CASE HISTORY
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CITY OF FT. PIERCE MARINA
FT. PIERCE, FL, USA

ISLAND BREAKWATER CREATION
Products: MacTube®, MacBag®, Maccaferri Polymeric Marine Mattress

Problem
The Ft. Pierce City Marina is located on the Indian River Lagoon, a long and wide estuarine water body separated from the Atlantic Ocean by barrier islands on Florida’s southeast coast. In 2004, Hurricane Frances made a slow 34 hour approach toward the marina as a Category 2 hurricane. Out of 269 slips, the hurricane totally destroyed the 138 slip floating dock portion of the outer marina and incurred additional damage to the inner marina basin slips. The hurricane caused approximately $14.9 million in damages to the boats and $13 million in damages to the marina facilities.

Solution
The City of Ft. Pierce recognized that simply replacing the marina facility ‘in-kind’ was not the solution for long term protection from potential future storms. The proposed solution was to create a permanent wave barrier configured as a carefully sculpted, but naturally appearing, artificial island breakwater to protect the marina from a 100-year storm event, as mandated by FEMA regulations. The project consists of constructing a 12 island breakwater and one peninsular structure storm protection system to harbor the marina and adjacent public waterfront areas, while providing storm protection, habitat creation, and water quality enhancement (grand total of 14.66 acres). Along with providing storm damage protection of the marina, upland infrastructure, and surrounding downtown waterfront area - the islands also provide significant environmental enhancements that include mangrove planting (1.54 acres), oyster recruitment (1.28 acres), shorebird habitat and natural limestone artificial reef areas. The state of Florida has recognized this project as a pilot study for its environmentally friendly and sustainable elements – potentially setting the bar for future storm damage protection projects as an alternative to typical shoreline hardening solutions.

Client
CITY OF FT. PIERCE, FL

Main Contractor
CASHMAN/LUCAS MARINE

Designer
TETRA TECH

Products Used
MACTUBE®, MACBAG®, MACCAFERRI POLYMERIC MARINE MATTRESS

Date of Construction
FEBRUARY 2012 — MAY 2013
Together with the City of Ft. Pierce and the coastal consulting firm, Tetra Tech, Inc., Maccaferri assisted in developing the MacTube® dimensional tube geometry, and fabric type. The MacTube® OS500 material was selected based on its strength properties. MacTube® OS500 is composed of high-tenacity polypropylene yarns, which are woven into a network in such a manner that the yarns retain their relative position to each other. The MacTube® OS500 material is inert to biological degradation and resistant to the most naturally encountered chemicals, alkalis, and acids.

**Technical Characteristics**

The storm protection breakwater system is anchored by a 10.5 acre peninsular island, known as Tern Island, which shelters the marina from large open water fetch and harsh wave climates to the south and southeast. This island is comprised of a) T–groin stabilized, crenulated beaches on the windward side of the island, b) a coastal sand dune in the island center, and c) a bench for oyster recruitment and mangrove planting along the leeward side.

The project foundation consists of nearly 10,700 LF of geotextile containment structures (consists of 30’ and 45’ circumference MacTubes® and small MacBags®). These structures were used in conjunction with 250,000 SF of Maccaferri Polymeric Marine Mattresses to establish the perimeter of Tern Island and provide a foundation and structural core for the groins. Approximately 35,000 tons of limestone armoring units were used to provide structural integrity to the breakwater system while providing ecological enhancements.

In order to achieve the island design elevations specified, four tube configurations were utilized. Single tubes were used in shallow water locations in the central portion of the island while two tier configurations were utilized in the deeper portions of the island. One configuration consists of a single 45’ circumference bottom tube and top layer of sand bags and was utilized along portions of the perimeter for oyster bench/dike creation. Another two tier configuration was utilized in deeper water consisting of two base tubes and a single top tier tube. A pyramid stack of 30’ circumference tubes was utilized for the structural core of groin #1, while a pyramid stack of 45’ circumference base tubes was utilized along the leeward side of the island in order to maximize the oyster bench area. Maccaferri Polymeric Marine Mattresses were installed in conjunction with the geotextile tubes and served as a critical component to their successful installation and structural protection of the island.