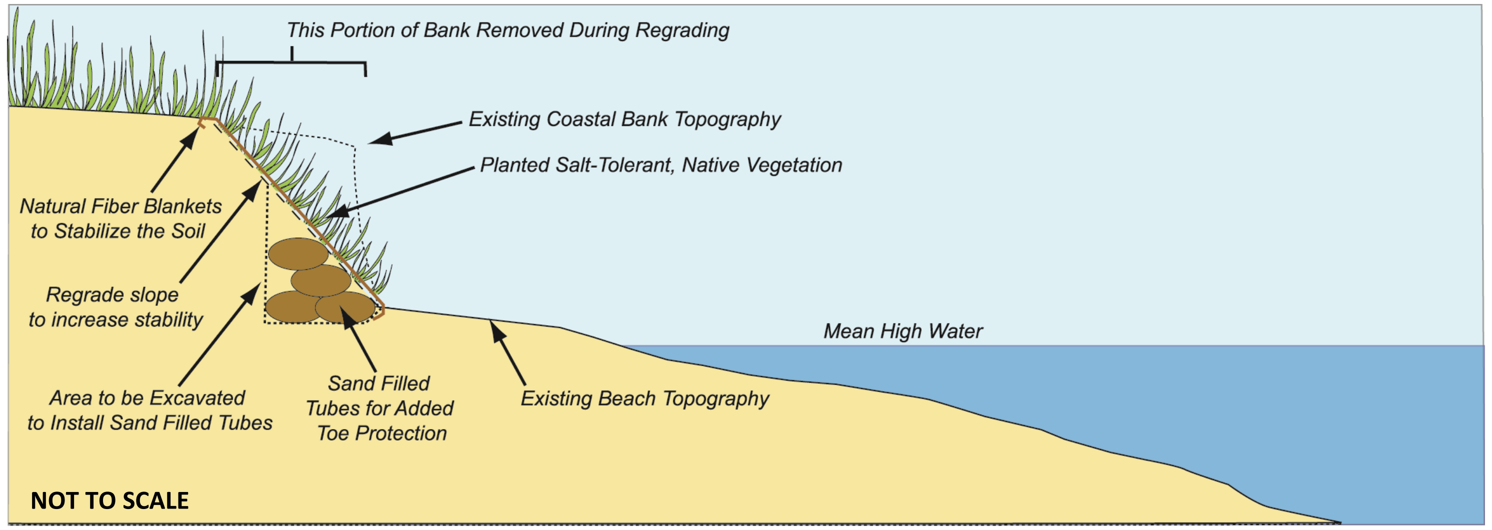
Coastal Bank – Engineered Core

Coastal bank protection, including slope grading, terracing, and toe protection and vegetation planting will reduce the steepness and protect the toe of the bank from further erosion. Engineered cores, of sand filled tubes, provide added protection from future bank erosion.

Objectives: erosion control; shoreline protection; dissipate wave energy; enhanced wildlife habitat.

Design Schematics



Case Study

Stillhouse Cove, Cranston, RI

Stillhouse Cove is the site of a public park and a previous salt marsh restoration project that was completed in 2007. Restoration of the coastal bank was initiated after Superstorm Sandy caused extensive erosion which over-steepened the bank and washed fill and soil into the adjacent marsh. Save The Bay and EWPA, working closely with the USDA Natural Resources Conservation Service, developed a design to reinforce and protect the eroding bank by reconfiguring the slope and using natural materials and vegetation.


Construction at Stillhouse Cove, RI
Photos courtesy of Janet Freedman

Project Proponent	City of Cranston, RI, Edgewood Waterfront Preservation Association (EWPA), Save The Bay, Natural Resources Conservation Service (NRCS).
Status	Completed in 2013. Maintained in 2014 (added coir logs and plantings).
Permitting Insights	The project had several iterations but was finally permitted as a Sandy Emergency Assent. An extension was required due to challenges of securing funding within the permit time frame.
Construction Notes	A key component of this project was regrading the bank from a vertical cut to create a more gradual slope. Once the slope was regraded, sand filled coir envelopes were installed, covered with soil and planted with salt tolerant vegetation.
Maintenance Issues	3 coir logs were installed at the southern end of project and planted with warm season grasses as part of the Dept. of Interior Hurricane Sandy Relief Grant Program. The base of the bank will be more frequently inundated as sea levels rise.
Final Cost	Permitting: No permit fee for municipalities Construction: $59,006 plus volunteer labor.
Challenges	Funding and coordination with partners and volunteers.

Design Overview

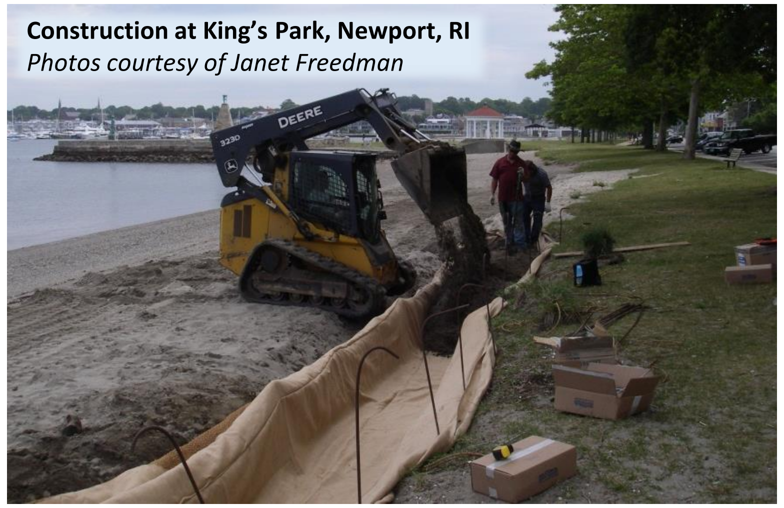
Materials	An engineered core could be constructed using coir envelopes, which are coir fabric filled with sand. Cutback/excavated material should be used to fill the coir envelopes but supplemental offsite material may be required. Anchors are necessary to secure the envelopes. Native vegetation with extensive root systems are often used in conjunction with coir envelopes to help stabilize the site. Also, natural fiber blankets can also be used to stabilize the ground surface while plants become established. (Blankets should be run up and down the slope rather than horizontally across it.)
Habitat Components	Because they are made with natural fibers and planted with vegetation, natural fiber blankets also help preserve the natural character and habitat value of the coastal environment.
Durability and Maintenance	A veneer of sand/sediment should be maintained over the sand filled tubes to prolong their lifetime. Regular maintenance, such as resetting, anchoring, replacement, or recovering, can increase the effectiveness of the project.[6] Invasive species management should be incorporated into the project. Runoff management and groundwater will also be crucial to project success.[6]
Design Life	As the sand tube material and natural fiber blankets disintegrate, typically over 5-10 years, the plants take over the job of site stabilization.
Ecological Services Provided	Upland plantings stabilize bluffs and reduce rainwater runoff.[11]
Unique Adaptations to NE Challenges (e.g. ice, winter storms, cold temps)	Shorter planting and construction window due to shorter growing season. Utilization of irrigation to establish plants quickly. Freeze and thaw processes can damage this design. Consideration should be given to the slope aspect and the implications on plant growth and microbiome from shading and sun exposure.


Completed Stillhouse Cove Project (RI)
Photo courtesy of Janet Freedman


Construction at Allin's Cove, Barrington, RI
Photo courtesy of Janet Freedman

Coastal Bank – Engineered Core

Engineered coastal bank protection projects are appropriate for almost any tide range, topographic slope, or grain size, provided that the toe of the bank is situated above mean high water where it will not be regularly inundated.



Construction at King's Park, Newport, RI
Photos courtesy of Janet Freedman

Regulatory and Review Agencies

Maine	Municipal Shoreland Zoning, Municipal Floodplain, ME Dept. of Environmental Protection, ME Land Use Planning Commission, ME Coastal Program, ME Dept. of Marine Resources, ME Dept. of Inland Fisheries and Wildlife, and ME Geological Survey.
New Hampshire	Local Conservation Commission, NH Natural Heritage Bureau, NH Department of Environmental Services (Wetlands Bureau, Shoreland Program, and Coastal Program), and NH Fish & Game Department.
Massachusetts	Local Conservation Commission, MA Division of Fisheries and Wildlife (Natural Heritage and Endangered Species Program), MA Environmental Policy Act, and MA Office of Coastal Zone Management.
Rhode Island	Coastal Resources Management Program.
Connecticut	Local Planning and Zoning Commission, and CT Department of Energy and Environmental Protection.
Federal (in all states)	U.S. Environmental Protection Agency, and U.S. Fish and Wildlife Service.

Siting Characteristics and Design Considerations

Selection Characteristics	Detail
ES Energy State	Low to high. Engineered cores, as part of a coastal bank protection project, can be used on both sheltered sites and sites exposed to wave energy. Additionally, they are most effective in areas with naturally occurring fringe protection (e.g. bedrock outcrop, salt marsh or higher beach elevations with some dry beach at high tide), where the toe of the bank is not constantly subject to erosion from tides and waves.[1]
EE Existing Environmental Resources	Coastal bank; vegetated upland.
SR Nearby Sensitive Resources	All. If the project is proposed in or adjacent to habitat for protected wildlife species or horseshoe crab spawning areas, there may be limitations on the time of year that the project can be constructed.[1] Mudflats, clam flats and other adjacent habitat are dependent on eroded habitat; this loss in sediment source to adjacent habitat must be accounted for. If trees are removed during construction, replanting is required; the removed trees can also be used to stabilize the toe of the bank.
TR Tidal Range	Low to high. An engineered coastal bank protection projects can be designed for all tidal ranges, provided the toe of bank is above the mean high water line and will not be regularly inundated.
EL Elevation	Above MHW
IS Intertidal Slope	Flat to steep. Although, flat to moderate slopes are preferred; steeper slopes may require armoring, which would result in a non-living shoreline.
BS Bathymetric Slope	Flat to steep
ER Erosion	Low to high. Steeper slopes may be more likely to erode, i.e. less stable. Coastal bank protection projects with engineered cores are preferred in areas of widespread erosion.
Other Characteristics	**Detail**
Impairment Level	Groundwater can be the cause of slope failure (particularly when clay is the base material), but wave exposure can be the dominant driver of loss.
Climate Vulnerability	Both horizontal and vertical loss to a coastal bank is permanent.
Surrounding Land Use	The ends of the sand tubes for an engineered coastal bank protection project should be carefully designed to minimize any redirection of waves onto adjacent properties. Tapering the tubes down in number and height so that the project blends in to the adjacent bank helps address this problem. [1] If pavement or lawn extends all the way to the edge of the top of the bank, or if forests are cut to the edge of the top of the bank, coastal bank loss is more likely; maintenance or creation of a vegetated buffer will mitigate loss.