

COASTAL STRUCTURES ALTERNATIVES ANALYSIS FOR SHORELINE STABILIZATION USING THE DELFT3D MODEL – COQUINA BEACH AND LONGBOAT PASS JETTY CASE STUDY

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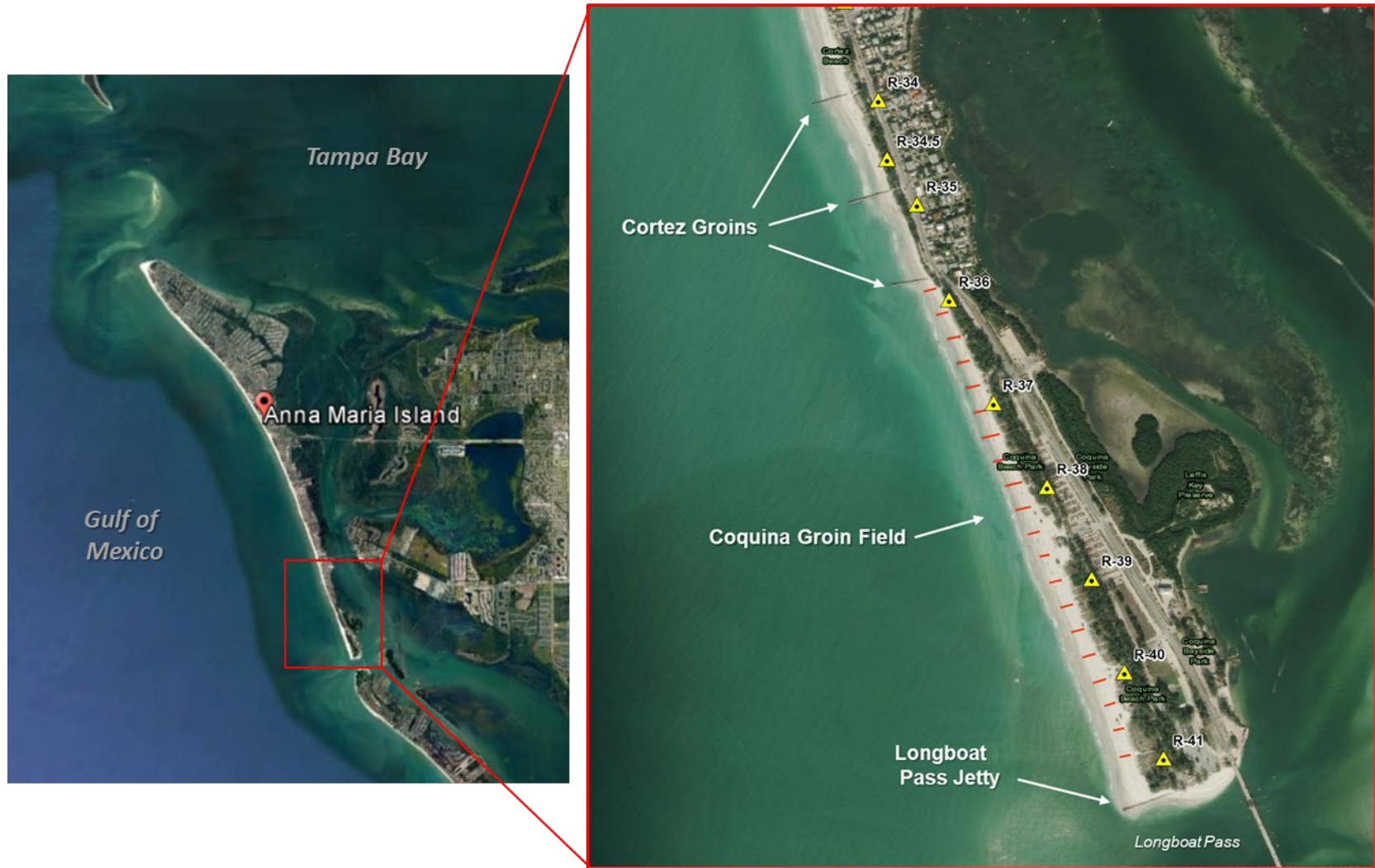
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STUDY AREA



OBJECTIVES

1

Evaluate alternatives to rehabilitate, remove and/or replace the Coquina Beach groins, including the evaluation of alternative coastal structures to assist in reducing erosion on Coquina Beach.

2

Expand upon previous effort on Longboat Pass jetty (CP&E, 2011) and provide further engineering analysis evaluating the performance of the jetty including rehabilitation, removal, extension, and deterioration.

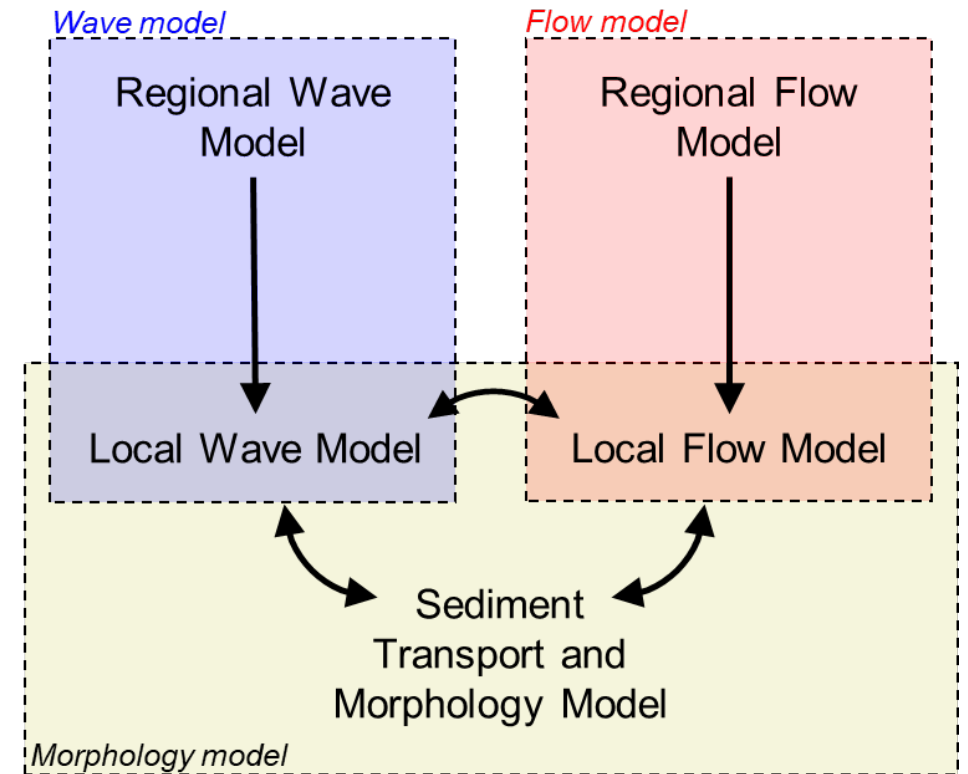
3

Evaluate the combined effects of objectives 1 and 2 in the context of the coastal system, aiming to maintain the sediment budget balance through Coquina Beach.



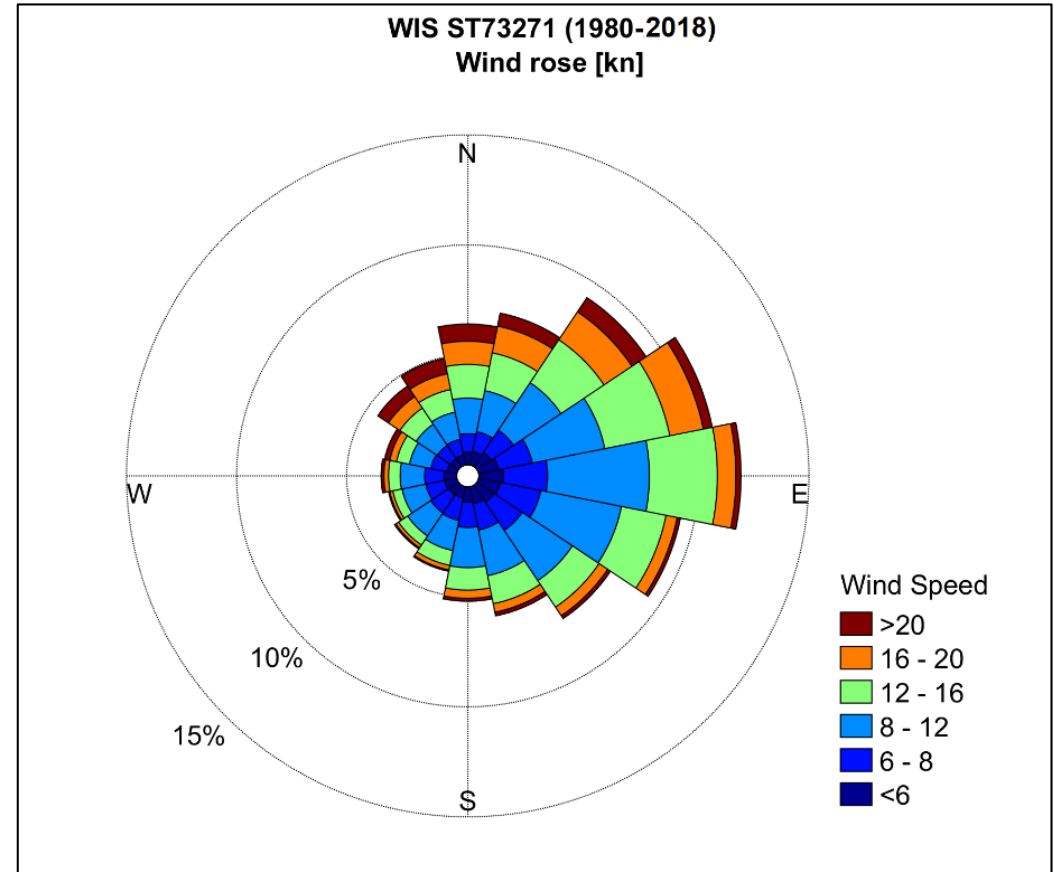
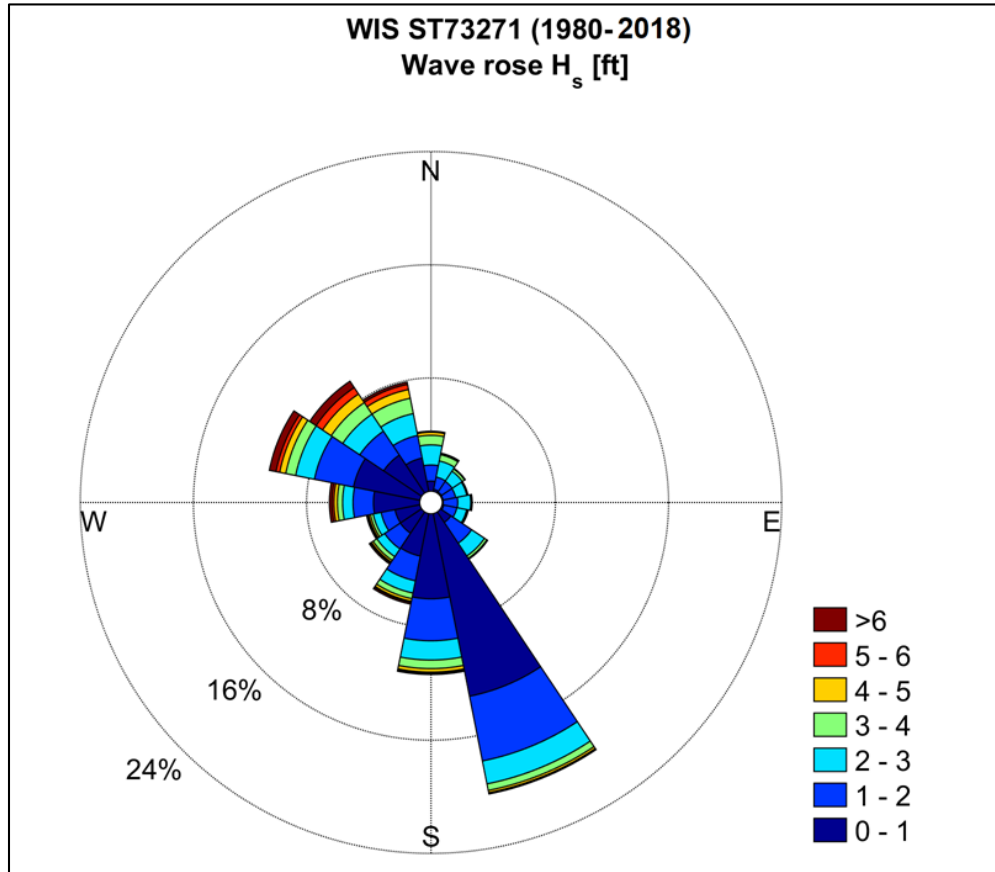
MODELING APPROACH

- ▶ The Delft3D modeling software suite was utilized to assist in the development of the Coquina Beach Shoreline Stabilization & Longboat Pass Jetty Reconstruction Feasibility Study.
- ▶ The Delft3D model was setup using a collection of survey data from different sources, including Aptim Coastal Planning & Engineering (APTIM), U.S. Army Corps of Engineers (USACE), and National Oceanic and Atmospheric Administration (NOAA).



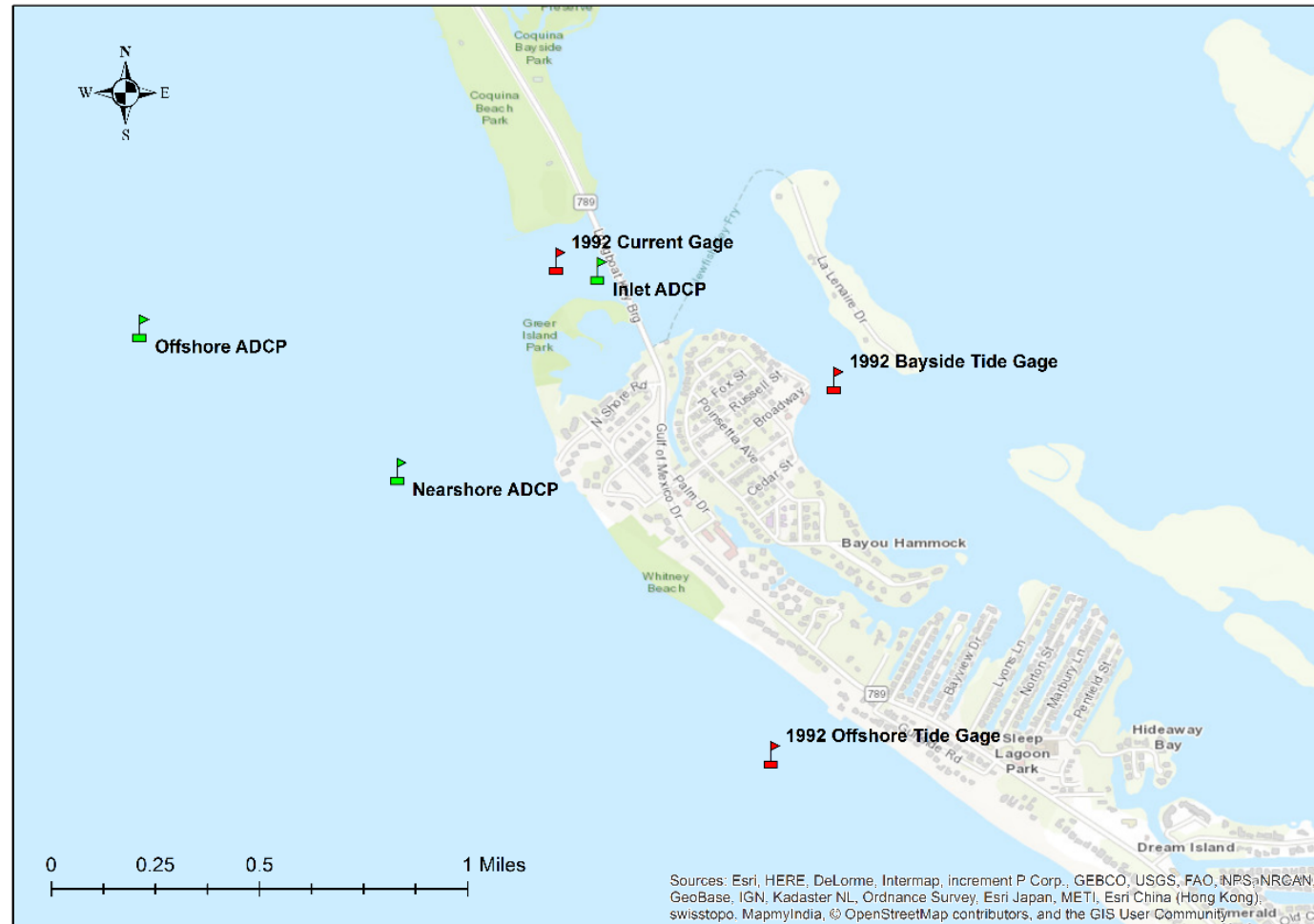
MODELING APPROACH

▶ Wave and Wind Data



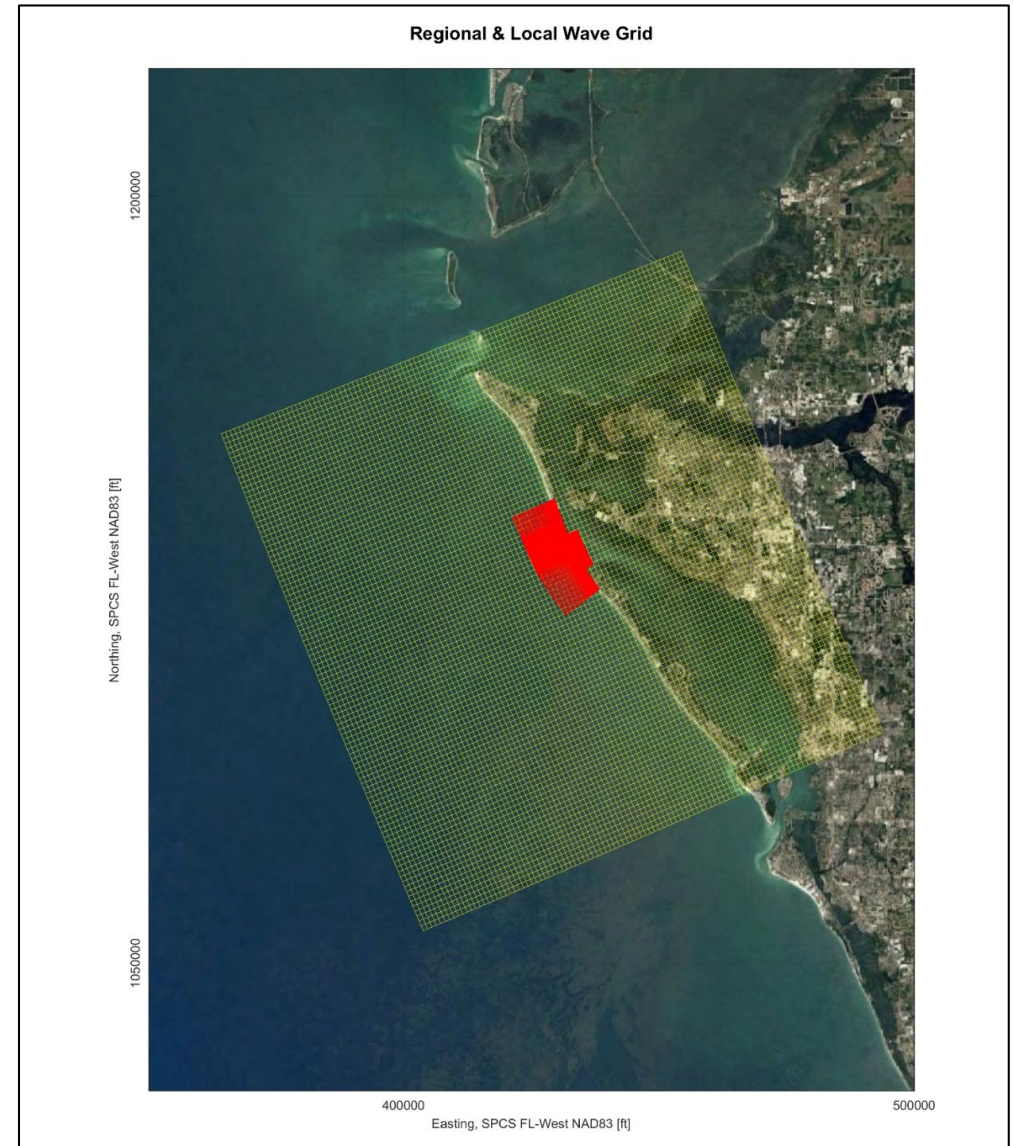
MODELING APPROACH

► Current and Water Level Data



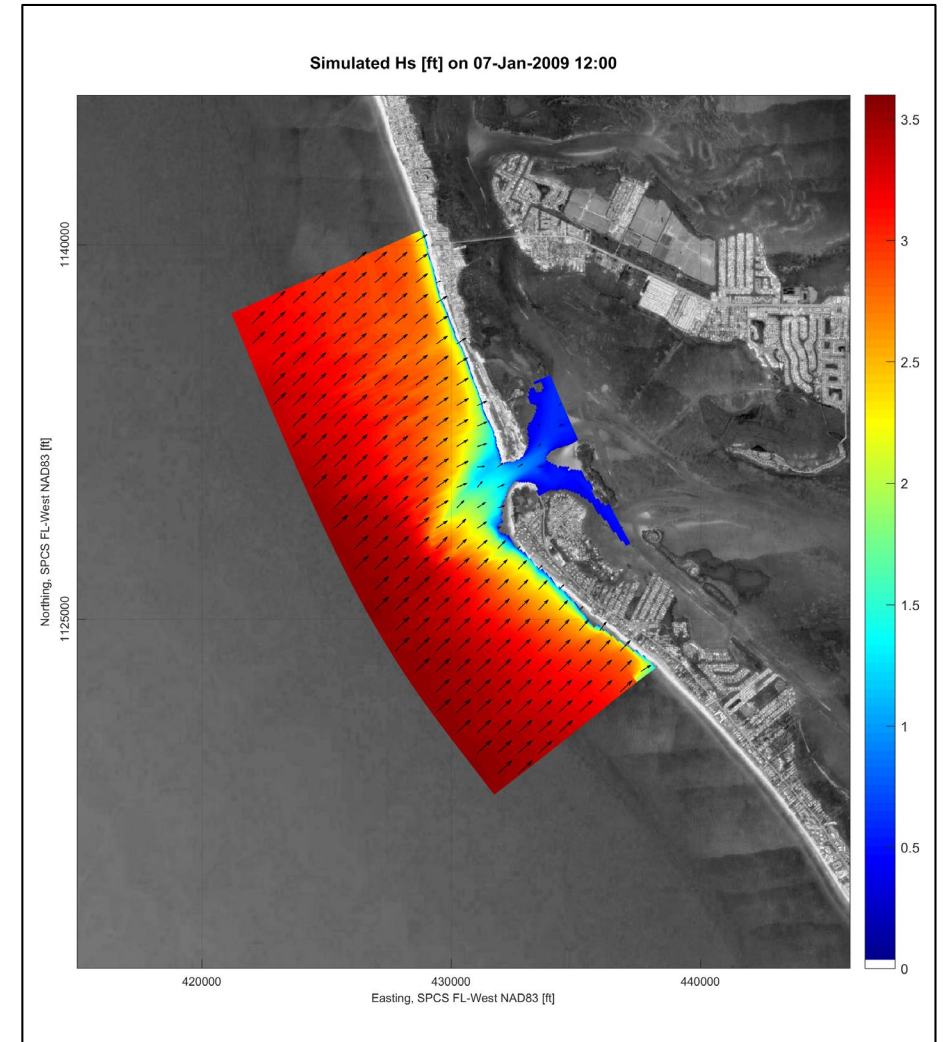
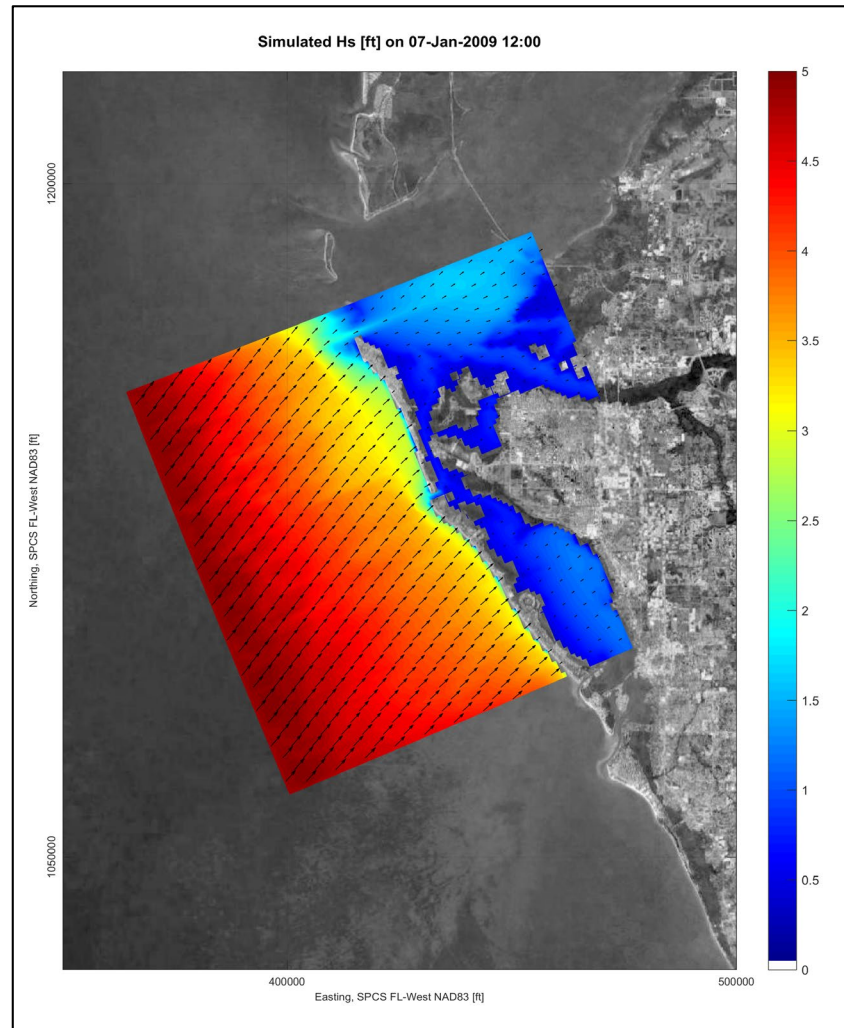
MODELING APPROACH

- ▶ The model computational grids were delineated to examine wave propagation, flow sediment transport and morphology change on both a regional and detailed local spatial scale.
- ▶ Structures were incorporated into the model based on recent aerial photographs and field visual inspections.



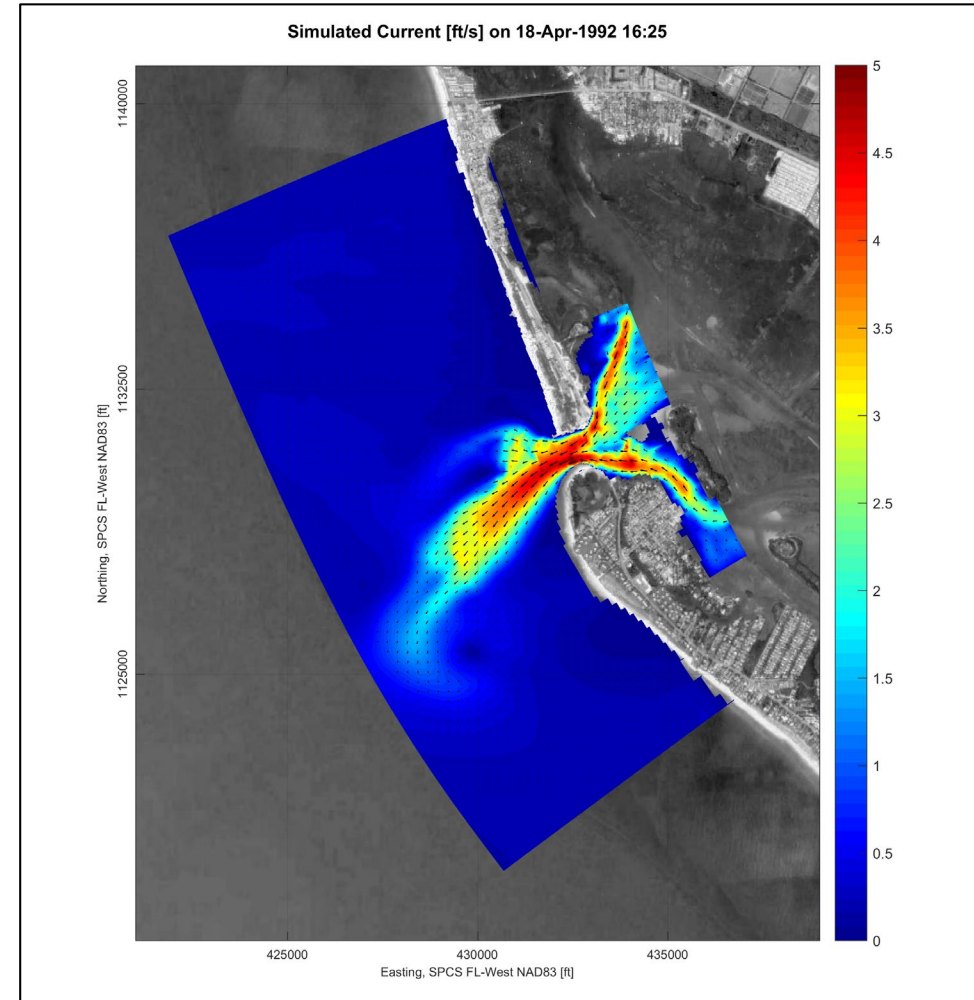
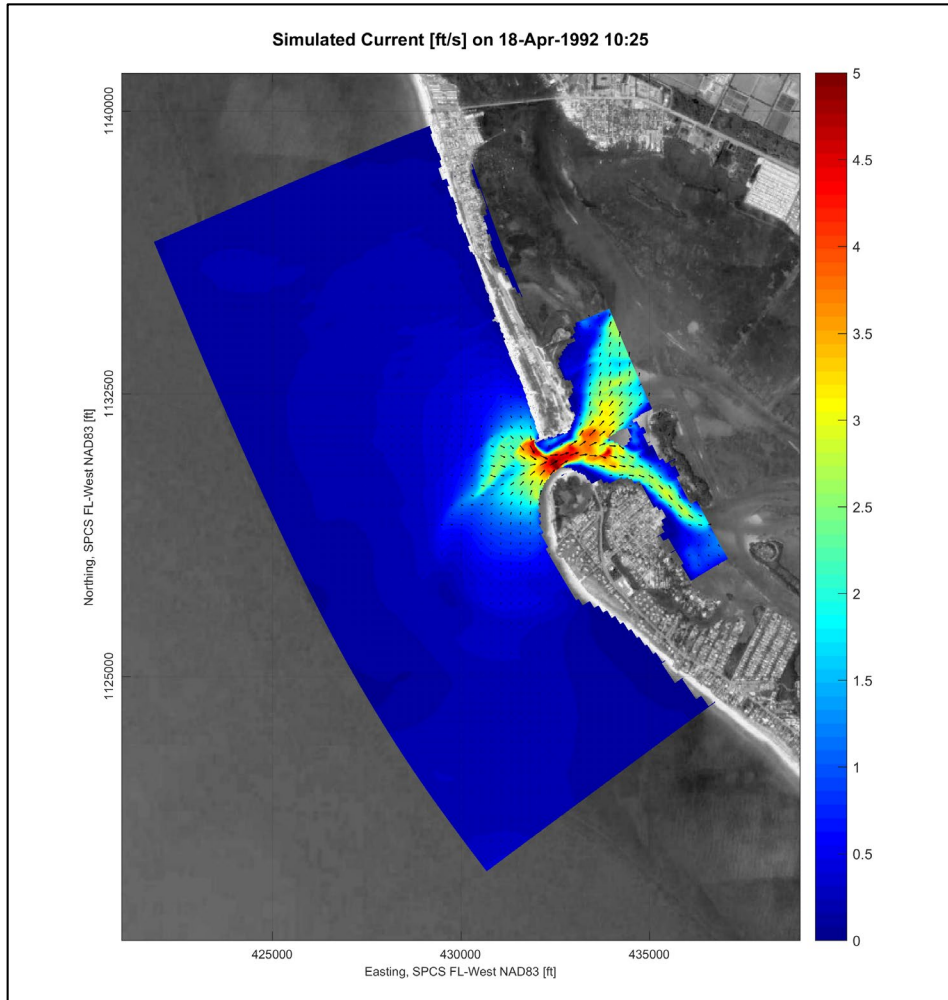
MODELING APPROACH

► Delft3D-WAVE (SWAN) Model Simulation



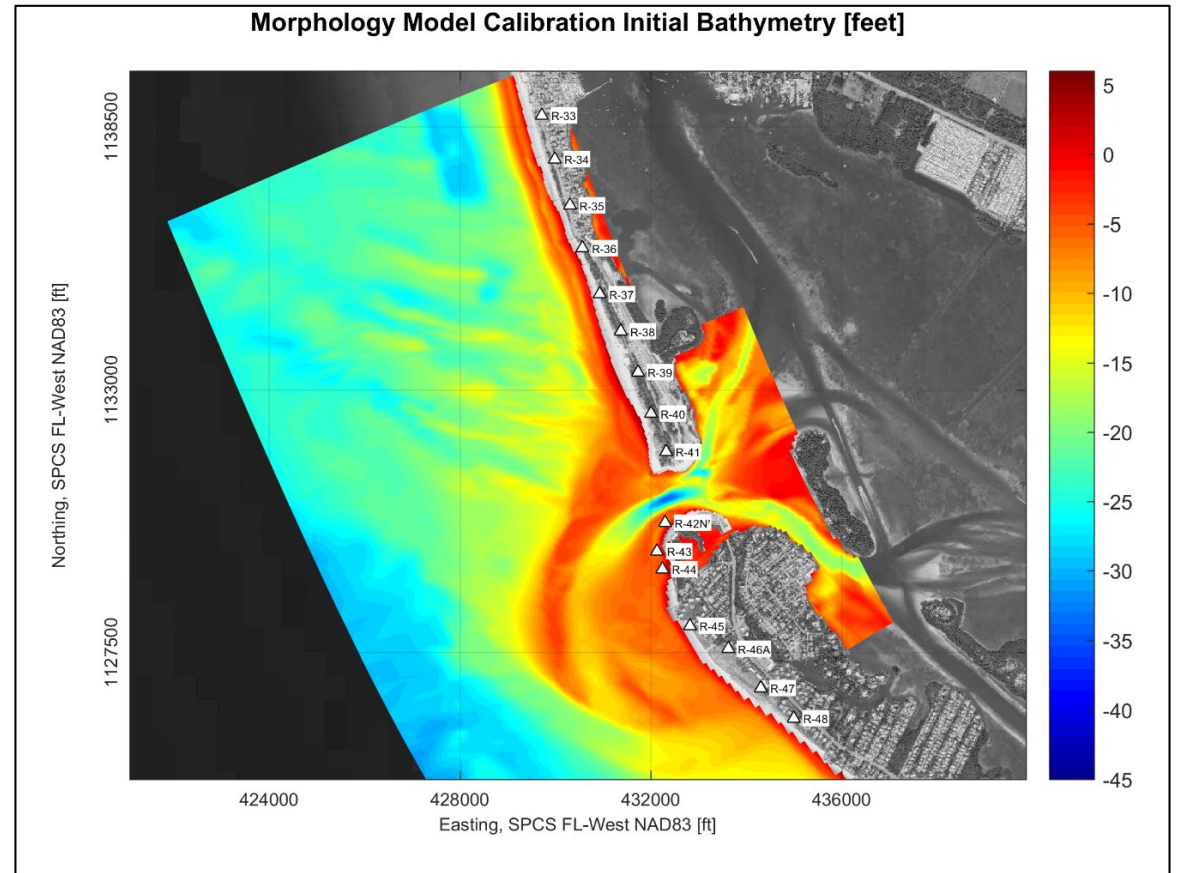
MODELING APPROACH

▶ Local Flow Model Simulation

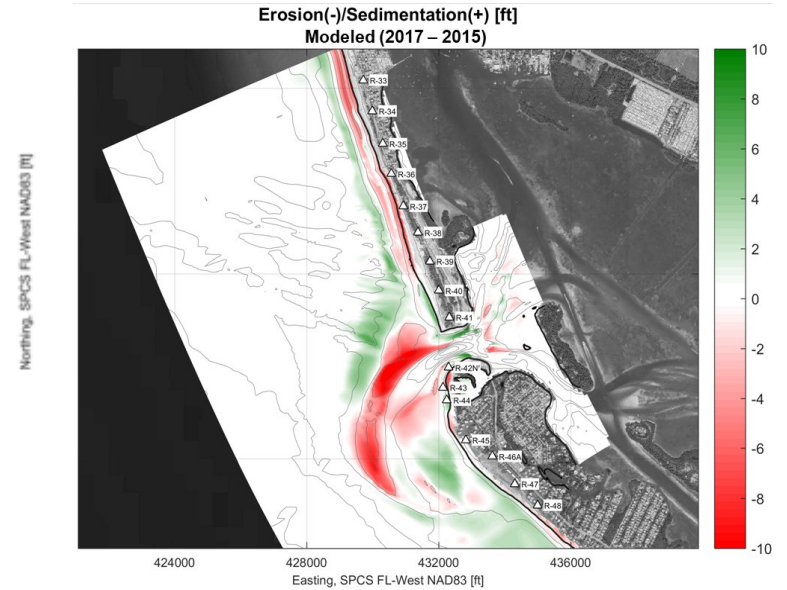
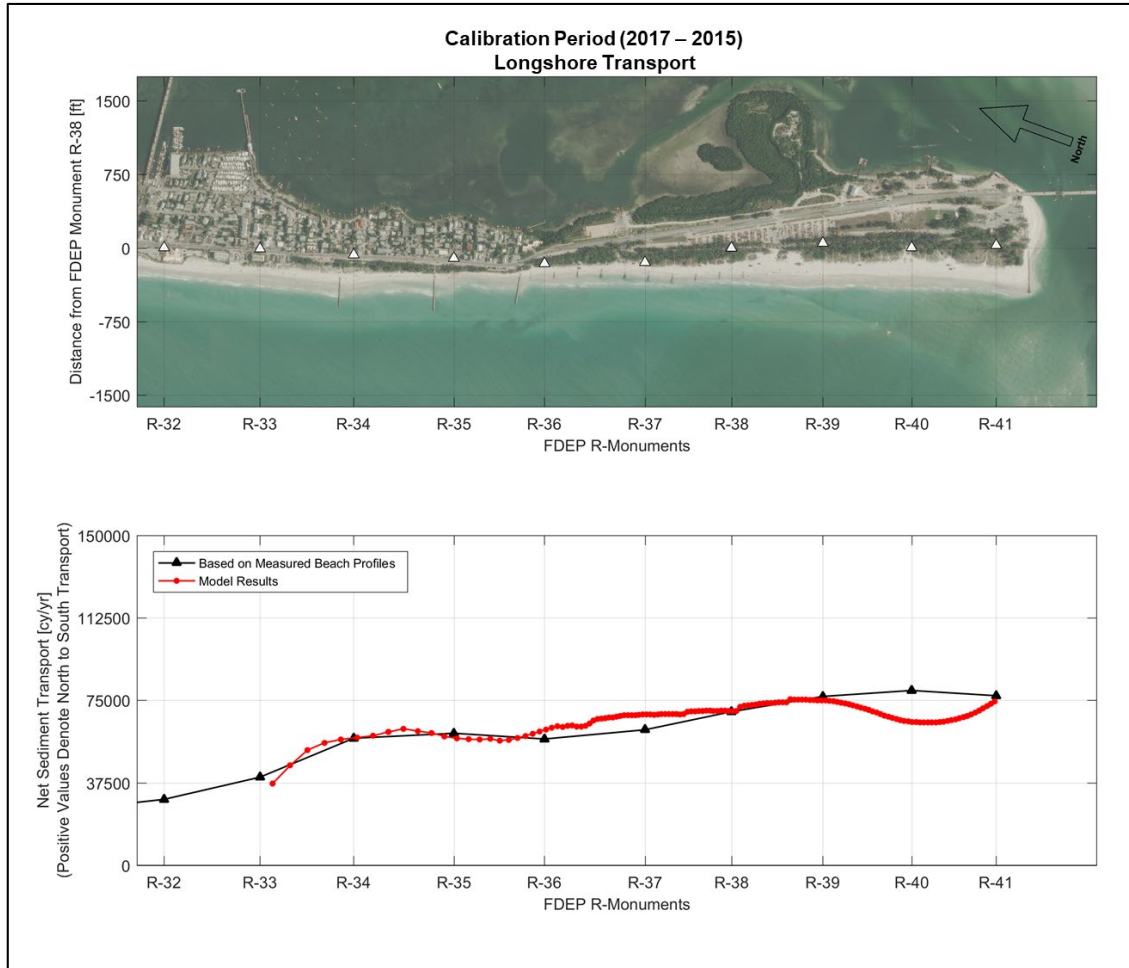


MODELING APPROACH

- ▶ Currents and water levels within the Delft3D-FLOW model were calibrated using water level and current measurements by ATM (1993) to support its 1993 Inlet Management Plan for Longboat Pass.
- ▶ The morphological model was calibrated using data measurements from June 2015 through September 2017 (2.3 years).



MODEL CALIBRATION

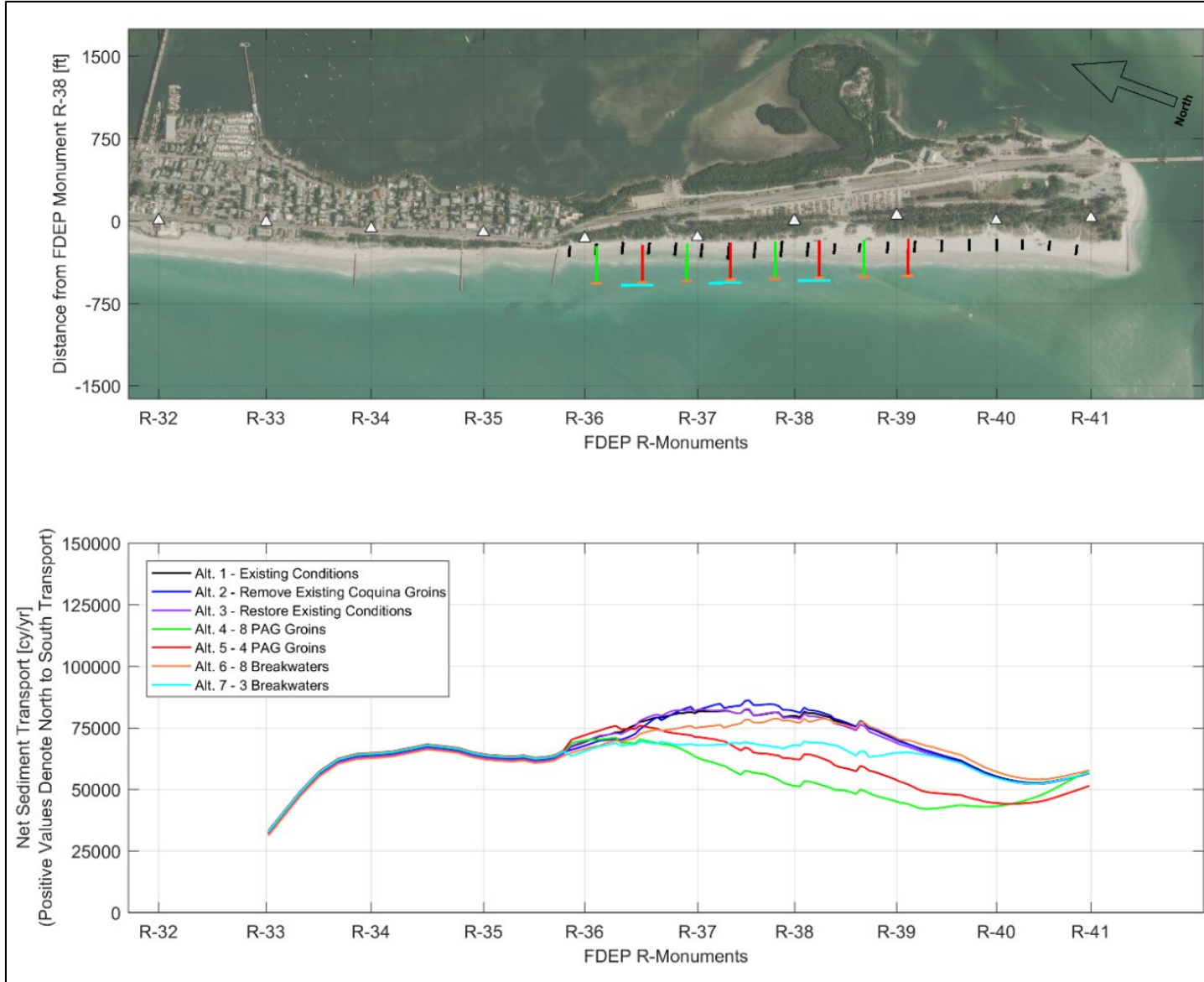


PRELIMINARY ALTERNATIVES

	Conceptual Alternatives
1	Existing Conditions (No Action)
2	Removal of Existing Coquina Beach Groins
3	Restoration of Existing Coquina Beach Groins
4	Removal of Existing Groin Field and Replacement with 8 PAGs
5	Removal of Existing Groin Field and Replacement with 4 PAGs
6	Removal of Existing Groin Field and Replacement with 8 Breakwaters
7	Removal of Existing Groin Field and Replacement with 3 Breakwaters
8	Alternative 7 + Longboat Jetty Removal
9	Alternative 7 + Longboat Jetty Extension of 100 feet
10	Alternative 7 + Longboat Jetty Deterioration



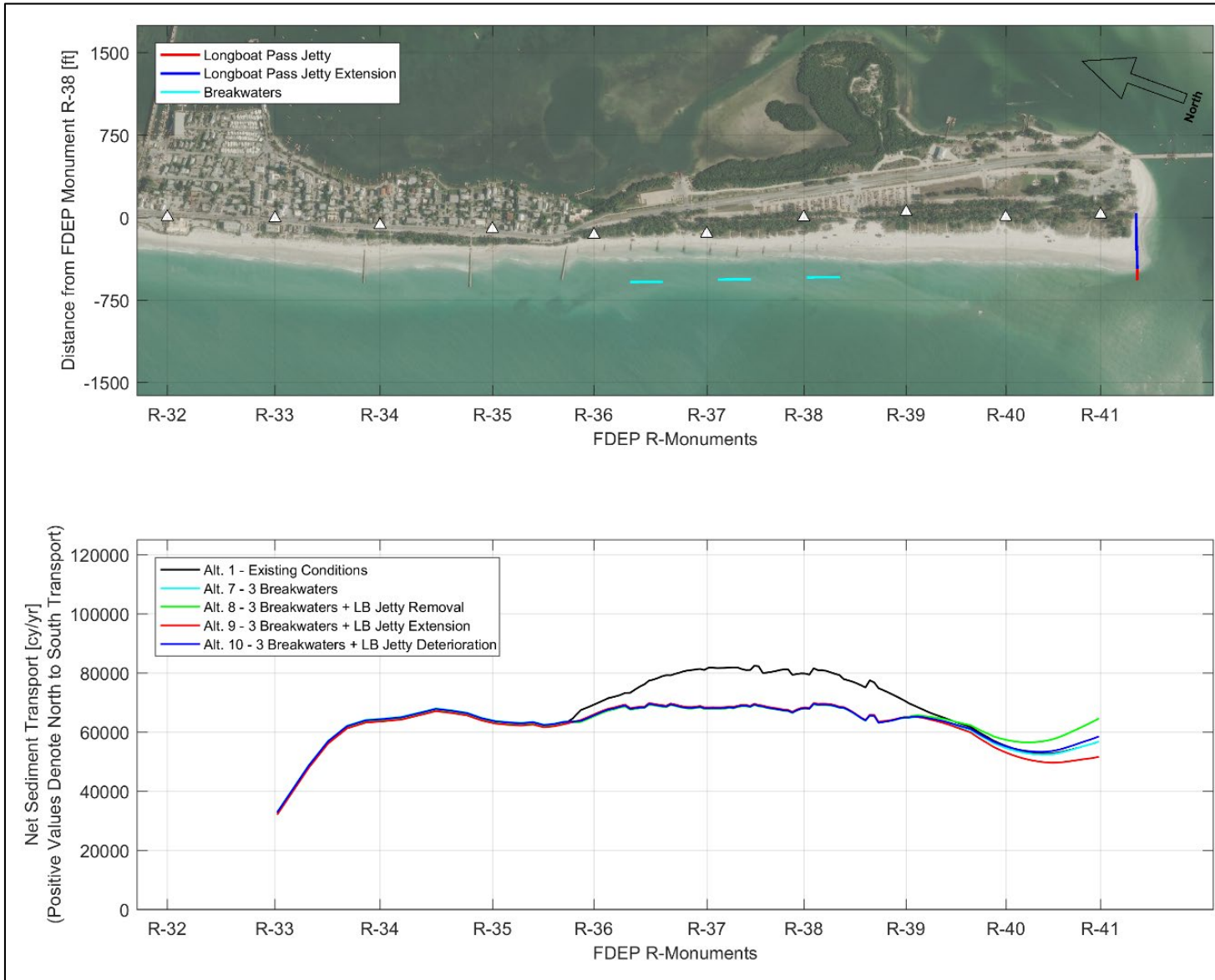
MODEL RESULTS – PRELIMINARY ALTERNATIVES



Alternative	Net sediment transport between monuments R-33 and R-41 [cy/year]	Net sediment transport difference between Alternative 1 and Alternative [cy/year]
1 Existing Conditions (No Action)	24,800	NA
2 Removal of Existing Coquina Beach Groins	24,700	-100
3 Restoration of Existing Coquina Beach Groins	24,500	-300
4 Removal of Existing Groin Field and Replacement with 8 PAGs	25,800	1,000
5 Removal of Existing Groin Field and Replacement with 4 PAGs	19,500	-5,300
6 Removal of Existing Groin Field and Replacement with 8 Breakwaters	25,700	900
7 Removal of Existing Groin Field and Replacement with 3 Breakwaters	24,800	0



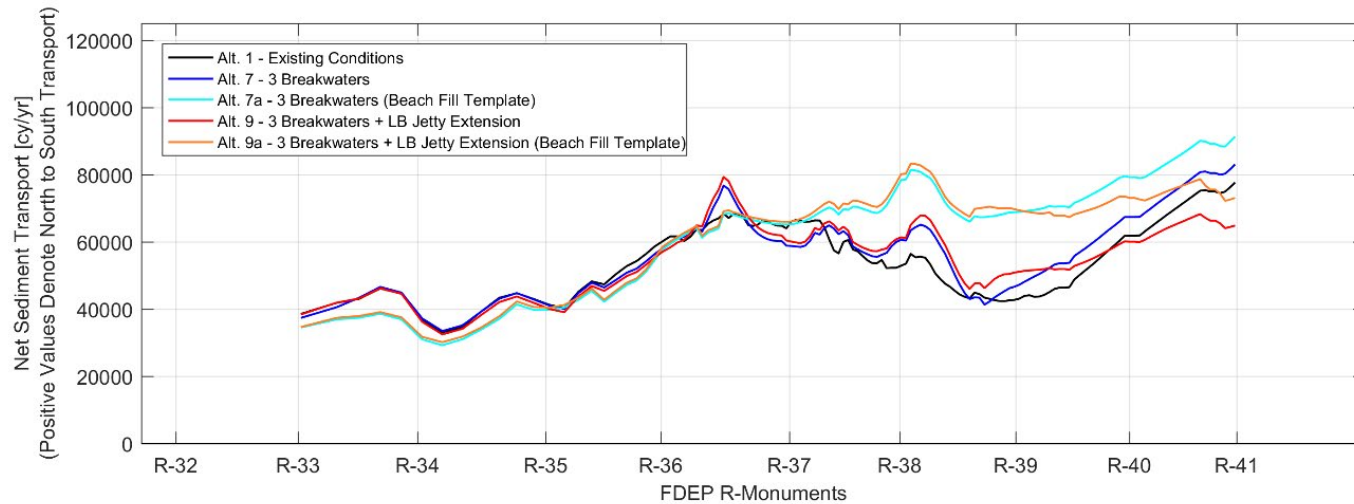
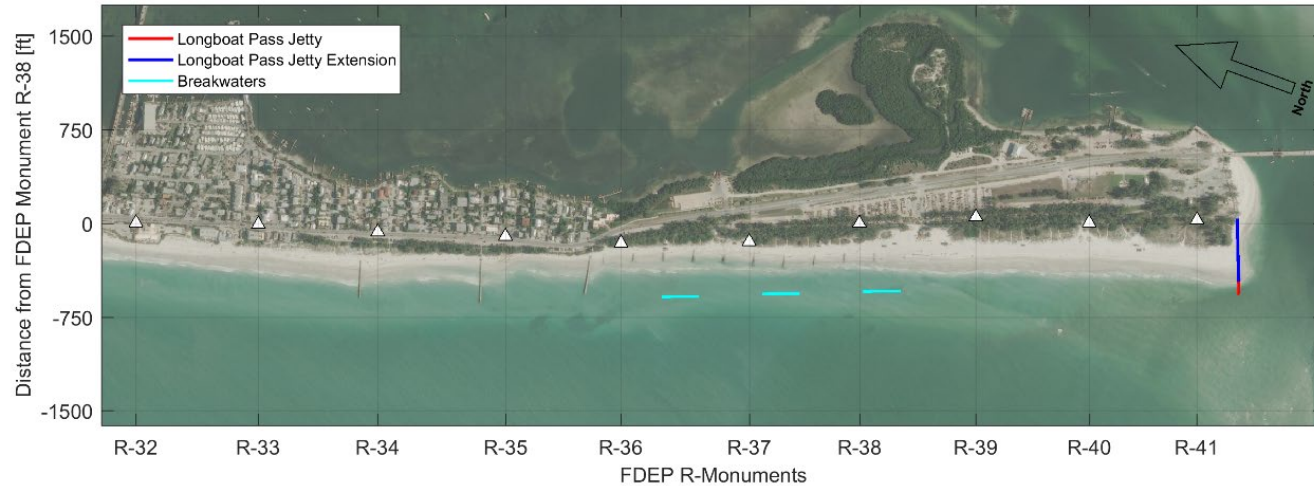
MODEL RESULTS – PRELIMINARY ALTERNATIVES



Alternative	Net sediment transport between monuments R-33 and R-41 [cy/year]	Net sediment transport difference between Alternative 1 and Alternative 7 to 10 [cy/year]
1	24,800	NA
7	24,800	0
8	32,600	7,800
9	19,600	-5,200
10	26,500	1,700



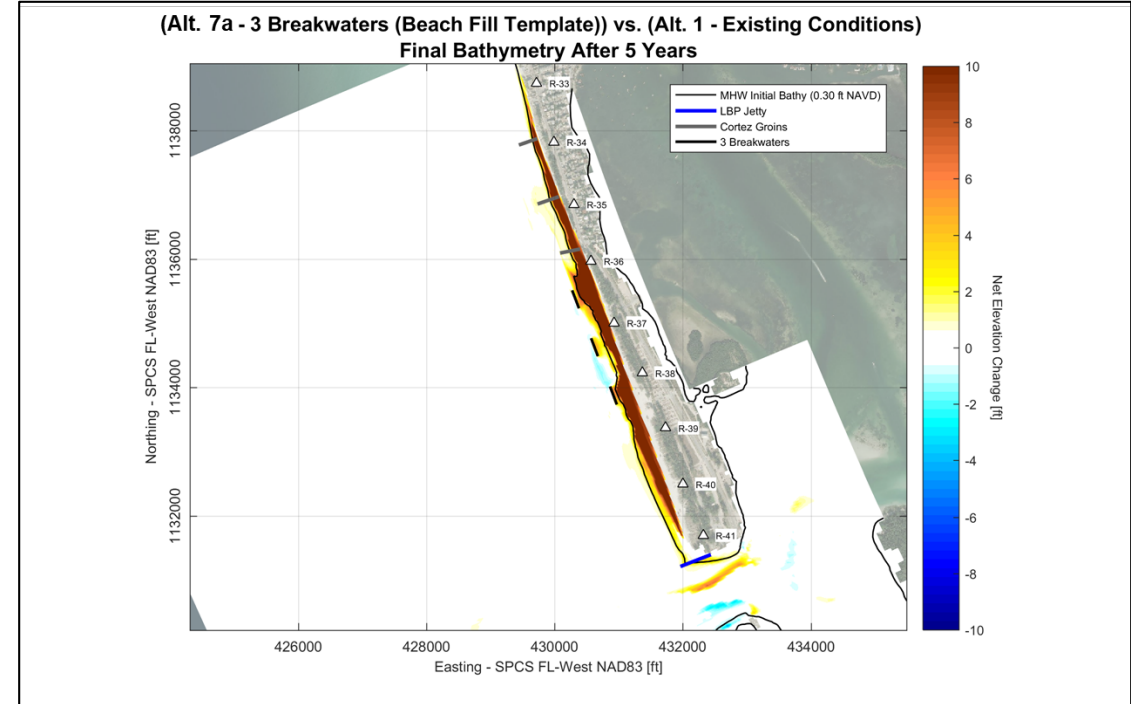
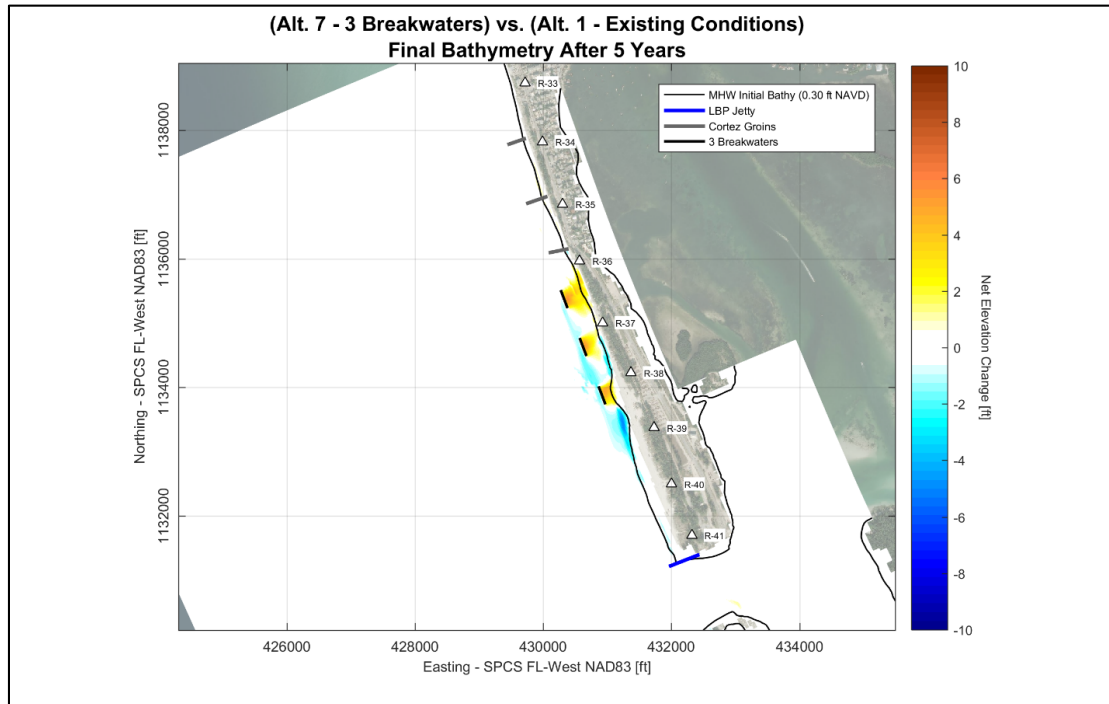
MODEL RESULTS – FINAL ALTERNATIVES



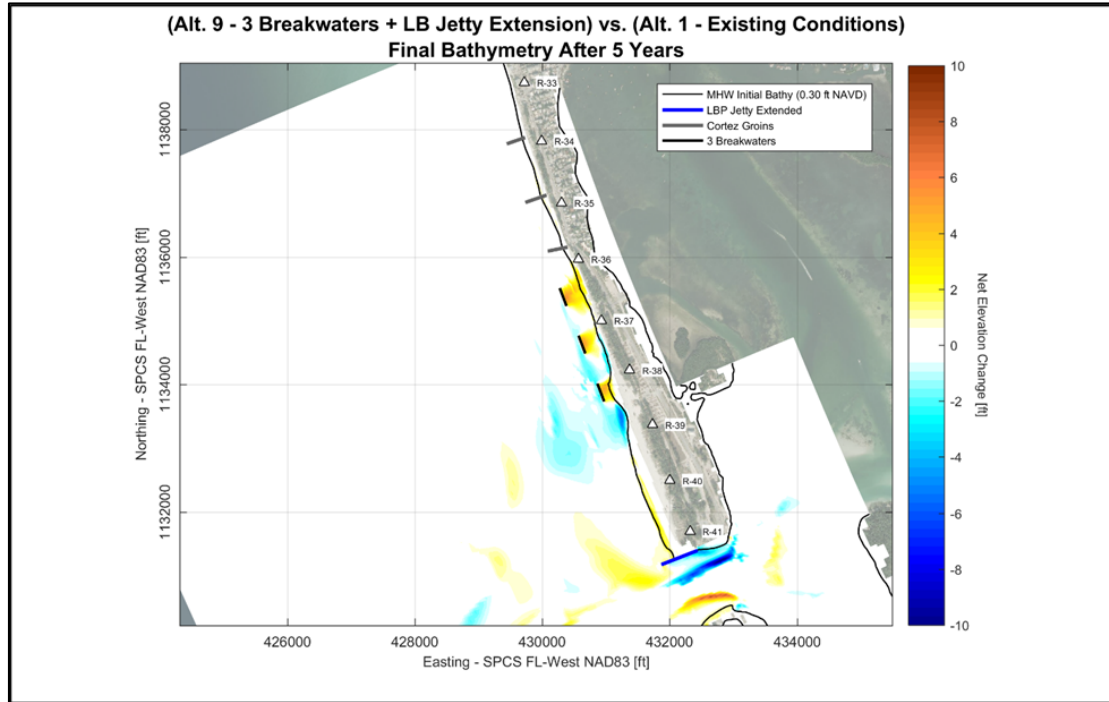
Alternative	Net sediment transport between monuments R-33 and R-41 [cy/yr]	Net sediment transport difference between Alternative 1 and Alternative [cy/yr]
1 Existing Conditions (No Action)	39,100	-
7 Removal of existing groin field and replace with 3 breakwaters	45,700	6,600
7a Alternative 7 + 2020 Beach Fill Template	56,800	17,700
9 Alternative 7 + Longboat Jetty Extension of 100 ft	26,500	-12,600
9a Alternative 9 + 2020 Beach Fill Template	38,400	-700



MODEL RESULTS – FINAL ALTERNATIVES



MODEL RESULTS – FINAL ALTERNATIVES



MODELING STUDY FINDINGS

- ▶ The morphological changes results of Alternative 7a (breakwaters + beach fill and no jetty extension) and Alternative 9a (breakwaters + beach fill + jetty extension), show similar trends; however, the extended jetty is able to retain the beach fill more efficiently than the current jetty configuration. The model results were able to demonstrate that, with the jetty extension, the fill sands that are transported to the south are deposited in the beach between R-41 and the jetty and in the ebb shoal instead of depositing in the Longboat Pass channel.
- ▶ Based on model results, the three breakwaters alternative, combined with the Longboat Pass jetty extension and beach nourishment, presented the best balance of targeted erosion control performance at the high erosion segment of the beach, combined with manageable downdrift impacts and the preservation of overall sediment transport gradient in the southern end of Anna Maria Island, between R-33 and R-41.
- ▶ For future engineering phases of this study, further investigation of different jetty extension lengths and fine tuning of breakwater dimensions and location are recommended.



QUESTIONS



THANK YOU

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