Designing the Edge

Where Land and Water Meet

Designing the Edge is a collaborative effort to develop a demonstration project that reconsiders the water's edge as more than just a boundary. Whereas waterfront construction is traditionally driven by the goal of keeping land from eroding into the water, Designing the Edge encourages interdisciplinary and participatory design to create edges that achieve multiple goals such as improved access, enhanced habitat and stormwater capture.

METROPOLITAN WATERFRONT ALLIANCE
A project of the Municipal Art Society

City of New York
Parks & Recreation

NYS DOS
Department
of Coastal Resources

Making Waterfronts Work

The area where land, air and water meet is in constant change. This interplay of elements nurtures life while also placing great stress on costly shoreline stabilization infrastructure such as piers, docks and bulkheads. Throughout New York City, there are a number of waterfront edge conditions: soft edges such as coastal wetlands and vegetated earth banks; constructed slopes such as stone riprap preventing bank erosion; and constructed seawalls of concrete, steel and stone which retain landfill. The structures hardening the shore were originally needed to accommodate the manufacturing and shipping industry that once lined the City's waterways, including the Harlem River.

With the shift away from industrial uses to recreational ones, the public is rediscovering its waterfronts. In the past 25 years, the standard edge for public urban waterfronts in New York has become a paved esplanade with an ornamental steel railing adjacent to a vertical masonry or steel sheetwall (think Battery Park City, Hudson River Park, East River Park, Roosevelt Island and Harlem River Park Phase I.) While these edges served their purpose at the dawning of the effort to build waterfront parks, today the demand for public access includes ferries for transportation, tourism and recreation; emergency evacuation by boat; launches for kayaks, rowboats and canoes; and research or educational access to the intertidal zone where crabs, shrimp, shellfish and other aquatic life can be observed on the edges of the NY/NJ Harbor estuary.

Each of the typical edge treatments in the City has its limitations: vertical bulkhead walls make ingress and egress virtually impossible, limit handicap accessibility and render the usually biologically rich littoral zone sterile. Steep, rocky riprapped shores make awkward surfaces for human activity and wetlands or soft edges are too fragile for frequent public use. A new challenge is to replace degraded steel walls along our waterways with something dramatically different: something that provides more habitat value; allows safe, recreational and environmentally sustainable use of the water; slows the pace of passing water, reducing scour along the edge and river bottom; absorbs wakes and wave action; and still functions to hold back landfill that supports upland uses.

Artists, engineer, landscape architect, planner and biologists look at the pre-construction conditions of Harlem River Park at 135th Street.

In response to this challenge, the New York City Department of Parks & Recreation, Metropolitan Waterfront Alliance and the Harlem River Park Task Force collaborated on a pilot project to design an alternative edge treatment for incorporation into the planned Harlem River Park, with funding provided by the New York State Department of State, Division of Coastal Resources, under Title II of the Environmental Protection Fund.

Fresh Perspectives

Richard Toussaint, Terry Boddie and Michael Lee Poy discuss possibilities for the park at the community design charette.

"Designing the Edge" is exciting because it explores the relationship between the natural and built environments in new ways, particularly how to create healthy, lasting improvements to this interaction. But another, and equally important aspect of the project is engaging the local community in evaluating the natural environment and identifying ways to improve it. With an emphasis on including community members and potential park users at the inception of the design, the Designing the Edge team worked with the Harlem River Park Task Force to strategize the best ways to interact with the community. The team subsequently met with Manhattan Community Boards 10 and 11 (and their parks and cultural committees) before convening a successful community design charrette to gather community input at the beginning of the design process. The ideas and visions developed in this charrette helped guide the design of the edge of Harlem River Park Phase II. The Parks Department is also exploring the application of these alternative edge design ideas to the rest of Harlem River Park and other waterfronts.

The team also worked hard to provide the community with a wide range of resources, technology and information by enlisting the expertise of a Parks Department waterfront specialist, landscape architect and planner, a marine engineer, a marine biologist and three environmental artists. These experts joined community board members, representatitves from elected officials, community organizations, tenant groups and the residents of Harlem and East Harlem for the community design charrette. Not only is it unusual for this range of skills to be at the same table, but it is also rare for the community to be such an involved part of the very beginning of the planning and design process. The team embraced the idea that getting the community to claim ownership of the public realm was essential. Lastly, an important aspect of this pilot effort was the linkage between the visioning process, the design work and their immediate application in a funded capital project. Early implementation provides a critical success for the community and a model for project proposals elsewhere. This will set an example for exploring new ways to design our urban edges, offering an effective participatory process that can be utilized as a model for community design efforts well into the future, both locally and nationally.

Greenwall by Michael Singer, Grand Rapids, MI

Designing the Edge in a Nutshell: Nine Ways to Create Your Own Living Edge

1. Install surfaces that support estuarine life. Use rough textured and differently sized materials to facilitate algae growth and provide habitat for different kinds of fish. Incorporate oyster and clam shells to encourage shellfish and filter-feeding organisms to attach (which in turn serve as a living water-filtration layer).

2. Reduce wave energy. Horizontal terraces and gently sloped banks result in shallow water zones with light penetration, which is important for fish and many other kinds of aquatic life. Choose porous and gently sloped structures to absorb wake energy (waves from boats) instead of reflecting it, reducing scour and stress on the shore and making the nearshore safer for kayaks and rowboats.

3. Reduce the speed of constricted, fast flowing water. Replacing straightened shorelines with irregular, staggered or curvilinear forms reduces flow velocity and scour, allowing sediment to settle out of the water, creating microconditions that are similar to natural shores.

4. Greenery. Porous materials with soil in the voids can grow plants, improving the shore's habitat, strengthening erosion resistance with a network of roots, making the City greener, sweeter-smelling and better-looking.

5. Bioremediation. Earthen banks filter rainwater flowing off polluted urban surfaces through layers of soil, allowing microorganism activity to cleanse the water on its way into the river.

6. Durability in urban tidal conditions. Choose materials that are durable, especially against salt corrosion, vandalism, wake action, ice scour, freeze/thaw expansion and contact with boats.

7. Hand-powered boats. Accommodate kayaks and rowboats in some part of the shore.

8. Visiting boats. Accommodate larger boats for visiting programs and emergencies.

9. Safe access. Incorporate design solutions that safely allow people to get to the water.

Harlem River Park: Applying Designing the Edge

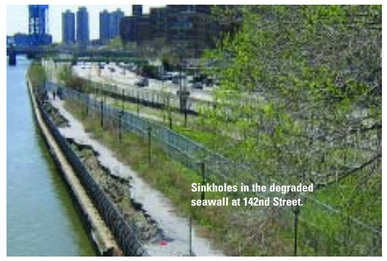
Background and Site Conditions

The Harlem River is a tidal estuary connecting the waters of the Hudson and East Rivers. It was developed as a shipping channel in the 19th Century through a process of realignment, landfilling, bulkheading and dredging. Like many of New York's waterways, roads were built along its edges, resulting in today's hardened shoreline of bulkheads and revetments. In the portion of the Harlem River between 139th and 145th Streets, the river was narrowed with landfill on the Manhattan side by approximately 1,000 feet and edged with a steel seawall.

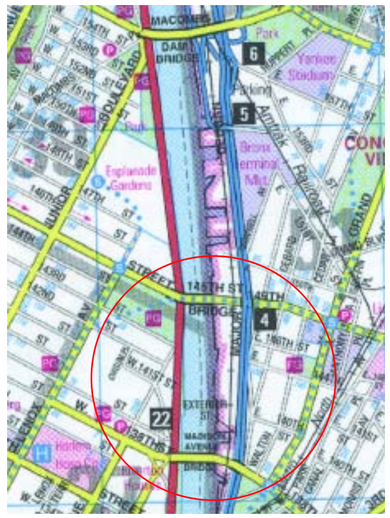
Separated from inland neighborhoods by Harlem River Drive, the project site is a narrow strip of undeveloped parkland along the bulkhead with pedestrian access from Manhattan via a walkway along the highway access ramp at 139th Street, a pedestrian bridge at 142nd Street and the Bronx via the Madison Avenue bridge. The site is 2,000 feet long, with developable park space varying from a width of 10' to 105'. Relatively level ground inside the bulkhead is vegetated by grassy meadow and volunteer trees and shrubs typical of urban coastal areas. 490 linear feet of steep riprap occupies the shoreline (see front page) just north of the Madison Avenue bridge. Extensive corrosion of the steel sheet-pile bulkhead and water seepage below the wall has left large sinkholes in the landfill behind the bulkhead, resulting in dangerously unstable surfaces along much of the site and closures along the section between 142nd and 145th Streets (shown far right). Views up and down the Harlem River are dramatic. As industrial use of the river declined, recreational river traffic increased and now includes jet skis, kayaks and Circle Line Ferries. The long range vision for Harlem River's west bank is a continuous greenway and public park with a multiple-use path from the Triborough Bridge to the new Peter Sharp Boathouse at the mouth of Sherman Creek. Harlem River Park started as a community plan, designed by local resident Richard Toussaint, to provide a bike path, esplanade and greenspace along the Manhattan side of the Harlem River. Upon completion of all segments (in 2017), the park will link 20 acres of waterfront land between 63rd and 145th Streets. While Phase I of the park (135th to 139th Streets) opened in 2002 — complete with seating, children's area, bikeway/greenway, colorful plantings and a new seawall with railing — there is currently no public access to the water itself.

Getting Started:

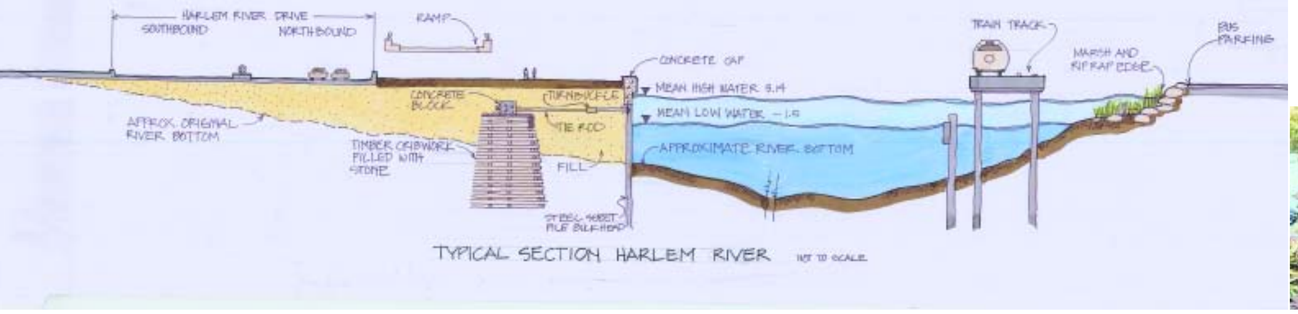
The goal of Designing the Edge was to infuse fresh, exciting ideas into the design of New York's waterfront edges. Using Harlem River Park as a prototype, a process was invented to engage points of view not typically involved in park design. A brainstorming and research phase was added to the design schedule. Three environmental artists, a marine engineer, a marine biologist and an architect joined the Parks specialist in urban waterfront ecology and a planner, MWA staff, the Harlem River Park Task Force, knowledgable residents, local artists and community leaders to develop an approach that was well suited to the specifics of the Harlem River but also had potential for being used on other waterfronts. The team asked and listened to the local community about how they wanted to interact with the water's edge on their new slice of waterfront open space. They also introduced ideas about improving the benthic and intertidal habitat, which would provide the public with ways to better understand and enjoy the natural resources of their urban shore. A community design workshop turned up a number of interesting ideas: several variatons of steps and terraces; tidepools; protection from deep water; emergency access to boats; ways to get out of the water; bioremediation and the use of soil as a filter to improve water quality; and public art that reflects the community's history and culture. From these ideas, a number of alternative shoreline types were considered. Four model shorelines were subsequently tested in a wave tank to see how they compared under the stress of waves the size of wakes from passing vessels and how they might alter the velocity and turbulence affecting sediment deposition.



Sinkholes in the degraded seawall at 142nd Street.



Harlem River Park Phase II and Designing the Edge project area.

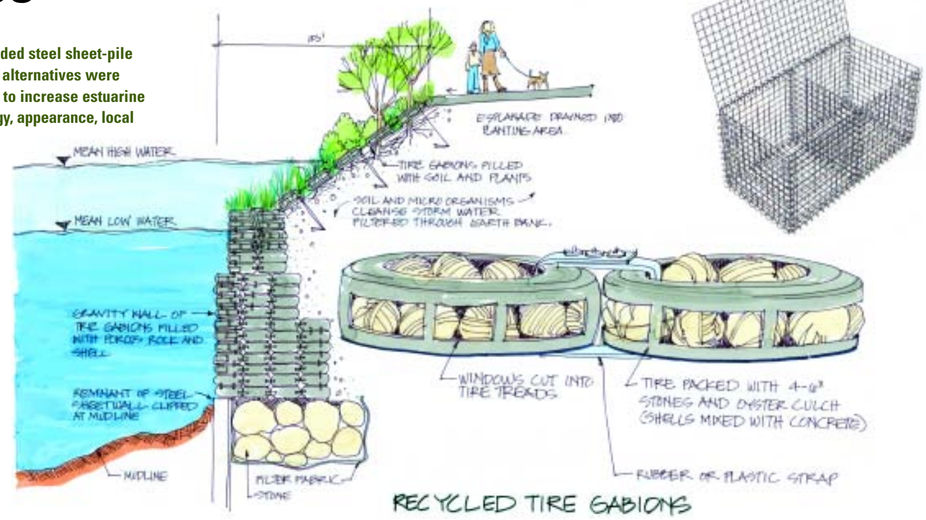


Alternatives

A number of ways to replace the corroded steel sheet-pile walls were considered. The following alternatives were compared by cost, durability, potential to increase estuarine habitat, potential to reduce wake energy, appearance, local availability and feasibility to install at this location:

Greenwalls: Precast, stacking concrete elements that can be filled with soil to create a gravity retaining wall. Plants growing in the soil pockets conceal most of the concrete framework, creating a sloping green-space. Greenwalls can be stacked almost vertically with tiebacks, in terraces or as a sloped wall. Below the water, the voids would be filled with heavy stone and oyster culch instead of soil.

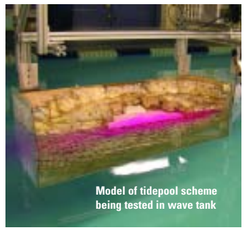
"Evergreen" wall, Athens, NY



Gabions: Basket-like containers filled with rock or stone that are tied together to serve as retention walls, revetments, channel liners or for erosion control on slopes. Historically made from flexible reeds and bamboo, contemporary gabions are flexible, porous stackable cells filled with stone. Gabions for salt water installations like Harlem River are manufactured from marine grade plastic straps or PVC-coated welded or twisted steel wire. A gabion variation made from recycled tires was also considered because tires are more vandal-resistant and durable in marine conditions. With "windows" cut into the rubber for more porosity, tire gabions are linked with rubber belt strips and stacked to form a gravity retaining wall. Any of the gabions for this project would blend oyster culch with stones to encourage shellfish attachment.

Macaferri gabions, Merrimac River, MA

Wave Tank Testing Results: Wave tank testing models of four possible approaches to the edge design produced the following conclusions:
(1) The existing sheet pile wall does not slow the flow of water along the edge of the river.
(2) A curved shoreline generates eddy circulations along the wall, with modest slowing of the velocity on quieter pockets.
(3) A cove with tide pool was very effective in ponding and slowing water.
(4) The greenwall slowed the flow at the leading edge of the model but caused water to downwell.



Model of tidepool scheme being tested in wave tank

Either the gabion or greenwall structure is recommended to slow the flow of water along the edge of the Harlem River to a point at which it is likely for suspended particulates and organisms to settle into the structure. The downwelling of water along the face of the greenwall, however, is a concern from both a safety and stability standpoint. Experience in Cape May, NJ has shown the plastic gabion blocks to be extremely porous, producing very little reflection even under direct wave attack. The tire gabion wall generated significant eddies where the waterline intercepts the vertical portion of the wall.

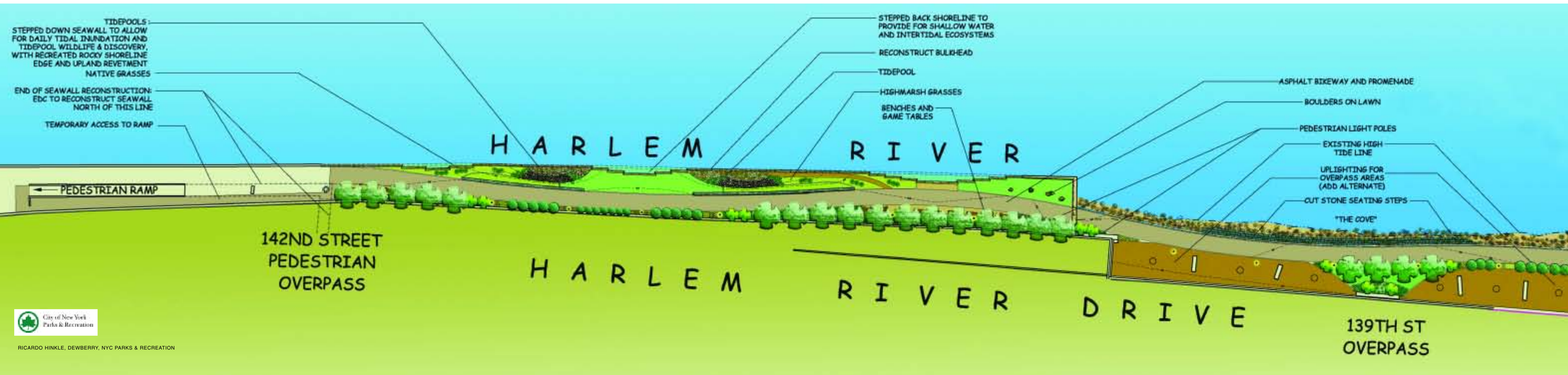
Sloping sections of any type of porous wall reduces flow, especially with plantings. Wave tests indicate that cove structures will be very effective in generating a region of slow water velocities, enhancing the trapping of sediments. It may be desirable to build a number of small coves at different elevations relative to mean low water along the wall. This would allow for the creation of a number of different tidal ecosystems.

Tensar cells, Guatemala

Marine Cells: Marine-grade plastic columns filled with rock. Marine cells are similar to large gabions but cylindrical. The rounded shapes can be beneficial in creating a shoreline with a greater variety of naturalistic microconditions.

Steel Sheet-Pile Wall: The traditional, industrial sheet wall was the "control" standard against which the others were compared as to benefits to the environment and cost. Various ways to reuse some of the existing sheetwall were evaluated, including patching the faulty parts of the wall; reinforcing it with a second wall cast out of concrete slurry, precast soldier pile wall, or supplemental recycled plastic or steel sheetpile; using the portions below 10 feet as a foundation for the new wall; or just using the portions below the mudline as foundation for a new wall.

Existing seawall, Harlem River Park



City of New York Parks & Recreation

RICARDO HINKLE, DEWBERRY, NYC PARKS & RECREATION

Harlem River Park Phase II Design

Although the City's early vision for the design of Phase II from 139th – 142nd Streets called for simply replacing the sheet-pile wall, the final design illustrates the influence of Designing the Edge principles:

1. Shoreline with various inlets and coves rather than a straight line.

2. Terraced steps to get closer to the water.

3. Tide pool to allow safe access to a shallow-water environment.

4. Gabions with oyster shells and rocks in the baskets to encourage attachment of filter-feeding shellfish and salt marsh grasses planted to enhance habitat value.

5. Variety in the arrangement of gabions to provide different microconditions.

6. Use of a porous edge to allow microorganisms in the soil to filter stormwater and to absorb wake energy, making the nearshore environment quieter and safer.

7. Providing access locations for kayaks and accommodating larger boats that could dock alongside the seawall for evacuation or special programs.

8. Retaining the sloping riprap portion of shore and rebuilding it to include seating steps.

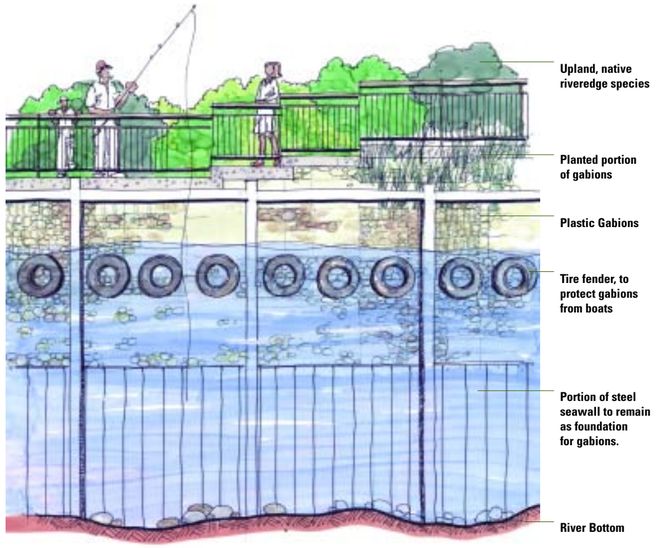
Scheduled for construction in 2007-8, an extension to Phase II (Funded by the Mayor and executed by the New York City Economic Development Corporation) will complete the park as far north as 145th Street. EDC has committed to continuing the Designing the Edge approach, including waterside access and ecological treatments.

Monitoring: A monitoring plan is being created for the Harlem River Park site to determine the success of the new waterfront edge treatments. Monitoring, which involves a local school or environmental group, will examine storm water quality; see how well the soil, rocks and plants are contributing to cleansing the surface water; effects on sedimentation; habitat value; numbers of species using the edge; presence of shellfish on the culch in the gabions; and the durability of the materials. Based on the results over five years, we will know which elements are workable and applicable in other waterfronts.

Costs and Life Expectancy: Hard costs associated with alternative edge treatments are estimated to be significantly less than constructing a new sheet-pile wall. Manufacturer-estimated costs for gabions and greenwalls range from $3,000 – $3,600 per linear foot, as compared to $5,000 per linear foot for steel sheet-pile. The initial estimated linear foot costs of the Harlem River Park edge, including the wall of plastic gabions plus stainless steel reinforcement and a recycled plastic lumber and tire fender system, are competitive with the costs of steel sheet-piling. The life extent of marine structures varies according to conditions such as current velocity, exposure to ice and freeze-thaw cycles, salinity, exposure to abrasion by floating debris and boats and vandalism. Installation methods are also important. Wire gabions are most vulnerable when the wire is exposed to water, especially salt water, after which the baskets break apart. When stones are loosely loaded into the baskets, tumbling during the normal course of waves abrades the PVC coating, exposing the wire, which will quickly rust. Gabions that are packed tightly by hand last much longer. The life expectancy of wire gabions ranges from a few years to 50 years. Plastic gabions of non-corrodable material are anticipated to last much longer. However, they haven't been in use as long as the other methods. Tire gabions, to our knowledge, have not yet been used in this exact manner; in other applications, tires have lasted indefinitely in marine conditions.

Community Art: Area residents and community leaders expressed a strong desire to have the park reflect and celebrate the unique aspects of the community and its history, especially if it could serve as an outlet for local artists. Through the design charrette, local artists helped residents imagine opportunities for incorporating art into the improved environment of their waterfront. Examples include images/textures/patterns in the pavement; horizontal steps or sea wall cap; images/colors of dawn on East-facing walls; and images associated with environmental themes. The final design includes 18 colorful lightpole banners of acrylic awning fabric with images to be created through a community-based competition. There will also be a series of stainless steel panels photo-etched with images at child's-eye-level celebrating the culture of Harlem and East Harlem.

All information in this publication is available online as a PDF. Please visit any of the following websites to download a copy or to share with others who might find it useful: http://www.nywaterfronts.com; http://www.harlemcdc.com; http://www.nyc.gov/parks; http://www.waterwire.net



A portion of the proposed new edge for Harlem River Park.

Methods	Pros	Cons
Greenwalls	Enable vegetation to grow on the face of near-vertical, structurally stable retaining wall. Porous surface, preferable for absorbing wake energy and allowing soil microorganisms to cleanse storm water. Minimal foundation needed.	Not flexible. Cannot be configured as a vertical wall. Some upland space required to achieve a battered slope. Meshing may be needed to retain soil in intertidal zone; stone or concrete required below waterline. Walking/climbing on structure is not appropriate.
PVC-Coated Wire Gabions	Can be installed with vertical face. Porous and flexible. Able to be installed with minimal equipment. Appropriate for hard-to-access/sensitive sites. No pile-driving needed, therefore less expensive. Can be filled with soil and rock, then planted. Used elsewhere in salt water environments. Can contain oyster shell, attracting a living crust of filter-feeding shellfish.	If walked on, may cause degradation. Life expectancy varies with installation method; sometimes last only a few years, sometimes 50 years. If PVC coating is scratched, wire quickly rusts. Wires can be cut by vandals. May be vulnerable to damage from big boats.
Plastic Gabions	Material is durable in ultraviolet and cannot rust. If walked on, plastic is more resistant to degradation than wire. All other attributes of wire gabions, above.	All attributes of wire gabions except rust.
Recycled Tire Gabions	Flexible and porous. Very durable in saltwater; not subject to corrosion. Much thicker and stronger than marine-grade plastic. Much harder to vandalize. Durable if hit by large boats. Durable if walked on. Uses a recycled material. Familiar nautical material, e.g. used on tugboats and elsewhere in the area for artificial reefs.	Connotations of undesirability/ "trash"; but less visible if used below tideline. Potential health hazard if burned (emits toxins), but this is not likely in the installation under consideration. No vertical installation was available for study.
Plastic Marine Cell	Cylindrical form more consistent with natural shape of banks than rectilinear modules. All other attributes of plastic gabions.	All other attributes of wire and plastic gabions, except rust.
Reusing Part of Steel Pile Wall	Cost effective method of building a wall foundation.	No ecological value; very little can attach. Reflects waves, creating rougher boating conditions near the shore; if cut well below intertidal zone, the wall's impact on wakes is insignificant. Not porous, so has no role in filtering storm water. Contributes pollutants to the river as it corrodes.

Credits:
Funding and donated professional services provided by the NYSDOS, Division of Coastal Resources; the City of New York Parks & Recreation; Stevens Institute of Technology, Center for Maritime Systems

Project Team:
Harlem River Park Task Force: Thomas Lunke, Co-Chair; Robin Chappelle, Co-Chair; Richard Toussaint, President, Riverton Tenants Association; Members of Community Association of East Harlem Triangle; Wagner Houses Tenant Association; Lincoln Houses Tenant Association; Esplanade Gardens Tenant Association; and Manhattan Community Boards 10 and 11
Metropolitan Waterfront Alliance: Lisanne Beretta; Carter Craft; Porter-Ann Gaines; Alan Gentile; Neal Kronley; Loren Talbot
NYC Department of Parks and Recreation: Michael Bolger, Team Leader for Manhattan; David Carlson, ASLA, Director of Landscape Architecture; Ricardo Hinkle, ASLA, Phase II Project Landscape Architect and Project Manager; Jennifer Hoppa, Deputy Director of Planning; Marcha Johnson, PhD ASLA, Landscape Architect/Waterfront Ecology Specialist, Designing the Edge Project Leader
New York State Department of State: Nancy Welsh, Division of Coastal Resources

Consultants and other participants
Art consultants: Terry Boddie, Jackie Brookner, Michael Lee Poy
Architect consultant: Michael Fishman
Marine Biology consultant: Dr. Michael Judge
Marine Engineering consultant: Dr. Thomas Herrington
Video film maker: Keith Rodan
Model designer/builder: Umit Koroglu
Wave Tank Model testing: Dr. Thomas Herrington, Dr. Raju Datla and Stevens Institute of Technology staff; Dr. Richard Royce, the Webb Institute
Brochure Design: Doris Halle Design
Community Workshop participants: Alice Blank, Justin Bloom, Hannah Brockington, Catherine Brown, Barbara Johnson, Alice LaBrie, Naomi Langley, Lisa Littlejohn, JP Magron, Judith Manning, Florence Middleton, Virginia Montague, Elaine Parker, Alfred Pallter, Daniel Perez, Karen Phillips, John Reddick, Eliza Strickland, Chris Williams

PRINTED ON RECYCLED PAPER WITH SOY-BASED INKS

METROPOLITAN WATERFRONT ALLIANCE
A Project of the Municipal Art Society
457 Madison Ave, 3rd Fl
New York, NY 10022