PROTECTING **RHODE ISLAND'S SHORELINES** FROM FLOODING AND EROSION

IN MANY PLACES ALONG Rhode Island's 420 miles of coastline, people are doing all they can to keep erosion at bay to protect their homes, roads, businesses, and beaches.

One thing they typically can't do is build a sea wall or other hard shoreline protection structure.

Rhode Island is one of several states with a near-ban on construction of new sea walls, which runs counter to many people's powerful urge to put as much rock and concrete as possible between their property and oncoming waves.

After Superstorm Sandy, one mayoral candidate proposed a $20 billion plan to protect New York City with sea walls and other measures. More than $40 million of local and federal money is being spent to build a sea wall to protect two towns in New Jersey that were heavily damaged by Sandy.

So why do Rhode Island regulations prohibit sea walls and similar structures for so much of the state's shoreline? First, beaches are naturally dynamic. Waves transport sand to and from beaches as conditions change. Upland areas erode, but that erosion replenishes the beaches in front of them. Beaches are on the move, and they are moving landward. However, when natural processes are allowed to take place, the beach and associated ecosystems are sustained.

Erecting hard shoreline stabilization structures interferes with these natural processes. These structures block the natural transportation of sand while deflecting wave energy back to the beach, thus scouring it away. Shorelines, therefore, can have sea walls or beaches, but not both.

And therein lies one of the most significant reasons that building new hard shoreline structures is banned in much of Rhode Island. The right to access the shoreline belongs to every resident of the state, beginning roughly at the high tide line. The R.I. Coastal Resources Management Council (CRMC) is charged with protecting that right. Revetments and sea walls serve to take away shorelines from public use and preserve them (to a point) only for private use.

Furthermore, while some states allow hardened shorelines, nearly half of Rhode Island's shore is unsuitable for hard structures due to its exposure to severe waves, flooding, and erosion. During Sandy, at the Charlestown breachway, huge boulders were picked up by the waves and dumped on each other. The breakwater in Galilee has suffered millions of dollars in damages due to several storms, including Sandy, which wiped out a section of boulders.

Closer to shore, during Sandy, natural dunes and setbacks in Misquamicut performed better than revetments that were, in some cases, built too close to the businesses they were intended to protect.

Revetments—engineered rock walls—can be overtopped by waves, allowing waves to hit the building behind them or to scour sand from behind the revetment, causing it to collapse. Waves can also scour in front of revetments, similarly damaging them.

Many of the revetments on properties in Rhode Island were put in prior to state regulations prohibiting shoreline structures and were built haphazardly or too close to the homes they are intended to protect, which can exacerbate damage to homes during storms. For instance, rocks that are too small may be picked up by waves and thrown against the building behind them. Sea walls reflect wave energy, but they, too, are not impenetrable, as the damage to the Narragansett sea wall during Sandy proved.

Produced by the CRMC with Rhode Island Sea Grant and the Coastal Resources Center at the the University of Rhode Island Graduate School of Oceanography

Even properly designed and sited shoreline protection structures are expensive to build: a revetment or wall that meets U.S. Army Corps of Engineers' standards for the high energy wave environment of Rhode Island's south shore costs up to $5,000 per linear foot. Additionally, the size—height and width—required to protect upland infrastructure from a significant storm or hurricane is generally much greater—and more expensive—than is typically built. Maintenance costs can be very high, and must be considered as part of the overall costs for shoreline structures. Additionally, such large structures would block visual and physical access to the ocean. On Rhode Island's south shore, a proper wall would often need to be over 20 feet high and sometimes completely surround the property.

A properly designed revetment is intended to dissipate wave energy through its angled construction and the gaps between the rocks. However, it deflects wave energy to either side, increasing erosion around the revetment, potentially increasing beach loss on neighboring properties. And studies have shown that property owners near the shore, but behind the first row of shoreline homes, have found their property values declining as shoreline protection structures have increased erosion and blocked their access to the beach (O'Connell).

The loss of beach can harm tourism in a state where beaches are a draw for in-state and out-of-state visitors alike. Additionally, such structures make the adjacent waters more hazardous for some recreational users. For instance, a surfer wiping out on a beach is less likely to be injured than one wiping out against a revetment or sea wall.

This doesn't mean that the CRMC is opposed to homeowners trying to protect their shoreline properties from the effects of coastal storms.

Soft structures made out of biodegradable coconut fiber such as supersized sand bags and coir logs are allowed (with permits) and tend to dissipate more wave energy than hard structures, reducing erosion. Despite being biodegradable, these measures are actually less expensive to build and maintain than hard structures.

No shoreline protection measure can completely stop erosion and no structure can guarantee full protection for properties against every storm. Homeowners who understand the erosion rates of the shoreline they live on can better understand what their vulnerabilities are and begin to plan and prepare for those changes. To see what your erosion rate is check out: www.crmc.ri.gov/maps/maps_shorechange.html.

For more information on the R.I. Shoreline Change Special Area Management Plan (Beach SAMP), which is being developed to help the state better protect itself from erosion, sea level rise, and flooding, visit the Beach SAMP website at www.beachsamp.org. ■

Reference

O'Connell, J.F., 2010, Shoreline armoring impacts and management along the shores of Massachusetts and Kauai, Hawaii, in Shipman, H. et al. eds., *Puget Sound Shorelines and the Impacts of Armoring—Proceedings of a State of the Science Workshop, May 2009: U.S. Geological Survey Scientific Investigations Report* 2010-5254, p. 65-76.

Above: A coir structure is used to protect Allins Cove in Barrington. **Below:** North Kingstown residents examine floodplain maps at a community meeting.