Living Shorelines
Cost and Effectiveness

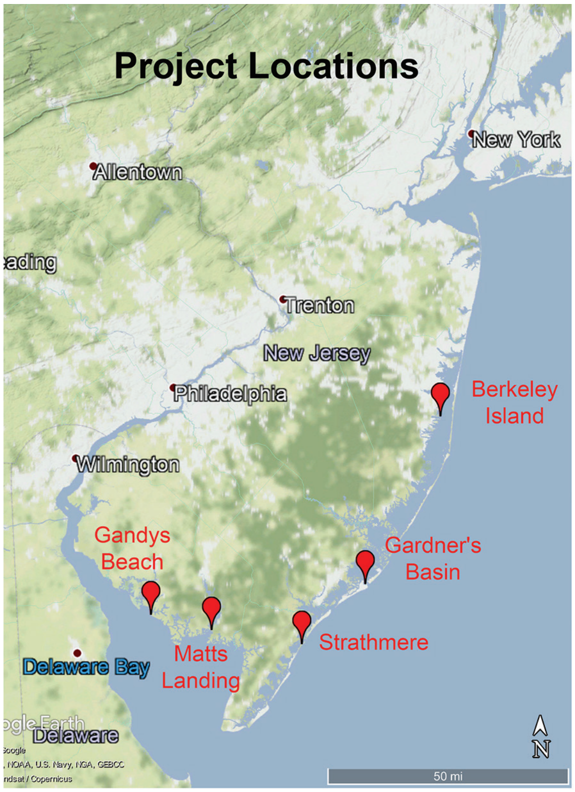
The Nature Conservancy
Protecting nature. Preserving life.

STEVENS INSTITUTE of TECHNOLOGY
THE INNOVATION UNIVERSITY®

Construction of Matts Landing coir roll living shoreline. © Partnership for the Delaware Estuary

Side by side living shoreline and wooden bulkhead at Matts Landing. © Stevens Institute of Technology

Upland planting behind rock sill living shoreline at Berkeley Island © T&M Associates



About this study

As landowners consider living shorelines, two recurring questions arise: 1) **Are they effective?** and 2) **How much do they cost?** Living shorelines are promoted for their multiple benefits; therefore, answering these questions of completed projects is important. Using a combination of field measurements, historical images, and cost records, this study analyzed a selection of living shoreline projects in New Jersey ranging in size, complexity, and cost.

THE ASSESSED PROJECTS:

The projects represent the range of living shoreline projects initially implemented in New Jersey. The projects are distributed throughout southern New Jersey, and are situated in diverse environments, ranging from extremely low energy to high energy. Construction materials also varied with site energy from soft coconut fiber material to concrete, wood, and rock. While the goal of each project was to stabilize the shoreline, typically consisting of a marsh edge, the designs differed among sites.

Are Living Shorelines Effective?

Over two years, the effectiveness of living shoreline projects was evaluated by looking at two important benefits: edge stabilization and wave attenuation. **Edge stabilization** was evaluated by comparing the rate of shoreline change before and after each project was constructed and further compared to a nearby control site (an area without a project). An effective project will, at a minimum, slow the rate of erosion, and ideally may even help collect sediment and promote plant colonization. **Wave attenuation** was evaluated using wave loggers at the three projects that included an offshore structure (sill or breakwater). A structure effectively attenuating waves will decrease the measured wave height from the seaward to the landward side of the structure and possibly reduce shoreline erosion.

Wave logger set up at Berkeley Island © Stevens Institute of Technology

Monitoring position and elevation of the shoreline at Matts Landing. © Stevens Institute of Technology

Top Effectiveness Results

- Three of the five living shoreline projects — Berkeley Island, Gandys Beach and Matts Landing — reduced erosion over the two-year study period.
- At Gandys Beach and Matts Landing, not only was erosion slowed but vegetation grew into previously barren areas.
- Edge stabilization results were inconclusive at Gardner's Basin and Strathmere likely due to the poor quality of historical imagery used to determine the rate of shoreline change prior to construction.
- All three living shoreline projects with wave-attenuating structures reduced wave energy to varying degrees. At Gardner's Basin and Berkeley Island, larger waves were educed by an average of more than 50%. Wave attenuation at Gandys Beach was highly variable due to the large tidal range, but longer-term post-construction monitoring determined an average of 31% reduction in wave energy[1].

PROJECTS BUILT TO STABILIZE THE EDGE

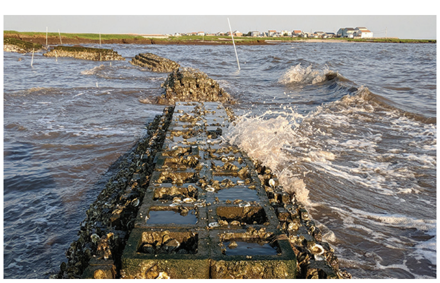
Strathmere: Coir roll terraced slope and water-ward rock sill

Matts Landing: Coir roll marsh edge protection

PROJECTS BUILT TO ATTENUATE WAVES

Berkeley Island: Rock sill with wooden bulkhead spine

Gardner's Basin: Rock sill with planted grasses



Gandys Beach: Oyster Castle® breakwaters

[1] Annual Wave Monitoring Report Mott MacDonald 2018

How much do Living Shorelines cost compared to conventional erosion control structures?

Volunteers, staff, and partners constructing a living shoreline with bagged oyster and clam shell. © The Nature Conservancy

For each of the five projects, the costs of each phase (design, permitting, construction, monitoring, etc.) were provided by individuals involved with each project. It should be noted that some project records did not contain sufficient detail for a thorough cost analysis, as this study was conducted 2-5 years after project construction; and, some projects included expenses such as monitoring while others did not. Therefore, the cost results should be considered estimates and interpreted with discretion. For comparison with their gray counterparts, the authors used both actual construction costs as well as cost estimates that had been solicited for nearby conventional erosion-control projects such as bulkheads.

Top Cost Results:

- Total costs and the distribution of costs, are fundamentally different for living shoreline versus conventional shoreline projects.
- The long-term costs of living shoreline projects are more evenly spread out over time, while the costs for conventional shoreline stabilization approaches are concentrated at the beginning and replacement phases of the structure lifecycle.
- As expected, project costs were directly correlated with project size and complexity. In general, the smallest, simplest project of each type was the least expensive, and the largest most complex project was the most expensive.
- Living shoreline projects cost less to construct than conventional projects, but cost more for other project phases, such as design and permitting, and monitoring (defined in full report). Some of the living shoreline projects were constructed either partially or fully with volunteer labor which helped reduce costs.
- The living shoreline projects cost less per linear foot than the conventional projects, even when maintenance, monitoring, and adaptive management are included.
- If only construction costs are considered, the gap between the lower-cost living shoreline and higher-cost conventional projects is larger.

- **When only the construction costs are considered, the range in cost for the living shoreline projects is $45 to $1,661 per linear foot.**

- **When only the construction costs are considered, the cost for conventional gray alternatives range from $437 to $3,507 per linear foot.**

A living shoreline was constructed at Berkeley Island County Park. © T&M Associates

Three years after construction, vegetation re-established behind the oyster reef breakwater at Gandys Beach. © The Nature Conservancy

This vinyl bulkhead in Wildwood, NJ, is an example of a conventional gray shoreline stabilization project. © The Nature Conservancy

COST COMPARISONS LIVING SHORELINES VS. CONVENTIONAL GRAY STRUCTURE

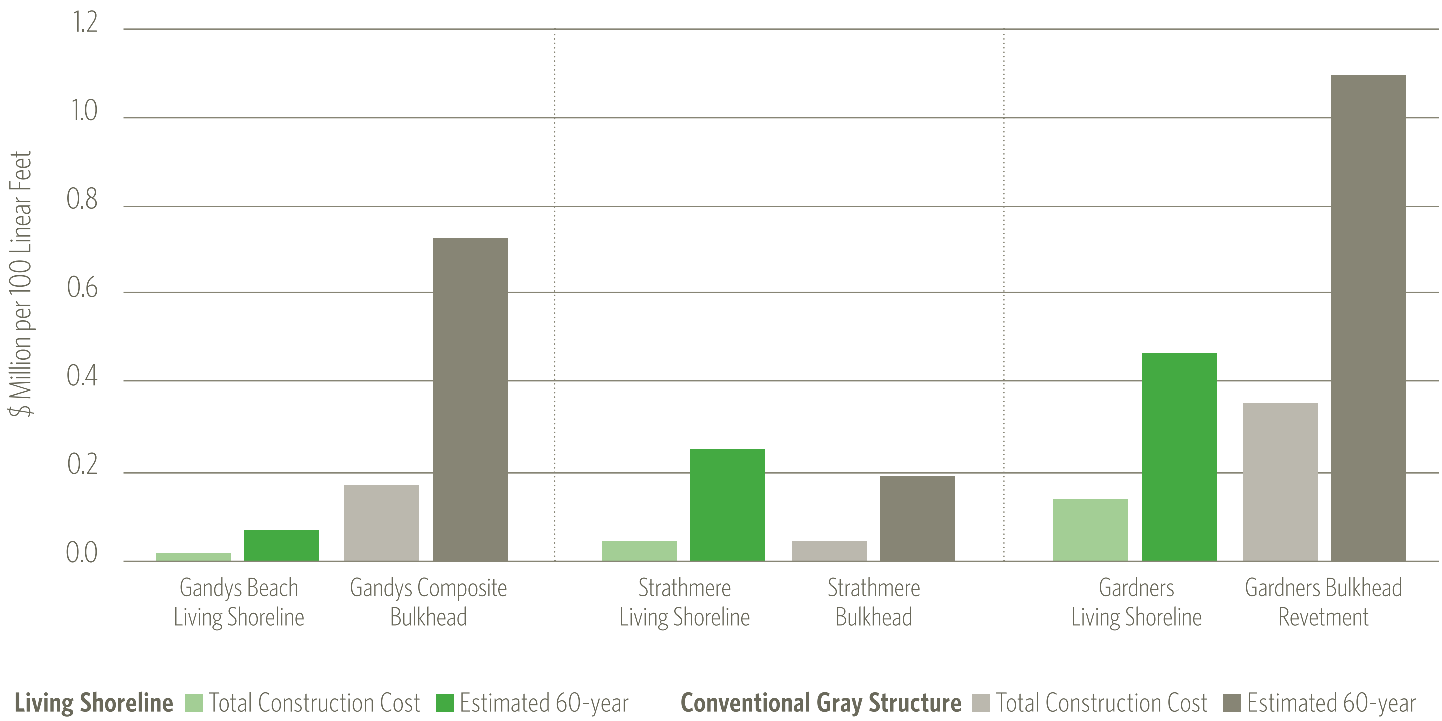


Figure 1: Comparing the cost of building a living shoreline to conventional gray infrastructure. For ease of comparison, project costs were standardized per 100 linear feet. Total construction costs, 60-year lifetime cost projections, project length, and other supporting details are included in the full report.

The Nature Conservancy New Jersey

Stevens Institute of Technology · The Innovation University

The Nature Conservancy
in New Jersey
200 Pottersville Road
Chester, NJ 07930

nature.org/newjersey

FOR MORE INFORMATION:

Stevens Institute of Technology/NJ Sea Grant Consortium
Project Leads
Jon K. Miller (PhD) jmiller@stevens.edu
Laura Kerr lkerr@stevens.edu

LINK TO FULL REPORT