

Applying Coastal Engineering Tools To Habitat Restoration Projects in Manatee County



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Acknowledgments

Manatee County Natural Resources Staff, CB&I Modeling Team, & Stantec



A World of Solutions





- Project area is located on the west coast of Florida in Manatee County
- Between Tampa Bay and Sarasota Bay, east of Anna Maria Island.









- Two Related Projects in Manatee County:
 - Perico Preserve
 - Robinson Preserve
- Former farmland purchased by Manatee County for habitat restoration to return public lands to predevelopment conditions with a special focus on plant diversity and coastal landscapes
- Coastal process modeling, tidal inlet dynamics, channel hydraulics, mitigation strategies, and environmental science:
 - Delft3D numerical model
 - Inlet stability analysis (Escoffier, 1940)















Project Area



A World of Solutions

Perico Apartments



- North side of Perico Island
- Creation of seagrass and mangrove habitat
- Numerical modeling to assess flow rates, flushing and the potential for sediment transport
- Existing datasets were supplemented with
 - bathymetric and topographic surveys
 - water level measurements
 - sediment samples
 - ground-level photography
- Design alternatives analyzed with Delft3D-FLOW model















Perico Project Concept





- Large regional flow grid
- Evaluated sensitivity to wind, rainfall, friction & grid spacing
- Calibrated based on water levels
- Simulation of existing conditions and 3 project alternatives
 - Flow rates and flushing



FL-West NAD83 Easting (feet)

Water Levels at the Foot Bridge Tide Gage, Calibration Run C with Rain Included, Wind Included, & Local Flow Grid





Perico Flushing Analysis





Perico Flow Analysis



- New pond can be created without impacts to regional flow
- Two tidal connections are needed to optimize connection from new preserve to existing bayou
- By comparing with and without scenarios, the mosquito ditch connection found to be unnecessary for pond flushing
- Project permitted and constructed with both tidal connections



Project Area



A World of Solutions

Perico Apartments



- Expansion of existing Robinson Preserve
- East of Perico Preserve, across Perico Bayou
- Creation of natural habitat and passive recreational area
- Utilizing existing regional grid from Perico Preserve with local data collection
- More complex than Perico Preserve analysis due to multiple tidal connections
- Simulation of existing conditions and 11 project alternatives
- Escoffier (1940) tidal inlet stability analysis















Robinson Preserve Phases





Robinson Preserve Restoration Concept











Palma Sola Bay Connection





Inlet Stability Analysis (Escoffier, 1940)

$$V_{m} = c \left(\frac{aH}{2pL}\right)^{1/2} \left\{ \left(1 + r^{2}\right)^{1/2} - r \right\}^{1/2}$$
$$r = \left(\frac{12054c}{M}\right)^{2} \frac{a^{2}}{2pHL}$$

- Vm = Mean velocity of peak tidal current (feet per second)
- a = Cross-sectional area of inlet channel in square feet
- p = Wetted perimeter of the inlet channel
- L = Channel length in feet
- H = Mean tidal variation of the sea in feet
- M = Water surface area of the bay in square feet
- c = Chezy's coefficient
- R = Area/Perimeter
- n = Manning's coefficient













Escoffier Stability Analysis of Robinson Preserve

Tidal Currents vs. Cross-sectional Area





 Different combinations of width and depth of the Palma Sola Bay channel were evaluated and compared to Alternative 7.



Alternative 7



- Design alternatives developed to evaluate current velocities at the Palma Sola Bay outlet and decrease current velocities.
- The Escoffier (1940) analysis was as a basis for modifying the existing channel cross-section.
- Final design developed on Stantec based on results of Alternative 11.





Time-tested methods developed for coastal engineering such as the 1940 Escoffier analysis can be used in conjunction with advanced numerical models like Delft3D to further the application of environmental science in coastal environments and habitat restoration projects.

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Manatee County Preserves





Perico Preserve 2012





Perico Preserve 2015







January 2013

October 2014



Perico Preserve Phase II - Rookery Island





Manatee County Preserves





Neal Preserve 2007





Neal Preserve 2012









During the depths of the Great Depression, with the ration's unemployment rate at nearly 25%, President Franklin D. Roosevelt instituted a series of relief programs under his "New Deal for America." In the southeastern United States, where unemployment had reached 30%, \$400 million was allocated IL PROJECT HILF AS CAUTION AND COOPERATION

to fund the Civil Works Administration (CWA) between November 1933 and February 1934 to create temporary jobs.

On December 7, 1933, approval was granted to the Smithsonian for a number of CWA-funded archaeological projects. Dr. Matthew W. Stirling, Chief of the Burcau of American Ethnology, U.S. National Museum, Smithsonian Institution, managed all of the CWA Florida projects. The project here on Perico Island was directed by physical anthropologist and archaeologist Dr. Machaell I. Natura

Dr. Marshall T. Newman.

Dr. Newman's work began here with CWA Civil Engineer George Ramsay, surveying and carefully mapping the shell mound complex. A shell burial mound was found with the help of Montague Tallant (a Manatee resident and amateur archaeologist), as well as a low



sand area within a failed citrus grove, where Tallant had also found skeletons.

WORK

ACCIDENTS,

C.W.A. jobs are SAFE jobs

SMITHSONIAN ARCHAFOLOGICAL

The shell burial mound was about 60 feet in diameter by 5 feet in height and was only slightly damaged by previous looting. Newman's crews uncovered evidence of 227 burials, 13 of which were infants or adolescents. Most of the dead had been placed in fetal positions facing various directions.

Because the nearby shell midden (partly used in constructing the mound) contained shell and bone artifacts, ceramic sherds, and food bones, there were only a few cases where there was any definite evidence of individual grave offerings. Newman noted that the physical type of the people was small and light-boned, and this contrasted sharply with the larger, more rugged physical type found in the cemetery.



The "cemetery" was an area 50 feet north to south by 50 feet east to west, defined by surface shell and human bone fragments. Preliminary excavation of this feature uncovered 43 skeletons, including 3 infants intermixed with several plain pottery sherds.

Further study of the site has revealed that the "cemetery" had actually been a low sand mound constructed over a shell midden deposit



Historic shatographs and drawings courtesy of the National Anthropological Archives, Washington, D







New Deal Archaeology on Perico Island



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Whelk Column Central spiral of a whelk shell, used for hammers and chisels as well as spear points. Perico Island Collection 0. 300 BC-100 AT



Perico Pottery Sherd Example of "punctate" decoration Formed by impressing the clay with a fingernail. Perion Island Collection a 300 BC-100 AD



Shell Artifact Note the chipping on the bottom of the shell

Perico Island Collection c. 500 BC-100 AD

Perico Island Culture

In 1989, after studying and comparing materials from hundreds of archaeological sites, Gordon R. Willey produced <u>Archaelogy of</u> the Florida Gulf Coast, the definitive book in its field. Willey defined the "Perico Island" culture period based on a careful organo the rene actions control perior based on a complete study of Nerson is seek and artifact at this leading, placing, the conter of this early Floridan culture in the Tampa Bay region. Recent work indicates that the burial features likely date to between 300 8C and 100 AD.



Drilled Shell Likely used for decoration or lewelry Perico Island Collection c. 300 BC-100 AD

Dating the Artifacts By studying artifacts and other physical clues that changed over time, archaeologists determine an area's culture history the succession of different cultures that were once present. The succession of different cultures that were note present. Compares in polarizery in the knows, of a linker added to the name clog), in vessel chapse, and in extense decorations - are very important in solving this puzzle. Early archaeology relied on these closes to detromine the relative ages of cultures and their artifacts. It was not until advent of radiocarbon dating in 1951. that more accurate timelines replaced the earlier educat quesses about are



Perico Pottery Sherd Note the incised pattern along the rim

Perioo Island Collection c. 300 BC-100 AD



Robinson Preserve Expansion





Robinson Preserve





Robinson Preserve Recreational Trails







Robinson Preserve





Thank You!



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