

Sand, sand everywhere... but nary a bit to borrow?

The challenge of addressing Florida's beach nourishment needs

By MICHAEL BARNETT, PE

The growth of coastal engineering is like a rising tide in Florida. Prestigious universities in the state and around the nation are graduating coastal engineers in large numbers. Many of these fresh faces will join the legions of seasoned professionals that are working on the restoration of Florida's critically eroding beaches.

Alternative means of shore protection have been employed, but generally the most viable, long-term solution to management of an eroding shoreline is to put more sand onto the beaches, or beach restoration. The relatively simple vision of replacing sand on a beach however, is far from the reality. The permitting of such projects can be an excruciating process, with many taking in excess of five years from initial design through final implementation.

One of the many challenges coastal engineers face in beach restoration projects is the identification and permitting of appropriate offshore sand sources or borrow sites. The appropriateness of sites varies for every project and is determined by a number of factors such as the compatibility of the borrow sand with the native material, the quantity of material available, and the location of the borrow site.

A treasure hunt

Finding compatible sand from offshore borrow sites is a complicated and time consuming process. Such sands are difficult to locate, expensive to thoroughly investigate, and require extensive review prior to authorization from state and federal regulatory and resource agencies.

In Florida, all parameters—such as grain size distribution, color, sediment particle size fractions, carbonate content, and the percent of silt/clay content—must meet stringent review criteria under Chapter 62B-41.008, FAC, in order for the Florida Department of Environmental Protection to consider the offshore sand source compatible with the existing beach sand for a particular project.

Outside of the specific regulatory requirements for sand compatibility, federal resource agencies, wildlife protection advocates and local preferences provide commentary on specific parameters of the sand that are regularly incorporated into the material determination process.

Buried treasure

Locating potential sand sources for

renourishing eroded beaches is a challenge in itself. The accumulation of sand that washes from the shore into a bay or out to the ocean to form coastal shoals may lead some to believe that the same sand could be simply be recaptured and placed again on the beach.

Unfortunately, this may not necessarily be so.

For instance, sand washed into a bay may realize rapid vegetation growth, and once vegetated, cannot be dredged. Conversely, while offshore shoals where eroded sand has accumulated do not typically become colonized by submerged aquatic vegetation, their removal will alter wave patterns along the beach and can result in adverse erosional impacts along the shoreline. This result, in turn, defeats the purpose of the beach restoration project, or transfers the problem to a different shoreline segment.

Numerical modeling using wave models such as REF/DIF that identify the possible patterns of wave refraction and diffraction is one useful tool in evaluating such project impacts. Beyond the erosion or accumulation impacts that the removal of sand may cause to shorelines, modeling also offers insight as to potential project effects on near-shore resources, including hardbottom and reefs.

As engineers attempt to refine the boundaries of the identified offshore borrow areas, they employ sophisticated equipment to assess the sites' potential. As with areas closer to shore, both surface and subsurface features of concern—including hardbottom, reefs, shipwrecks, and surface-piercing obstructions—must be detected to avoid any negative impacts.

The absence of near-shore sand resources is not a problem for all of Florida's beaches. For portions of the Panhandle, the absence of sea grasses, peat, hard-bottom, and reefs allows engineers to complete the geotechnical studies and modeling required to permit sources. Similarly along the eastern coast, significant volumes of sand off Duval and Martin counties' shores offer the promise of ready sand sources for years to come, and because these sources are close to shore, their use may result in lower transportation costs.

Even when close locations can be found and permitted they don't always provide the desired cost-savings. The dredging of sand from Blind Pass to renourish Upham Beach in the St. Petersburg area uncovered pockets of oil from fuel spilled during a shipping crash in the Tampa Bay vi-

city years before. In addition to the time delays for the project, it blossomed into an expensive cleanup project.

The next wave

With so much beach renourishment needed in Florida, efforts are well underway to identify sand sources in advance of the anticipated demand. As borrow areas close to project sites are depleted, engineers will increasingly be required to evaluate the engineering and associated costs of transferring the sand from distant sources.

Along the eastern coast, the Continental Shelf resides three to eight miles out to sea. Public Law 102-426 enacted in 1994 gave the Minerals Management Service of the U.S. Department of the Interior the authority to negotiate rights to sand, gravel and shell resources for shore protection and beach restoration projects, among other uses. The MMS has been aggressively assessing the potential offshore sand resources along the northeast coast of Florida and has examined regional management strategies for identified borrow areas.

No pain, no gain

The identification and permitting of appropriate sand sources is a challenge for engineers that will be increasingly difficult into the future. This process can be made less burdensome with collaboration among community members, regulators and coastal engineers.

Capitalizing fully on each project that is undertaken may involve the incorporation of more extensive and expensive design elements such as a sloping beach extending far into water to break the wave energy and reduce erosion. Other options include the implementation of thoughtfully designed hard structures in conjunction with beach nourishment, or the implementation of additional sediment bypassing plants at inlets and the development of improved regional sediment bypassing management practices.

We know it has to get done, we just have to decide which "long haul" we are in for.

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