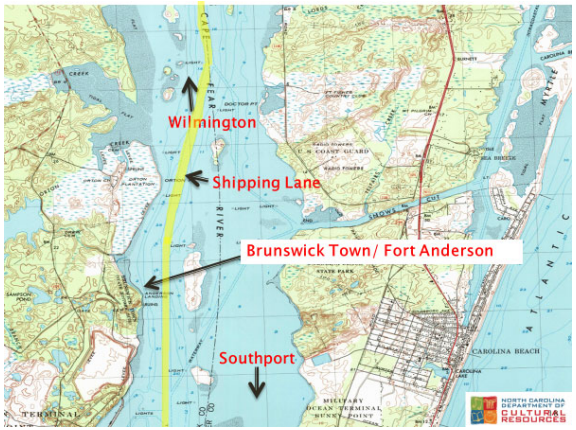
Implementing a Resilient Structure to Protect Coastal & Historic Resources at Brunswick Town/ Fort Anderson



Abstract

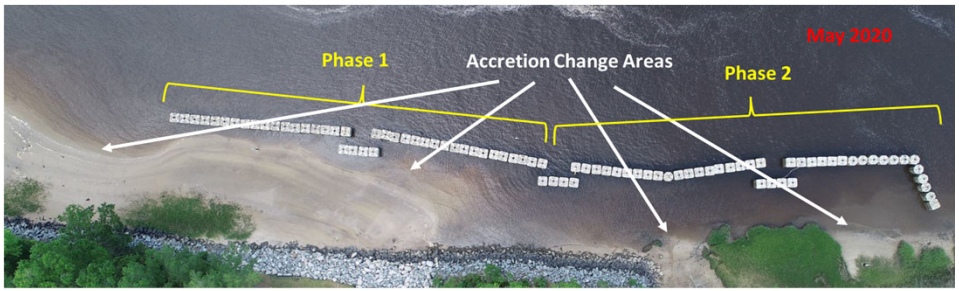
Brunswick Town/ Fort Anderson (BTFA) is a state of North Carolina historical site, and experiences rapid shoreline erosion from constant tide forces and dynamic wave action. The North Carolina Department of Natural and Cultural Resources (NCDNCR) seeks to halt the shoreline erosion to prevent additional buried colonial-era wharf destruction, the undermining of Civil War-era batteries and three other colonial era wharf sites and loss of coastal marsh. Erosion on the banks of BTFA was first noted in 2008, and, from 2008 to 2013, the site lost 75-120' of shoreline.

The primary project objectives were to protect (and restore) the coastal marsh ecosystem and protect historic site features. Secondary objectives were no/minimal maintenance of the structure and able to adjust for sea level change (SLC). Reefmaker (RM) structure was identified the solution as it is a water flow through wave attenuation system that includes individual, stackable disks on a fiberglass pile and perched above the substrate by a mechanical support system.

The RM redefines "living shorelines" system with many natural and nature-based functions. While wave attenuation is the primary function of the RM concept, the system also protects/ restores the shoreline and marsh, while providing habitat for marine fauna, sessile and motile organisms, and not impeding faunal organisms movement from shore to open water.

The RM concept was selected over a rock sill at the BTFA site because the structure:

- Allows for modular construction which enables easy adjustments to accommodate for sea level change (SLC)
- Works in horizontally limited areas like natural, river drop offs
- Minimizes 'foot print' impact to substrate as RM utilizes 12" diameter fiberglass pile (0.785 ft^2 / pile)
  - Reefmaker – 500 ft long structure (100 piles) = 78.5 ft^2
  - Rock Sill – 500 ft long with 2:1 slopes = 10,000 ft^2
- Dissipates destructive wave energy
- Sets base unit above the substrate
  - Minimizing scour
  - Minimizing sand/sediment re-distribution
- Works in high energy wave environments
- Permits flushing along the entire shoreline

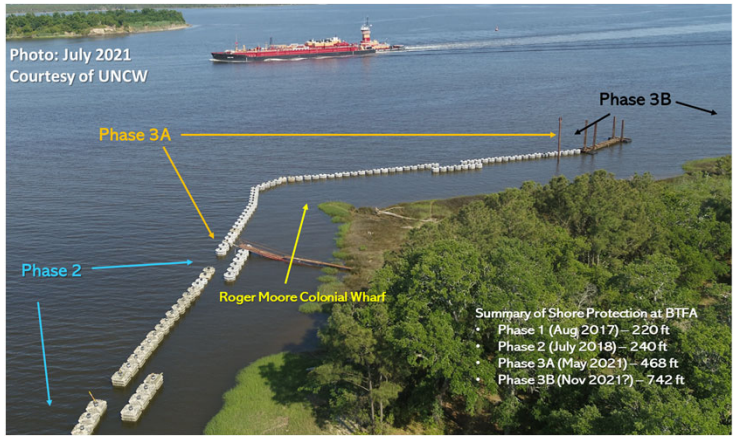


Implementation has occurred in phases due to funding limitations. Today, shoreline protection/ restoration totals 928 feet, including Phase 1 (220', completed in 2017), Phase 2 (240', completed in 2018) and Phase 3A (468', completed May 2021). Phase 3B commenced in September 2021 and protect 743'. By December 2021, shoreline protection/ restoration at BTFA will total 1,671' and incalculable ecosystem service benefits.

Awards/ Recognition

BTFA has been recognized by several groups for its innovation and ecological services. These awards include:

- American Council of Engineering Companies – NC (2019)
- *At Atlas: Volume 2* (April 2021) from the Engineering with Nature of the Corps of Engineers for
  - Using science & engineering to produce operational efficiencies
  - Using natural processes to maximum benefit
  - Increasing the value provided by the project to include social, environmental and economic benefits
  - Using collaborative processes to organize and focus interests, stakeholders and partners
- 2021 *Best Restored Shores* by American Shore & Beach Preservation Association



Results

As part of a National Fish and Wildlife Foundation grant, the University of North Carolina at Wilmington (UNCW) is currently conducting monitoring for several project phases.

There is accretion on the open water and shoreside of the structure. There is 2' of accretion at up river of Phase 1 and 1' of accretion at behind Phase 2.

Remnant marsh grass populations are expanding now that wave energy has been dissipated. BTFA staff has noticed an increase in the blue crab population, and recreational fishing is now common of the BTFA shoreline near the structure.

From September 13-16, 2018, the RM structure withstood Hurricane Florence's landing near the site. The hurricane brought several high tide cycles with pounding storm surges and flooding against the structure. After this storm and others, there has been no damage nor maintenance of the structure.

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