# Re-opening the East Pass, Bay County, Florida
## *Summary Report*
DRAFT

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## Executive Summary

The overall findings presented throughout the report and appendices are summarized below:

- The historic East Pass closed in 1998 and the 2001 Experimental Re-opened East Pass was unstable and closed naturally. Historically, East Pass required periodic maintenance to keep the inlet open.
- Nine (9) preliminary alternatives were evaluated for average annual wave conditions for a 5-year period. Of the nine (9) simulated alternatives, four (4) indicated a hydraulically stable inlet over a 5-year period. The recommended alternative (1c) is a proposed inlet located 1.4 miles west of the 2001 Experimental Re-opened East Pass. Alternative 1c consists of a 2,130 feet (ft) long channel with a width of 655 ft excavated to -10 ft, NAVD88.
- Although the results of this study show that the proposed inlet would be stable over a 5-year period under average wave conditions, major storm events have the potential to change the performance of the inlet. Simulations of major storm events (Hurricane Ivan, 2004) showed that the inlet response varies significantly depending on the timing of the storm with respect to the inlet construction.
- Water quality modeling incorporating salinity and injecting a conservative tracer was simulated for Alternative (1c) and compared to existing conditions (no dual inlet), Alternative 1c modeling results showed an increase in flushing capacity in Old Pass Lagoon.
- The simulations of Alternative 1c did not indicate any adverse impacts to the St. Andrew Bay Entrance (SABE). The simulated discharge through the SABE and the tidal prism for the Alterative 1c simulation were within 1% of the existing conditions simulation.
- An initial cost of $7.4 million was estimated for the re-opening of East Pass for the Alternative 1c configuration. A cost per maintenance dredge event of $2.6 million was estimated, assuming the inlet will be dredged every 6 years. The estimated annualized cost over a 50-year period is $868,500.
- The re-opening of East Pass can be located on Tyndall Air Force Base property provided there are no Federal funds used in the construction and maintenance of the proposed channel in accordance with Coastal Barrier Resources Act (CBRA) (USFWS, 2022).
- Obtaining regulatory permits to construct Alternative 1c on Shell Island will be a challenge due to the potential impacts to listed species, designated critical habitat, and essential fish habitat (EFH)s. The re-opening of East Pass will require sufficient justification to demonstrate that the inlet will meet the stated purpose and need for the project while minimizing and mitigating any anticipated adverse impacts that may occur to the coastal system. Utilizing the initial dredge spoils to construct a dune on the west side of the proposed channel is within State owned-lands and will require the State of Florida to be a co-applicant to the permits.
- Based on the results of the study and the findings presented herein, it is recommended that the Bay County Board of County Commissioners (the County) select Alternative 1c as the preferred alternative to move forward with the development of an EA/EIS and permitting. In addition, we recommend conducting meetings with the State and Federal regulatory and resource agencies to

discuss the findings of this investigation, approach going forward and the challenges in obtaining the necessary authorizations and permits to re-open East Pass.

# 1.0 Introduction

The Bay County Board of County Commissioners (the County) and MRD Associates, Inc. (MRD) entered into an agreement for "*20-36 Feasibility Study of Re-opening the East Pass, Bay County, Florida*", dated March 25, 2021. This report summarizes the results of the Feasibility and Design study outlined in Task 1.6. of Task Order No. 001, dated February 10, 2021.

The focus of this study is the historic East Pass (or Old Pass), which was located in Bay County along Sand Island (more commonly known as, and referred to throughout this report as, Shell Island) on the Gulf Coast of Florida. The adjacent inlet is St. Andrew Bay Entrance (SABE), which is located approximately 8 miles northwest of the historic East Pass location. The St. Andrew Bay system consists of St. Andrew Bay, West Bay, North Bay, and East Bay. Additionally, Grand Lagoon extends to the west and Old Pass Lagoon extends to the east of SABE. East Pass was originally formed in 1851 as the result of the Great Middle Florida Hurricane. East Pass was maintained for safe navigation up until the construction of the St. Andrew Bay Entrance (SABE) in 1934. Following the construction of SABE, East Pass gradually closed by 1998. East Pass was re-opened in 2001 as part of the East Pass Experimental Re-opening project and closed again by 2004. ***Figure 1*** shows the project area along with the location of the 2001 East Pass Experimental Re-opening project.


***Figure 1.*** *Location Map.*

## 1.1 Project Goals

The County desires to achieve these goals and objectives:

1) *Design a hydraulically stable channel that will remain open without dredging for a specified length of time (many years). This will include the optimal placement of the dredged material in the form of either a dune, beach and dune, or other locations consistent with Florida Department of Environmental Protection (FDEP) criteria.*
2) *The proposed design shall not require shoreline stabilization of the pass to remain open. This pertains to armoring the channel shoreline. The State of Florida will not allow shoreline stabilization like the rock jetties on the Panama City shipping channel.*
3) *Restore and enhance water quality within St. Andrew Bay. This pertains to improved marine habitat for fish, shellfish, and seagrasses in conjunction with water clarity.*
4) *Not result in significant adverse impacts to endangered species. This pertains to the endangered species that utilize the surrounding waters and the beach area (e.g., Gulf sturgeon, Choctawhatchee beach mouse, sea turtles, and wintering piping plovers and red knots).*
5) *Provide a Public Benefit(s).*
6) *Not have an adverse impact on the existing SABE.*
7) *Qualify for the necessary regulatory permits from the FDEP and the U.S. Army Corps of Engineers (USACE).*

This study investigated goals 1), 2), 3), and 6), and addressed goals 4), 5) and 7) on a cursory basis.

### 1.2 Purpose and Scope

The primary purpose of this study was to determine if re-opening a secondary pass into the St. Andrew Bay system from the Gulf of Mexico is in the County's best interest. The study assesses the coastal processes at historic East Pass and SABE.

The scope of this study included literature review, data collection, feasibility and design assessment, alternatives analysis using advanced numerical modeling, and recommendations. The alternatives analysis used the numerical model Delft3D to evaluate conceptual inlet configurations for long-term stability and short-term storm impacts. Additionally, a Technical Advisory Committee (TAC) was created and included in the study development.

The information presented in this study has been developed to support future permitting efforts and implementation of the re-opening of the historic East Pass in St. Andrew Bay to a natural, non-armored channel. Appendices A through F include Definitions (A), TAC Presentations (B), Data Collection (C), Feasibility and Design Assessment (D), Water Quality Assessment (E), and Numerical Modeling Documentation (F).

## 2.0 Technical Advisory Committee (TAC)

A Technical Advisory Committee (TAC) was formed to assist, review tasks, and provide oversight, guidance, and suggestions in the development of a Feasibility and Design Study. The TAC was used to engage with stakeholders, disseminate information, and seek project consensus on action items. The goal of the TAC was to identify and address potential issues and to develop a general consensus before commencing on the permitting process. The stakeholders included representatives from Bay County, FDEP Beaches, Inlets & Ports Program (BIPP), Tyndall Air Force Base (AFB), USACE, USFWS, National Marine

Fisheries Service (NMFS), Florida Fish and Wildlife Conservation Commission (FWC), Environmental Protection Agency (EPA), Friends of Shell Island, and Coastal Protection Engineering (CPE).

Three (3) TAC meetings were held during the development of the Feasibility and Design Study. The meetings were held virtually on October 14, 2021, January 13, 2022, and April 7, 2022. Appendix B details the presentations made to the TAC as well as the participants who attended each meeting.

# 3.0 Background

## 3.1 East Pass Inlet History

As part of a two-part online article series sponsored by the Bay County Historical Society, local historian Robert Hurst published a history of the formation and changes of East Pass from the 1700's until the early 2000's (Hurst, 2021). Historic charts from 1768 depict three islands located off the coast in the vicinity of what is now known as St. Andrew Bay (Williams, 1827). The Great Middle Florida Hurricane of August 23, 1851 formed named passes that were present into the 20th century. Due to constant shifting sand, shoaling of channels, and the efforts to make a major harbor at Panama City, Congress authorized dredging of the Main Pass and the Inner Channel to provide safe navigation. In 1934, the pass and channel were abandoned and the USACE cut a new pass, now referred to as St. Andrew Bay Entrance (SABE), into the mainland peninsula. This eventually created significant changes in the old entrance into the bay. Sometime after 1940, the historic islands merged with what was once the mainland peninsula, and formed the island known as Shell Island.

***Figure 2*** and ***Figure 3*** show nautical charts from 1886 and 1935, respectively, before and after the construction of SABE. The charts show the location of Crooked Island and the scattered shoals that would eventually merge to become Shell Island. Additionally, ***Figure 3*** shows the location of what is now known as the St. Andrew Bay Entrance (SABE).

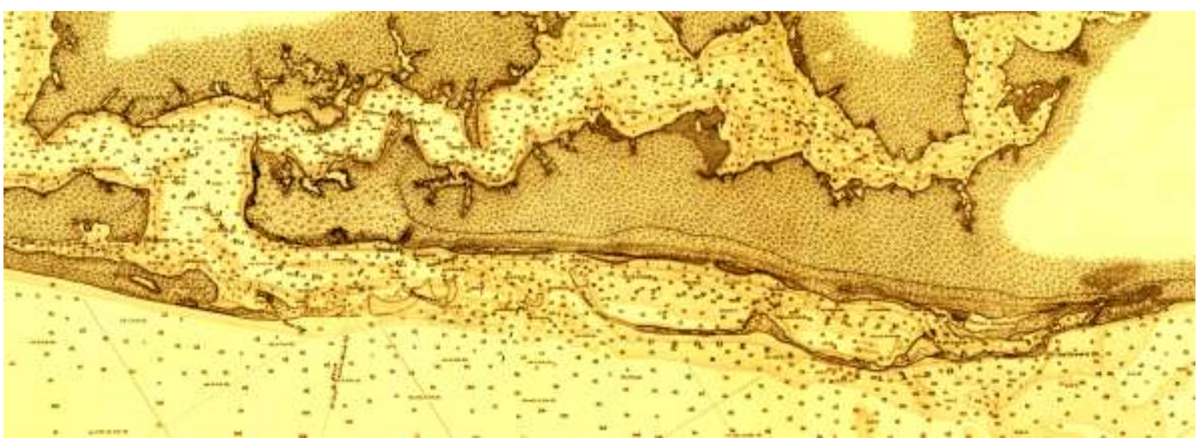

***Figure 2.*** *Nautical Chart for St Joseph and St Andrew Bay (USCGS, 1886).*

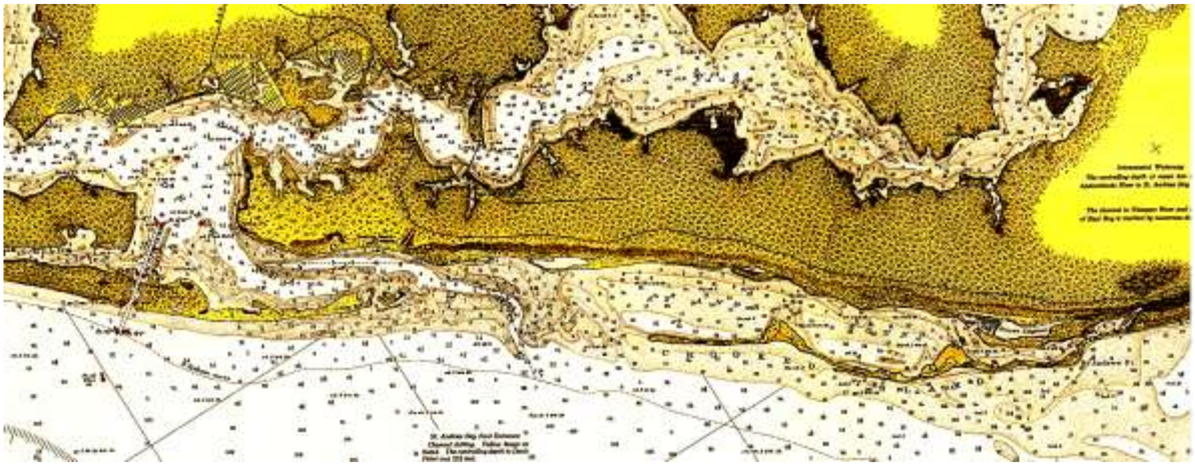

***Figure 3.*** *Nautical Chart for St Joseph and St Andrew Bay (USCGS, 1935).*


***Figure 4.*** *Aerial photographs from 1974 and 1997 showing the gradual closing of the historic East Pass.*

Following the construction of SABE, a gradual narrowing of the historic East Pass occurred. Over time, barrier islands formed and gradually developed into a peninsula attached to the mainland and the extension of lands ultimately closed East Pass. Historic East Pass was officially closed by 1998. ***Figure 4*** shows the narrowing of the historic East Pass between 1974 (left) and 1997 (right). The experimental re-opening of East Pass was authorized by Bay County in 2001. The project consisted of excavating approximately 350,000 cubic yards (270,000 $m^3$) of sand from the location of the historic East Pass (***Figure 1***), with placement of dredged material on adjacent beaches to construct a dune. The construction of the re-opened East Pass was completed in December 2001 and by 2004 the pass had closed again. Hurricanes Ivan (2004), Katrina, and Dennis (2005) resulted in the temporary re-opening of the East Pass, but it closed again shortly following the storms. ***Photo 1*** and ***Photo 2*** show aerial photographs of the East Pass Experimental Re-opening immediately after the re-opening (December 2001) and 1.5 years post-construction (July 2003).

***Photo 1.*** *Aerial photo of the East Pass Experimental Re-opening following construction in December 2001.*

***Photo 2.*** *Aerial photo of the East Pass Experimental Re-opening in July 2003.*

## 3.2 St. Andrew Bay Tidal Prism

The tidal prism in SABE was measured prior to construction of the re-opening of East Pass in 2001 (Jain, Paramygin, & Mehta, 2002a). Following the re-opening in December 2001, the tidal prism in SABE and the re-opened East Pass were measured two (2) times: December 2001 immediately following construction (Jain, Paramygin, & Mehta, 2002b) and March 2002 three (3) months post-construction (Jain, Paramygin, & Mehta, 2002c). The tidal prisms measured during flood and ebb for the SABE and the re-opened East Pass are shown in ***Table 1***. The flood tidal prism ranged between 173 x $10^7$ $m^3$ and 304 x $10^7$ $ft^3$ and the ebb tidal prism ranged between -131 x $10^7$ and -332 x $10^7$ $ft^3$. The tidal prism measured within i SABE during May 2021 as part of this study showed that the tidal prism increased compared to the measurements in 2001/2002, likely due to the variations in tide range at the time of data collection. The 2021 measurements were collected during a peak spring tide with resulting maximum velocities in SABE of 4.9 ft/s, whereas data collected in 2001/2002 reported maximum velocities between 1.37 and 2.26 ft/s. See Appendix C – Data Collection for more information on the boat-mounted ADCP measurements collected between May 26 and 27, 2021.

***Table 1.*** *Measured Tidal Prism for SABE and the re-opened East Pass.*

| Date | SABE | | Re-opened East Pass | | Tide Range at time of Data Collection |
|---|---|---|---|---|---|
| | Flood ($ft^3$) | Ebb ($ft^3$) | Flood ($ft^3$) | Ebb ($ft^3$) | (ft) |
| September 18-19, 2001* | 173 x $10^7$ | -131 x $10^7$ | - | - | 0.52 |
| December 18-19, 2001 | 237 x $10^7$ | -173 x $10^7$ | 8.12 x $10^7$ | -9.53 x $10^7$ | 1.67 |
| March 26-27, 2002 | 304 x $10^7$ | -332 x $10^7$ | 6.71 x $10^7$ | - | 1.44 |
| May 26-27, 2021* | 728 x $10^7$ | -684 x $10^7$ | - | - | 2.43 |

*Note: East Pass was closed when these measurements were taken.

### 3.3 Historic Shoreline and Volume Changes (Shell Island)

The shoreline (Mean High Water Line) changes were analyzed between 1998 and 2020, which included the closing of the historic East Pass and the experimental re-opening and closing of East Pass in 2001. The Mean High Water Line (MHWL) was found using LIDAR datasets from 1998, 2007, 2015, and 2020. Three time intervals were analyzed: 1) 1998-2007 (includes opening and closing of the experimental 2001 East Pass re-opening project, ***Figure 6***, black), 2) 2007-2015 (***Figure 6***, red), and 3) 2015-2020 (includes post Hurricane Michael (2018) and Hurricane Sally (2020) data, ***Figure 6,*** blue). The shoreline changes were calculated at each DEP reference monuments (R-monument) (R-98 to R-121) and virtual reference monuments V-301 to V-309 and VM-310 to VM-321 spaced approximately 1,000 feet apart. Comparisons of the shoreline positions can suggest erosion or accretion trends.

***Figure 5*** shows the distance from the monuments for four different shorelines: 1998, 2007, 2015, and 2020. The shoreline change rates for the limits of the project are shown graphically in ***Figure 6***. Additional information on the shoreline change rates including additional figures and tables can be found in Appendix D – Feasibility and Design Assessment.

The average shoreline changes between 1998 and 2015 show a general accretional trend along the eastern end of Shell Island from V-309 to VM-321. The western half of the monitoring area (R-98 to R-120) experienced relatively small erosion rates between 1998-2007 and 2007-2015 (***Figure 6***, black and red).

The third time interval (2015 to 2020) reveals a shift in accretion/erosion trends (***Figure 6***, blue). The shoreline is erosional along the entire Shell Island with only V-318 being accretional. This would demonstrate that the two previous time intervals were “filling in” an unnatural bend in the shoreline and it has now reached a more natural shape. Shoreline erosion rates between 2015 and 2020 were greater than during the previous monitoring periods (1998-2015), especially between R-109 and V-300. Within the project area between R-98 and VM-321, the shoreline change rates ranged from -20.5 feet per year (ft/yr) at R-113 to +0.04 ft/yr at VM-318. The average over the project limits was -9.2 ft/yr.

Bathymetric data is limited to LIDAR datasets which typically only extend out to the water line at the time of the data collection. The available data didn’t allow for comprehensive calculations of volume change rates within the project area. Therefore, an approximate relationship between shoreline change rates and volume change rates was used to estimate the volume changes within the project area. The general "rule of thumb" is for every 1 foot of shoreline change per year (ft/yr) is equivalent to 1 cubic yard per linear foot per year ($yds^3$/lf/yr) of volume change. ***Table 2*** shows the estimated volume changes between 1998 and 2020 along Shell Island.

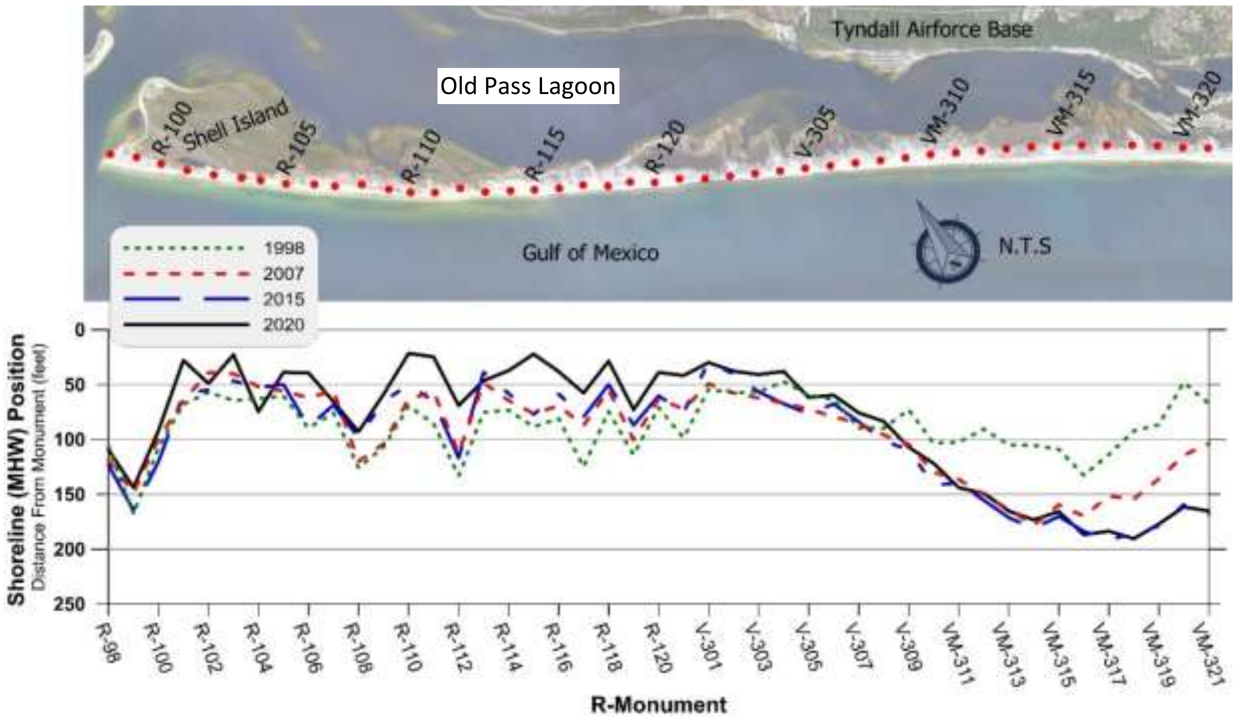


***Figure 5.*** Shoreline Position (feet) between 1998 and 2020.

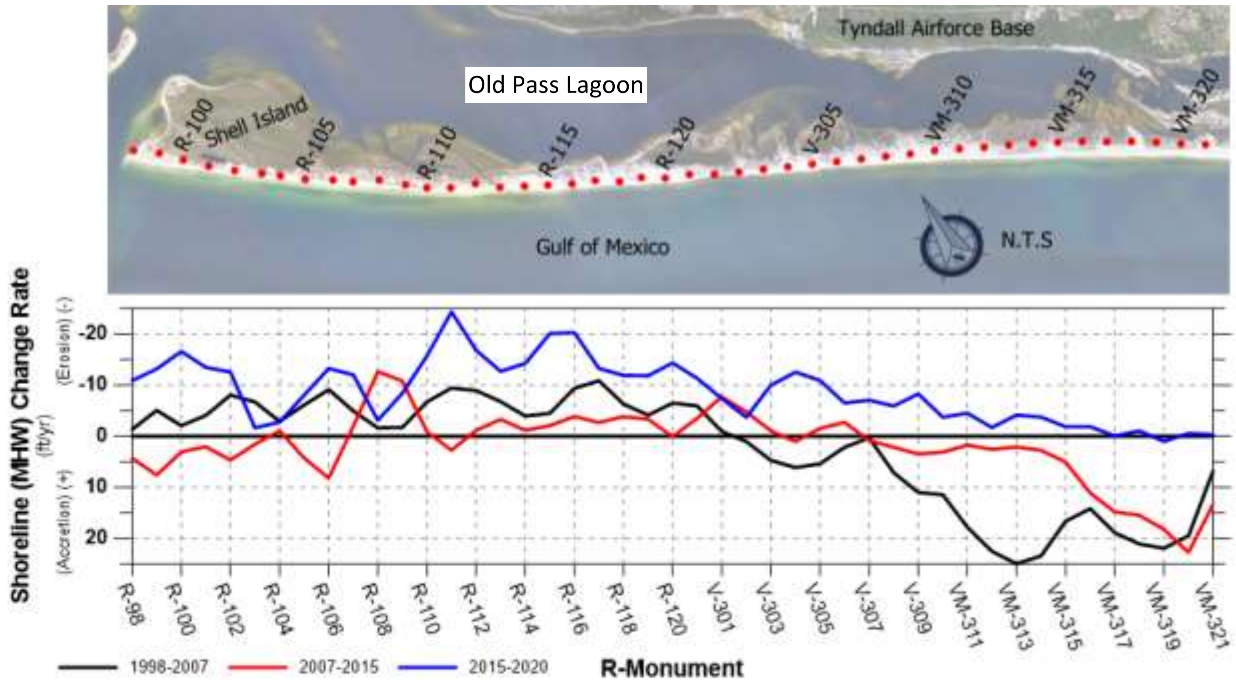


***Figure 6.*** Shoreline change rates in feet per year (ft/yr) between 1998 and 2007 (black), 2007 to 2015 (red), and 2015-2020 (blue).

***Table 2.*** Estimated volume and volume change rates (yds$^3$/yr).

| Shoreline Segment | 1998 to 2007 (yds$^3$) | 2007 to 2015 (yds$^3$) | 2015 to 2020 (yds$^3$) |
|---|---|---|---|
| Western Half (R-98 to R-120) | -1,099,705 | -81,641 | -1,480,633 |
| Eastern Half (R-121 to VM-321) | 2,233,965 | 811,231 | -572,490 |
| **Total** (yds$^3$) | **1,035,549** | **710,342** | **-2,087,855** |
| **Annual Rates** (yds$^3$/yr) | 119,486 | 89,728 | -397,687 |

## 3.4 Existing Sediment Transport and Sediment Budgets

In their 1994 General Reevaluation Report (GRR), the USACE developed a sediment budget by calculating longshore sediment transport potential using WIS hindcast wave data and GENESIS support programs WAVETRAN and SEDTRAN. They estimated a net longshore transport rate between 66,000 yds$^3$/yr and 79,000 yds$^3$/yr from east to west. The sediment budget developed as part of this study is illustrated in ***Figure 7*** (USACE, 1994).

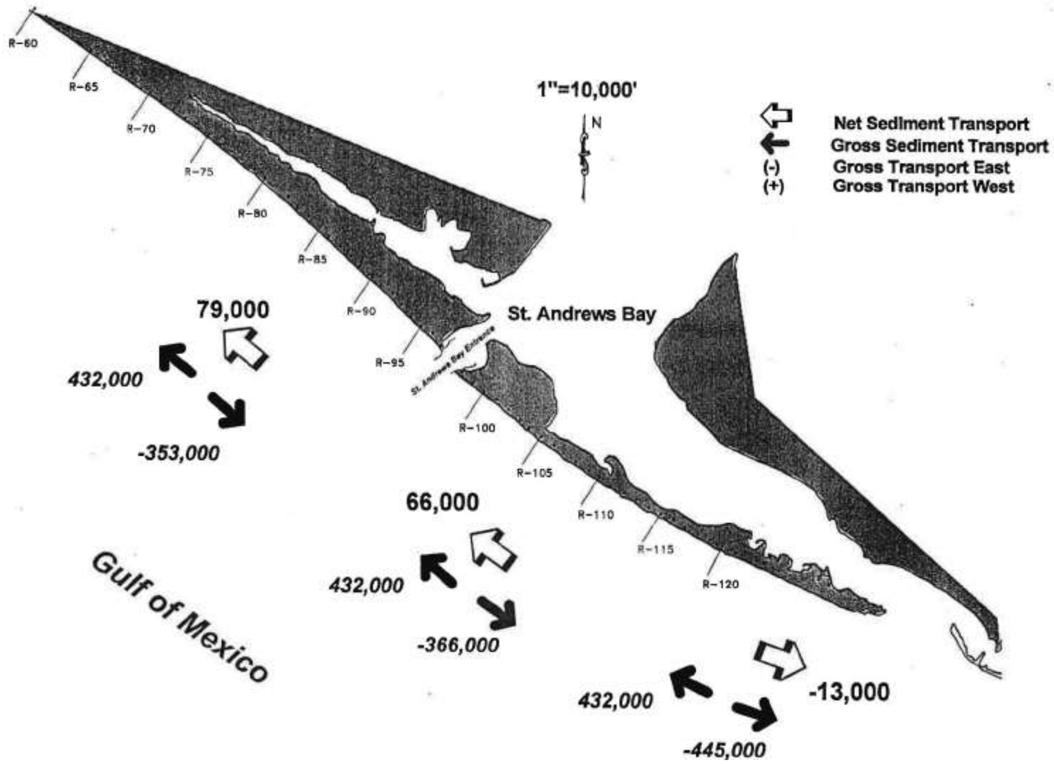


***Figure 7.*** Estimated longshore sediment transport rates (CTC, 2000) originally published in *Panama City Beaches, Florida. General Reevaluation Report-Beach Erosion Control and Storm Damage Reduction Project* (USACE, 1994).

An updated sediment budget was developed by Coastal Planning & Engineering, Inc. (CP&E) as part of the borrow area impact study (CP&E, 2011) for the time frame between 1999 and 2010, which included a 5-year period without storm events (1999 to 2004) and a period with storm events (2004 to 2010). The sediment budget includes the effect of four (4) hurricanes and a full-scale beach nourishment project constructed between April 2005 and March 2006 consisting of the placement of 3.3 million yds$^3$ along the Panama City Beaches. They determined that alongshore sediment transport is primarily to the west in the project area, but that sediment transport to the east toward the historic East Pass was dominant along Shell Island with a net sediment transport rate of 75,800 yds$^3$/yr from west to east (***Figure 8***).

***Figure 8*** also indicates an unknown amount of sediment transport from the Gulf beaches into Old Pass Lagoon. This quantity is the amount of sediment transport due to overwash on Shell Island. Overwash occurs when sediment transport is dominated by elevated wave and water levels. It has been documented in previous studies that overwash plays a dominant role in the condition of the shoreline along Shell Island (CP&E, 2011). When overwash occurs on Shell Island, the sediment is transported out of the active profile and into Old Pass lagoon. Due to a lack of sufficient profile data, the amount of overwash cannot be quantified but the topography along Shell Island consists of lower dunes than adjacent shorelines making the area susceptible to frequent overwash.

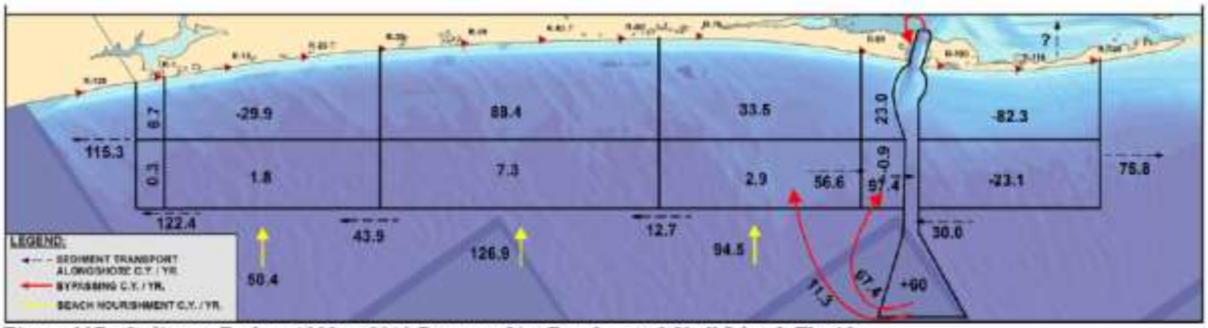


**Figure 29B. Sediment Budget 1999 to 2010 Panama City Beaches and Shell Island, Florida**

***Figure 8.*** *Sediment budget between 1999 and 2010 for Panama City Beaches and Shell Island. Initially published in the Panama City Beach Renourishment Engineering and Modeling Report (CP&E, 2011).*

## 3.5 Dredge Records

Dredge records were obtained from the UUSACE, Panama City Site Office and are summarized in ***Table 3***. Maintenance dredging occurs periodically within three (3) segments of the Panama City navigation channel including the approach channel, inlet channel, and interior channel. Additionally, dredging occurs periodically within Grand Lagoon. The existing disposal areas include the USACE beach disposal area within St. Andrews State Park between R-92 and R-97, the Gator Lake shoreline, located along the western interior shoreline of SABE, and west of St. Andrews State Park within the USACE Panama City Erosion Control project limits.

Additionally, Panama City Beaches have been nourished four (4) times over the last 20 years using various sediment sources. Between April 2005 and May 2006, 3.3 million yds$^3$ was placed along Panama City Beaches using three (3) inlet borrow areas and three (3) offshore borrow areas. In 2011, 1.37 million yds$^3$ of sand was placed over eight (8) miles of Panama City Beach shoreline using sand from two (2) offshore borrow areas. In 2017, an interim beach nourishment project was constructed consisting of approximately 950,000 yds$^3$ of sand using an offshore and an inlet borrow area. Most recently, the USACE completed construction of the 2020/21 re-nourishment which placed 2.1 million yds$^3$ along Panama City Beaches using borrow area S1-A, located offshore of Shell Island, and an inlet borrow area.

***Table 3.*** *SABE channel dredge records.*

| Year | Quantity (yds$^3$) | Dredge Location | Disposal Location |
|---|---|---|---|
| 2003 | 467,940 | Inlet Channel | Gator Lake |
| 2004 | 394,096 | Approach Channel | Beach R-92 to R-97 |
| | 123,895 | Inlet Channel | West of Park |
| | 238,975 | Interior Channel | Beach R-92 to R-97 |
| | 108,900 | Inlet Channel | West of Park |
| 2005 | 263,000 | Inlet Channel and Grand Lagoon | West of Park |
| 2006 | 75,559 | Grand Lagoon | Gator Lake |

| | | | |
|---|---|---|---|
| 2006-07 | 61,885 | Inlet Channel | Gator Lake |
| 2008 | 56,633 | Inlet Channel | Gator Lake and R-92 to R-97 |
| 2009 | 202,589 | Inlet and Approach Channel | Gator Lake and R-92 to R-97 |
| 2011 | 215,554 | Inlet and Approach Channel | Gator Lake and R-92 to R-97 |
| 2013 | 112,128 | Inlet Channel | Gator Lake |
| 2015 | 92,903 | Inlet and Approach Channel | Beach R-92 to R-97 |
| 2016 | 96,211 | Inlet and Interior Channel | Gator Lake and R-92 to R-97 |
| 2020 | 194,806 | Inlet and Approach Channel | Beach R-92 to R-97 |

## 3.6 Water Quality

The historic and existing water quality in the St. Andrew Bay waterbody was evaluated in Appendix E – Water Quality Assessment. Existing water quality data within the St. Andrew Bay watershed, with a focus on Old Pass Lagoon, was analyzed at four (4) water quality stations. Three (3) water quality parameters including pH, salinity, and Secchi depth (water clarity) were analyzed for historic trends. Water quality data was supplied by St. Andrew Bay Watch (SABW), formally known as St. Andrew Bay Resource Management Association (SARMA) (SABW, 2022) and the STORET (FDEP, 2022a) and WIN (FDEP, 2022b) databases provided by the State of Florida.

The pH in Old Pass Lagoon showed a decreasing trend prior to the experimental re-opening in 2001. An increase in pH (more basic) was seen following the re-opening but recent water quality data (2003-2020) shows the pH has returned to a decreasing trend. Salinity within Old Pass Lagoon has historically been measured both at the surface and the bottom. The measured salinity within Old Pass Lagoon ranged between 18 and 38 ppt with average surface measurements ranging between 30.2 and 31.5 ppt for the four (4) available stations within Old Pass Lagoon. The measured Secchi depth is a way of determining the turbidity of a waterbody which is an indication of water clarity; a decrease in Secchi depth corresponds to an increase in turbidity and a decrease in water clarity. The measured Secchi depths in Old Pass Lagoon ranged between 2 and 22 feet and showed a slight decreasing trend over the measurement period.

## 3.7 CBRA Considerations

Shell Island is located in the St. Andrew Complex P31 Unit of the Coastal Barrier Resources System (CBRS). The Coastal Barrier Resources Act (CRBA) of 1982 was passed to limit Federal expenditures in undeveloped coastal areas (USFWS, 2022).

> *"… Federal Government have historically subsidized and encouraged development on coastal barriers, resulting in the loss of natural resources, threats to human life, health, and property, and the expenditure of millions of tax dollars each year. CBRA seeks to minimize these effects by restricting federal funding and financial assistance affecting the CBRS.*
>
> > *(3) The term "financial assistance" means any form of loan, grant, guaranty, insurance, payment, rebate, subsidy, or any other form of direct or indirect Federal assistance other than–*
> >
> > > *(D) assistance for environmental studies, planning, and assessments that are required incident to the issuance of permits or other authorizations under Federal law …*

*Federal funds can be provided for certain exempted activities including:*

- *Improvements to existing, but not construction of new, navigation channels:*

*CBRA does not prohibit the expenditure of private, state, or local funds within the CBRS. Additionally, it does not prevent federal agencies from issuing permits or conducting environmental studies. Areas within the CBRS may be developed, provided that private developers or other non-federal parties bear the full cost and risk."*

Based on the above language from USFWS (2022), the opening of East Pass can be located on Tyndall Air Force Base property as long as there are no Federal funds used in the construction and maintenance of the channel in accordance with the CBRA (1982).

# 4.0 Alternatives Analysis

The alternatives analysis evaluated various inlet configurations which may be available to accomplish the project goals (see Section 1.1). The alternatives were developed to address the rapid infilling of the 2001 re-opened East Pass without causing negative effects to the coastal system. The alternatives analysis included a preliminary analysis of nine (9) alternatives at three (3) potential locations (***Figure 9***) to determine the most hydraulically stable inlet location and configuration.

The numerical model, Delft3D, was setup and calibrated for the St. Andrew Bay system. The Delft3D model was used to simulate hydrodynamics, waves, sediment transport and morphology changes. Morphology change results were then interpreted to calculate channel infilling rates associated with each project alternative and associated erosion and sedimentation of adjacent beaches. The details of the model setup and calibration are provided in Appendix F – Numerical Modeling Documentation.

The preliminary alternatives were evaluated for a 5-year period. The minimum depth within the proposed channel at the end of the 5-year simulation, infilled volume within the limits of the proposed channel, and change in cross-sectional area over time were calculated and compared to evaluate the performance of each preliminary alternative. Based on the results of the preliminary alternatives, a preferred alternative was selected and further evaluated for a storm event (Hurricane Ivan, 2004) to assess how the stability of the inlet is affected by major storm events. Additionally, the potential benefits to water quality of the preferred alternative were analyzed for two (2) water quality parameters: salinity and a conservative tracer. The results of the water quality modeling for the preferred alternative were compared to existing conditions (no dual inlets).

Results of each alternative are summarized in this report. Detailed results and additional discussion of the project alternatives are provided in Appendix F – Numerical Modeling Documentation.

## 4.1 Alternatives

Three (3) locations were investigated as part of the initial alternatives analysis (***Figure 9*** and ***Figure 10***). Location 0 is located between VM-317 and VM-318, where the 2001 East Pass Experimental Re-Opening Project was constructed. Locations 1 and 2 are located to the west of the East Pass Experimental Re-opening. Location 1 is located 1.4 miles (2,200 m) west of the 2001 East Pass location and 6.2 miles (10,000 m) east of SABE between VM-310 and VM-311. Location 2 is located 3.9 miles (6,300 m) west of the 2001 East Pass location and 3.8 miles (6,100 m) east of SABE at R-

118. ***Table 4*** summarizes the benefits and challenges associated with each of the three (3) locations. All three (3) locations are located within piping plover, Gulf sturgeon, and Choctawhatchee beach mouse critical habitat (CH, ***Figure 10***). Location 2 poses additional challenges since it is located within the St. Andrews Aquatic Preserve and within state lands (***Figure 10***).

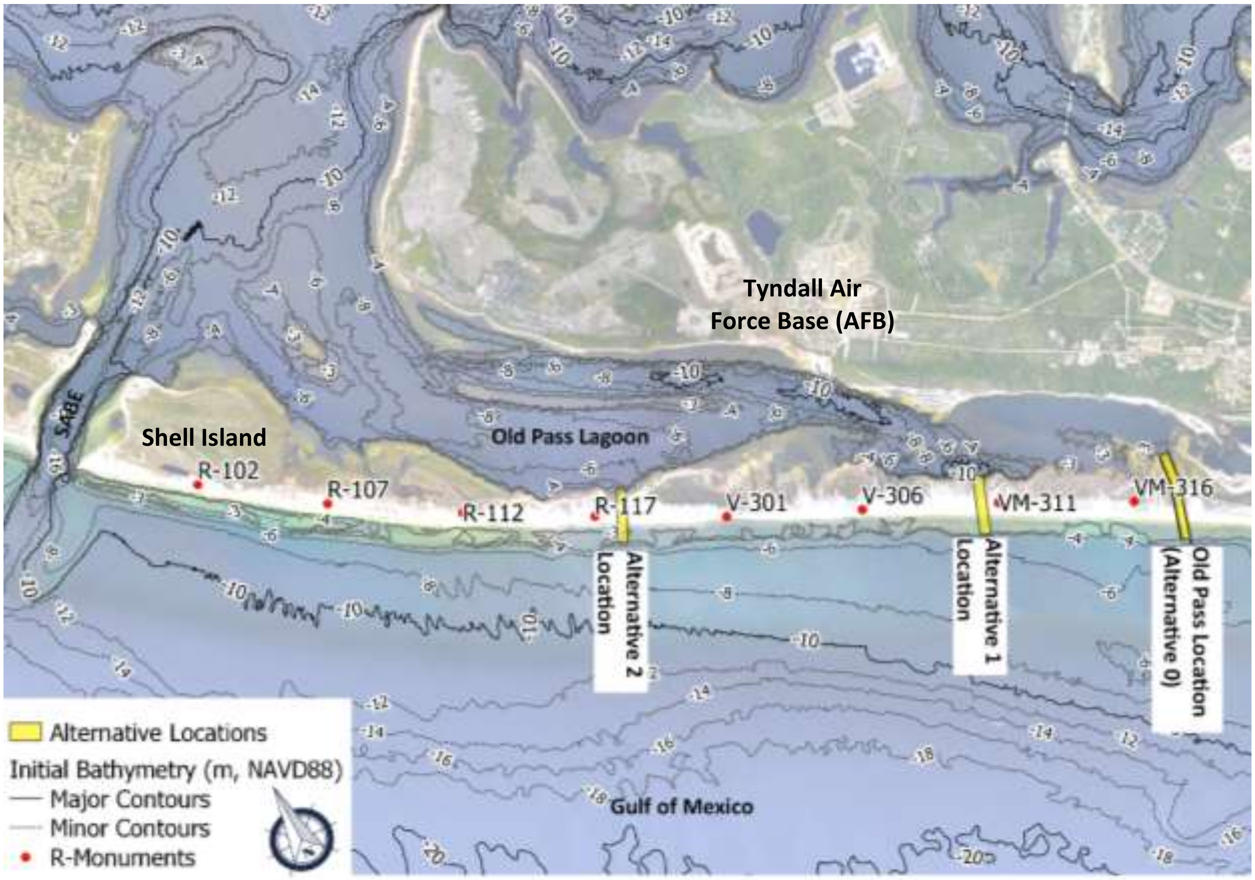


***Figure 9.*** *Summary of potential Alternative Locations.*

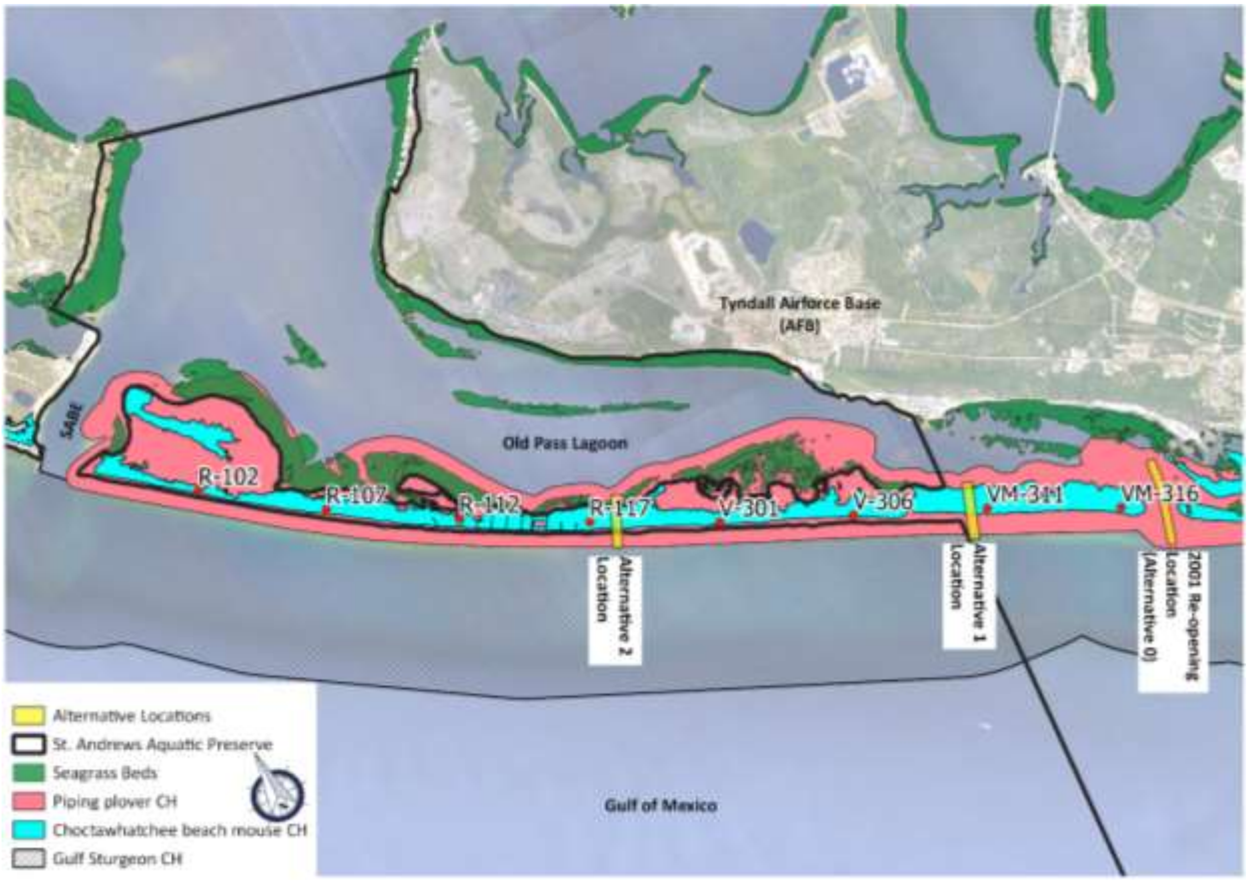


***Figure 10.*** *Summary of potential Alternative Locations.*

***Table 4.*** *Summary of benefits and challenges for each of the three (3) analyzed locations.*

| Location | Benefits | Challenges |
|---|---|---|
| **Location 0**<br>**Old Pass Location** | • Outside of Aquatic Preserve<br>• Limited Seagrasses within proposed channel | • Shallow depths within the Bay<br>• Historically closed within 2-3 years<br>• Within piping plover CH<br>• Within Gulf sturgeon CH<br>• Within Choctawhatchee beach mouse CH |
| **Location 1**<br>**Middle Location** | • Bay depths greater than 10 meters<br>• Narrow barrier island (reduced initial dredge volume)<br>• Outside of Aquatic Preserve<br>• Limited seagrasses within proposed channel | • Within piping plover CH<br>• Within Gulf sturgeon CH<br>• Within Choctawhatchee beach mouse CH |
| **Location 2**<br>**Western Location** | • Deeper bay depths than Location 0 (6 meters)<br>• Narrow barrier island (reduced initial dredge volume) | • Existing seagrass beds within limits of proposed channel<br>• Within Aquatic Preserve/State Lands<br>• Within piping plover CH |

| | | |
|---|---|---|
| | • Shorter flow paths from the bay | • Within Gulf sturgeon CH<br>• Within Choctawhatchee beach mouse CH |

## 4.2 Preliminary Alternatives Analysis

Various alternative configurations were developed for each of the three (3) locations along Shell Island. Due to the historic closing of the 2001 East Pass Experimental Re-opening, only one (1) configuration was simulated at location 0, which utilized the same dredge template as the experimental re-opening. Six (6) alternative configurations were simulated at Location 1 (1a through 1f) and two (2) alternatives were simulated for Location 2 (2a and 2b) with channel widths ranging from 330 ft (100 m) to 650 ft (200 m) and dredge cuts between -10 and -16 ft, NAVD88 (-3 and -5 m, NAVD88). ***Table 5*** shows the length, width, elevation, and angle of each of the alternative configurations along with the estimated initial dredge volume.

***Table 5.*** *Summary of preliminary alternatives.*

| Alternative | Location (0, 1, 2) | Dredge Volume (*yds$^3$) | Initial Area of Impact (*acres) | *Description |
|---|---|---|---|---|
| Alternative 0a | 0 | 392,000 | 24.7 | 3,280 ft long channel, 330 ft wide, excavated to -10 ft, NAVD88 perpendicular to the shoreline (same configuration as 2001 experimental re-opening). |
| Alternative 1a | 1 | 255,000 | 16.1 | 2,130 ft long channel, 330 ft wide, excavated to -10 ft, NAVD88 perpendicular to the shoreline. |
| Alternative 1b | 1 | 536,000 | 20.3 | 2,690 ft long channel, 330 ft wide, excavated to -16 ft, NAVD88 perpendicular to the shoreline. |
| Alternative 1c | 1 | 510,000 | 32.1 | 2,130 ft long channel, 650 ft wide, excavated to -10 ft, NAVD88 perpendicular to the shoreline. |
| Alternative 1d | 1 | 1,072,000 | 40.5 | 2,690 ft long channel, 650 ft wide, excavated to -16 ft, NAVD88 perpendicular to the shoreline. |
| Alternative 1e | 1 | 275,000 | 17.3 | 2,300 ft long channel, 330 ft wide, excavated to -10 ft, NAVD88 15° clockwise of shore perpendicular. |
| Alternative 1f | 1 | 341,000 | 21.5 | 2,850 ft long channel, 330 ft wide, excavated to -10 ft, NAVD88 45° clockwise of shore perpendicular. |
| Alternative 2a | 2 | 353,000 | 22.2 | 1,970 ft long channel, 490 ft wide, excavated to -10 ft, NAVD88 perpendicular to the shoreline. |
| Alternative 2b | 2 | 736,000 | 27.8 | 2,460 ft long channel, 490 ft wide, excavated to -16 ft, NAVD88 perpendicular to the shoreline. |

*Note: 1 yds$^3$ is equal to 0.76 m$^3$, 1 ft is equal to 0.3048 m, and 1 acre is equal to 4,047 m$^2$.

Each preliminary alternative was simulated for a 5-year period using a schematized annual wave climate and mean tide. Three (3) metrics were used to compare the preliminary alternatives and gauge the stability of the inlet configuration: (1) infilled volume within the limits of the channel over the 5-year period; (2) change in minimum cross-sectional area over the 5-year period; (3) depth within the channel at the end of the 5-year simulation. The infilled volume within the channel over the 5-year period was used to calculate the annual dredging volume necessary for the maintenance of the inlet and to develop maintenance cost estimates for each preliminary alternative.

### 4.2.1 Performance of Preliminary Alternatives

The results for each of the three (3) analyses utilizing the three metrics previously described are shown in ***Table 6***. The infilled volume ranged between 148,700 $yds^3$ (Alternative 1c) and 363,500 $yds^3$ (Alternative 1d). The percent of initial dredge volume infilled within the limits of the channel ranged between 29% (Alternative 1c) and 73% (Alternative 1a). The percent change in minimum cross-sectional area over the 5-year simulation ranged between a reduction of 37% (Alternative 1c) and the inlet completely closing or a reduction of 100% (Alternatives 0a and 1a). The maximum change in the channel depth from the start to the end of the 5-year simulation ranged between -4.9 ft (Alternative 1c) and -11.8 ft (Alternative 1b).

***Table 6.*** *Summary of preliminary alternative analysis results.*

| Alternatives | Percent of Initial Dredge Volume Infilled within the limits of the Channel over the 5-year Simulation (%) | Percent Change in Minimum Cross-Sectional Area over the 5-year Simulation (%) | Change in Minimum Channel Depth over 5-year Simulation (*ft) |
|---|---|---|---|
| 0a | 46% | -100% | -9.8 |
| 1a | 73% | -100% | -9.8 |
| 1b | 58% | -70% | -11.8 |
| 1c | 29% | -37% | -4.9 |
| 1d | 34% | -53% | -9.8 |
| 2a | 41% | -43% | -7.5 |
| 2b | 41% | -65% | -10.5 |

*Note: 1 ft is equal to 0.3048 m.

The final minimum depths within the proposed channel at the end of the 5-year simulation for each alternative are shown in ***Figure 11***. Two (2) of the alternatives (Alternatives 0a and 1a) closed completely within the 5-year period with minimum depths within the channel of zero (0). As the initial dredge volume (and cross-sectional area) increased, the depths within the channel at the end of the 5-year simulation increased as well as illustrated in ***Figure 11***. Four (4) of the simulated alternatives had depths greater than 3.3 ft (1 m) at the end of the 5-year simulation including Alternatives 1b, 1c, 1d, and 2b. The maximum depth within the channel at the end of the 5-year simulation is approximately 6.6 ft (2 m) for Alternative 1d, which consists of a channel with a width of 650 ft (200 m) and an initial depth of 16 ft (5 m) at Location 1.

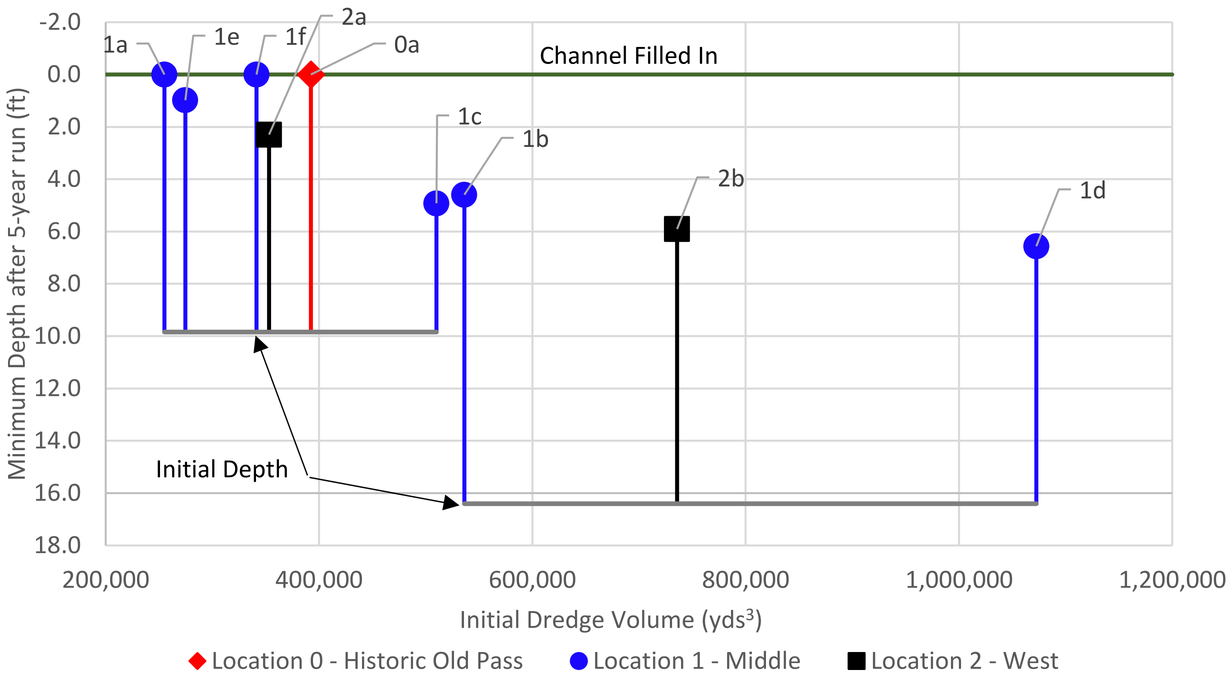


***Figure 11.*** *Summary of final depths at the end of the 5-year simulation for the preliminary alternatives.*

Based on the results of the preliminary alternatives analysis, Alternative 1c was selected as the preferred alternative to be further investigated because it had the lowest amount of volume infilling within the channel, the smallest maximum percentage change in cross-sectional area, and the least amount of change in minimum depth when compared to the other alternatives evaluated. Volume infilling from Alternative 1c was 148,700 yds$^3$, which is equivalent to 29% of the initial dredged volume. All other alternatives evaluated showed volume changes greater than 179,000 yds$^3$. The minimum cross-sectional area over the 5-year simulation for Alternative 1c varied from 6,500 ft$^2$ to 4,100 ft$^2$, a 37% change in cross-sectional area. All other alternatives simulated had cross-sectional area change >43% and some exhibited a cross-sectional area change of 100% (complete infilling at a location within the dredged channel). Change in the minimum depth of the channel associated with Alternative 1c was -4.9 ft, with the channel going from 10 ft deep at the start of the simulation to 5.1 ft deep at the end of the 5-year simulation. Depth changes for all other alternatives were greater than -7.5 ft, with some as high as -11.8 ft. Based on these observations, Alternative 1c was deemed as the optimum channel configuration and selected for further analysis. Additional refinement in engineering and design of the alternatives presented will be required for permitting and implementation.

### 4.2.2 Preliminary Alternatives Costs

The initial costs for each preliminary alternative are presented in ***Table 7***. These costs were calculated based on the estimated initial dredge volume shown in ***Table 5***. The assumptions made to estimate initial dredging costs included a mobilization and demobilization cost of $500,000 and a dredge cost of $12/yds$^3$. The initial costs for the alternatives ranged between $4.3M (Alternative 1a) and $14.4M (Alternative 1d).

The maintenance costs for each preliminary alternative were calculated based on the annual infilling rate (cy/yr) and the dredging interval. The annual infilling rate was determined based on the total simulated amount of accretion within the limits of the channel at the end of the 5-year simulation and ranged between 29,740 yds$^3$/yr (Alternative 1c) and 72,703 yds$^3$/yr (Alternative 1d). The dredge interval was estimated by analyzing the results of the 5-year simulation, the trigger for a dredging event to take place was a proposed channel depth of equal or less than 1 m. The dredge intervals for the alternatives evaluated ranged between 3 and 6 years. The assumptions made to estimate dredging maintenance costs were consistent with the assumptions made for the initial dredging costs stated above. The dredging maintenance costs for the alternatives evaluated over the five-year period ranged between $1.8M (Alternative 0a) and $5.7M (Alternative 1d).

Annualized costs were calculated for a 50-year design life assuming $125,000/yr for monitoring costs and a 4% inflation rate. The 50-year annualized cost revealed that Alternatives 1a and 1c have the lowest annualized costs over a 50-year period. The annualized costs show a cost savings of approximately $25,000/yr for Alternative 1a or 1c compared to the 2001 East Pass opening location (Alternative 0a).

***Table 7.*** *Summary of initial, maintenance, and annualized cost for each preliminary alternative.*

| Alternative | Dredging Frequency (yrs) | Initial Cost | Maintenance Cost | Annualized Cost |
|---|---|---|---|---|
| 0a | 3 | $5,971,064 | $1,800,900 | $977,161 |
| 1a | 3 | $4,273,542 | $1,833,768 | $908,529 |
| 1b | 5 | $7,749,421 | $4,242,162 | $1,246,168 |
| 1c | 6 | $7,426,083 | $2,641,280 | $868,569 |
| 1d | 6 | $14,377,842 | $5,734,679 | $1,652,310 |
| 2a | 4 | $6,577,322 | $2,220,344 | $952,058 |
| 2b | 6 | $10,214,870 | $4,843,868 | $1,326,017 |

## 4.3 Preferred Alternative Analysis

Based on the results of the preliminary alternatives (Section 4.2), Alternative 1c was selected as the preferred alternative for further analysis. Alternative 1c is the least costly over a 50-year period (Section 0) and remains open for a reasonable amount of time (greater than 5 years). The performance of the preferred alternative was further evaluated with additional simulation of storm events and water quality. Additionally, the potential permitting challenges and cost estimates associated with this alternative were addressed.

### 4.3.1 Preliminary Design

The recommended preferred alternative (1c) consists of a 650 ft wide channel excavated to -10 ft, NAVD88. The channel cut requires initial dredging of 510,120 $yds^3$ of sediment from the inlet. The sediment would likely be placed on the beach to build a dune adjacent to the newly opened inlet, similar to what was done during the 2001 Experimental East Pass Re-opening Project. The constructed dune would have a crest elevation between +15 and +20 feet and a crest width between 20 and 30 feet. The dune would extend for approximately 2.5 miles on either side of the proposed inlet. Other beneficial uses of the dredged material within the coastal system will also be explored in future phases of project design and permitting. Constructing the dune on the west side of the proposed channel is within State owned-lands and would require the State of Florida to be a co-applicant on any permit applications.

Empirical relationships between the tidal prism of an inlet, cross-sectional area, and the volume of sand in the outer bar (Dean & Dalrymple, 2002) were also evaluated for the preferred alternative. The simulated peak discharge through the re-opened inlet was used to calculate the tidal prism, cross-sectional area, and volume of sand in the outer bar based on empirical relationships. The peak discharge through the re-opened pass was extrapolated from the Delft3D modeling for the preferred alternative and was equal to 17,550 $ft^3/s$ (ebb) for a spring tide, equivalent to a peak velocity of 2.7 ft/s (given the 6,500 $ft^2$ cross-sectional area). The tidal prism (P) was estimated using the following equation:

$$P = \frac{Q_{max}\, T}{\pi C_K} \qquad \text{(Eq. 1)}$$

where P is the estimated tidal prism, $Q_{max}$ is the peak discharge through the inlet, T is the (semi-diurnal, $M_2$) tidal period, and $C_K$ is a coefficient equal to 0.86 (Keulegan, 1967). The tidal prism was calculated as 29.2 x $10^7$ $ft^3$. Using the estimated tidal prism, the throat area of a sandy inlet in equilibrium was calculated using the O'Brien relationship (Dean & Dalrymple, 2002):

$$A_C = a\, P^b \qquad \text{(Eq. 2)}$$

where $A_C$ is the throat area, P is the tidal prism, and a and b are constants. For natural inlets (without jetties), a and b are equal to 1.58 x $10^{-4}$ and 0.95, respectively (Jarrett, 1967). The resulting throat area is 6,300 $ft^2$, which indicates that the cross-sectional area of alternative 1c of 650 ft by 10 ft is adequate for the expected tidal prism.

The volume in the outer bar was calculated for the preferred inlet alternative using the following equation:

$$V = a\, P^{1.23} \qquad \text{(Eq. 3)}$$

where V is the volume of sand in the outer bar ($yds^3$), a is the level of wave exposure between 8.7 x $10^{-5}$ (low) and 13.8 x $10^{-5}$ (high), and P is the tidal prism ($ft^3$). Assuming low wave exposure, the estimated volume in the outer bar based on empirical relationships is 2.25 million $yds^3$.

#### 4.3.2 Recommended Alternative Performance

*Storm Modeling*

Since only average annual long term schematized wave conditions were simulated during the preliminary alternative analysis, the performance of the preferred alternative was further investigated by conducting simulations of an extreme storm event (Hurricane Ivan, 2004). The storm event was simulated using measured water levels and waves between September 12 and September 22, 2004, when Hurricane Ivan made landfall. The storm simulation was conducted in 'brute force', with no morfacs or any kind of wave or tide schematization. The storm model was simulated for two (2) scenarios: 1) immediately following construction of the preferred alternative (1c) and 2) 5-years post-construction of the preferred alternative (1c). The results of the storm modeling showed that if a significant storm event occurs immediately following construction of the preferred alternative (1c), when there has been no adjustment to the inlet or growth of the ebb shoal, the storm results show significant scour of the inlet attempting to match the 30 ft contours present in Old Pass Lagoon. There is no ebb shoal to reduce wave energy from the storm entering Old Pass Lagoon immediately following the construction of the preferred alternative (1c).

The results of the storm modeling using the bathymetry from the 5-year simulation showed increased sedimentation within the inlet compared to the previous simulation (immediately after construction). The developed ebb shoal acts as a source of sediment that is transported into the inlet during major storm events. The results of the simulations of major storm events show that the response of the preferred inlet alternative is heavily dependent on the timing of the storm in relation to the construction of the inlet, or maintenance dredging events.

*Water Quality Modeling*

One of the project goals was to improve water quality within the St. Andrew Bay system. To understand the impact of the preferred inlet alternative on water quality, two (2) simulations were run for the preferred alternative (1c) and compared to the existing conditions (no dual inlets):

1. Circulation (flushing) of a conservative tracer within Old Pass Lagoon; and
2. Salinity changes within Old Pass Lagoon.

A conservative tracer was simulated in Delft3D using the D-Water Quality Module using the D-WAQ PART version 4.04.01. The water quality module uses the results from the Delft3D-FLOW simulation to generate the input for the water quality simulation. The particle tracking module can simulate two (2) substances: a conservative tracer or oil. A conservative tracer was used for this modeling effort. The goal of this modeling effort was to understand how the new proposed inlet affects the circulation and flushing of a conservative tracer within Old Pass Lagoon.

A conservative tracer was injected continuously into the model domain within Old Pass Lagoon over a 12-hour period. A total of 10,000 particles were injected over a radius of 10 m for existing conditions and for the preferred inlet alternative (1c). ***Figure 12*** shows the particle concentrations for the existing conditions and the preferred alternative 96-hours after the start of the simulations. The particle concentration at the injection point over time shows that for the existing conditions (no dual inlets), a hypothetical substance is reduced to 10% of the initial concentration within 18 hours. For the preferred alternative (1c), a hypothetical substance is reduced to 10% of the initial concentration within 5 hours. These results indicate that a hypothetical substance will flush out about 3.5 times faster from Old Pass Lagoon by re-opening East Pass (Alternative 1c).

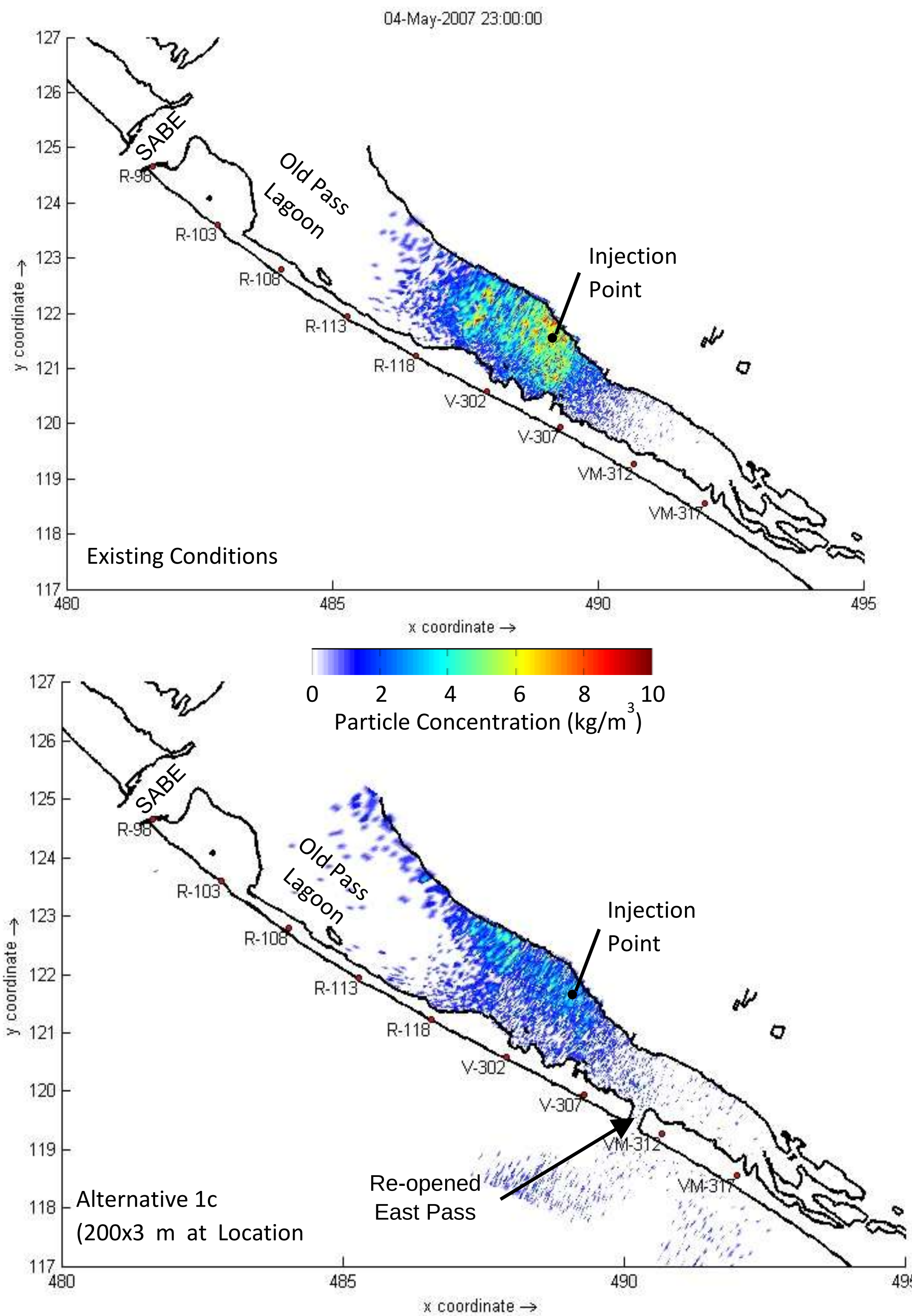


***Figure 12.*** *Simulated particle concentration after 96-hours the (top) existing conditions and for the (bottom) preferred alternative (1c). The black dot indicates the location of the injection of particles.*

The salinity within Old Pass Lagoon historically ranges between 18 and 36 ppt at the surface and is highly dependent on rainfall and wind events (Section 3.6 and Appendix E – Water Quality Assessment). For existing conditions (no dual inlets), the turnover of seawater in Old Pass Lagoon is mainly dependent on the influx of seawater through SABE. When brackish water (salinity of 25 ppt) was simulated at the surface within Old Pass Lagoon, the inflow of seawater (36 ppt) from the Gulf through SABE gradually increased the simulated salinity within Old Pass Lagoon by 2 ppt (25 ppt to 27 ppt) over a 14-day period (spring/neap tidal cycle). When the preferred inlet alternative (Alternative 1c) is simulated, the brackish water (salinity of 25 ppt) in the eastern end of Old Pass Lagoon is replaced with seawater (36 ppt) within approximately four (4) tidal cycles. ***Figure 13*** shows the spatial variations in salinity during a peak flood tide for the preferred alternative (left) and the existing conditions (right). It should be considered that the model simulations did not include rainfall and urban drainage, therefore the bay system salinity are likely to be overestimated. The results are useful for a comparative analysis between with and without the project, however, cannot be interpreted to determine absolute bayside salinity values after opening East Pass.

The measured salinity for the two conductivity, temperature, and depth (CTD) gauges deployed within Old Pass Lagoon indicated an existing largely saline environment with little tidal variation (Appendix C – Data Collection). The measured salinity values at Old Pass Pier and R-114 showed variations between 28 and 40 ppt over the 1-month deployment. Although Old Pass Lagoon is a largely saline environment, when a large inflow of fresh water lowers the salinity in the Lagoon, the preferred inlet alternative (1c) flushes the brackish water within 4 tidal cycles.

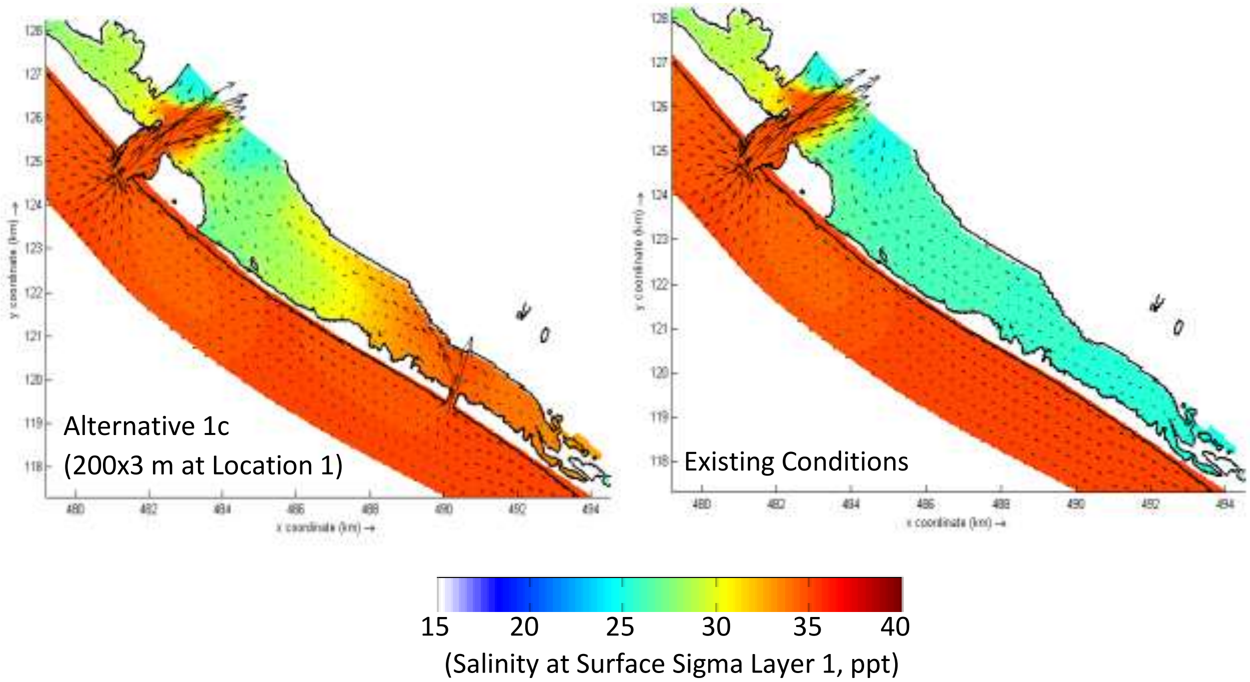


***Figure 13.*** *Comparison of salinity in Old Pass Lagoon during peak flood tide for (left) the preferred alternative (1c) and (right) existing conditions (no dual inlets) after 30 days.*

*Simulated Ebb and Flood Shoal Growth*

Additional analysis was performed using the 5-year simulation of the preferred alternative to determine the simulated growth of the ebb and flood shoals. The simulations showed that the most significant changes to the ebb shoal occurred during small wave events (wave cases 1-6). During medium and large wave events (wave cases 7-18), the volume in the ebb shoal decreased (wave cases shown in ***Table 2*** of Appendix F – Numerical Modeling Documentation). The growth of the ebb shoal isolated for smaller wave events (wave cases 1-6) was 89,115 yds$^3$. The growth of the ebb shoal for all simulated wave cases (wave cases 1-18) was 44,990 yds$^3$. The estimated volume in the outer bar using empirical relationships (Eq. 3) is significantly higher than the simulated volume, likely because the inlet has not reached an equilibrium at the end of the 5-year simulation.

Alternatively, the flood shoal increased in size during all simulated wave cases, depositing material into the existing deep channel located within Old Pass Lagoon. The growth of the flood shoal is expected since there are no counterbalancing forces that limit the growth of the flood shoal (Dean & Dalrymple, 2002). It is expected that over time the growth of the flood shoal would reduce the water depths in the existing channel, reducing cross-sectional area and increasing the tidal currents. Once an equilibrium is reached, the rate of deposition in the flood shoal is expected to decrease. The simulated growth of the flood shoal for all wave cases (wave cases 1-18) was 521,710 yds$^3$.

*Effects on St. Andrew Bay Entrance (SABE)*

A secondary goal of this project is to avoid any adverse impacts to the SABE as a result of the re-opening of East Pass. The simulations of the preferred alternative were investigated and compared to the simulated existing conditions. Discharge through SABE was compared for the two (2) simulations as shown in ***Figure 14***. The maximum difference between the existing conditions (no dual inlets) and the preferred alternative (Alternative 1c) was 11,000 $ft^3/s$, less than 1% of the total discharge through SABE.

Additionally, the tidal prisms with and without the preferred inlet alternative were compared. The tidal prism was calculated by integrating discharge over time for a flood and ebb tidal cycle during a spring tide. There was no discernable difference in the tidal prism through SABE as a result of the construction of preferred alternative. The tidal prism for Alternative 1c for both flood and ebb were within 1% of the simulated existing conditions (***Table 8***). The tidal prism through the preferred inlet Alternative 1c is over an order of magnitude less than the tidal prism through SABE. Based on these analyses it can be concluded that no adverse impacts to SABE are expected because of the re-opening of East Pass.

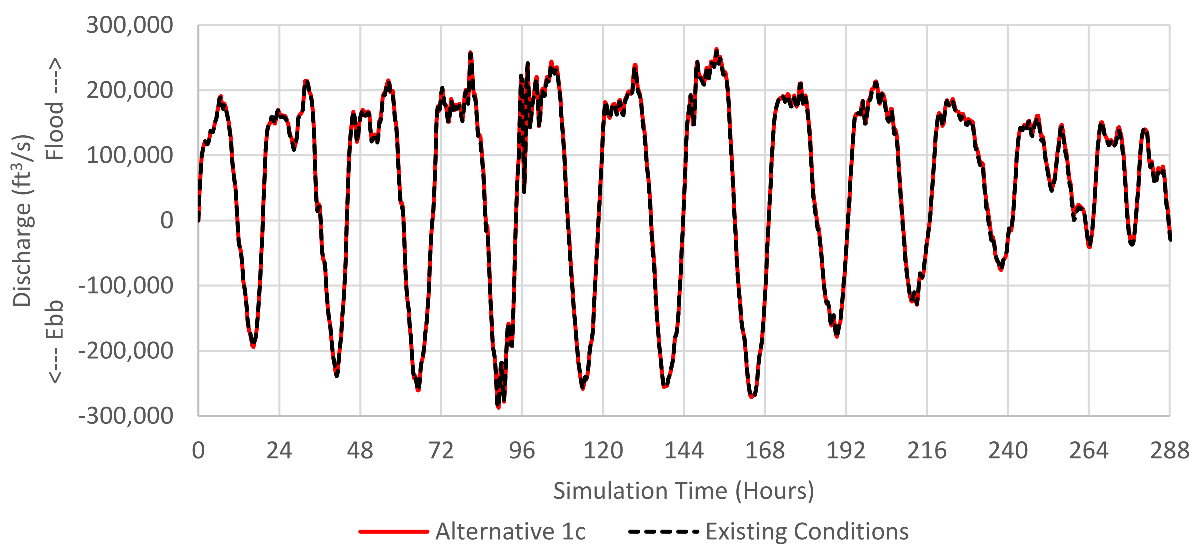


***Figure 14.*** *Simulated discharge through SABE for both the existing conditions and the preferred alternative 1c (dual inlet).*

***Table 8.*** *Comparison of the simulated Tidal Prism for existing conditions and preferred alternative 1c through SABE and the re-opened East Pass.*

| Alternative | SABE | | Re-opened East Pass | |
|---|---|---|---|---|
| | Flood (*$ft^3$) | Ebb (*$ft^3$) | Flood (*$ft^3$) | Ebb (*$ft^3$) |
| Existing Conditions | 879 x $10^7$ | -575 x $10^7$ | - | - |
| Alternative 1c | 893 x $10^7$ | -572 x $10^7$ | 73.1 x $10^7$ | -48.4 x $10^7$ |

*Note: 1 $ft^3$ is equal to 0.0283 $m^3$.

### 4.3.3 Permit Feasibility

The Florida Department of Environmental Protection (FDEP) and the U.S. Army Corps of Engineers (USACE) issued regulatory permits for the construction of the 2001 Experimental East Pass Re-opening Project. FDEP issued a 5-year Joint Coastal Permit (JCP) No. 0164900-001-JC on February 5, 2001, which expired on February 5, 2006. The USACE issued Department of the Army (DA) Permit No. 200000350 on June 20, 2001, which expired on June 20, 2006. The re-opening of East Pass will require a new JCP and DA permit applications to be submitted, processed, and issued by FDEP's Beaches, Inlets & Ports Program (BIPP) and the USACE, respectively. Obtaining regulatory permits to construct a new inlet along the non-developed shoreline of Shell Island will be a challenge due to the potential direct and indirect impacts to seagrass, sea turtle nesting habitat, and critical habitat for piping plover, Gulf sturgeon, and Choctawhatchee beach mouse. The re-opening of East Pass will require extensive analysis and coordination with U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Services (NMFS), and the Florida Fish and Wildlife Conservation Commission (FWC).

The re-opening of East Pass will require additional justification to demonstrate that the inlet will achieve the stated purpose and need for the project while minimizing and mitigating any anticipated adverse impacts that may occur to the coastal system.

Preliminary meetings with the TAC led by MRD during the development of this study identified agency concerns with potential adverse impacts to existing water quality, existing seagrass beds within Old Pass Lagoon, listed species, and critical habitat. Additionally, concerns were raised regarding the potential increase in boat traffic that could result from re-opening the pass. In addition, beneficial use of dredge material to build dunes on the west side of the proposed channel is within State owned-lands and will require the State of Florida to be a co-applicant.

### 4.3.4 Estimate of Preliminary Costs

*T*he preliminary opinion of initial construction costs for the preferred alternative (Alternative 1c) is shown in ***Table 9***. The estimated dredge interval based on the results of the Delft3D modeling is ~6 years. This does not include the potential impacts to the inlet due to extreme storm events.

***Table 9.*** *Preliminary Opinion of Initial Construction Costs for the preferred alternative (1c).*

| Item | Description | Quantity | Units | Unit Price | Sub-Total | Total |
|---|---|---|---|---|---|---|
| **Initial Construction Costs** | | | | | | |
| 1.0. | Mobilization/Demobilization | 1 | L.S. | L.S. | $500,000 | |
| 2.0. | Excavation and Fill Placement | 510,120 | C.Y. | $12.0 | $6,121,440 | |
| 3.0. | Contingencies (Items 1.0-2.0) | 3 | % | L.S. | $204,643 | |
| | | | | | **Sub-Total:** | **$6,826,083** |
| **Professional Services** | | | | | | |
| 4.0. | Final Design and Bidding | 1 | L.S. | L.S. | $250,000 | |
| 5.0. | Construction Phase Services | 1 | L.S. | L.S. | $350,000 | |
| | | | | | **Sub-Total:** | **$600,000** |
| | **Preliminary Opinion of Probable Construction Costs:** | | | | | **$7,426,083** |

C.Y. - Cubic Yards, L.S. - Lump Sum

## 5.0 Study Findings

East Pass is a historic tidal inlet, that prior to the construction of the SABE was the primary entrance to St. Andrew Bay. The pass had naturally closed and re-opened periodically. The historic East Pass closed naturally in 1998 following the construction of the SABE in 1934. East Pass was re-opened as part of the experimental re-opening in 2001 and closed again naturally by 2004.

It is the goal of the Bay County Board of County Commissioners to develop a feasibility study to evaluate the benefits, costs and potential impacts associated with re-opening the historic East Pass. Based on a review of available literature, the history of the inlet, historic aerial photographs, monitoring data, and input from the TAC and local stakeholders, an alternative analysis was performed with the Delft3D numerical model. The analysis of preliminary alternatives included simulation of nine (9) alternatives at three (3) potential locations to identify the most hydraulically stable inlet location and configuration. A preferred alternative (1c) was selected based on the alternative performance, estimated dredging frequency, and costs. The preferred alternative consists of a 2,130 ft shore-perpendicular channel with a width of 650 ft excavated to -10 ft, NAVD88 located between VM-310 and VM-311, 2,200 m (1.4 miles) west of the 2001 East Pass location.

The overall findings presented throughout the report and appendices are summarized as follows:

- The historic East Pass and the 2001 experimental re-opened East Pass were unstable and closed naturally. Historically and prior to the 2001 experimental re-opening, East Pass required periodic maintenance to remain open.
- Profile data is limited along Shell Island, especially east of R-121. Shoreline changes based on post-storm LIDAR surveys show that the shoreline in the vicinity of the 2001 re-opened East Pass was accreting between the closing of the historic East Pass in 1998 until approximately 2015, while the western portion of Shell Island was eroding. The most recent monitoring period, between

2015 and 2020, shows that the shoreline in the vicinity of the re-opened East Pass has become stable to erosional.

- Net Longshore Sediment Transport rates in the project area are predominantly from east to west. A nodal point in the net longshore sediment transport has been documented between R-110 and R-115 along Shell Island. East of R-115, where East Pass is proposed to be re-opened, the net longshore transport is predominantly from west to east. Comprehensive survey data is not available for Shell Island so volume changes cannot be quantified for the eastern side of Shell Island but a net longshore transport rate from west to east of 75,000 cubic yards per year was reported by CP&E as part of a borrow area impact study (CP&E, 2011).
- Nine (9) preliminary alternatives were evaluated using a 5-year schematized wave climate. Of the nine (9) simulated alternatives, four (4) alternatives were hydraulically stable over a 5-year period. The preferred alternative (1c) is an inlet located 1.4 miles west of the 2001 East Pass re-opening. The preferred configuration consists of a 2,130 ft channel with a width of 650 ft excavated to -10 ft, NAVD88 and an initial dredging volume of 510,100 $yds^3$.
- Although the results of this study show that the inlet (Alternative 1c) would be stable over a 5-year period under a long-term schematized wave climate, major storm events have the potential to change the performance of the inlet in a short amount of time. Simulations of a major storm event, Hurricane Ivan, demonstrated that the inlet response to storms can vary significantly depending on the timing of the storm with respect to the construction and maintenance of the of the inlet and pre-storm ebb-shoal morphology.
- Water quality modeling incorporating salinity and a conservative tracer were simulated independently for the preferred alternative (1c) and compared to existing conditions (no dual inlets). Results of the simulated conservative tracer for the preferred alternative (1c) showed an increase in flushing capacity in Old Pass Lagoon compared to the existing conditions. Results of Delft3D modeling with salinity simulated showed an increase in salinity of the Old Pass Lagoon when compared to existing conditions.
- The simulations of the re-opening of East Pass (Alternative 1c) did not cause adverse impacts to SABE. The discharge through SABE and the tidal prism were within 1% of the no dual inlet condition.
- An initial cost of $7.4 million was estimated for the re-opening of East Pass (Alternative 1c). A maintenance cost per maintenance dredge event of $2.6 million was estimated, assuming the inlet will be dredged every 6 years. The estimated annualized cost over a 50-year period is $868,500.
- The opening of East Pass can be located on the Tyndall Air Force Base property provided there are no Federal funds used in the construction and maintenance of the channel in accordance with CRBA (USFWS, 2022).
- Obtaining regulatory permits to construct a new inlet along the non-developed shoreline of Shell Island will be a challenge due to the potential impacts to seagrass, listed species, and critical habitat. These environmental impacts will be addressed in the next phase of work through the

development of an Environmental Assessment/Environmental Impact Statement (EA/EIS) in compliance with National Environmental Policy Act (NEPA) requirements. The re-opening of East Pass will require additional justification to demonstrate that the inlet will achieve the stated purpose and need for the project while minimizing and mitigating any anticipated adverse impacts that may occur to the coastal system. In addition, constructing the dune on the west side of the proposed channel is within State owned-lands and will require the State of Florida to be a co-applicant.

## 6.0 Recommendations

Based on the results of the study and the findings presented herein, it is recommended that the Bay County Board of County Commissioners select Alternative 1c as the preferred alternative to move forward with the development of an Environmental Assessment/Environmental Impact Statement (EA/EIS) and federal and state permitting. Once the County, State and Federal agencies have had the opportunity to review this report in its entirety, we recommend conducting meetings with these agencies to discuss the findings of this initial evaluation, the permitting approach going forward, and the challenges associated with authorizations and permits needed to re-open East Pass. These discussions may result in modifications to the recommended Alternative 1c as a result of further refinement in the engineering and design for permitting and implementation which may be conducted in future phases.

Should Bay County choose to move forward with the preferred alternative (1c), *Phase II - Permit Support Documentation, Applications and Processing* services would consist of the development of an EA/EIS followed by conducting surveys, geotechnical investigations, and a cultural resources assessment to support the permit application.

## 7.0 References

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# APPENDIX A

Definitions

# APPENDIX B

Technical Advisory Committee (TAC) Presentations

# APPENDIX C

Data Collection and Analysis

# APPENDIX D

Feasibility and Design Assessment

# APPENDIX E

Water Quality Assessment

# APPENDIX F

Numerical Modeling Documentation