street Vehicle Access*

### 6.2.3 Manatee Public Beach

The next vehicle access point was located at the Manatee Public Beach access (R-20.5). The proposed modifications to this area (partial gap closure with dune construction) were discussed in greater detail previously in the Dune Incorporation section.

### 6.2.4 30th Street

The 30th Street (R-24) vehicle access is part of a 60-ft long gap in the dunes described in **Table 6-2** as part of the Dune Incorporation section. As part of the recommendation to close the gap, the USACE also recommends angling the existing vehicle access using sand placement and dune vegetation planting, as seen in **Figure 6-5**. The access is currently approximately 30 ft wide but it is part of a larger gap in the dune. The elevation in this area is approximately 6 ft NAVD88.

*Figure 6-5: Proposed Modifications at the 30th Street Vehicle Access*

### 6.2.5 3rd Street South

The next vehicle access is located at 3rd Street South (R-33.1). This vehicle access is approximately 12 ft wide and is shore-perpendicular. The elevation in this access is approximately 6 ft NAVD88. This vehicle access is located 700 ft north of the next vehicle access in the project area (6th Street South). Due to this proximity to 6th Street South, the USACE recommends closing this vehicle access and converting it into an angled pedestrian access, as seen in **Figure 6-6**. Vehicle traffic for this access can be diverted to 6th Street South.

*Figure 6-6: Proposed Modifications at the 3rd Street South Vehicle Access*

## 6.3 Pedestrian Access Points

Pedestrian access points were evaluated as potential vulnerabilities in the project area. The pedestrian access points in the project are a mixture of wooden ramps and walkthroughs that are curved (i.e. not shore-perpendicular) paths directly through the dunes to allow access to the berm. Often the wooden ramps will end partially through the dune and continue the rest of the way as a walkthrough between or on top of the existing dunes. The USACE typically recommends placing dune walkovers at all pedestrian access in order to keep people out of the dunes. However, in areas where there are dune walkthroughs or where the dune walkovers end in the middle of the dune, the USACE recommends incorporating sand fencing on the dunes immediately adjacent to access points. Sand fencing traps material which will help maintain the ground at a higher elevation. Sand fencing aids in trapping wind-blown sediment by slowing the wind and resulting in deposition of entrained sand. By placing sand fencing adjacent to the pedestrian access points, it can encourage this deposition of sand to occur within the access itself. This can potentially help offset the erosion caused by pedestrian traffic through the access. The sand fencing can also help guide pedestrians to stay along the centerline of the access which can prevent an access from becoming wider (and thus more vulnerable to inundation) over time. Maintaining a higher elevation at the walkthroughs can potentially reduce the risk of inundation through the accesses which can cause backside erosion and flanking of the adjacent dune. **Figure 6-7** displays a typical alignment for sand fencing through a dune. The exact placement of sand fencing will be based on the dominant direction of sand transport due to the wind, which will be determined at the time of plans and specifications. Additionally, placing signs and rope lines to guide pedestrians to designated walkthroughs has been shown in other places to be an effective tool to mitigate damage from people walking on, and damaging the dune vegetation. There are eight public accesses (out of 47) in the SPP that are shore-perpendicular and it is estimated that it will require an average of 40 ft of sand fencing at each access for a total of approximately 320 ft of sand fencing needed for the project. The local sponsor indicated at a meeting on 29 July 2020 that they would prefer to not include sand fencing in the project and would prefer to the addition of post and rope fencing to remain consistent with the rest of the project. The post and rope fencing would serve to keep pedestrians on the guided paths through the dunes and mitigate damage from people walking on dune vegetation but does not have the added benefit of trapping sand like sand fencing.

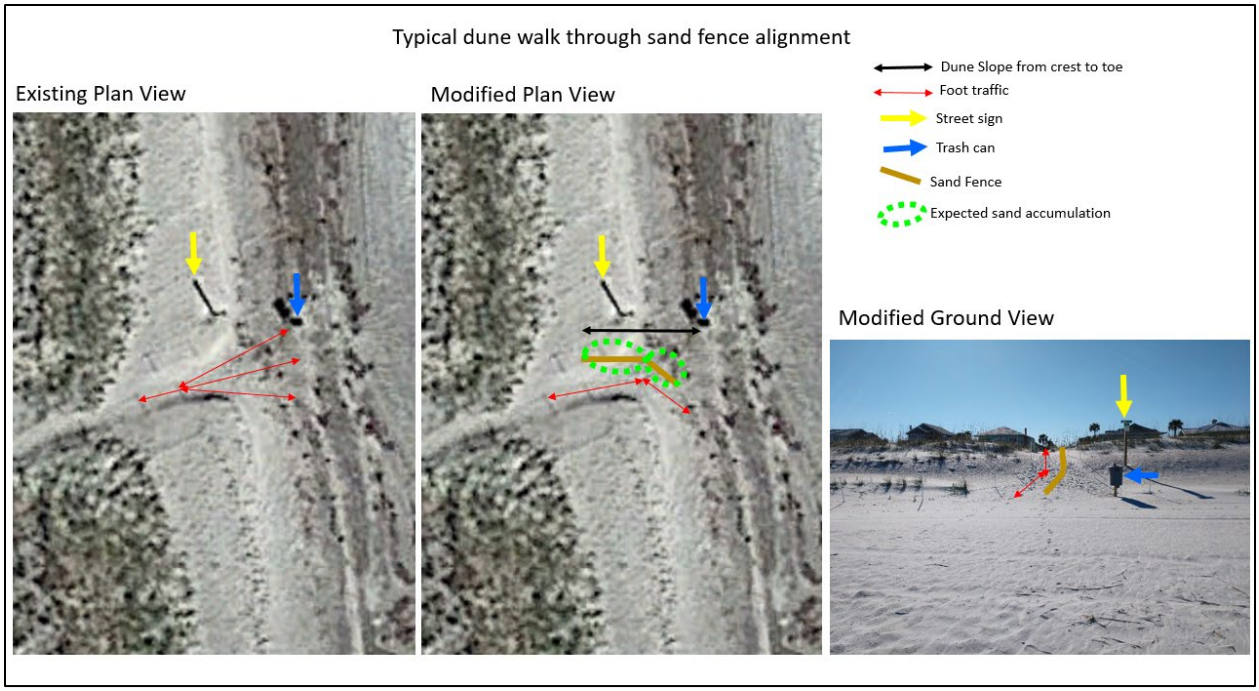



*Figure 6-7: Typical Sand Fence Alignment for Dune Walkthroughs*

## 6.4 Summary of Recommended Design Changes

The design changes recommended to increase resilience for the Manatee County SPP, Anna Maria Island Segment include dune incorporation, pedestrian access modifications with sand fencing, and vehicle access modifications as described in the previous sections. **Table 6-3** provides a summary of the recommended design changes, **Figure 6-8** and **Figure 6-9** shows the location of the recommended design changes along the project area shoreline.

*Table 6-3: Summary of Recommended Design Changes*

| Design Change | Summary of Recommendation |
|---|---|
| Dune Incorporation | Dune incorporation is recommended along portions of the project. Dunes could be constructed as part of the project in the event that the existing dune becomes eroded in the future. The volume of sand to be placed in the dune template, should it erode, would be treated as part of the Project's advanced fill volume. There are 10 areas with gaps in the dunes that are recommended to be closed with the proposed template and planted with native dune vegetation. |
| Vehicle Access Modifications | Modifications for vehicle access points that include angling accesses, narrowing accesses and converting them to pedestrian-only access. |
| Pedestrian Access Modifications | Placing sand fencing along the side of the walkthrough to trap material in the access and help it to maintain a higher elevation. Approximately 40 feet of post and rope fencing would be needed at each access point to be modified. |

*Figure 6-8: Location of Recommended Design Changes*

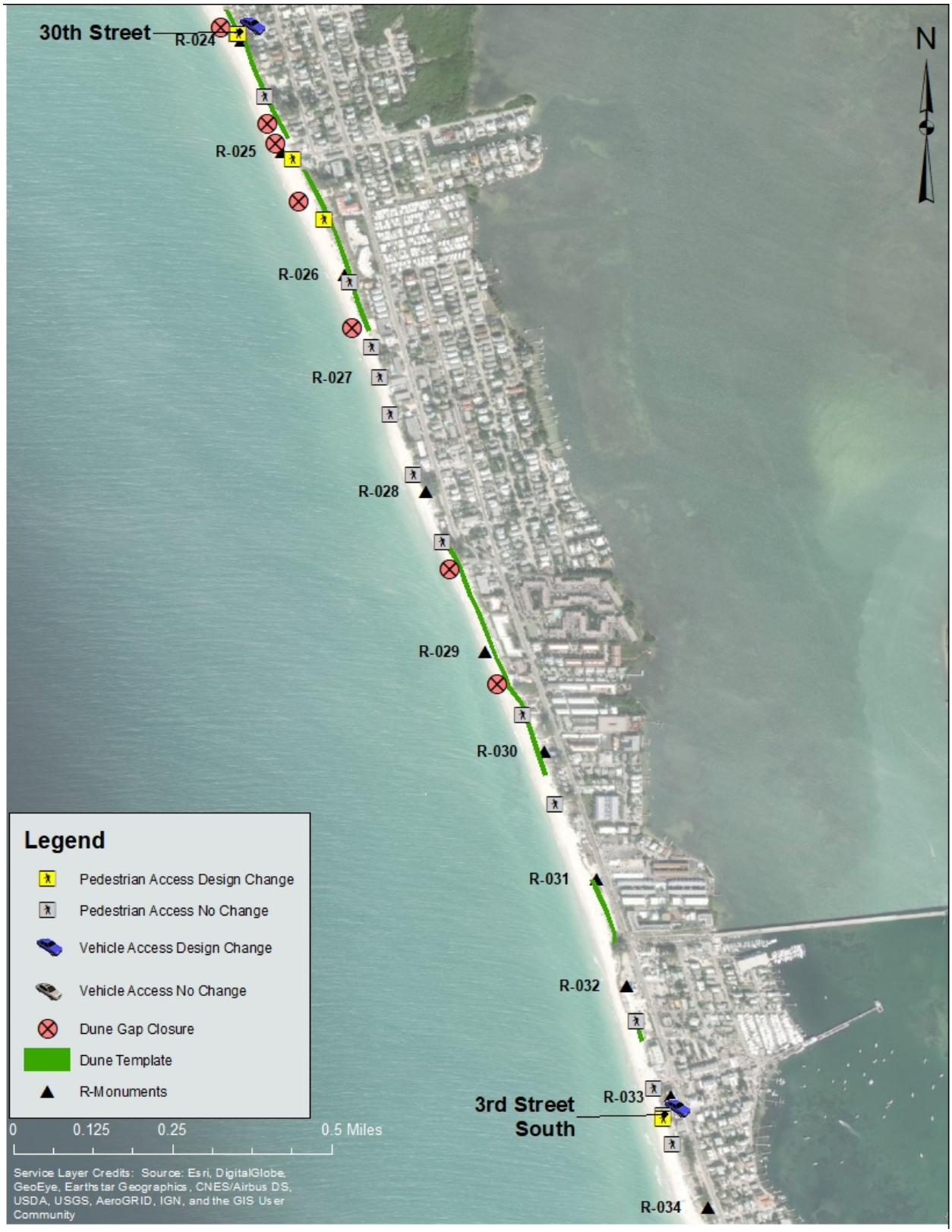



*Figure 6-9: Location of Recommended Design Changes*

### 6.4.1 Volume Calculations

**Table 6-4** presents the estimated volume of material needed to facilitate all of the resiliency measures recommended herein. The table shows a description of the proposed activity and the approximate volume needed to complete the measure. For the Manatee County SPP, Anna Maria Island Segment, the anticipated volume needed to complete the proposed alternatives is 4,025 cy.

To give perspective of the volume typically used to construct this project, the initial construction was 2,324,000 cy and the project has an authorized renourishment volume of 612,000 cy every 9 years. If an extreme erosion event occurs and completely erodes the existing dune down to the berm elevation (4 ft NAVD88), it would require approximately 39,700 cy (3.3 cy/ft) to restore the dune to the template described in **Table 6-1**. This volume includes the proposed dune template along approximately 12,100 ft of the project, including 800 cy at Manatee Public Beach (250 ft gap length partially closed). The final designs for this project will be developed during the PED phase of the project to account for existing project conditions and engineering judgment. The final designs are not anticipated to vary greatly from the templates presented herein. **Figure 6-1** shows the application of the proposed dune at R-20 in order to demonstrate how the proposed template compares to the typical, existing project dune. The proposed dune template is the maximum dune that would be rebuilt by USACE if the existing dune was ever severely eroded. The volume of sand used to rebuild the dune will come from the project's advanced fill portion of the template volume. As a result, the construction berm width will be modified based on the conditions of the project at the time of construction so that the total advanced fill volume (berm plus dune) remains consistent with the authorized project. The changes in the advanced fill shape are shown in **Figure 6-1.** The maximum dune template may not be built if it is determined that building the maximum template will cause the berm width to be reduced so that it is too narrow to maintain a healthy project as determined by analysis of the project conditions at the time of construction.

This calculation was performed using the triangle volume tool in Microstation Inroads to compare the proposed template to a flat berm at 4 ft NAVD88. The calculated volume (39,700 cy) is 2% of the initial construction volume from 1992. It is extremely unlikely that the dune would be completely lost due to a given storm event, thus the dune restoration volume is likely a conservative (over) estimate.

*Table 6-4: Requirements for Recommended Plan*

| Gap Type | Gap Location | Closure Recommendation | Description of Closure | Closure Dimension |
|---|---|---|---|---|
| Vehicle Access | 67th Street | 25 cy of Sand | Angle Access using Sand Placement and Dune Vegetation Planting | triangular shape with base of 25 ft and height of 25 ft and elevation of +2 ft above existing elevation |
| | | 315 $ft^2$ of Vegetation | | |
| | 46th Street | 40 cy of Sand | Angle Access using Sand Placement and Dune Vegetation Planting | 2 triangular shapes with bases of 40 ft and heights of 25 ft and elevation of +2 ft above existing elevation |
| | | 500 $ft^2$ of Vegetation | | |
| | 30th Street | 140 cy of Sand | Angle Access using Sand Placement and Dune Vegetation Planting | 60-ft long gap with a height of +2 ft above existing elevation, a 10 ft crest width, and a 1V:3H slope. And 2 triangular shapes with bases of 30 ft and height of 30 ft |
| | | 2,220 $ft^2$ of Vegetation | | |
| | 3rd Street South | 20 cy of Sand | Narrow Access and Convert to Pedestrian Access Using Sand Placement and Dune Vegetation Planting | 4 triangular shapes with bases of 15 ft and heights of 15 ft and elevation of +2 ft above existing elevation |
| | | 450 $ft^2$ of Vegetation | | |
| Dune Gaps | Manatee Public Beach Gap | 800 cy of Sand | Close Gap partially using Sand Placement and Dune Vegetation Planting | 250 ft long gap with height of +4 ft above existing elevation, a 10 ft crest width and a 1V:3H slopes |
| | | 9,000 $ft^2$ of Vegetation | | |
| | Other Gap Closures | 3,000 cy of Sand | Close Gaps using Sand Placement and Dune Vegetation Planting | Total length of other gaps is 930 ft, with a height of +4 ft above existing elevation, a 10 ft crest width and 1V:3H slopes |
| | | 32,300 $ft^2$ of Vegetation | | |
| | Total Sand (cy) | 4,025 | | |
| | Total Dune Vegetation ($FT^2$) | 44,785 | | |
| | Total Pedestrian Post and Rope Fencing (FT) | 320 | | |

# 7 CURRENT ENGINEERING STUDIES, INVESTIGATIONS, AND DESIGN

The 1991 General Design Memorandum (USACE, 1991) is the most recent Engineering Appendix and it governs the analysis presented in this EDR. Monitoring reports written after each construction event detail this project's history along with shoreline and volume changes over time.

The USACE Coastal Engineering Manual (CEM) and Natural and Constructed Coastal Foredunes Fact Sheet (USACE, 2018a) from the USACE Engineer Research and Development Center (ERDC) were also consulted in the design of the proposed dunes in order to ensure that the proposed dunes designs are consistent with existing technical guidelines. Dune slopes typically range from about 1V:4H to 1V:7H based on the grain size and wind velocity in the project area (USACE, 2006). The proposed slopes for the project is slightly steeper (1V:3H) than the typical dune slope range due to the limited available footprint in some portions of the berm.

## 7.1 SEA LEVEL CHANGE ANALYSIS

A sea level change analysis was also conducted. While sea level change is not expected to significantly affect the project design during its current project life, it is important to consider when making any changes to the design. **Figure 7-1** displays sea level trends near the Manatee County SPP Anna Maria Segment using the USACE Sea Level Tracker Tool (USACE, 2018b). The tool shows the historical observed changes in mean sea level (MSL) as measured and reported for National Oceanic Atmospheric Administration tide gauges and mapped against the USACE sea level change (SLC) projections. For NOAA Station 8726520 at St. Petersburg, Florida, the linear trend for 1979 to 2019 and 19-year moving average are both close to the medium curve, while the 5-year moving average is between the medium and high curves, as seen in **Figure 7-1**. All three sea level change curves from the tracker tool originate from 1992, which is the midpoint of the NOAA National Tidal Datum Epoch (NTDE) of 1983-2001.

The St. Petersburg station is slightly closer to the project area than the Clearwater Beach station but it is located inside of Tampa Bay. The sea level trends at both stations were similar when compared. The St. Petersburg, Florida station was chosen rather than the station at Clearwater Beach, Florida (8726724) because the St. Petersburg station has a greater amount of recorded data.

**Figure 7-2** shows sea level projections curves from the USACE Sea Level Tracker Tool with the 1% exceedance probability extreme water level (5.92 ft) from NOAA. The extreme water level (EWL) value is a statistically-derived water level based on the probability of an extreme hydrologic event or storm calculated by NOAA (USACE, 2018b). This extreme water level was plotted on top of the High sea level change curve to represent the worst case scenario of sea level change plus the EWL intersecting the berm and dune crests. Using this scenario in the Sea Level Tracker Tool, a 1% event may inundate the berm in in the present, but the proposed dune crest of 8 ft NAVD88 may not be inundated until 2061.

The project berm elevation in the 2000 LRR is referenced to Mean Low Water (MLW) which means that as the sea level changes, the berm elevation should be adjusted accordingly. The period of federal participation in this project expires in 2042 and sea level changes are not expected to significantly impact the function or maintenance of the SPP during this time period. The project will be restudied if federal participation continues and at that time, sea level change will be re-evaluated and reconsidered in the new project design.

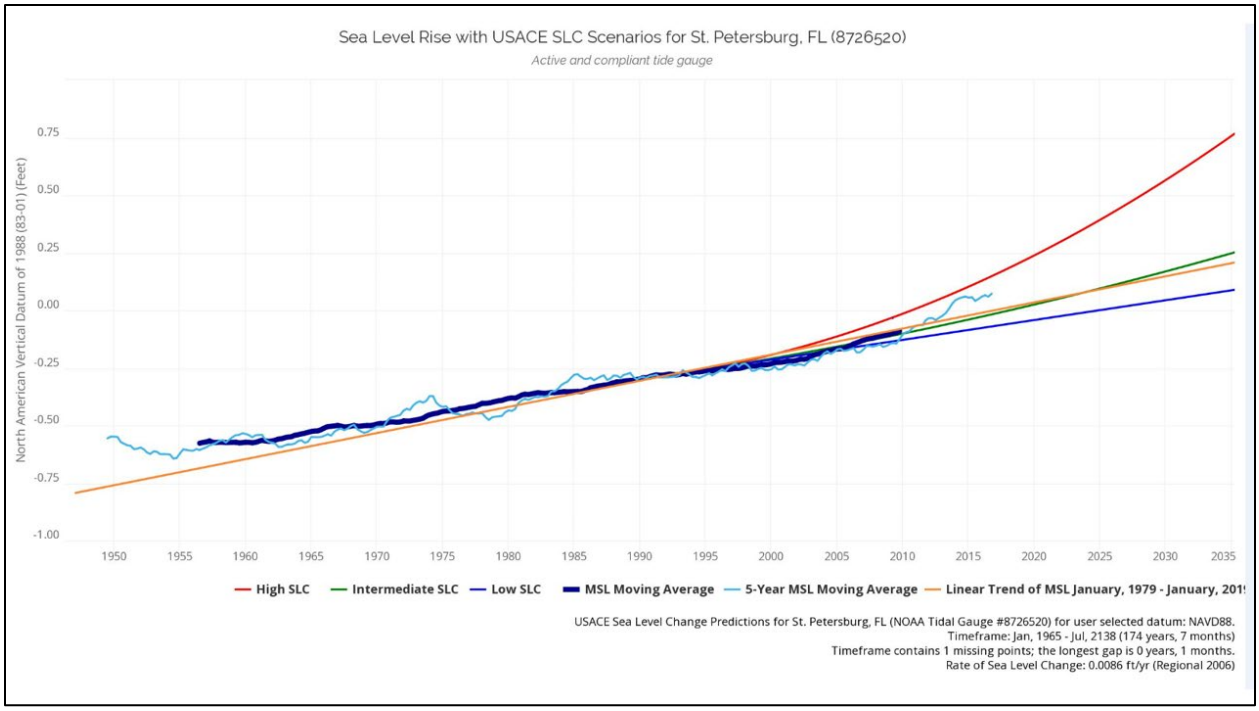



*Figure 7-1: Sea Level Change Trends for the USACE Sea Level Tracker, St. Petersburg, FL NOAA Station (8726520)*

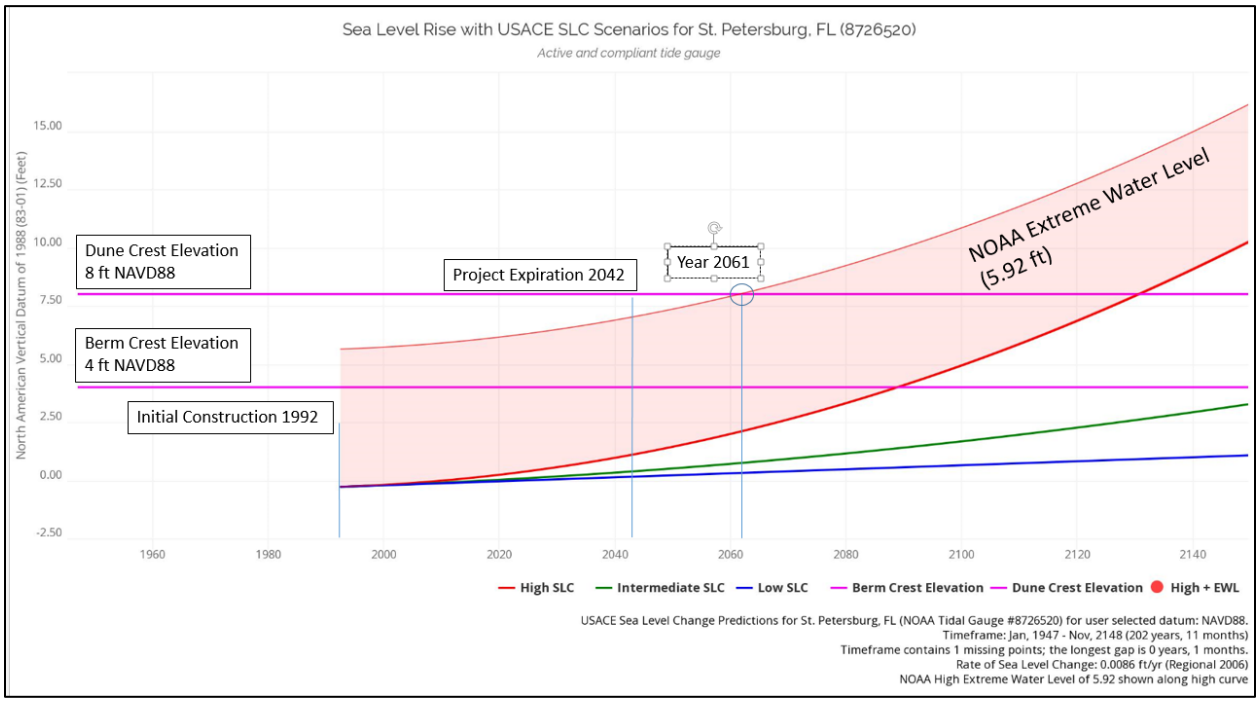



*Figure 7-2: Sea Level Change and Extreme Water Level for the St. Petersburg, Florida NOAA Station (8726520)*

# 8 COST ESTIMATE

Rough Order of Magnitude (ROM) Estimates have been prepared in support of this Engineering Documentation Report (EDR) for Dune Resilience. This EDR is assumed to contain 10% level of design and according to the ER 1110-2-1302, this project is in the early concept technical information stage. Therefore, this estimate is considered a Class 4. As a result, due to the minimal level of design, 45% contingency was chosen and included on all estimated costs to address the risk of potential scope growth that may occur. Also, 10% was assumed for each of the following: mobilization and demobilization, environmental monitoring, and for maintenance of traffic (MOT). All of these costs are assumed to be best captured as a percentage at this point in time taking into consideration the level of design and the recommended work along the Manatee County Project. $20,000 lump sum amount was added for future update of the O&M manual for this project. No abbreviated risk analysis (ARA) was performed based upon the small magnitude of the Project and minimal complexity of the work.

This work is assumed to be as a one-time occurrence. Any future adaptive management or maintenance required to the proposed dune design refinements is assumed to be performed by the non-federal Sponsor. This estimated cost for the proposed work is approximately $2M per project supplemental funding allowance guidelines. Title IV of the Bipartisan Budget Act of 2018 (BBA-18) indicates that Section 902 of Water Resources Development Act of 1986 shall not apply to funding received under BBA-18. If in the future the dunes become damaged the assumption is that the core of the dune would be restored through reshaping of the remaining material to facilitate recovery of the dune system. This is assumed to be a low risk and negligible cost relative to the overall renourishment cost and is assumed to be captured in the existing risk based contingency. Therefore, there has been no update to the Total Project Cost for this project.

Non-Construction Costs have also been included. A minimum of $100K is considered to be sufficient under a regional contract for PED. Also, 9% of the total construction cost was assumed for Construction Management (S&A). These values are consistent with similar District projects.

Specific to Manatee County, Florida SPP, the following recommended dune resiliency measure is vegetated dune incorporation and construction. Material for these areas is assumed to be purchased from an upland borrow source to provide for a conservative estimate pending further coordination and design.

Similar coastal resiliency efforts are being planned for the region. As a result, this estimate assumes that the design associated with the coastal resiliency efforts would be shared with other projects regionally. Construction of these EDR recommendations could be accomplished through a type of services contract. Or the work could potentially be performed by USACE Operations or the non-federal sponsors resources. However, it is most likely that these recommendations would be constructed in conjunction with an ongoing or future renourishment. This could be completed as part of the larger renourishment contract or as a separate small business contract. The acquisition strategy will be further evaluated in an effort to determine the most appropriate mechanism that takes into consideration the project schedule and that helps to reduce acquisition costs and time to efficiently provide resiliency measures to this project

All costs are considered to be burdened with all necessary contractor markups. The markups applied vary by cost item because some are quoted, some are parametric, and some are estimated based upon labor, equipment, and materials.

The total estimated cost for the recommended modifications described in this EDR is $1,169,500. Costs for specific design refinements are shown in **Table 8-1.**

*Table 8-1: Manatee County SPP EDR Budget Estimate*

**MANATEE COUNTY SPP, ANNA MARIA SEGMENT EDR BUDGET ESTIMATE**

| Location | Feature | Description | Estimated Cost |
|---|---|---|---|
| 67th Street | Dune construction to angle access | Angle Access using Sand Placement and Dune Vegetation Planting | $ 1,700 |
| | Dune Vegetation | | $ 1,800 |
| 46th Street | Dune construction to angle access | Angle Access using Sand Placement and Dune Vegetation Planting | $ 2,700 |
| | Dune Vegetation | | $ 2,900 |
| 30th Street | Dune construction to angle access | Angle Access using Sand Placement and Dune Vegetation Planting | $ 9,400 |
| | Dune Vegetation | | $ 12,600 |
| 3rd Street South | Dune construction to angle access | Narrow Access and Convert to Pedestrian Access Using Sand Placement and Dune Vegetation Planting | $ 1,400 |
| | Dune Vegetation | | $ 2,600 |
| Manatee Public Beach Gap | Dune construction to angle access | Close Gap using Sand Placement and Dune Vegetation Planting and Construct Wooden Pedestrian Walkover | $ 53,600 |
| | Dune Vegetation | | $ 50,800 |
| Other Gap Closures | Dune construction to angle access | Close Gap using Sand Placement and Dune Vegetation Planting | $ 201,000 |
| | Dune Vegetation | | $ 182,200 |
| Pedestrian Post and Rope Fencing | Post and Rope Fencing | Estimated that it will require an average of 40 ft of Post and Rope Fencing at each access | $ 1,600 |
| **SUBTOTAL** | | | **$ 524,300** |
| **ASSOCIATED GENERAL ITEMS** | | | |
| **Mob/Demob** | | 10% | **$ 52,400** |
| **Environmental Monitoring** | | 10% | **$ 52,400** |
| **Maintenance of Traffic** | | 10% | **$ 52,400** |
| **TOTAL CONSTRUCTION COST** | | | **$ 681,500** |
| | | | |
| **NON-CONSTRUCTION COST** | | | |
| **PED** | | | **$ 100,000** |
| **S&A** | | 9% | **$ 61,300** |
| **Update O&M Manual** | | | **$ 20,000** |
| **CONTINGENCY** | | 45% | **$ 306,700** |
| **TOTAL ESTIMATED COST** | | | **$ 1,169,500** |

# 9 ECONOMIC ANALYSIS

The purpose of this section is to document investigations conducted to identify the National Economic Development (NED) benefits of the proposed dune construction activities for the Manatee County, Florida SPP. It is important to note that any indication of a benefit-to-cost ratio (BCR) in this report is a remaining-benefit-remaining-cost ratio (RBRCR) based on the remaining period of Federal participation. A primary RBRCR will be demonstrated (i.e. storm-damage reduction, land loss, and other primary benefits) as well as a secondary RBRCR which includes incidental recreation benefits.

Per ER 1110-2-1150, Engineering and Design for Civil Works Projects, if design modifications to an authorized project increase costs, the project benefits and annual costs presented in the last approved decision document will be updated as appropriate and a new benefit-to-cost ratio provided.

In most beach nourishment projects the quantity of sand in the system correlates with benefits. This is true of both the sand located in the berm as well as within the dune system. Sand dunes along the shoreline play a critical role in enhancing the storm protection, environmental, and aesthetic functionality of beach systems. Sand dunes serve as the ultimate line of defense against storms, acting as a natural buffer to protect inland infrastructure. Sand dunes also provide important habitat for many plants and animals. Though dunes were not part of the original project design, the benefits were predicated upon the assumption that any existing dunes would remain intact; the Manatee County SPP is no exception.

Dunes are important for increasing resilience with respect to beach erosion. During storms when the beach is being actively eroded, sand removed from the dunes is deposited on the beach profile and serves as a natural, albeit limited, sand source for the berm. Over time the dunes are replenished by windblown sand from the berm. This transfer back and forth captures sand that may otherwise be lost from the system and provides the project the resilience needed in the face of rising seas and storms. Additionally, this increased resilience from the sand transfer from dune to berm during storms may postpone future nourishments and/or reduce quantities needed for emergency actions following major storms and will thus potentially decrease the average annual cost of the authorized project.

For the reasons stated above, it is concluded that the average annual benefits from the last authorized report (1991 Manatee County, Florida SPP General Design Memorandum) would not be negatively impacted by the proposed dune incorporation. Using 2019 Google Earth and other GIS imagery on a sampling of homes and businesses in the area it has been verified that the number of structures and value of the infrastructure at risk is at a minimum similar to that in the previous report and in many places is more updated (i.e. higher depreciated replacement value). As such, said benefits are assumed to be valid as of the writing of this report, and will be applied for the purposes of this analysis.

Costs for dune modifications specific to this EDR were created by cost engineering in Fiscal Year 2020 (FY20). Future monitoring, PED, and nourishment costs are based on the latest Total Project Cost Summary (TPCS) developed for budget updates. The Civil Works Construction Cost Index System (CWCCIS) dated 31 March 2018 was then used to convert the cost estimate for dune construction as well as the remaining periodic nourishment(s) to the 1QFY1999 level (i.e. price level of the benefits in the last approved report). This was done so that the price levels for cost and benefit were based on the same fiscal year. A price level deflation adjustment factor of 0.4604 was calculated and applied to the estimated remaining costs. A present worth adjustment factor using the current discount rate of 2.750% was then applied to these costs and then annualized using an economic period of analysis of 23 years (i.e. the remaining years of

Federal participation). The remaining cost and associated events in FY20 price level is presented in **Table 9-1**, and the price level adjustment and amortization is presented in **Table 9-2**

*Table 9-1: Manatee County SPP Remaining Costs (FY20)*

| Year | Cost (FY20) | Event |
|---|---|---|
| 2020 | $1,169,500 | Dune Resilience Action (EDR) |
| 2021 | $900,000 | Monitoring |
| 2022 | $15,362,557 | Periodic Nourishment |
| 2023 | $362,500 | Monitoring |
| 2024 | $350,000 | Monitoring |
| 2025 | $350,000 | Monitoring |
| 2026 | $87,500 | Monitoring |
| 2027 | $243,750 | Monitoring |
| 2028 | $150,000 | Monitoring |
| 2029 | $306,250 | Monitoring |
| 2030 | $906,250 | Monitoring |
| 2031 | $17,634,508 | Periodic Nourishment |
| 2032 | $362,500 | Monitoring |
| 2033 | $350,000 | Monitoring |
| 2034 | $350,000 | Monitoring |
| 2035 | $87,500 | Monitoring |
| 2036 | $243,750 | Monitoring |
| 2037 | $87,500 | Monitoring |
| 2038 | $243,750 | Monitoring |
| 2039 | $87,500 | Monitoring |
| 2040 | $243,750 | Monitoring |
| 2041 | $87,500 | Monitoring |
| 2042 | $268,750 | Monitoring |
| **Total:** | **$40,235,315** | |

*Table 9-2: Manatee County SPP Remaining Cost Price Level Adjustment and Amortization*

| FY Cost is Incurred | Costs (FY20) | 2.750% Present Worth Adj. Factor | Price Level Adj. Factor (FY99/FY20) | Price Level & Present Worth Adj. |
|---|---|---|---|---|
| 2020 | $1,169,500 | 0.947 | 0.5352 | $ 592,866 |
| 2021 | $900,000 | 0.922 | 0.5352 | $ 444,036 |
| 2022 | $15,362,557 | 0.897 | 0.5352 | $ 7,376,616 |
| 2023 | $362,500 | 0.873 | 0.5352 | $ 169,403 |
| 2024 | $350,000 | 0.850 | 0.5352 | $ 159,184 |
| 2025 | $350,000 | 0.827 | 0.5352 | $ 154,923 |
| 2026 | $87,500 | 0.805 | 0.5352 | $ 37,694 |
| 2027 | $243,750 | 0.783 | 0.5352 | $ 102,195 |
| 2028 | $150,000 | 0.762 | 0.5352 | $ 61,206 |
| 2029 | $306,250 | 0.742 | 0.5352 | $ 121,618 |
| 2030 | $906,250 | 0.722 | 0.5352 | $ 350,257 |
| 2031 | $17,634,508 | 0.703 | 0.5352 | $ 6,633,161 |
| 2032 | $362,500 | 0.684 | 0.5352 | $ 132,704 |
| 2033 | $350,000 | 0.666 | 0.5352 | $ 124,699 |
| 2034 | $350,000 | 0.648 | 0.5352 | $ 121,361 |
| 2035 | $87,500 | 0.631 | 0.5352 | $ 29,528 |
| 2036 | $243,750 | 0.614 | 0.5352 | $ 80,056 |
| 2037 | $87,500 | 0.597 | 0.5352 | $ 27,969 |
| 2038 | $243,750 | 0.581 | 0.5352 | $ 75,828 |
| 2039 | $87,500 | 0.566 | 0.5352 | $ 26,492 |
| 2040 | $243,750 | 0.551 | 0.5352 | $ 71,823 |
| 2041 | $87,500 | 0.536 | 0.5352 | $ 25,093 |
| 2042 | $268,750 | 0.521 | 0.5352 | $ 75,008 |
| | | | | |
| **Total Remaining** | **$40,235,315** | | | **$16,993,720** |

Total present value was calculated to be $16,993,720 in FY1999 dollars at the current discount rate, which amounts to an average annual cost of $1,006,778 (See **Table 9-3** for calculation). Comparing these costs to the $13,567,000 in primary average annual CSRM benefits yields a RBRCR of 13.5 to 1. Adding in the incidental recreation average annual benefits of $961,000 brings the total benefits to $14,528,000 and provides a RBRCR with recreation of 14.4. See **Table 9-3** and **Table 9-4** for the RBRCR calculations.

*Table 9-3: Primary RBRCR*

| RBRCR Without Incidental Recreation Benefits | |
|---|---|
| | **Current Rate FY20** |
| Rate: | 2.750% |
| Total Cost Present Value: | **$16,993,720** |
| CRF i=2.750% n=9 | **0.0592** |
| AAEQ Cost | **$1,006,778** |
| | |
| AAEQ Benefits (Primary) | **$13,567,000** |
| AAEQ Net-Benefits | **$3,426,720** |
| **Total BCR** | **13.5** |

*Table 9-4: RBRCR with Recreation*

| RBRCR With Incidental Recreation Benefits | |
|---|---|
| | **Current Rate FY20** |
| Rate: | 2.750% |
| Total Cost Present Value: | **$16,993,720** |
| CRF i=2.750% n=9 | **0.0592** |
| AAEQ Cost | **$1,006,778** |
| | |
| AAEQ Benefits (W/Rec) | **$14,528,000** |
| | |
| **Total BCR** | **14.4** |

# 10 COST ALLOCATION AND COST SHARING

The current project cost share for periodic nourishment is 63.6% Federal and 36.4% non-Federal for R-12 to R-33.4, and 100% non-Federal for the taper extending from R-33.4 to R-36. There is no change to this cost allocation for periodic nourishments associated with the design refinements recommended by this EDR.

For implementation of the dune design refinements recommended by this EDR, the existing LCA will need to be amended to reference this EDR. The cost share for the one time dune design refinements recommended by this EDR will be at the current cost share rate in accordance with implementation guidance for supplemental projects. This will be documented in the amended PCA.

# 11 ENVIRONMENTAL DOCUMENTATION AND COORDINATION

National Environmental Policy Act (NEPA) coordination (including Section 106 National Historic Preservation Act) for the addition of dune design refinements to the Manatee County, Florida SPP, in support of PARA principles for resilience, was initiated on 3 December 2018 in the form of a scoping letter emailed to property owners, Federal agencies, state agencies and tribes. Supplemental Environmental Assessment, Dunes and other Resiliency Design Refinements, Manatee County, Florida Shore Protection Project covering the recommended project modifications described in this EDR will be coordinated with the appropriate Federal, state, and local agencies, tribes, and businesses, organizations and individuals for their review and comment. Comments received will be reviewed and incorporated as appropriate in the final NEPA document.

# 12 REAL ESTATE

The design refinements being recommended via this Engineering Documentation Report (EDR) are located between FDEP Monuments R-12 and R-36. The Erosion Control Line (ECL) is the landward extent of the proposed design refinements, and the proposed design refinements do not require the acquisition of any real property interests from private landowners.

The lands seaward of the ECL require sovereign submerged lands authorization from the State of Florida. The Jacksonville District has acquired a consent of use for the sovereign submerged lands via the Consolidated Joint Coastal Permit and Sovereign Submerged Lands Authorization dated 28 August 2013, Permit Number: 0039378-010-JC. The permit expires 28 August 2028. If the State of Florida determines that a modification to the permit is required, then the Corps shall apply for and obtain the modification.

Manatee County, Florida provided staging and access areas located on County-owned lands (parcels #7384200059 and #7759200004) via a Certification of Lands dated 10 December 2019. The access granted in the certification terminates on 28 August 2028.

Parcel #7384200059 (Manatee Public Beach, Holmes Beach) would require a new certification if any work is conducted on this parcel landward of the ECL because the existing certification only covers staging and access.

Because the proposed design refinements are located only on public lands, the acquisition of additional real property interests from private owners is not required to implement the recommended design refinements within this EDR.

# 13 APPROVAL

The proposed design refinements involve a change in scope that can be approved within the District Commander's delegated approval authority. The District has considered the guidance provided in the CESAD-PD Memorandum dated 30 January 2019.

The nature of the primary problem addressed by the proposed design refinements is beach erosion, which is the same problem addressed by the existing project. The authorized design template of the existing project is unchanged. The design changes are considered to be minor as they do not increase the total volume of sand to be placed over the period of Federal participation or Total Project Cost. The one time dune design refinements recommended by this EDR will be implemented with funding provided under the Bipartisan Budget Act of 2018 (BBA-18) which are not applied towards the Section 902 limit. Following the one time construction of these pedestrian and vehicle access modifications an updated Operations and Maintenance (O&M) Manual will be provided to the local sponsor for maintenance of these modifications. There are minimal additional environmental impacts associated with the proposed design refinements. The proposed design refinements do not require an increase in cost that is greater than increases in price level changes and do not require subsequent legislation.

The Jacksonville District has completed the required technical reviews for the Manatee County, Florida Shore Protection Project, Anna Maria Island Segment. All concerns resulting from the technical reviews have been resolved and comments are incorporated. The recommendations are made in accordance with guidance contained in ECB 2018-2, for applying the USACE principles of resilience – Prepare, Absorb, Recover and Adapt (PARA) in support of risk-informed decision making and the Director of Civil Works Memorandums dated 21 June 2017 and 3 May 2018, to operationalize risk-informed decision making in order to make the full project lifecycle processes more efficient and effective.

I certify this EDR documents the design changes for the Manatee County, Florida Shore Protection Project, Anna Maria Island Segment to be correct and accurate, and I determine that the design refinements are consistent with the Manatee County, Florida Shore Protection Project Anna Maria Island Segment authorizations, applicable law, policy, and guidance.

Andrew D. Kelly
Colonel, U.S. Army
District Engineer

# 14 REFERENCES


U.S. Army Corps of Engineers 1991. *Manatee County, Florida Shore Protection Project General Design Memorandum with Supplemental Environmental Impact Statement*, Jacksonville, FL.

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Wootton, L., Miller, J., Miller, C., Peek, M., Williams, A., and Rowe, P. 2016. *New Jersey Sea Grant Consortium Dune Manual*. Accessed April 2019. Retrieved from *njseagrant.org/dunemanual*.