

**Crews Race Against Hurricane Season
To Repair U.S. Coastal Barrier Reef**

Putzmeister pumps deliver special concrete mix to anchor lattice and boulders

STURTEVANT, Wis. — The National Oceanic and Atmospheric Administration (NOAA) recently completed a month-long reef restoration project off the coast of Key West, Fla., just in time to beat the hurricane season.

And it wasn't just any reef they repaired. This one has a reputation for being one of the best dive sites in the United States — the coastal barrier reef in the Florida Keys National Marine Sanctuary.

This unlikely offshore location was the work site for two dozen scuba divers, construction equipment operators, engineers and marine biologists. The crew's challenge was to repair and revitalize a living coral reef that was severely damaged in 1994 by a grounded ship, and do it before hurricane season hit. The team's equipment included a 160x55-foot (48.8x16.8 m) barge, a 100-ton (90.7-metric-ton) crane, a ready-mix truck and a special hydraulic concrete pump.

To help rehabilitate the reef, NOAA chose Team Land Development, an environmental restoration firm that has worked on projects from the Everglades to Key Largo – including reef-restoration work.

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Weather was the wild card

The company's game plan was simple. On a weekly schedule they loaded the barge with 200 tons (181.4 metric tons) of limestone boulders, 30 tons (27.2 metric tons) of concrete, and 15,000 gallons (56,781.2 l) of fresh water to mix the concrete. The company towed the barge to a mooring site where the boulders were lowered into position and the concrete was placed. The wild card was the weather.

If the ocean was rough, the shallow, 8-foot (2.4 m) water depth was unworkable. The average July and August air temperature was 95 degrees (35 C), not including radiant heat off the steel barge and water. And delays could have put them in the path of hurricane season, typically mid-August to mid-October.

The plan to repair each of the four damaged portions of the reef was similar. On July 22, Team Land put the first two scuba divers in the water to begin work on the first of two smaller damaged areas. By working on the smaller sites first, they could easily identify and address any design or material problems. Fortunately, no significant problems occurred, and the project proceeded smoothly until its completion in mid-August.

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Divers directed boulder placement

The divers directed the crane operator where to place the washed 3- to 5-ton (2.7-to 4.5-metric-ton) boulders in the large voids on the living reef. When the first layer of boulders was in place, the underwater concrete operation began.

A special concrete mix was used for the project. Charles Callaway, Team Land's project manager, explained that it contained an anti-washout additive that greatly reduces the cloudiness that occurs when regular concrete goes into water. This allowed the divers to clearly see the concrete pour as well as the entire work area while they placed the material. This special mix also protected marine life.

The 7,000 psi (483 bar) mix contained plasticizer and 3/8-inch (1 cm) pea gravel. The divers used the concrete to anchor fiberglass rebar lattice between layers of boulders and as a grout between the boulders.

In a typical day, the team placed up to 40 cubic yards (30.6 m³) of concrete. The mix set in four to six hours, and Callaway said, "It achieved its compression strength much faster than planned. The seven-day breaks came in at 6,000 psi (413 bar)." In total, he estimated 250 cubic yards (198.8 m³) of concrete were pumped for the job.

To ensure the optimum concrete mix was used in each pour, a ready-mix truck mixed the concrete on the barge in 5-cubic-yard (3.8 m³) batches. Each batch was prepared according to very stringent hour-long procedures. Then it was loaded into a Putzmeister hydraulic pump that was specially chosen for the project.

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Thom-Katt® selected

George White, vice president of Quality Concrete Pumping, said the Putzmeister Thom-Katt® 2050 pump was chosen for three reasons: “It’s reliable, it handles both 2- and 3-inch hose systems, and with the harsh-mix hopper with a remixer, it handles any of the concrete mixes required.”

“When you’re working with concrete that hardens in just 30 to 40 minutes, you don’t get second chances,” said White. “And when you’re working offshore, you need top-notch equipment. A breakdown on this job would have delayed the project for days.” He said it took a full day to move the barge from the mooring site to the shore.”

An average of three rows of boulders were placed on each repaired portion of the reef. The top layer was placed to reproduce the relief of the natural reef. And after the site was completed, various corals, sponges and other marine life were transplanted to the new reef structure.

This \$3.76 million reef project was the subject of considerable media attention, including a special Internet site managed by NOAA at www.sanctuaries.nos.noaa.gov/special/columbus/columbus.html, filming by CNN, PBS and Florida television crews, newspaper and magazine coverage, and daily visits by dozens of boaters.

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In fact, Callaway added, "It was the first time I felt as if I was on the inside of the fishbowl, instead of the outside. Needless to say, it has been very exciting to be part of this restoration project!"

Putzmeister America is the North American headquarters of one of the world's largest manufacturers of concrete pumps and conveyors. Putzmeister offers a complete line of truck-mounted concrete boom pumps, separate placing booms, portable and truck-mounted telescopic conveyors, trailer-mounted concrete pumps, as well as mortar, grout, shotcrete, plaster and fireproofing pumps and mixers.

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Design engineer: Coastal Planning and Engineering Inc., Boca Raton, Fla.
General contractor: Team Land Development, Inc., Pompano Beach, Fla.
Concrete contractor: Quality Concrete Pumping, Coral Springs, Fla.
Equipment: Putzmeister Thom-Katt® 2050 pump

Putzmeister reef photo

A Putzmeister Thom-Katt® 2050 pump is readied to pump concrete in the \$3.76 million reconstruction of a damaged barrier reef off Key West, Fla. The concrete contained an additive that prevented clouding in the water — allowing divers to clearly see when placing the mix — and protected marine life.

Additional photos for this story can be found at www.putzmeister.com and requested by calling Tom McLaughlin at Malcolm Marketing Communications (414) 633-4500, ext. 28.

Putzmeister reef photo

Workers connect a hose to a Putzmeister Thom-Katt® 2050 pump to begin pumping the first of 250 cubic yards (198.8 m³) of concrete to repair a coastal barrier reef off Key West, Fla. The month-long project was made more urgent by the approaching hurricane season.

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Putzmeister reef photo

Crane operators placed 3- to 5-ton limestone boulders in the large voids on the reef. After the first layer of boulders was in place, the underwater concrete operation began. Divers used 7,000 psi concrete to anchor fiberglass rebar lattice between the layers of boulders and as a grout between the rock. In a typical day, up to 40 cubic yards (30.6 m³) of concrete were placed.

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