



New Meadowlands
Meadowlands, NJ



Hunts Point Lifelines
South Bronx, NYC



**Resist, Delay,
Store, Discharge**
Hoboken, NJ



The BIG U
Lower East Side, NYC



Living with the Bay
Nassau County, NY



Living Breakwaters
Staten Island, NYC

Rebuilding with Resilience

Lessons from the Rebuild by Design Competition After Hurricane Sandy

REBUILD
BY
DESIGN



GEORGETOWN CLIMATE CENTER
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Rebuilding with Resilience

Lessons from the Rebuild by Design Competition After Hurricane Sandy

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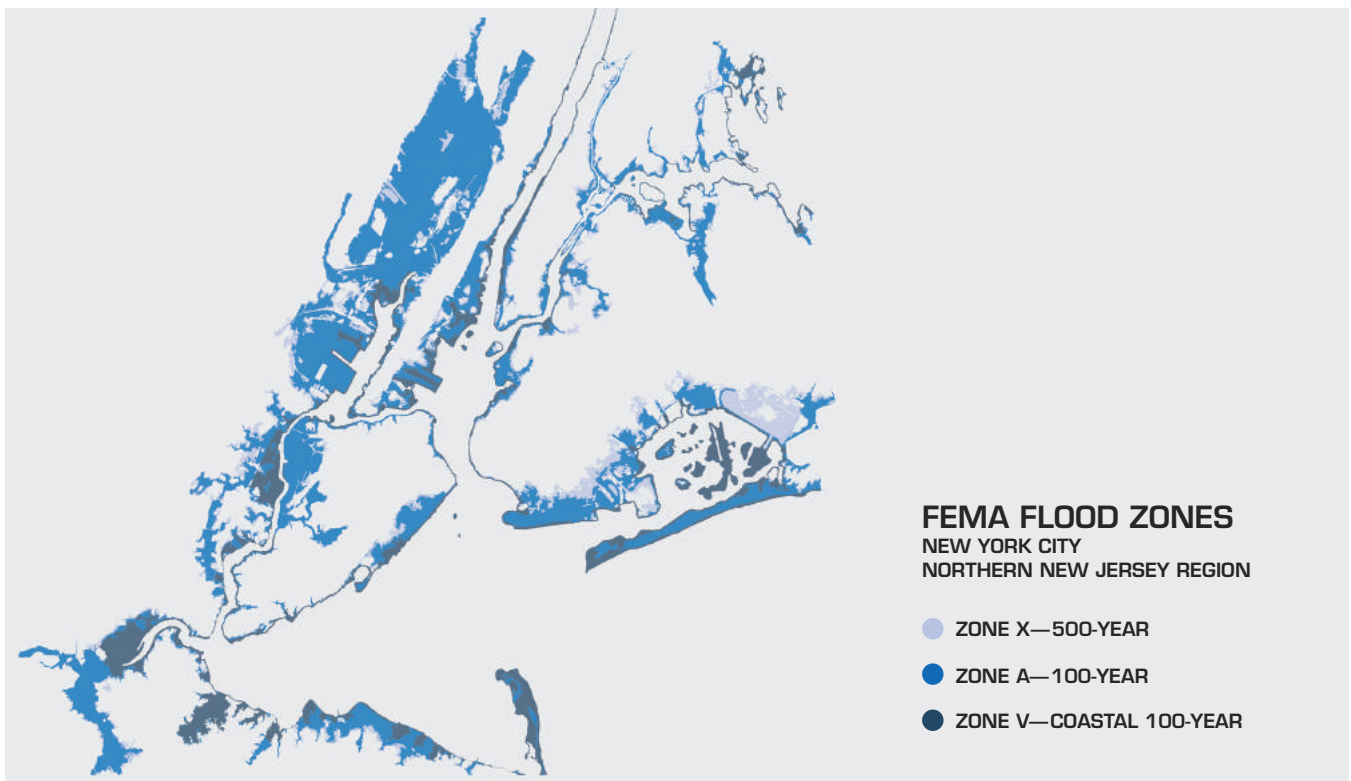
Summary of Lessons Learned

INTRODUCTION

In the aftermath of Superstorm Sandy, the Obama administration, in partnership with The Rockefeller Foundation, launched the innovative Rebuild by Design (RBD) competition, which sought to inspire affected communities to rebuild differently in ways that would enhance their physical, economic, social, and environmental resilience. This report aims to capture and share lessons learned from the innovative process for developing the RBD proposals and the novel projects that were generated through this competition.

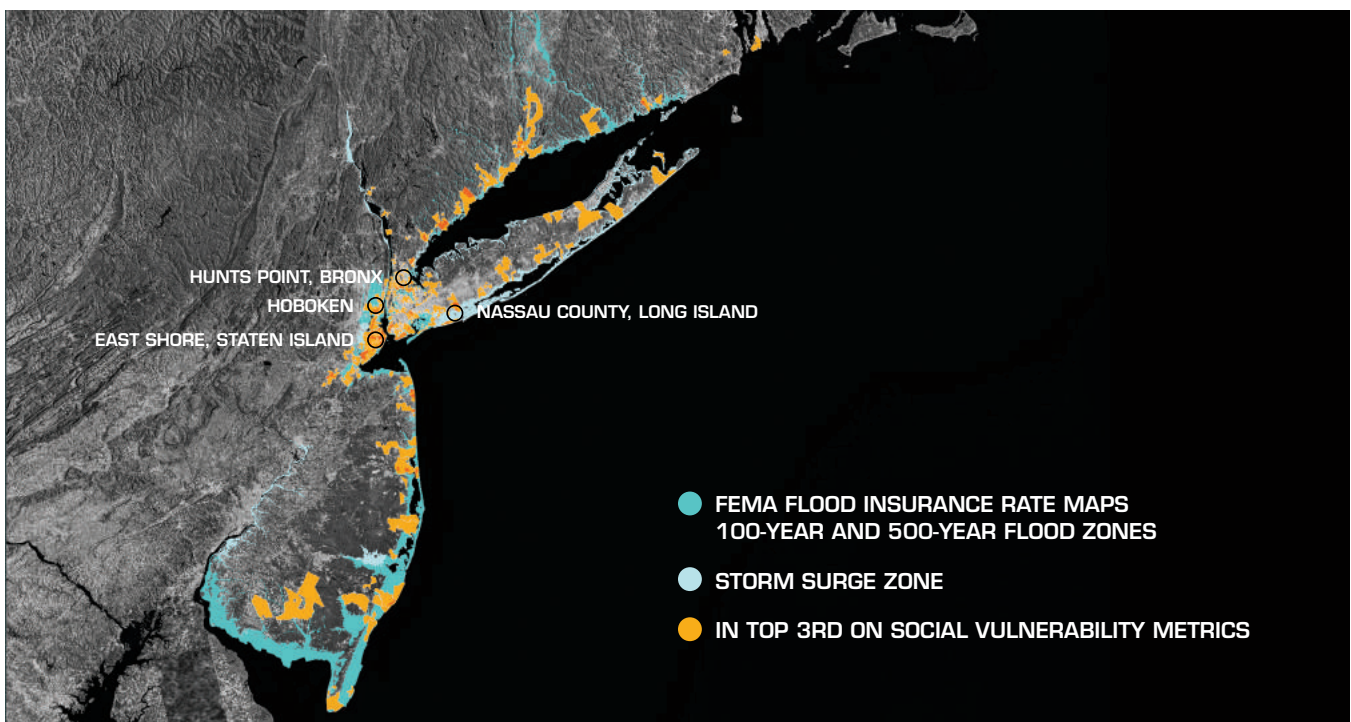
Superstorm Sandy exposed the region's vulnerability to extreme weather: Sandy's 14-foot storm surge overtopped sea walls; city blocks were inundated with 2 to 3 feet of flood water; damaging waves destroyed whole towns along the New Jersey shore; and the storm knocked out power and wastewater treatment facilities across the region.¹ Sandy also provided a glimpse of the impacts the region can expect with additional climate change. Sea levels in this region already have risen 1 foot over the last century (which contributed to the storm's devastation), and are expected to rise by 4 feet or more by the end of this century. The National Climate Assessment estimates that a 2-foot rise in sea levels would triple the frequency of coastal flooding in the Northeast.² In addition, the region is anticipated to experience an increase in rainfall and heavy downpour events, causing more interior flooding, combined sewer overflows, and attendant water pollution. These forces will combine to greatly increase flood risks across the Sandy-affected region and along the North Atlantic coast.

Sandy also exposed the role that chronic societal stressors—such as poverty, lack of mobility, and lack of social cohesion—can play in both increasing community vulnerability and hindering a region's ability to recover from a disaster. Sandy's flooding and power outages trapped people in high-rise apartment buildings and public housing; hospitals had to be evacuated; people were unable to travel to work; small businesses were forced to permanently close; and the region lost already scarce affordable housing. Existing social and economic stressors made it much more difficult for frontline communities to bounce back after the storm.



Flood Risk in the New York and New Jersey Region

Using FEMA floodplain maps the MIT CAU + ZUS + URBANISTEN team analyzed flood risk in the New York and New Jersey metropolitan region showing that 2.5 million people are at risk of flooding during the 100-year flood event. This map shows parts of the region that are vulnerable to the 100- and 500-year flood events based upon historical data.



Social Vulnerability to Flooding

This map overlays flood and storm surge risk for the region with six indicators of social vulnerability developed by HUD: poverty rate, population under 10 years of age, population over 65 years of age, English language proficiency, immigrant population percentage, and rate of disability.

Recognizing the need and the opportunity to build the region back stronger, HUD sought to use the Rebuild by Design competition to not only inspire innovative approaches for rebuilding after Sandy, but also to transform how federal agencies fund disaster recovery. Federal disaster recovery programs were originally designed to help communities rebuild what had been in place before a disaster. As a result, these programs have historically limited the rebuilding of damaged infrastructure and facilities to their *pre-disaster* designs and footprints.³ The President's Hurricane Sandy Rebuilding Task Force (Sandy Task Force), acknowledging the deficiencies of these historical practices, developed the Rebuild by Design competition to inspire a new form of resilient disaster recovery—one where communities were encouraged to build back better and more resilient to future impacts. The competition was designed to stimulate innovation in how federal agencies coordinate disaster recovery efforts horizontally across federal agencies and vertically with state and local partners, both in the administration of disaster recovery funds and in how projects are approved and permitted.

THE REBUILD BY DESIGN COMPETITION

In June 2013, the RBD competition was launched through a partnership between the Sandy Task Force, the U.S. Department of Housing and Urban Development (HUD), and the Rockefeller Foundation, among others.⁴ The RBD competition was a ground-breaking approach designed to spur innovation in the disaster recovery process and to catalyze cutting-edge projects that could demonstrate how communities can rebuild with resilience. In the first stage, 148 interdisciplinary teams (including experts in planning, design, engineering, sociology, hydrology, finance, etc.) applied to participate in the competition. Ten design teams were selected as finalists to develop resilience approaches for reducing the physical and social vulnerabilities of communities that were affected by Superstorm Sandy.⁵

In subsequent stages of the competition, the design teams worked in collaboration with local governments, community organizations, and the public to understand each region's vulnerabilities and to develop proposals for how communities in the region could rebuild with increased resilience. The design teams were required to develop innovative approaches that were both locally appropriate and also regionally scalable. The design teams were also required to address financial and legal feasibility. Proposals had to scope the projects into severable components where the disaster recovery funds could be used to implement one component of the project, with pathways for permitting and funding future phases of work.

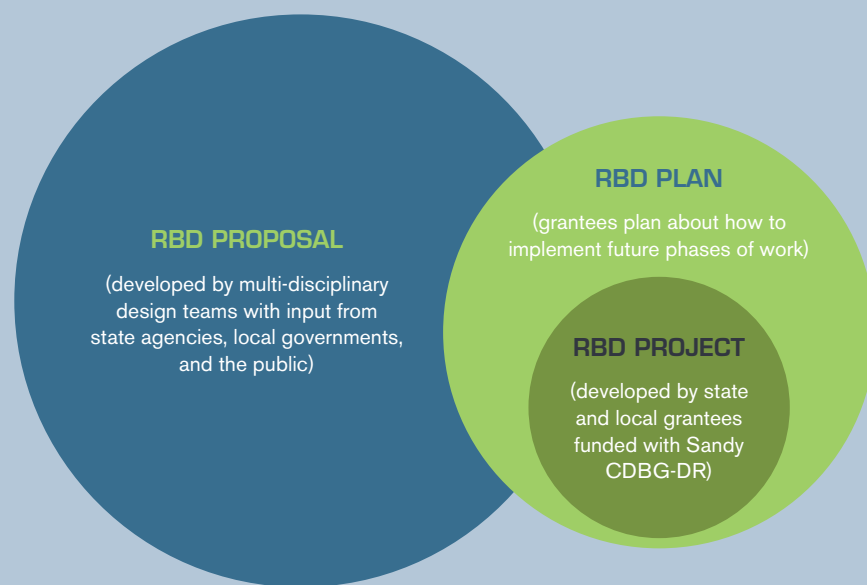
From the ten competing teams, a competition jury selected six winning proposals for implementation. HUD awarded \$920 million in Community Development Block Grant—Disaster Recovery (CDBG-DR) funding⁶ to New York, New Jersey, and New York City to help implement specific projects identified in the RBD proposals:⁷

- **The BIG U**—\$335 million was allocated to build a mix of structural and nature-based flood defenses and recreational amenities in the Lower East Side of Manhattan in New York City, where large blocks of affordable and public housing were affected by the storm. The BIG U proposal called for the integration of nature-based flood defenses into city parks and structural flood defenses (e.g., deployable flood walls) in areas where site constraints limit the feasibility of larger permanent structures. It also called for recreational amenities (like greenways, bike paths, and nature trails) that would enhance these public spaces and improve access to, and connectivity along, the waterfront.

- **Living Breakwaters**—\$60 million was allocated to implement a living breakwater project along the South Shore of Staten Island in Tottenville, New York. The proposal called for natural and nature-based flood protection—including oyster-seeded breakwaters and living shorelines—which together would reduce risks for communities along the southern tip of Staten Island and improve habitats and the environment. The proposal also called for amenities to improve the social resilience of the region by creating “hubs” that could provide recreational, educational, and emergency response functions.
- **Living with the Bay**—\$125 million was allocated to implement stream restoration and green infrastructure improvements along the Mill River in Nassau County on Long Island, New York. The proposal called for a “buffered bay” approach to protect against the region’s multiple water-based threats: sea-level rise, excessive stormwater and wastewater spills, and storm surges. The proposal recommended different interventions for different parts of the watershed to protect against storm surge and coastal erosion at the oceanfront and in the bay, and to better manage stormwater and interior flooding in upland parts of the river system that drain into the bay.
- **Resist, Delay, Store, Discharge**—\$230 million was allocated to implement flood risk reduction measures in Hoboken, New Jersey. The proposal called for construction of a comprehensive water management strategy for reducing the city’s flood risk, including: engineered and landscape-based coastal defenses (or *resist* strategies) to reduce storm-surge flooding, and green and gray infrastructure approaches (*delay, store, and discharge* strategies) to manage stormwater runoff and excess rainwater during heavy rainfall events. When combined, the four lines of defense would reduce flood risks for residential and commercial development as well as for critical assets, such as wastewater and transportation infrastructure.
- **New Meadowlands**—\$150 million was allocated to implement flood risk reduction measures in the towns of Little Ferry, Moonachie, Carlstadt, Teterboro, and a portion of South Hackensack in the Meadowlands region in New Jersey. To rebuild and protect the region from storm surges, the New Meadowlands proposal called for an integrated and linked system of berms (the “Meadowband”) with restored wetlands (the “Meadowpark”) to provide flood protection across the Meadowlands region.
- **Hunts Point Lifelines**—\$20 million⁸ was allocated to assist with continued study, analysis, planning, community engagement, design, and engineering for a pilot project considered in the RBD proposal in the Hunts Point region of the South Bronx in New York City, New York. The proposal called for four integrated components, called “Lifelines,” to build the physical, economic, and social resilience of the Hunts Point peninsula. The proposed components included green and gray flood protection; measures to protect critical economic assets in the region (like the food distribution center); and transportation improvements to increase safety, connectivity, and environmental quality.

While the proposals were developed by the multidisciplinary competition design teams, the funding to implement the projects was allocated by HUD to state and local “grantees” (the State of New York, the State of New Jersey, and New York City). It is these grantees who must now turn the innovative *conceptual designs* (the “RBD proposals”) into *capital projects* (the “RBD Projects”) that can be built with the allocated funding.⁹

FIGURE 1: Relationship of the RBD Proposal to the RBD Projects



This graphic is intended to visualize the relationship of the winning proposal to the actual project that will be implemented with HUD funding:

- The RBD project will be smaller in scope and have a more limited budget than the series of projects identified by the design teams in the RBD proposals.
- The RBD project may also be somewhat different than the projects that were proposed, due to physical, legal, technical, or other constraints.
- As a condition of the funding, the grantee must also develop an RBD implementation plan for how they will implement and finance future phases of work as described in the RBD proposal.

RESILIENCE VALUE

One important innovation that was stimulated by the competition was the “resilience values” that the proposals aim to deliver for these communities. Unlike traditional disaster recovery projects, the proposed RBD projects were not intended to merely reduce risks from extreme “shock” events, like Sandy, but to also provide *everyday* environmental, social, and economic benefits for residents. To this end, the design teams looked across government services and systems to develop more holistic disaster recovery projects that reduced risks while also alleviating long-term stressors (e.g., crime, pollution, poverty, lack of open space). In addition to reducing risk from flooding and climate change, the proposals sought to deliver multiple resilience benefits, including improved air and water quality, increased social cohesion, new job opportunities, increased access to waterfronts and recreational amenities, among other benefits.

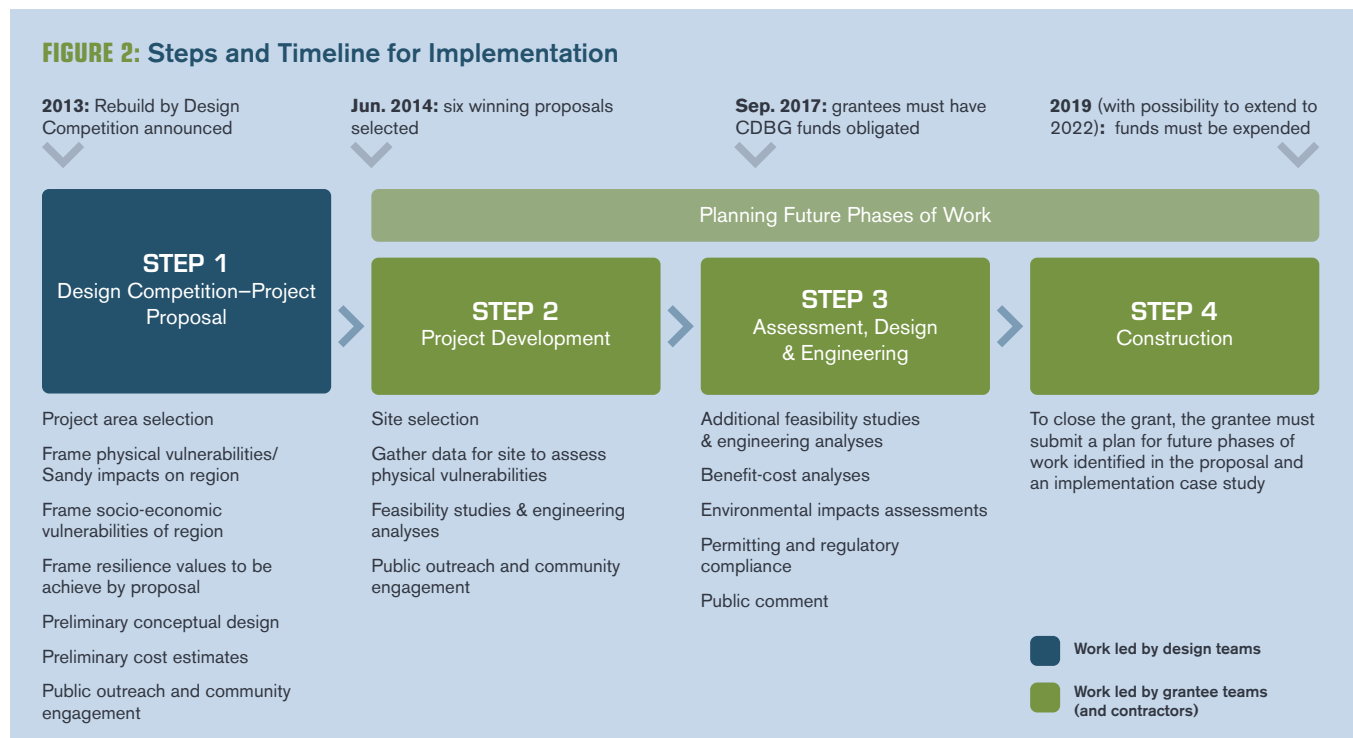
However, as these proposals move into implementation, the grantees are having to work hard to ensure that the resilience values of the project are not lost in translation. Everyday systems and government processes (like cost benefit analysis, permitting, and procurement) are not well equipped to deliver projects that provide multiple benefits across a number of government silos. As a result, implementation of these innovative RBD projects is requiring unprecedented coordination among agencies at all levels of government to ensure that these projects can truly deliver the resilience benefits promised by the proposals.

TRANSITIONING TO IMPLEMENTATION

The structure of the competition and the source of the funding to implement the projects also created two big challenges for the grantees:

- **Funding Gap**—The proposals resulted from a 9-month design competition where the design teams were encouraged to be visionary and “think big” without constraints on the level of ambition. Invariably the funding allocated by HUD to the grantees to implement a specific project was a fraction of the total budget called for in the proposal. As a result, the grantees must make difficult choices about how to scale and scope the ideas envisioned by the proposal into a project that can be feasibly implemented while still delivering the resilience values envisioned by the proposal. The grantees and other beneficiaries are also having to consider longer-term strategies for raising funds to support future phases of work.
- **Tight timelines**—The grantees are under tight timelines to construct the projects and spend their Sandy CDBG-DR funding. The Supplemental Appropriation Act allocating the funds included language requiring that the funds be obligated by no later than September 30, 2017 and expended by 2019, with the possibility of an extension through 2022¹⁰. To obligate the funds, the grantees must have a project design that is sufficiently detailed for HUD to complete an environmental assessment pursuant to the National Environmental Policy Act (NEPA)¹¹ and sign the grantees’ CDBG-DR grant agreement.

In making the transition to implementation, the grantees are facing other project- and site-specific legal, political, and policy challenges. Each grantee is developing inventive approaches for overcoming these challenges (described below), which can be instructive to other state and local decisionmakers who want to implement similar projects in the future.¹² The proposals and the competition process can also be instructive to other federal agencies that support state and local resilience initiatives.



This graphic visualizes the steps and timelines for implementing different Phases of the RBD work—from the RBD proposal phase through the design and construction of an RBD project. Note that in some instances the team that developed the RBD proposal has been hired by the grantee to lead implementation of the project.

PURPOSE & ROADMAP

2016 is the two-year anniversary of the announcement of the winning RBD proposals. It marks an opportunity to take stock of the challenges that the grantees are encountering as they work to implement these ambitious and visionary projects, and to examine the lessons they are learning along the way. The success of these projects will depend on a number of factors:

- **The ability of grantees** to move these projects from concept to implementation, to deliver the range of resilience values described in the RBD proposals, and to develop a longer-term vision for achieving the broader goals of the RBD proposals; and
- **The ability of federal, state, and local decisionmakers** to learn from these projects and to institute broader legal and policy reforms so that these practices can be replicated and scaled throughout these communities and regions, and in other places.

To that end, this report is designed to help others learn from the obstacles and opportunities exposed by implementation of the RBD projects, including:

- **Needed legal and policy reforms**—This report documents how the grantees are navigating and overcoming legal and policy barriers. The hope is that local, state, and federal decisionmakers can use the lessons the grantees are learning to make reforms to laws, policies, and regulations, where needed, so that these types of innovative projects will have easier pathways forward in the future.
- **Opportunities to institutionalize, scale up, and replicate**—To have the broad effect envisioned by the competition, decisionmakers at all levels of government will need to determine how to institutionalize, scale up, and replicate the innovative practices developed through the RBD competition and identified in the RBD proposals. Additionally, to achieve the more holistic resilience visions laid out in the proposals, each of the grantees will need to find other ways to fund and implement future phases of work. The state and community beneficiaries can scale up implementation with other sources of funding and through other regulatory pathways.¹³ State and federal policymakers will also need to figure out how to learn from these RBD projects so that the practices can be encouraged and replicated in other cities, regions, and states. For example, the competition can inform how federal agencies administer disaster recovery programs and other funding sources, and these projects can help regulators at all levels of government improve and streamline permitting of resilience projects.

This report first describes the common resilience interventions that were proposed in each of the winning proposals (e.g., nature-based coastal defenses, green infrastructure, and land-use approaches) and the shared challenges and lessons learned for each of these interventions. It then provides a summary of the legal and policy challenges that the grantees are facing as they work to implement their RBD projects and describes how the grantees are working to overcome those challenges.

After this summary chapter, the report includes individual case studies of each of the winning RBD proposals to describe how each of the grantees are transitioning to develop specific capital-improvement projects that can be implemented with the CDBG-DR funding. These case studies include discussion of the legal and policy challenges particular to each project and the pathways the grantees are exploring for overcoming challenges and scoping future phases of work. The lessons included in this summary are derived from these case studies.¹⁴

RESILIENCE INTERVENTIONS

The RBD proposals included many similar approaches for increasing the physical resilience of communities and addressing the water-based threats common to communities in the New York and New Jersey region. This section describes these approaches (or “resilience interventions”), which include natural and structural flood defenses, green infrastructure approaches for managing stormwater, and land-use (or “nonstructural”) strategies for ensuring that public and private development is designed and sited to be more resilient to flooding. This section discusses the common legal and policy challenges that the grantees are facing as they work to implement these resilience interventions, and describes opportunities for scaling and replicating these approaches throughout the project areas, and more broadly across these cities, the region, and beyond.

FLOOD DEFENSES¹⁵

Most of the damage from Sandy resulted from storm surge; consequently, all of the RBD proposals focused, in one way or another, on interventions to reduce impacts from extreme storms. Sandy brought 12- to 14-foot storm surges, which overtopped flood defenses, battered beaches and wetlands, and inundated communities up and down the coast with several feet of floodwaters. This region is also anticipated to see 4 feet or more of additional sea-level rise over the next century, which will increase flood risks.¹⁶

As a result, all of the winning proposals developed innovative ideas for building “berms with benefits” — flood control structures that can provide other important everyday environmental, social, and economic benefits:

- **The BIG U proposal** called for integrating flood protection into a city park and using deployable flood walls underneath raised highways where space is constrained;
- **The Living Breakwaters proposal** called for the construction of breakwaters that would double as oyster reefs to dampen storm surge, enhance marine habitats, and reduce or reverse erosion of beaches; and
- **The Living with the Bay proposal** called for living shorelines, restored marshlands, and constructed barrier islands to provide natural defenses to storm surge.

The RBD proposals also often called for combining “gray” structural flood protection devices (such as berms or breakwaters) with “green” natural and nature-based approaches (such as restoring wetlands) to reduce impacts from storm surges. “Green” or “natural” defenses refer to approaches that restore, mimic, and enhance natural coastal features to reduce coastal flooding and erosion risk, including beach nourishment, dune management, living shorelines,¹⁷ and wetland restoration. Natural defenses are a more ecologically beneficial way of addressing coastal flood risk compared to traditional “gray” or “structural measures,”¹⁸ which rely on engineered structures designed to decrease shoreline erosion, dampen wave action, and protect against flooding. Structural measures include levees, storm surge barriers, sea walls, revetments, groins, and breakwaters.

FIGURE 3: Structural or "Gray" Coastal Defenses



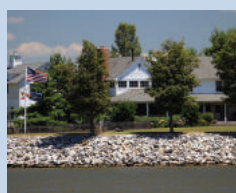
Levees

Levees are man-made structures, often earthen embankments, designed to control or divert floodwaters to reduce flood risks.



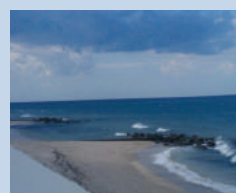
Storm Surge Barriers

Storm surge barriers are often included within a levee system and include movable gates that stay open during normal conditions to allow natural water flow, but that can be closed to protect against storm surges.



Seawalls & Revetments

Seawalls are onshore structures built parallel to the shoreline with the purpose of preventing flooding. Revetments are onshore structures designed for the purpose of reducing erosion.



Groins

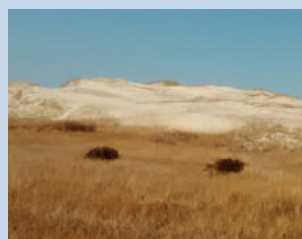
Groins are structures built perpendicular to the shoreline for the purpose of stabilizing the shoreline, reducing erosion, and capturing sediment.



Breakwaters

Breakwaters are offshore structures built parallel to the shoreline with the purpose of reducing wave energy to reduce shoreline erosion.

FIGURE 4: Nature-based or "Green" Coastal Defenses



Dunes & Beaches

Beaches can be nourished, dunes can be built, and sediment can be managed to create beach systems that dissipate wave energy.



Restoration

Restoration of coastal wetlands and ecosystems can provide important flood risk reduction benefits. Wetlands vegetation slows storm surges and improves water quality. Living shorelines combine natural coastal features and structural components (such as low rock sills).



Reefs

Oyster and coral reefs attenuate wave action and can reduce shoreline erosion. Oyster reefs can be restored to provide offshore living breakwaters.



Barrier Islands

Barrier islands provide a first line of defense against storm surge. Management of barrier islands can preserve the important flood risk reduction benefits provided by barrier island systems.

Hybrid “green-gray” approaches to flood protection, however, can be complicated and time consuming to design, permit, and build. Natural-defense projects can trigger onerous permitting involving federal, state, and local regulators.¹⁹ These projects can encounter state and federal regulatory barriers because they often involve “in-water” components (such as low rock sills or the placement of fill), which can affect navigability, sensitive aquatic habitats, water quality, and wetlands. For example, in New York, the placement of fill in a tidal wetland is considered a “presumptively incompatible use” under state law. To receive a permit, the grantees will need to show that the project will protect, preserve, and enhance tidal wetlands.²⁰ To implement the natural-defense

components of the RBD proposals, many of the grantees will need to navigate complicated and time-consuming federal and state permitting requirements. But regulators can learn from implementation of these projects to reform regulatory programs to ensure more streamlined permitting for natural-defense projects in the future.

In addition to the legal obstacles, both green and gray approaches raise interesting policy challenges. While green approaches are more environmentally friendly and can provide valuable natural amenities for residents, the level of storm-surge protection provided by green approaches alone may in some cases be insufficient for certain types of critical infrastructure (e.g., wastewater treatment facilities), and the environmental benefits they provide can be difficult to quantify with existing data and tools.²¹ In contrast, while gray approaches are thought to provide a more certain level of protection, they can have environmental impacts on habitats and ecosystems, are not visually appealing, can obstruct views and access to the waterfront, and are costly to build and maintain. The grantees are balancing both the legal and policy trade-offs as they seek to design, permit, and get public support for different approaches for building coastal flood defenses. Once constructed, the RBD projects will provide important data on the performance of these approaches.

Other challenges that the grantees are navigating to implement innovative flood-defense projects are described in the legal challenges section below and in the individual case studies.

GREEN INFRASTRUCTURE²²

In addition to the challenge of reducing impacts from sea-level rise and coastal storms, local governments in the Sandy-affected region face serious challenges managing urban stormwater (surface water runoff resulting from rainfall or snowmelt). Climate change will cause more intense storms and heavy downpours. These changing precipitation patterns—when combined with aging infrastructure, watershed deforestation, and increasing amounts of impervious surfaces such as roadways and parking lots—will exacerbate urban flooding and the pollution of waterways.

In response to these challenges, cities across the country are beginning to innovate with a wide array of new “green infrastructure” approaches that reintegrate natural elements into traditionally impervious urban environments to retain and treat stormwater where it falls. Green infrastructure approaches utilize nature-based strategies instead of the century-old practice of relying exclusively on centralized “pipes and pumps” to capture and channel rainwater away as quickly as possible. These approaches also provide an attractive alternative to traditional concrete (or “gray”) infrastructure by replacing paved and hard surfaces with surfaces that are vegetated or permeable. Permeable pavements and green roofs both capture rainfall and retain it on site, keeping it out of the stormwater system.

Several of the RBD proposals recommended use of green infrastructure to manage stormwater and interior flooding while also providing other amenities:

- **The Resist, Delay, Store and Discharge proposal** for Hoboken called for the broad deployment of green roofs, bioswales, and permeable pavement;
- **The BIG U proposal** called for “Green Streets” and integration of green infrastructure into public housing; and
- **The Meadowlands proposal** called for a “green infrastructure berm,” green roofs, and enhancement and creation of open space.

Such green infrastructure approaches can provide multiple co-benefits that are not delivered by traditional gray approaches. In addition to managing stormwater, green infrastructure can reduce the urban heat island effect,²³ improve air quality, provide wildlife habitat, double as recreational and open space, and help sequester greenhouse

gases. Many cities also are linking their programs with workforce development and local hiring policies to ensure that investments in green infrastructure are leading to job opportunities for economically disadvantaged residents.²⁴ Green infrastructure also provides an opportunity to educate the public about water quality and other environmental issues.

FIGURE 5: Green Infrastructure Approaches



Street Features

Green infrastructure approaches can be incorporated into street design with permeable pavements, bioswales, tree pits, green streets, green alleys, and green parking.



Building Features

Buildings can be “greened” with green roofs, downspout disconnections, and rain barrels.



Landscape Features

Landscapes can be used to manage stormwater with rain gardens, urban tree canopy, land conservation, stream buffers, and stormwater parks.

While most of the grantees are currently exploring capital projects to install green infrastructure on publicly owned lands and right-of-ways, green infrastructure must be deployed broadly throughout a watershed in order to be an effective method for managing stormwater. To ensure this broad deployment, local governments in the project areas will need to require or encourage the use of green infrastructure on both public and private lands. Many of the communities where RBD projects will be implemented are already experimenting with and planning for green infrastructure. New York City and Hoboken, in particular, have created green infrastructure strategic plans, and New York City has made significant progress in designing and building green infrastructure pilot projects and studying the effectiveness of current installations. In all cases, however, more opportunities exist to fully integrate green infrastructure into regular government operations, such as street design, and into regulatory processes such as building and zoning codes, and landscaping and stormwater ordinances, among others.²⁵ Local governments in both New York and New Jersey have authority over zoning codes and general government functions such as street paving and design. Therefore, the state grantees (i.e., all but New York City) will need to work closely with their local government partners in the project areas to help them implement policies that can ensure a broader deployment of green infrastructure over the longer term.

LAND-USE APPROACHES²⁶

Many of the RBD Proposals also called for the use of land-use approaches to reduce flood risks to private development, direct new development out of harm’s way, and generate tax revenues by allowing higher density development in “high and dry” areas:

- **The Living Breakwaters proposal** called for structures near the shore to be elevated and designed to withstand flood impacts;
- **The BIG U proposal** called for public housing retrofits using a “wet feet” strategy where the first floor would be designed to be floodable;
- **The Living with the Bay proposal** called for buying out structures in flood-prone areas and allowing additional density (i.e., upzoning) in “high-and-dry” areas that have lower risk of flooding and are close to transit.

FIGURE 6: Land-Use (or “Non-Structural”) Approaches



Floodplain Management

State and local governments can implement comprehensive floodplain management planning and regulations to preserve and enhance natural floodplains



Elevation

Governments can require that structures be built to withstand greater flood impacts through land-use regulations and building codes. For example, residential structures can be elevated with additional height to account for future sea-level rise.



Floodproofing

Governments can require non-residential structures to be floodproofed with deployable floodwalls, flood-resistant materials, or by elevating utilities.



Relocation

Flood-prone properties can be acquired and relocated out of harm's way

These types of strategies must, however, be implemented by local governments. Both New York and New Jersey are “home rule”²⁷ states where land-use authority has been delegated to local governments. Thus, similar to the green infrastructure approaches, the state grantees will need to work with the individual municipalities within each project area to facilitate implementation if these approaches are to be adopted. The good news is that municipalities have many tools in their toolbox to ensure that new development and redeveloped areas are more resilient to flooding. Municipalities can use zoning and floodplain ordinances to require private development to be built or retrofit to be more resilient to flood impacts. Municipalities can also provide incentives, grants, and tax breaks to encourage landowners to design structures to be more resilient to flooding or to preserve floodplains as natural open space. Some Sandy-affected communities, like New York City, have already taken steps to remove barriers in zoning rules to allow structures to be rebuilt to be more resilient to flooding.²⁸ Although large cities, like New York City, have the needed technical capacity to undertake these legal changes, smaller cities in the region may need technical assistance and funding to help them design and adopt the “flood-smart” land-use approaches identified in the RBD proposals (as described in more detail below).

SUMMARY OF LESSONS

The challenges the grantees have worked to overcome on their paths to implementing these innovative RBD projects provide important lessons for others seeking to build resilience across the country. Their work also offers important lessons for federal agencies administering funding programs or providing technical assistance. This section of the report summarizes the key lessons from all of the RBD projects.

THE DESIGN COMPETITION MODEL

The RBD competition showcased an innovative approach for allocating federal disaster recovery funds and bringing the expertise of multi-disciplinary design teams to disaster-affected communities. The process captivated the public’s imagination, generated excitement, and inspired new ideas for building community resilience. However, the design competition approach created some challenges when the grantees transitioned from concept to implementation.

- **Mismatch with city and regional priorities**—The competition brought experts from a diversity of countries and disciplines (engineering, architecture, hydrology, sociology, etc.) to help inspire innovation in the rebuilding process. While the competition sought to encourage close coordination among the design teams, state and local officials, and the public, the designs were judged based upon their creativity and innovation.²⁹ This has proved challenging for the grantees who are responsible for implementation but who did not lead development of the proposals. Some are now struggling with how to reconcile these projects with other existing community priorities and goals. The design teams that worked closely with state and local government officials and the public developed proposals that were easier to implement because they built upon and were consistent with established community priorities and plans (developed before or in the immediate aftermath of Sandy). With future competitions or other competitive grants, federal agencies should continue to encourage and require design teams and contractors to coordinate closely with state and local decisionmakers and consult existing plans to ensure that the projects they develop are easier to implement and consistent with local priorities.
- **Community engagement and public expectations**—The design competition appropriately emphasized community engagement and outreach; in the design phase, many teams worked closely with community stakeholders using creative approaches for engaging with residents. Extensive public engagement successfully brought new people and groups into the conversation and generated excitement and interest in resilience. It also increased the level of understanding around current and future vulnerability as well as the need to address it.³⁰ As a result of this engagement, however, public expectations were raised, and the grantees now face challenges managing expectations as they work to implement the projects with constrained budgets. Because the available funding will only support construction of a piece of the larger vision, grantees face the difficult task of delivering the news that the project may be reduced in scale or scope, and that the direct benefits of the project may flow to smaller geographic areas, fewer jurisdictions, or fewer residents. Nevertheless, some communities, like Hoboken and New York City, have used the competition as inspiration to find funds for future phases of work and to adopt policies to support additional implementation. And all of the grantees reported that going through the iterative design process and evaluation of alternatives with the community has led to better projects with stronger public support. State and local grantees and federal agencies can learn from the engagement processes inspired by the competition to encourage replication of these approaches in the development of future projects and plans—approaches that move beyond historic practices of “checking” the public outreach box to practices that result in true collaboration with community partners.

FUNDING CHALLENGES

As described above, the funding allocated to the grantees was, in most cases, a fraction of what it would take to implement the grand visions laid out in the RBD proposals. The grantees’ efforts to nonetheless implement ambitious and visionary projects provide many lessons for improving project design and the administration of funding programs generally.

- **Need for a long-term view**—The RBD competition demonstrates the importance of developing projects that can be phased over time as one way for designers and agencies to manage the funding gaps inherent in any large-scale infrastructure project. The RBD funding was never intended to fully fund the ideas put forth in the proposals. Instead, it was intended to catalyze investment in these innovative proposals, applying the concept: “If you build it, they will come.” During the RBD process, the design teams were required to anticipate funding limits and develop project “components” or “compartments” that could be implemented progressively as grantees identified additional funding. By taking a longer-term view when designing these comprehensive resilience projects, designers and states can theoretically lay the groundwork for successive stages of work. This approach has proven particularly helpful for New York City’s BIG U proposal, which the

design team divided into three compartments that could be constructed individually. New York City is using its RBD funding to implement Compartment 1 in the Lower East Side. The city is drawing on funding from the National Disaster Resilience Competition and city sources to support an additional phase of work. Still, New York City and other grantees will need to figure out how to fund and implement future phases of work. At these early stages of implementation, many grantees are still struggling to raise additional resources. In some cases, the full resilience value of the original proposals may go unrealized because the grantees are not able to raise the needed funds during these critical early stages of design, engineering, and construction. For example, without additional funds, some grantees may have to build smaller scale flood-defenses, which will mean that the community foregoes protection from higher-intensity storms or greater sea-level rise. This suggests that the grantees need assistance from partners (federal or state agencies, universities, and non-profits) to help them identify funding sources and financing strategies both in the short term, to implement the intended resilience benefits during this current phase of work, as well as longer-term strategies to allow them to phase in additional project components over time. Federal agencies should also monitor these projects to test assumptions and determine whether additional sources of funds in fact flow to these projects over the longer term and how the grantees are able to develop additional resources.

- **Quick timelines**—The funding challenge is compounded by the fact that the grantees are on tight timelines to spend their disaster recovery dollars, which is forcing the grantees to focus on designing projects quickly and limiting their capacity to identify other sources of funding. Although it was hoped that the grantees would be able to leverage other public and private sources of funding, grantees have struggled to do so. Public sources (such as local or state funds) are constrained and often pre-committed through capital-budgeting processes that lock in budgets many years in advance.³¹ Additionally, the grantees lack capacity to seek out other philanthropic or private sources of funds or apply for competitive federal grants under these time frames.
- **Disaster recovery funding sources**—The RBD process also brought attention to the challenges of using federal funding programs, specifically disaster recovery programs, to fund large-scale resilience projects. Despite HUD’s creative allocation of CDBG-DR funding through the RBD competition, federal disaster recovery funding programs are not well suited for these types of holistic community rebuilding efforts. Federal recovery programs were designed largely to provide funds to restore communities as they were *before a disaster*, not to rebuild them to be more resilient to future catastrophes. Disaster recovery programs also tend to be reactive and backward looking, flowing only to those areas immediately affected by the disaster. This limits the ability of grantees to fund interventions that could more holistically reduce the full suite of future risks faced by the region or community.³² This challenge raises two lessons from Rebuild by Design. First, grantees will need to identify other funding mechanisms and pathways for implementing additional phases of work if they are to holistically reduce risks—the RBD funding alone will be insufficient. For example, grantees focusing on building storm-surge protection with their RBD funding will also need to find ways to ensure that drainage and green-infrastructure improvements are made in the project areas either through other funding sources or through land-use approaches (e.g., zoning code or stormwater ordinances). Second, federal agencies and Congress must find ways to give grantees more flexibility to use disaster recovery dollars in ways that do not merely react to the last disaster but, instead, allows them to rebuild differently in more holistic ways and with climate change in mind.
- **Administrative mismatch between federal funding programs**—Grantees are also facing challenges combining funds from multiple federal (or state) programs because each program comes with its own procedural and administrative requirements. This is particularly challenging for disaster recovery efforts, which are funded through many different federal programs.³³ Each of these has different rules and

timelines for how and when the funds are made available to state and local grantees, making it difficult for grantees to combine streams to support comprehensive rebuilding visions. For example, FEMA's benefit-cost analysis (BCA) process is different from HUD's and the Army Corps of Engineers'.³⁴ As a result, the BCA developed for one agency may not meet requirements of another. These challenges are exacerbated by the fact that these innovative, large-scale projects require more complex permitting and environmental review, and better coordination across agencies and jurisdictions. Federal agencies should try to coordinate administrative requirements to the maximum extent possible to allow grantees to combine different sources of funding to support more comprehensive resilience initiatives.

- **Programmatic silos of different funding sources**—In addition to having different rules, federal funds are often constrained by programmatic silos where certain sources can only be used for certain types of projects. These funding silos have limited the ability of the grantees to use other federal funds to support implementation of the RBD projects. For example, FEMA funds are often limited to projects that demonstrably reduce flood risks. So grantees often struggle, for example, to justify the use of hazard mitigation funds to support investments in green infrastructure approaches for managing stormwater.³⁵ EPA funds, in turn, are often limited to improving water quality, which complicates their use for hazard mitigation. As a result, it is difficult for grantees to justify the higher costs of larger-scale green infrastructure projects that will both reduce flood risks during higher-intensity, lower-frequency storms and improve water quality. If these funding sources could be more easily combined, or if grantees could use co-benefits to justify investments in these types of multi-benefit projects, grantees could implement more holistic approaches that deliver a wider range of resilience benefits (e.g., improved water quality and flood-risk reduction benefits).³⁶
- **Limitations with CDBG-DR funding**—Although CDBG-DR is more flexible than other disaster recovery programs, it also comes with its own limitations that can inhibit implementation of large-scale resilience projects. In keeping with CDBG-DR's statutory mandate to provide assistance to low- and moderate-income (LMI) communities, 51 percent of the grantees' expenditures must benefit these groups.³⁷ This requirement has been challenging because the grantees received "pre-packaged" projects that were selected by the competition jury. As a result, the grantees have limited flexibility to redirect the projects to areas with higher percentages of LMI residents. Moreover, the benefits of these types of large-scale infrastructure projects, like the RBD projects, flow to geographically and economically diverse areas, which often dilutes the percentage of LMI residents benefited.³⁸ Federal agencies should consider how they can give grantees more flexibility in the expenditure of the funds (through waivers or other mechanisms) so that the grantees are not penalized for implementing the project that was selected through the design competition or for having an ambitious project that benefits a large area.
- **Long-term operations, maintenance, and monitoring**—Long-term maintenance, operations, and monitoring are not eligible expenses under the CDBG-DR program (nor under many other federal programs) and grantees must therefore identify funding or financing options for this work on their own. Monitoring is especially important for these types of innovative resilience projects because data can help demonstrate the efficacy of novel approaches and inform the deployment and refinement of future projects. To support monitoring, many of the grantees are trying to develop early relationships with academic institutions as they collect baseline data and set up monitoring programs. It is hoped that these relationships will make these institutions more competitive for other federal grants that could be used to support long-term monitoring of the projects. Grantees could also use support from partners (federal and state agencies, universities, and non-profits) to help identify sources of funding or financing strategies that can be used to support long-term maintenance, operations, and monitoring.

- **Incentives for pre-disaster planning and mitigation**—The RBD proposals show that pre-disaster plans can set a foundational vision for how a community can rebuild more resiliently in the aftermath of a disaster. However, communities only receive these large influxes of federal money *after* a disaster. Far fewer resources are available for pre-disaster planning and mitigation, which can help to prevent or reduce impacts before a disaster strikes. State and local governments should dedicate more funds to planning and mitigation *before* a disaster occurs. And federal agencies, Congress, and even the private sector (e.g., insurance companies and bond-rating agencies) should consider ways that they can provide incentives and reward communities that proactively take steps to reduce their vulnerabilities. This would facilitate more thoughtful and holistic post-disaster rebuilding and could spur projects that deliver multiple community benefits and reduce future losses.

LEGAL CHALLENGES

Innovative resilience projects raise many legal challenges related to permitting, intergovernmental coordination, and procurement, among others. The RBD experience has identified opportunities to reform regulatory programs and improve coordination among jurisdictions and levels of government.

- **Permitting barriers**—Many of the RBD proposals called for innovative hybrids of natural and structural flood defenses. By integrating environmental components (e.g., seeding breakwaters with oysters in the Living Breakwaters project), flood defense projects can be engineered to provide multiple benefits in addition to reducing flood risks. However, these types of hybrid approaches are new and untested in this region and, as a result, will trigger complicated and time-consuming state and federal permitting requirements. The RBD projects are offering lessons that can be instructive for both design teams and regulators. Design teams can ease implementation of innovative natural defense projects by anticipating legal barriers and exploring design alternatives that avoid those barriers (e.g., the BIG U flood protection could be built without “in-water” elements to avoid permitting requirements). They can also ease implementation by working early with regulators to ensure that the project is being designed to meet the permitting criteria used by the different regulatory agencies (e.g., the Living Breakwaters team used the Technical Coordinating Teams (described below) to address regulatory concerns about potential impacts to shipping channels and marine habitats early in the design phase. Regulators, in turn, can learn from these RBD pilots to refine and streamline permitting processes across federal and state agencies, remove legal barriers, and ensure that these types of multi-benefit approaches can be permitted more easily in the future.
- **Interagency coordination**—Because of the number of agencies involved and the diverse interests of those agencies, permitting nature-based projects has historically been time-consuming and challenging in many parts of the country.³⁹ In most states, permitting a natural-defense project requires the iterative review of the various agencies charged with managing impacts to specific resources, including the Army Corps (navigation), EPA (water quality), and the National Marine Fisheries Service (habitat and fish species). And any individual agency can raise objections late in the permitting process. To preempt these types of delays in obtaining permits for the RBD projects, HUD convened local, state, and federal regulators through Technical Coordinating Teams (TCTs) to get early input from the full range of officials and regulators who will need to approve these projects.⁴⁰ It is hoped that the TCTs will help streamline and coordinate review across the relevant agencies for the RBD projects. The benefits and challenges of the TCT model for facilitating Sandy recovery should be explored and communicated. The TCT model could also be continued and expanded as a way to coordinate and speed up permitting generally and for future disaster recovery efforts specifically.

- **Land ownership**—Project designers need to consider land ownership when they propose large flood-protection systems, particularly when the land needed is not already publicly owned and where there is not funding or political support for the use of eminent domain to acquire needed parcels. With the BIG U project, the design team facilitated implementation by purposefully limiting the proposed project site to government-owned land (city parks and rights-of-way). The Meadowlands design team also sought to maximize sites on publicly owned land, but the team had to consider sites that were privately owned in the proposal because most of the waterfront land in the Meadowlands region is in private ownership. This is making it challenging for the grantee, given the deadlines for spending the RBD funding, because acquiring the private lands needed to construct the proposed berm system would be costly and time consuming. As a result, the grantee is having to reevaluate a variety of different alternatives for the Meadowlands project to identify an approach that can be feasibly implemented given land, budgetary, and time constraints.
- **Levee certification**—For projects involving the construction of levees, berms, or other flood defenses, HUD is requiring that the grantees “take action”⁴¹ to pursue levee certification from FEMA. FEMA certifies levees that provide flood protection from a 100-year flood event.⁴² Properties protected by a FEMA-certified levee can be exempted from having to carry flood insurance, providing significant cost savings to homeowners and businesses. HUD worked to ensure that the design teams and grantees were in frequent and ongoing contact with FEMA to discuss the proposed designs and project alternatives. However, FEMA has not been able to provide any definitive guidance to the grantees on whether the innovative RBD designs will be certifiable once constructed. FEMA should update guidance to establish clear criteria for how innovative green-gray flood defense projects (like the RBD projects) can be designed and constructed to receive FEMA-certification and what kind of modeling is required to demonstrate the protectiveness of nature-based, flood-risk-reduction projects. Proponents of nature-based approaches need more certainty that the project they build can be certified, so that they are not pushed to more conventional gray approaches to ensure certification.
- **Wetlands restoration**—Contamination has been a challenge for implementing several of the RBD projects that proposed wetlands restoration activities to improve ecosystems and provide nature-based protection from storm surges. For example, the Hoboken and Meadowlands proposals both called for the restoration of wetlands, which is not being pursued because of regulators’ concerns that restoration efforts could stir up contaminated sediment with consequences for water quality and public health. Regulators should help find ways to promote restoration projects that reduce contamination over the long term, while also providing the important ecological, recreational, and flood-risk-reduction benefits that will accrue from restoring these systems. EPA, the Corps, and others should promote research on strategies for restoring contaminated wetlands in ways that reduce potential short-term impacts to water quality and public health.
- **Local opposition and environmental review**—Environmental reviews required by the National Environmental Policy Act (NEPA) are also making it difficult for the grantees to implement these complex infrastructure projects on tight timelines. To comply with NEPA, grantees must identify feasible project alternatives and analyze environmental impacts. Most of this work will need to be completed in order to obligate project funds by 2017. Because NEPA allows for citizen enforcement through litigation, the grantees must work closely with the public to ensure that opposition to the project does not delay implementation. A lengthy legal challenge could make it difficult to spend the funding by 2022 (as required by the Appropriation Act). A benefit of the RBD process has been the focus on extensive and ongoing community engagement. In most instances, this engagement has helped build public support and created stronger project alternatives, which may ease the NEPA process for these projects.

- **Procurement**—Inflexible procurement rules can also limit the ability of the grantees to hire the multi-disciplinary teams of experts needed to implement these complex resilience projects. State rules have historically created separate processes for procuring design and construction services. Whereas state agencies can contract for *design* services based upon the expertise and qualifications of the contractors, *construction* of “public works” contracts (i.e., contracts for the construction of public buildings and facilities) often require state agencies to hire contractors through a competitive process where the contract must be awarded to the *least-cost* responsible bidder.⁴³ While these state procurement rules were put in place to ensure competition and the responsible use of taxpayer dollars, this traditional system of procurement can restrict innovation and increase the time and budgets needed to implement complex infrastructure projects. Because of the unique process for developing the RBD projects, HUD issued a waiver allowing the grantees to hire the design teams without competition,⁴⁴ and in some instances the grantees were able to use “sole source”⁴⁵ procurement rules to hire the design teams, easing contracting and allowing these grantees to begin work more quickly. However, in other cases, state competitive bidding rules limited the ability of the grantees to hire the competition design team. In New Jersey, for example, the grantee felt compelled to competitively bid the RBD project.⁴⁶ As a result, the grantee was not able to bring on the design team that had the greatest institutional knowledge about the project and it took many months to hire a contractor to begin work, which compounded the state’s challenge of implementing the RBD projects under the tight timelines. In order to facilitate these types of innovative infrastructure projects, state procurement rules need to allow agencies more flexibility to hire contractors based upon cost and other factors including specialized expertise and qualifications, while also maintaining fairness in the contracting process and ensuring sound use of taxpayer dollars. Nonprofits and other institutions could develop model procurement rules or bid documents that states could adopt to give public entities greater flexibility.

LAND-USE CHALLENGES

Many of the elements in the RBD proposals also called for land-use changes—flood resilient development and green infrastructure approaches for managing stormwater—that will need to be implemented by local governments using their powers to regulate the use and development of land. In these early stages of implementation, many of the grantees are primarily focused on implementing the capital-improvement components of projects. However, land-use and other legal changes will be critical for achieving comprehensive resilience in these communities. To fully realize the resilience value promised by the RBD proposals, the grantees (working with other partners) will need to empower local governments to adopt necessary land-use or other policy changes.

- **Flood resilience through zoning**—The RBD capital projects will reduce some flood risk, but will not eliminate all risk in these communities (nor could any public infrastructure project). Land-use regulations, including regulations to direct higher-density uses out of floodplains and to require flood-resilient construction, will be critical to addressing the residual flood risks that these communities face. To facilitate implementation of the proposed “flood-smart” land-use practices, state agencies or federal partners could increase efforts to provide models, technical assistance, financial support, or other incentives to encourage or require local governments to adopt more robust land-use regulations in flood-prone areas.
- **Managing community opposition to zoning changes**—Land-use policies can also face community opposition (particularly with policies like upzoning⁴⁷ that allow additional density or more intensive uses). To effectively address community concerns, local governments need to have dynamic community engagement processes for identifying and resolving problems, and building community support, which requires staff capacity and resources. State and federal partners could provide support and technical assistance to help local officials meaningfully engage with the community on an ongoing basis.

- **Land use as a financing tool**—Land-use policies can also be used to generate tax revenue to finance resilience investments. The RBD projects will provide tangible benefits to the surrounding areas by reducing flood risks, creating new recreational amenities, improving access to waterfront areas, and more. These types of capital improvement projects will often increase property values in surrounding neighborhoods. Many of the proposals called on local governments to try to capture this value through tax increment financing (TIF) or other financing models.⁴⁸ For example, because of Hoboken’s proximity to New York City and transit, the RBD proposal called on the city to implement a TIF district to capture the value of additional development and increases in property taxes. To use these types of financing tools, however, local governments often need help from state and local partners to craft and pass the ordinances needed to implement these types of measures.⁴⁹ If successful, revenues developed could be used to support future phases of work and additional resilience investments.
- **Affordable housing**—Sandy exacerbated the affordable housing crisis in New York City and surrounding communities. Many lower-income homeowners could not afford to fix their homes. In addition, some landlords were forced to leave basement apartments vacant due to enhanced or newly enforced floodplain regulations.⁵⁰ To address this challenge, many RBD proposals called for the development of new affordable housing in “high-and-dry” areas (e.g., Living with the Bay). These types of strategies will, again, require local government action and state and federal support. While there are existing models for using land use to ensure that development is designed and sited to be more resilient to flood impacts and other models for providing affordable housing, there are few existing models combining these two strategies. State, federal, and other partners could help local governments develop zoning regulations or other land-use incentives to require or encourage development of resilient affordable housing in appropriate areas (e.g., out of flood zones, around transit, etc.) or retrofits to existing housing. These groups can also help develop protections for tenants who might face rent increases as a result of new or newly enforced building codes requiring resilient construction.
- **Regional coordination**—Sandy demonstrated that the impacts of climate change will not respect jurisdictional boundaries and that solutions often need to be implemented at a regional scale. Regional coordination can help communities pool resources to implement more holistic and cost-effective resilience projects. It can also help jurisdictions avoid solutions that will exacerbate risks to their neighbors. To address this need, many of the RBD proposals developed resilience approaches at a watershed or landscape scale crossing multiple jurisdictions. The Living with the Bay proposal, for example, included projects spanning several different small municipalities and the county. Implementation at this scale, however, is uncommon and uniquely difficult. Smaller municipalities, in particular, have limited capacity and resources, which makes coordination even more challenging. To manage these difficulties, New York convened Executive Steering Committees to provide a forum for regular “check-ins” with local leaders to deliver updates, hear feedback, and address problems. The state is also using the CDBG-DR funding as a “carrot” to build local capacity to manage, maintain, and scale-up resilience investments after project completion. Local public works officials will receive training on the use and maintenance of green infrastructure. Federal agencies could encourage more regional coordination by providing funding and other resources to help state and local governments develop regional governance models for building resilience. In one successful example, HUD provided support for regional planning through its Sustainable Communities Initiative, however this program has not received funding from Congress in recent years.

DATA AND INFORMATION NEEDS

State and local policymakers also need data and information to help them assess their risks and design projects to effectively address vulnerabilities, which will be compounded by climate change and existing social and economic stressors. This information must be detailed enough to help inform the design and engineering of projects that

address both extreme shocks and chronic stressors. They also need tools and resources to help them monitor the efficacy of resilience approaches once implemented.

- **Projecting future risk**—In order to prepare for climate change, communities need good data, tools, and maps to understand how sea-level rise and changes in precipitation will likely affect their region and exacerbate their flood risks. This information must be translated so that it can affect the engineering and design of projects on the ground. For example, the primary tool that state and local governments currently use to assess flood risks are the Flood Insurance Rate Maps (FIRMs) developed by FEMA, which are based on *historical* flood data only. In the aftermath of Sandy, a variety of federal agencies worked together to overlay sea-level-rise projections on the FIRMs for the region to inform state and local rebuilding efforts. In addition, over the past several years federal agencies have rolled out a series of new tools and portals such as the US Climate Resilience Toolkit and NOAA’s Climate.gov, Digital Coast, and sea-level rise viewer.⁵¹ Federal agencies should evaluate how grantees and others are using these maps and tools to determine whether they are providing the right information at sufficient levels of detail to inform the design and construction of resilience projects that account for future climate risk. If not, federal agencies should continue to work with state and local partners to improve and enhance these tools and other products to ensure that they are effectively informing local resilience planning and project implementation.
- **Long-term monitoring**—As described above, to build support for these types of innovative resilience approaches, grantees will need to assess the effectiveness of the RBD projects across the range of benefits that they are intended to deliver. In addition to funding long-term monitoring after the project is complete, the grantees must also develop innovative programs that include new metrics for evaluating the economic, social, and other ecological benefits of these projects. Grantees and other partners will also need to package monitoring data in ways that can help demonstrate the effectiveness of the RBD projects. Such monitoring data will be invaluable for communicating the return on investment that these approaches deliver to elected officials, federal agencies, and the public. Monitoring data can also be used to inform future benefit-cost analyses that will determine what future projects are funded and implemented. Grantees should consider online platforms or other ways to make monitoring data available to the public so that other researchers can access this information for broader analysis and evaluation.

CONCLUSION

The RBD competition was not merely a unique process for facilitating disaster recovery at the federal level, it also inspired innovative proposals for how disaster-affected communities can rebuild in ways that will reduce their risks to future disasters while increasing social, economic, and environmental resilience. Implementing the visions articulated in these proposals, however, is not an easy task. These types of innovative projects test the bounds of government rules, processes, and capacity. The challenges that the grantees face as they seek to transform the RBD conceptual designs into feasible projects, and the innovative ways they are overcoming challenges provide instructive lessons for how policymakers at all levels of government can facilitate and ease implementation of resilience projects in the future. This summary was informed by the following case studies of each of the winning RBD proposals, the projects they inspired, and the specific legal and policy challenges that the grantees are facing in implementing these projects.

CHAPTER 1 END NOTES

- 1 Federal Emergency Management Agency (FEMA), *Mitigation Assessment Team Report: Hurricane Sandy In New Jersey and New York, Building Performance Observations, Recommendations, and Technical Guidance*, FEMA P-942 (Nov. 2013), <https://www.fema.gov/media-library/assets/documents/85922>.
- 2 “Northeast”. *2014 Nat’l Climate Assessment*, GlobalChange.gov; <http://nca2014.globalchange.gov/report/regions/northeast>.
- 3 The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) governs presidential disaster relief declarations and the administration of federal disaster relief funds. 42 U.S.C. § 5122 (2006). A presidential declaration makes funds available to state and local governments to help them respond to and recover after a catastrophe. 42 U.S.C. § 5122 (2006). Disaster relief funding is appropriated to a variety of federal programs administered by different federal agencies, and each program has its own rules and limitations. The Stafford Act created two programs for supporting the long-term recovery, the Public Assistance (PA) program and the Hazard Mitigation Grant Program (HMGP), both administered by the Federal Emergency Management Agency (FEMA). Disaster relief appropriations often provide funds to other programs, such as the Community Development Block Grant program administered by HUD, which was the source of funds for the Rebuild by Design competition. See Jessica Grannis, Aaron Ray, Vicki Arroyo & Sara Hoverter, *Preparing Our Communities for Climate Impacts: Recommendations for Federal Action* Ch. 2, Georgetown Climate Center (Sep. 4, 2014); Jeffrey Thomas & James DeWeese, *Reimagining New Orleans Post-Katrina: A Case Study in Using Disaster Recovery Funds to Rebuild More Resiliently*, Georgetown Climate Center (August 2015); Justin B. Clancy & Jessica Grannis, *Lessons Learned from Irene: Climate Change, Federal Disaster Relief, and Barriers to Adaptive Reconstruction*, Georgetown Climate Center (December 2013); Nicole Smith & Jessica Grannis, *Understanding the Adaptation Provisions of the Sandy Disaster Relief Appropriations Act (H.R. 152)*, Georgetown Climate Center (May 2013). All Georgetown Climate Center adaptation reports listed above can be found at: <http://www.georgetownclimate.org/reports/adaptation.html>.
- 4 With the philanthropic support, U.S. HUD Secretary Donovan launched Rebuild by Design. Four key organizations to help administer the competition: The Institute for Public Knowledge at NYU, The Municipal Art Society, the Regional Plan Association, and The Van Alen Institute. Additional support during the Hurricane Sandy Design Competition came from Deutsche Bank, Hearst Foundation, the JPB Foundation, Surdna Foundation, and the New Jersey Recovery Fund. <http://www.rebuildbydesign.org/what-is-rebuild-by-design/>.
- 5 Rebuild by Design, *Promoting Resilience Post-Sandy Through Innovative Planning and Design* at 3 (Jun 21, 2013), <https://portal.hud.gov/hudportal/documents/huddoc?id=REBUILDBYDESIGNBrief.pdf>.
- 6 The funding for these projects came from HUD-administered Community Development Block Grant Disaster Recovery (CDBG-DR) funds appropriated through the Hurricane Sandy Disaster Relief Appropriations Act (hereinafter the “RBD” or “Sandy funding”). Following Hurricane Sandy, Congress appropriated \$16 billion (\$15.18 billion after sequestration) to the CDBG program (\$15.18 billion after sequestration). Disaster Relief Appropriations Act of 2013, Pub. L. No. 113-2, 127 Stat. 4 (H.R. 152, 113th Cong., Jan. 29, 2013) [hereinafter “Sandy Relief Act”] (West 2013). HUD allocated \$930 million of its \$16 billion in appropriated CDBG-DR funds to implement projects developed through the RBD competition. U.S. Dep’t of Housing and Urban Development (HUD), *Third Allocation, Waivers, and Alternative Requirements for Grantees Receiving Community Development Block Grant (CDBG) Disaster Recovery Funds in Response to Hurricane Sandy*, 79 Fed. Reg. 62182 (Oct. 16, 2014) [hereinafter HUD, *Third Allocation*]. HUD conducted the competition pursuant to Section 105 of the America COMPETES Reauthorization Act of 2010 (15 U.S.C 3719), which authorizes federal agencies to carry out programs to award prizes competitively to “stimulate innovation that has the potential to advance the mission of the agency.”
- 7 The Resilient Bridgeport proposal was a runner-up and the state of Connecticut was allocated \$10 million, however, to manage the scope of this report, we only analyze the implementation challenges and pathways for the six winning projects. Connecticut received additional funding under the National Disaster Resilience Competition and will be able to implement components of the Resilient Bridgeport Design. Press Release. U.S. Dep’t of Housing and Urban Development, *HUD Awards \$1 Billion Through National Disaster Resilience Competition* (January 21, 2016).
- 8 Full implementation of a phase of work was not funded by this allocation, however the city has contributed an additional \$25 million of CDBG funding to this project.

- 9 See *supra* note 6. HUD’s Third Allocation Notice awarded \$930 million of the total \$15.18 billion of Community Development Block Grant Disaster Recovery (CDBG-DR) funds appropriated through the Hurricane Sandy Disaster Relief Appropriations Act to the State of New York, the State of New Jersey, and New York City. The Notice provided that the grantees have to use their CDBG allocation to implement a RBD Project consistent with the RBD Proposal “to the greatest extent practicable and appropriate, considering the technical, fiscal, environmental, legal and other constraints or opportunities that may be encountered.” Funds can be used to conduct additional research, studies, analysis, planning, stakeholder engagement, design, engineering or other “pre-development activities” necessary to implement the RBD Project, as well as to prepare the site and construct the project. The grantees were required to amend their CDBG Action Plans for HUD approval to describe how the funds will be used to implement an RBD Project implementing the winning RBD Proposal (to the extent feasible). The Sandy Relief Act requires each state or local grantee to submit an “action plan” for using the funds to the HUD Secretary for approval. The plan must demonstrate how the intended use of the funds will address the “long-term recovery, restoration of infrastructure and housing, and economic revitalization in the most impacted and distressed areas.” Sandy Relief Act, Pub. L. No. 113-1, 127 Stat. at 38 (Jan. 29, 2013). Fifty percent of the funds must be used to support activities benefitting persons of low or moderate income, unless the Secretary waives this requirement based upon a finding of compelling need. *Id.* at 38. The Action Plan amendments were required to include: a general description of the proposed RBD project; a description of how the grantee will partner with other public entities (e.g., state agencies, municipal governments) to implement the RBD project; a description of the grantee’s citizen engagement strategy; a timeline for development and implementation of the project; a description of additional funds that will be leveraged to support project implementation; a benefit-cost analysis for the project; and a monitoring plan. (HUD, Nov. 18, 2013 Notice).
- 10 Disaster Relief Appropriations Act of 2013, Pub. L. No. 113-2, 127 Stat. 4 at Ch. 9, pp. 36-37 (H.R. 152, 113th Cong., Jan. 29, 2013) [hereinafter “Sandy Relief Act”] (West 2013). See also HUD, *Third Allocation*, 79 Fed. Reg. 62,182, 62,185 (Oct. 16, 2014). HUD can grant waivers to this deadline if the grantee can demonstrate a compelling legal, policy or operational challenge justifying an extension of the deadline, but in the Third Allocation HUD warns that waivers may not be approved.
- 11 The National Environmental Policy Act (NEPA) requires federal agencies to assess the environmental consequences of “major federal actions significantly affecting the environment.” NEPA provides three main pathways for complying with environmental review requirements: (1) statutory exclusions, (2) categorical exclusions, and (3) Environmental Impact Statements (EISs). Actions that do not significantly affect the quality of the human environment may be statutorily or categorically excluded from NEPA review. All other actions that do not fit into one of the two exclusions must complete an environmental review document (EIS or Environmental Assessment). National Environmental Policy Act (NEPA), 42 U.S.C. § 4321 *et seq.* (1970). This can be problematic for projects on quick timelines because EISs require lengthy and sometimes expensive analysis and processes such as the identification and evaluation of alternatives, disclosure of environmental impacts, and public scoping and comment periods. Memorandum from Nancy H. Sutley, Chair, Council on Env’tl. Quality, to the Heads of Fed. Dep’ts & Agencies, Memorandum from Nancy H. Sutley, Chair, Council on Env’tl. Quality, to the Heads of Fed. Dep’ts & Agencies, Improving the Process for Preparing Efficient and Timely Environmental Reviews Under NEPA (Mar. 6, 2012); Executive Order 13604, Improving Performance of Federal Permitting and Review of Infrastructure Projects (Mar. 22, 2012); Linda Luther, CRS Report for Congress RL34650, Implementing the National Environmental Policy Act (NEPA) for Disaster Response, Recovery, and Mitigation Projects; Memorandum from Nancy H. Sutley, Chair, Council on Env’tl. Quality, to the Heads of Fed. Dep’ts & Agencies, Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions (Feb. 18, 2010). Each of the RBD projects are likely to require an Environmental Impact Statement (EIS) pursuant to NEPA. Once the grantee has completed a draft EIS, they must submit another Action Plan Amendment to reflect the final RBD project that will be implemented with the Sandy funding. The Amendment must describe the RBD project scope, and how the project is consistent with the winning proposal. If, as the grantee finalizes the EIS, material changes are made to the project, the grantee must submit an additional Action Plan Amendment reflecting the changes to the project. After approval of the amended Action Plan, funds will be made available to the grantee for construction of the project. HUD, *Third Allocation*, 79 Fed. Reg. at 62,187.
- 12 To close out the grant, the grantees are also required to develop an implementation case study and lessons-learned document to describe new and creative coordination structures, decisionmaking processes, or other innovations deployed to implement these projects to inform future disaster recovery efforts. HUD, *Third Allocation*, 79 Fed. Reg. 62,186 (Oct. 16, 2014).
- 13 Recognizing that the Sandy funding would be insufficient for the grantees to fully build out the RBD Projects, HUD is requiring the grantees to develop an “Implementation Strategy” for future phases of work, including potential funding sources and financing mechanisms, and an “Implementation Case Study” describing the barriers the grantees encountered in implementing the project. Each grantee’s Implementation Strategy must also consider potential displacement of residents, businesses, and other entities due to

increasing costs of rent and property ownership in the years following completion of the RBD Project, and ways to mitigate those impacts. Meanwhile, the “Implementation Case Study” must describe the lessons learned and process for implementing the RBD Project, including discussion of any new coordination structures, partnerships, and decisionmaking processes that are developed to implement the project. HUD, *Third Allocation*, 79 Fed. Reg. at 62,186 (Oct. 16, 2014).

- 14 The lessons described in this report were informed by the winning RBD proposals, RBD project documents, interviews with and comments received from each of the grantees and HUD staff, and the Rockefeller-supported RBD staff who are helping to facilitate implementation of these projects. The thoughtful comments provided by all of the parties who are working tirelessly to implement these innovative and inspirational projects were invaluable to the development of this report.
- 15 This report applies the Army Corps of Engineers’ definition of natural and nature-based flood risk reduction strategies: “Natural features are created through the action of physical, biological, geologic, and chemical processes operating in nature, whereas nature-based features are created by human design, engineering, and construction,” including dunes and beaches, vegetated features such as wetlands and submerged aquatic vegetation (SAV), oyster and coral reefs, barrier islands, and maritime forests. US Army Corps of Engineers Civil Works Directorate, *Coastal Risk Reduction and Resilience* 2-3 (Jul. 2013), http://www.corpsclimate.us/docs/USACE_Coastal_Risk_Reduction_final_CWTS_2013-3.pdf.
- 16 “Northeast”. 2014 Nat’l Climate Assessment, GlobalChange.gov; <http://nca2014.globalchange.gov/report/regions/northeast>.
- 17 Living shorelines are nature-based approaches that combine restoration of natural features (such as wetlands) with some structural measures (such as low rock sills) to dampen storm surges and reduce erosion on waterfront properties while maintaining tidal connectivity. See Nat’l Oceanic and Atmospheric Admin., *Guidance for Considering the Use of Living Shorelines* (2015), <https://coastalscience.noaa.gov/news/climate/noaa-releases-guidance-for-the-use-of-living-shorelines/>.
- 18 As defined by the Corps, “structural measures reduce coastal risks by decreasing shoreline erosion, wave damage and flooding.” Army Corps, *Coastal Risk Reduction and Resilience*, *supra*.
- 19 No single entity has complete regulatory control over activities that affect intertidal areas (areas where the land meets the sea). Local governments typically have authority over the uplands under traditional land-use authorities. State agencies often have oversight or permitting authority over intertidal activities under state water quality, wetland, and coastal management laws. At the federal level, permitting decisions must comply with Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act (RHA) as administered by the Army Corps of Engineers (Corps). The Corps must coordinate its review of Section 404 permits with the US Environmental Protection Agency (EPA) and the National Fish and Wildlife Service (FWS) and National Marine Fisheries Services (NMFS).
- 20 N.Y. Environmental Conservation Law § 25-0401 (McKinney); 6 NYCRR 661.9; and New York State Department of Environmental Conservation, *Tidal Wetlands Permit Program: Do I Need a Permit?* (2015), <http://www.dec.ny.gov/permits/6359.html>.
- 21 Many organizations are beginning to gather the data necessary to establish the efficacy and economic value of these types of interventions. For example, The Nature Conservancy (TNC) has established its Return on Investment Project to help quantify the economic value of conservation in areas ranging from fisheries improvement to the reduction of coastal erosion and associated property damage. <http://www.nature.org/science-in-action/the-roi-project-making-conservation-even-smarter.xml>. In April 2016, TNC also established the Center for Sustainability Science. Among other things, the center aims to produce case studies and science-based metrics and tools for businesses to assess the value of using nature-based solutions for things such as flood protection. <http://www.nature.org/science-in-action/center-for-sustainability-science.xml>. The National Wildlife Federation recently released a compilation of case studies demonstrating how communities across the United States are using nature-based infrastructure to mitigate natural hazards. See NWF, *Natural Defenses in Action* (June 21, 2016), http://www.nwf.org/~media/PDFs/Global-Warming/Reports/NWF_Natural-Defenses-in-Action_Report.pdf. Meanwhile, the federal government also has begun the difficult task of quantifying environmental benefits from green and other nontraditional infrastructure. FEMA recently developed a benefit-cost analysis tool to calculate the ecosystem services benefits of hazard-mitigation projects based on green infrastructure or nature-based design as part of its *Climate Resilient Mitigation Activities* (CRMA) agenda. FEMA, *Climate Resilient Mitigation Activities*, <https://www.fema.gov/climate-resilient-mitigation-activities-hazard-mitigation-assistance>, see also Office of Management and Budget, *Incorporating Ecosystem Services Into Federal Decision Making* (Oct. 7, 2015), <https://www.whitehouse.gov/blog/2015/10/07/incorporating-natural-infrastructure-and-ecosystem-services-federal-decision-making>.

- 22 In its *Notice of a Second Allocation* of CDBG-DR funding from the Sandy Supplement, HUD expressly required grantees to include in their Action Plans a summary of the green infrastructure projects and activities they plan to construct. 78 Fed. Reg. 222 at 69107 (Nov. 18, 2013). In the Notice, HUD defined green infrastructure broadly as “the integration of natural systems and processes, or engineered systems that mimic natural systems and processes into investments in resilient infrastructure. Green infrastructure takes advantage of the services and natural defenses provided by land and water systems such as wetlands, natural areas, vegetation, sand dunes, and forests, while contributing to the health and quality of life of those in recovering communities.” The notice seems particularly focused on green infrastructure such as wetlands and dunes for coastal protection; we generally use the term nature-based coastal protection for these practices throughout this report. For purposes of clarity, this report applies the more limited definition of green infrastructure adopted by EPA: “Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water.” EPA, *What is Green Infrastructure*, http://water.epa.gov/infrastructure/greeninfrastructure/gi_what.cfm. From this definition we separate out natural and nature based approaches for reducing flood and erosion risks along coastal shorelines (which we collectively refer to as “green” or “natural defenses”).
- 23 The EPA defines the term heat island as “built up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with 1 million people or more can be 1.8–5.4°F (1–3°C) warmer than its surroundings. In the evening, the difference can be as high as 22°F (12°C). Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality.” *Heat Island Effect*, Environmental Protection Agency, <https://www.epa.gov/heat-islands> (last updated March 30, 2016).
- 24 For example, the Milwaukee Metropolitan Sewerage District (MMSD) has a Workforce and Business Development Resource Program through which it works to hire consultants, contractors, vendors, and local workers within its service area. *Workforce & Business Development*, Milwaukee Metropolitan Sewerage District, <http://www.mmsd.com/procurement/workforce-and-business-development>. Washington DC is another example of a city that is encouraging local hiring through green infrastructure investments. DC Water (Washington DC’s water and sewer authority) launched the “DC Water Works!” initiative to boost local hiring on infrastructure projects being constructed with ratepayer dollars. The program includes a targeted campaign to advertise DC Water jobs to local residents, a job training and apprenticeship programs, and an incentive-based program to encourage DC Water contractors to interview and hire District residents. The programs are estimated to have created 7,090 jobs created per year. DC Water Works! https://www.dewater.com/employment/water_works.cfm; *Economic Impact of Utility Operations at the District of Columbia Water and Sewer Authority (DC Water)*, (Aug. 2014), https://www.dewater.com/site_archive/news/documents/DC_R01.PDF.
- 25 For a discussion of strategies for scaling up green infrastructure approaches see Sara Hoverter, Georgetown Climate Center, *Green Infrastructure Toolkit* (Sep. 2016), <http://www.georgetownclimate.org/adaptation/toolkits/green-infrastructure-toolkit/introduction.html>. Stormwater ordinances generally dictate how much rainfall a property must retain. Seattle’s Stormwater Code, for instance, imposes retention requirements on residential properties that vary according to several factors, including the type of sewer system or water body to which the site discharges and the size of the land disturbance or impervious surface on that site. Seattle, Wash., Stormwater Code ch. 22.805.050; ch. 22.805.080.B.2. (2009). Like Stormwater ordinances, zoning codes can integrate green infrastructure. Binghamton, NY, requires property owners seeking permits for construction to submit an Urban Runoff Reduction Plan (URRP) to show how they will manage stormwater after construction. The URRP must show how the development will manage a 10-year, 24-hour storm event and include green infrastructure techniques. City of Binghamton, NY Code of Ordinances § 227-10.
- 26 As defined by the Army Corps as “complete or partial alternatives to structural measures, including modifications in public policy, management practices, regulatory policy and pricing policy.” Nonstructural measures essentially “modify the impacts” of the flood hazard, as compared to structural measures, which “modify the flood hazard.” The impacts of the flood hazard can be modified by reducing susceptibility to flood and coastal storm damage and disruption and by reducing the flood and coastal storm impact on individuals and communities. Nonstructural measures include structure acquisitions or relocations, flood-proofing of structures, implementing flood warning systems, flood preparedness planning, establishment of land-use regulations, development restrictions within the greatest flood hazard areas, and elevated development. Nonstructural measures can be blended well with the natural and nature-based features of the coastal environment, as well as structural measures. USACE, *Coastal Risk Reduction and Resilience* (Sep. 2013), available at: http://www.corpsclimate.us/docs/USACE_Coastal_Risk_Reduction_final_CWTS_2013-3.pdf.

- 27 The term “home rule” refers to the majority of states that have delegated autonomy to local governments (through statutes or state constitutions) to manage local affairs when the locality adopts a home-rule charter. Statutes granting home rule often grant local governments the power to pass laws to regulate the health, safety and welfare within their boundaries, determine the structure of local government and hire staff, tax, provide services to its citizenry, acquire property etc. State legislatures will also often make specific delegations to local governments to plan for and regulate the use and development of land through zoning enabling acts. Courts also interpret these powers broadly to find that localities possess both the express powers included in the delegation, but also all implied powers needed to implement those powers. Laws granting home rule authority to local governments both grant authority to localities, but they also often protect local governments from intrusion by state agencies and the legislature. This means that although state legislatures can pass laws requiring localities to meet state minimum standards, or preempting local authority over certain matters of state concern, often there are requirements that the laws be generally applicable to all local governments of similar size or classes, and in some states certain laws must be passed by supermajority (e.g., 2/3 of legislature must approve). David J. McCarthy, Jr. & Laurie Reynolds, *LOCAL GOVERNMENT LAW IN A NUT SHELL* (5th ed. 2003).
- 28 In the aftermath of Sandy, the New York City mayor issued Executive Order No. 230 suspending height and other zoning restrictions that prevented property owners from rebuilding structures to complete with updated FEMA flood standards. The City of New York Office of the Mayor, *Executive Order No. 230, Emergency Order to Suspend Zoning Provisions to Facilitate Reconstruction in Accordance with Enhanced Flood Resistant Construction Standards* (Jan. 31, 2013), http://www.nyc.gov/html/om/pdf/eo/eo_230.pdf. In October 2013, the City Council adopted an amendment to the city’s zoning ordinance to facilitate flood-resilient reconstruction, including requiring 1- or 2-feet of additional elevation based upon FEMA’s updated flood elevations, accommodating building access, requiring mechanical systems be located above flood levels, accommodating off-street parking, improving streetscape requirements, among other provisions. *New York City Flood Resilience Text Amendment to the Zoning Resolution* (Oct. 9, 2013), http://www1.nyc.gov/assets/planning/download/pdf/plans/flood-resiliency/flood_resiliency.pdf. New York City also updated its local Waterfront Revitalization Program (LWRP) to require development and redevelopment projects to consider and mitigate against the risks posed by climate change and sea level rise. The updated LWRP includes several policies to encourage projects to incorporate resilience measures: development and redevelopment must consider and minimize risks of flooding posed by climate change and sea-level rise over the project’s lifetime (Policy 1 and Policy 6); maritime and industrial development projects must minimize impacts to nearby neighborhoods and ecological resources (Policy 2); smaller sites of ecological significance may be targeted for restoration and enhancement (Policy 4); and green infrastructure strategies can be used to capture and retain stormwater and improve water quality (Policy 5). The NYC LWRP was approved by the City-council in December 2014, and adopted in June 2016 after being approved by state and federal agencies. NYC Planning, *The New York City Waterfront Revitalization Program* (June 2016), <http://www1.nyc.gov/site/planning/applicants/wrp/wrp.page>.
- 29 Henk Ovink, *Rebuild by Design: Redesigning the Design Competition*, URBAN SOLUTIONS, Issue 9 (Jul. 2016), http://www.clc.gov.sg/documents/publications/urban-solutions/issue9/us_i9_8_EssayRedesigningtheDesignCompetition.pdf.
- 30 Ovink, *Redesigning the Design Competition* at 48.
- 31 Municipal budgets forecast both the revenues that a city will take in (from property taxes, sales taxes, and other sources) and the expenditures it will incur to provide city services and to build and maintain capital improvements (like roads, bridges, and other public facilities). As part of its budgeting process, a city will often develop an operating budget (for expenses providing services) and a capital improvement budget (for costs to build projects to maintain or improve the city). Whereas the operating budget is generally paid out of the city’s general fund (annual tax revenues and other fees and payments), capital improvement projects can be financed, meaning that the city can let bonds to borrow money to pay for the costs to construct the project and then pay back the costs (plus interest) over the life of the improvement using special assessments, taxes, or fees. Municipalities often develop a capital improvement plan (CIP) to set priorities for funding needed capital improvement projects over a 3 to 5 year period. The CIP will analyze available funds and city needs, and compare and rank projects against each other. The city then develops a capital budget, which identifies appropriate funds and authorizes expenditures on priority projects identified in the CIP. Cities typically adopt a capital budget on a 1 or 2 year cycle. For a detailed description of municipal budgeting processes see Vicki Elmer, *Capital Improvement Plans and Budgets*, Univ. of Cal. Berkeley Dept. of City & Reg. Planning (undated).
- 32 For example, Sandy’s impacts were primarily caused by storm-surge-driven flooding (i.e., flood waters that piled up on the shore due to hurricane force winds offshore). As a result, many of the RBD grantees are focusing primarily on projects to build flood defenses. However, storm surges are just one of this region’s risk and the track and character of the next storm will differ from that of Sandy. Rain-driven flooding is also a threat in this region, as heavy downpours can easily overwhelm aging sewer systems and cause floodwaters to

back up into homes, basements, and streets. Those flood risks will be exacerbated by projected increases in precipitation due to climate change. Responding to stormwater flooding, however, requires different approaches. While storm-surge flooding is addressed through coastal defenses, rain-driven flooding is often addressed with green infrastructure and pumping stations.

- 33 Congress funded the Sandy recovery through more than 23 different federal programs, administered by more than 18 federal agencies or departments. These include: CDBG-DR, the Public Assistance and Hazard Mitigation Grant programs administered by FEMA, the Emergency Relief Program administered by the Department of Transportation, and the State Revolving Funds overseen by the Environmental Protection Agency, among others. Georgetown Climate Center, *Understanding the Adaptation Provisions of the Sandy Disaster Relief Appropriation* (H.R. 152) (May 2013) <http://www.georgetownclimate.org/reports/understanding-the-adaptation-provisions-of-the-sandy-disaster-relief-appropriations-act-h-r-152.html>.
- 34 FEMA HMGP expenditures must be “cost-effective,” and to determine cost effectiveness FEMA requires Benefit-Cost Analysis (BCA) that shows a benefit to cost ratio of greater than 1. 44 C.F.R. § 206.2. FEMA uses a benefit-cost worksheet that relies on historical flood data to calculate the cost effectiveness of a project. In past recovery efforts, this has limited the ability of grantees to factor in the long-term benefits of adapting to future impacts, in addition to other non-economic benefits such as recreational and ecosystem benefits provided by a project. Post-Sandy, FEMA has issued policies and tools that allow communities to consider future climate impacts and ecosystem services in their calculation of benefits. However, it is unclear whether states and localities will have the technical capacity to allow them to effectively leverage these new policies without further guidance on how to quantify future and non-economic benefits. FEMA guidance also only apply to FEMA programs and cannot be used to support any BCA requirements for programs administered by other federal agencies. FEMA, *Mitigation Policy – FP-108-024-01, Consideration of Environmental Benefits in the Evaluation of Acquisition Projects Under the Hazard Mitigation Assistance Programs* (Jun. 18, 2013), <https://www.fema.gov/media-library/assets/documents/33295>; FEMA, *Incorporating Sea Level Rise (SLR) into Hazard Mitigation Assistance (HMA) Benefit Cost-Analysis Frequently Asked Questions (FAQs)*, <https://www.fema.gov/media-library/assets/documents/89659>; see also FFEMA, *Benefit Cost Tool Version 5.0 New Features* (Apr. 2014), <https://www.fema.gov/benefit-cost-analysis>.
- 35 See e.g., Jeffrey Thomas & James DeWeese, *Reimagining New Orleans Post-Katrina: A Case Study in Using Disaster Recovery Funds to Rebuild More Resiliently* (Aug. 2015); <http://www.georgetownclimate.org/reports/reimagining-new-orleans-post-katrina.html>.
- 36 “Co-benefits” generally refer to ancillary benefits that accrue from projects beyond their primary purpose. For example, depending on how it is constructed, a project primarily intended to reduce interior flood hazards by using natural systems to capture and retain rainfall may also provide additional environmental benefits, such as water filtration, infiltration to replenish aquifers and reduce subsidence, and cleaner air. When such an intervention also includes landscaped open space, it can also provide recreational amenities that also promote public health and wellbeing. FEMA has recently revised its Hazard Mitigation Assistance guidance and policies to explicitly encourage the incorporation of green infrastructure and nature-based systems into hazard-mitigation proposals. To facilitate the required benefit-cost analysis for funding applications, FEMA also has created a tool quantify so-called ecosystem services, including aesthetic value, air quality, recreational space and water filtration. See FEMA, *Hazard Mitigation Assistance Climate Resilient Mitigation Assistance Benefit Cost Analysis Tools Policy Clarification* (May 27, 2016), <https://www.fema.gov/media-library/assets/documents/110202>; see also Thomas, *Reimagining New Orleans Post-Katrina*, *supra* note 2.
- 37 In addition to the Stafford Act programs described above, Congress often appropriates disaster relief funds through the Community Development Block Grant (CDBG) program. The CDBG program is authorized by the Housing and Community Development Act of 1974 and administered by HUD. CDBG was originally created as a formula block grant program to support economic development activities of state and local governments. However, in disaster relief appropriations bills since Hurricane Andrew in 1992, Congress has appropriated funding to the CDBG program to also support disaster response and recovery (CDBG-DR). 42 U.S.C. § 5306(d) (2006); 42 U.S.C. § 5172(c)(1)(A) (2006), amended by Sandy Relief Act, sec. 428, 127 Stat. at 41. Brown, note 33 at 12; GAO-09-541, *Gulf Coast Disaster Recovery: Community Development Block Grant Program Guidance to States Needs to Be Improved* at 2 (Jun. 2009). The purpose of CDBG-DR funding is to provide long-term disaster recovery assistance to low- and moderate-income communities in the most “impacted and distressed areas.” Fifty-one percent of the grantees’ total CDBG-DR expenditures (including their RBD funding) must go to benefit low- and moderate-income (LMI) residents (unless this requirement is waived by HUD). 42 U.S.C. § 5306(d) (2006). For the purposes of the CDBG program, a “low- and moderate-income person” means a member of a family having an income equal to or less than the Section 8 low-income limit established by HUD every year. 24 C.F.R. § 570.3 (2012). Generally, a Section 8 low-income family is one whose annual income does not exceed 80 percent of the median income for the area, adjusted for family size. 42 U.S.C. § 5302(a)(20)(A).

- 38 HUD regulations also require the calculation of area-wide benefit based upon census block data. Where, for example, a project will benefit a whole city, the area-wide benefit of the project is calculated based on the median income of the census blocks in that city. 24 C.F.R. § 570.208. With the Hoboken project, for example, the flood defenses that the state plans to build with its RBD allocation will benefit almost all of the residents of the city of Hoboken. As a result, the grantee must calculate percentage of LMI across the city as a whole, and the LMI ratio is about 40 percent citywide. Additionally, HUD’s formulas for calculating LMI do not precisely capture the large regional differences in income and cost of living. In the New York and New Jersey counties that were affected by Sandy, the formulas calculate LMI as an income of approximately \$65,000 to \$75,000 for a family of four, but families in the greater New York metropolitan region face the highest costs of living to meet basic needs (housing, food, transportation, energy costs, etc.) in the country. HUD, Office of Policy Development and Research, *Data Sets, FY 2016 Income Limits Documentation System*, https://www.huduser.gov/portal/datasets/il/il16/index_il2016.html. While grantees can seek waivers from the LMI requirements, significant documentation is required to support a waiver request and LMI is one of the three core national objectives of the CDBG program. Additionally, where the area-benefit of the RBD projects to LMI residents will be less than 51 percent, this will make it more difficult for the grantees to show that 51 percent of their total Sandy CDBG-DR allocation is benefitting LMI residents.
- 39 In some cases, innovative green-gray projects have taken up to three years to permit. Kim Diana Connolly, et al., *Wetlands Law and Policy: Understanding Section 404* at 152 (ABA, 2005).
- 40 Based upon the specific needs in each region, the TCTs include officials from the Army Corps of Engineers (USACE), Federal Emergency Management Agency (FEMA), US Environmental Protection Agency (EPA), HUD, Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), the New York New Jersey Port Authority, transit agencies, state environmental agencies, etc.—all of the state, federal and other agencies that will need to be involved in permitting and funding recovery efforts.
- 41 “The grantee must certify in its Action Plan Amendment that it, or the local authority assuming ownership of a levee, will take action to ensure the levee is certified and meets FEMA standards at 44 CFR 65.10 and is subsequently accredited by FEMA, which allows for floodmaps to be re-drawn accordingly. HUD, *Third Allocation*, 79 Fed. Reg. 62182-01 (Oct. 16, 2014). HUD can also waive this requirement if the grantee is unable to get certification once the flood control structure is complete.
- 42 This certification can be used to justify remapping of a community’s floodplain maps, and areas protected by FEMA-certified levees are not subject to flood insurance purchase requirements or minimum floodplain regulations. This has a significant financial benefit for protected property owners, because it means that they would no longer have to carry flood insurance. FEMA, *Levees – Frequently Asked Question*, http://www.fema.gov/media-library-data/20130726-1803-25045-4819/st_broomelv.pdf.
- 43 State procurement rules differ, however, all states have some form of rules requiring competitive bidding for certain types of contracts over a certain dollar amount. Amer. Bar Assoc., *Guide To State Procurement: A 50-State Primer on Purchase Laws, Processes and Procedures* (2011).
- 44 HUD, *Third Allocation* at 62190 [“Grantees should ensure that individuals with a strong working knowledge of both the RBD Project to be implemented and the overall proposal are among the consultants hired to advance the project. Given the unique knowledge and understanding that each RBD design team possesses regarding their respective proposal, grantees should consider how it may procure design team members noncompetitively... [T]he grantee is reminded of the provisions of 24 CFR 85.36, which set forth the conditions under which a grantee may engage in a non-competitive, single source procurement (§ 85.36(d)(4)). Grantees operating under part 85 are granted the authorization referenced under § 85.36 (d)(4)(i)(C) only regarding procurement of the design teams (or members of the design teams) that participated in the development of selected RBD proposals through the HUD-sponsored RBD competition.”].
- 45 Sole source procurement rules allow public entities to hire a contractor without competitive bidding, where only that one contractor has the expertise or skills needed to satisfy the agency’s contracting needs. Sole source procurement typically may only be used in “exceptional circumstances.” See *Government Contract Guidebook* § 3:7 (4th ed.). The federal government has specific rules for when and how sole source procurement can be used and states have their own rules, which can in some cases be more restrictive than the federal rules.
- 46 In New Jersey, for example, contracts for construction of public works projects over \$25,000 must be awarded through a competitive bidding process. N.J. Stat. Ann. § 52:34-7 (West). Bids must be evaluated by based upon pre-established criteria set in the bidding documents, and the contract must typically be awarded based upon cost (and in some cases conformance with evaluation criteria specified in the bid documents). In New Jersey, state agencies can bypass a lowest bidder by showing poor performance by the lowest bidder on a past contract. New Jersey also limits the ability of state agencies to award a contract without competition in the very limited

circumstances where the agency can show that the contractor is the *only source of supply available*. N.J. Stat. Ann. § 52:34-10 (West). For “professional services” contracts requiring specialized expertise, like architect and engineering services, state agencies can also use a request for qualifications process where the agency can select a contractor based upon qualifications and expertise rather than solely on cost. N.J. Stat. Ann. § 52:34-9.5 (West). However, contracts for the construction of “public works” project are subject to the competitive bidding requirements described above. Public works contracts involve contracts for the construction of public buildings or facilities. Bidders that are not awarded a contract can also protest the award of the contract through various administrative and civil proceedings. N.J. Admin. Code §§ 17:12-3.1 – 3.3.

- 47 “Upzoning” is an informal, but broadly understood, term of art that means “a rezoning or reclassification to a more intensive use category” allowing for increased densities or a broader range of permissible activities on a parcel or area of land. Rathkopf’s *The Law of Planning and Zoning* (4th Ed. 2016), §38:12.
- 48 Tax-increment financing (TIF) is a method of financing a project or development in a designated geographic area based on the anticipated increase in property tax assessments that will be generated by the project. Tax Increment Financing originally was utilized as a means of financing the redevelopment of “blighted” areas, but its use has expanded to include municipal or private financing of infrastructure improvements. The TIF model is appealing because it allows development or infrastructure projects to self-finance. The tax revenue from the increase in assessed property value (caused by the development) is used to repay the cost of the infrastructure development. This process allows a local government to finance a capital project without raising property tax rates or exceeding a municipal debt limit. See Smart Growth America, U.S. PIRG Education Fund, *Tax-Increment Financing: The Need For Increased Transparency and Accountability in Local Economic Development Subsidies* (2011).
- 49 For example, to use the TIF model, Hoboken must follow the requirements established in the state enabling law, the New Jersey TIF Revenue Allocation District Financing Act passed in 2002. NJ Stat. Ann. § 52:27D-459 *et seq.* Under the Act, the Hoboken City Council would need to pass an ordinance designating an area as a Revenue Allocation District. Non-contiguous areas may be included as part of a single district if the municipality can show that such areas comprise “part of a common development project or plan.” NJ Stat. Ann. 52:27D-462.
- 50 See generally Furman Center for Real Estate & Urban Policy, New York University, *Sandy’s Effect on Housing in New York City* (Mar. 2013), https://s3.amazonaws.com/KSPProd/ERC_Upload/0083708.pdf; see also Enterprise Community Partners, *Hurricane Sandy Housing Needs One Year Later* (Oct. 2013), https://s3.amazonaws.com/KSPProd/ERC_Upload/0083708.pdf.
- 51 The US Climate Resilience Toolkit (<https://toolkit.climate.gov/>), NOAA’s Climate.gov (<https://www.climate.gov/>), Digital Coast (<https://coast.noaa.gov/digitalcoast/>), and the Sea Level Rise Viewer (<https://coast.noaa.gov/digitalcoast/tools/slr.html>).

Rebuild by Design Projects

New Meadowlands
Meadowlands, NJ



Hunts Point Lifelines
South Bronx, NYC



Resist, Delay, Store, Discharge
Hoboken, NJ



Living with the Bay
Nassau County, NY



The BIG U
Lower East Side, NYC



Living Breakwaters
Staten Island, NYC



The BIG U

Lower East Side of Manhattan New York City



BACKGROUND

Hurricane Sandy brought 14 feet of storm surge that caused devastating flooding in low-lying areas of lower Manhattan and neighborhoods along the East River. Flooding extended several blocks inland, inundating areas of the city with two to three feet of floodwaters. Power and transportation infrastructure were disabled, people (especially more vulnerable residents like the elderly) were trapped in their apartments, and much of the Financial District was shut down for a week. Lower Manhattan and East River neighborhoods suffered significant damages during Sandy, including the flooding of large public housing complexes.

THE PROPOSAL

The BIG U proposal narrowed in focus through the different phases of the RBD competition. In the first phase, the proposal looked at developing flood protection in the shape of a “U” along the entire Southern tip of Manhattan from West 57th Street to East 42nd Street. The BIG team was selected to develop a Phase Two proposal, in which the BIG team developed a more detailed conceptual design for providing flood protection for 10 contiguous miles of lower Manhattan from the southern tip at the Battery along the East River up to East 23rd Street. This focus was based upon the city’s priorities of providing protection for public and affordable housing located in neighborhoods along the East River, particularly the Lower East Side neighborhood, and of increasing community access to the waterfront.

COMPETITION DESIGN TEAM

Team lead by Bjarke Ingels Group (BIG), One Architecture, Starr Whitehouse, Buro Happold, Level Infrastructure, ARCADIS, James Lima Planning & Development, Green Shield Ecology, AEA Consulting

PROJECT AREA

The final RBD proposal focused on three contiguous regions called “compartments” along the southern and eastern shorelines of Manhattan from the Battery at the southern tip to East 23rd Street.¹ The phase currently being implemented with RBD funds will focus on Montgomery Street to East 23rd Street (with one alignment extending to 25th Street)

GRANTEE

New York City, Mayor’s Office of Resilience and Recovery

AMOUNT AWARDED

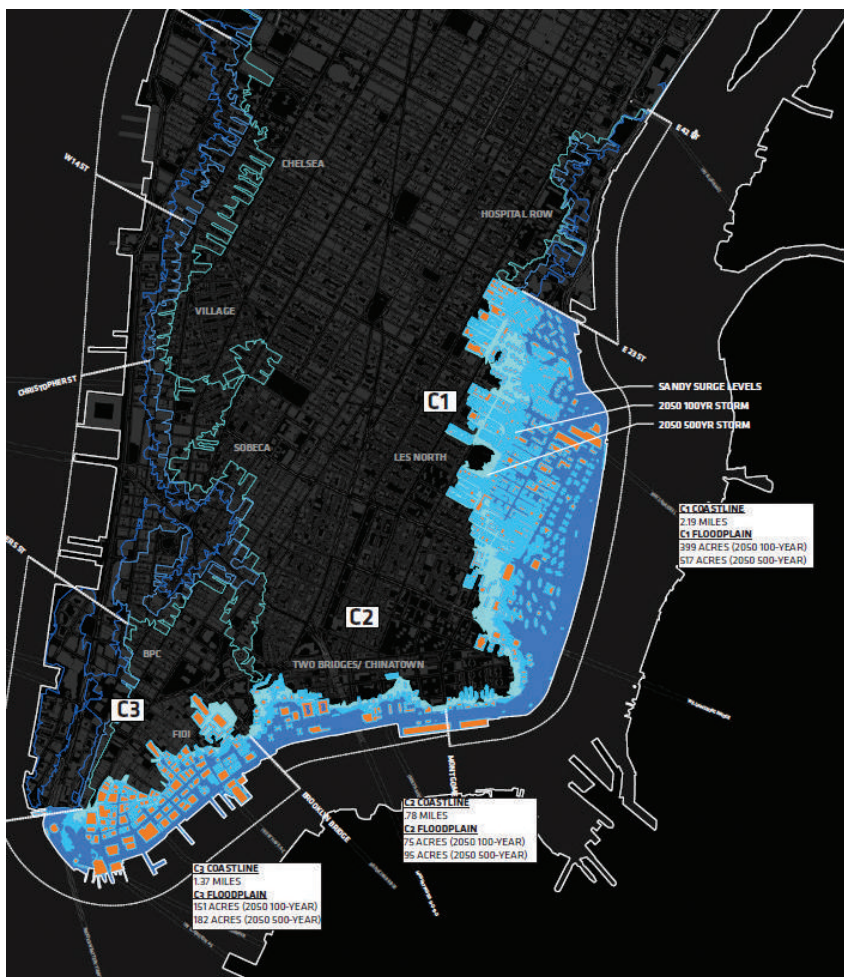
\$335 million

PROPOSAL LINK

<http://www.rebuildbydesign.org/our-work/all-proposals/winning-projects/big-u>

PROJECT WEBSITE

<http://www.nyc.gov/escr/>



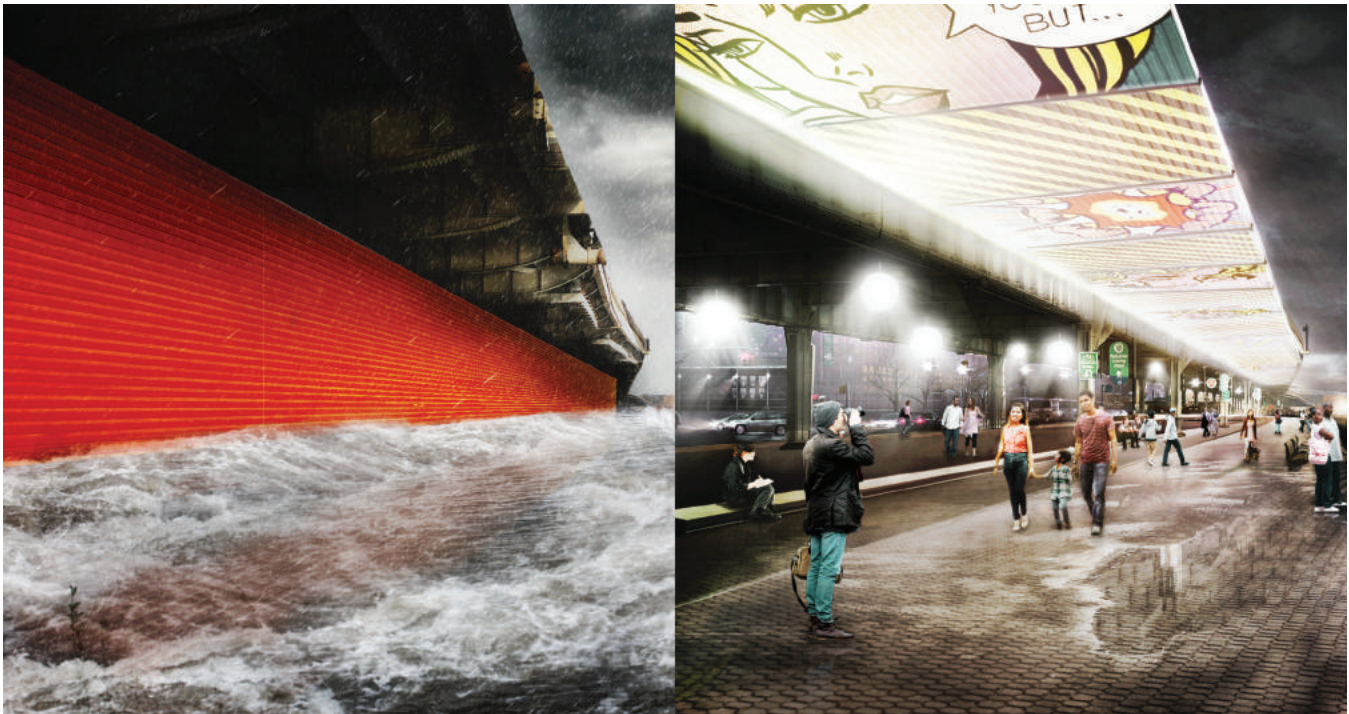
BIG U Compartments

This picture illustrates the flood risks in each of the compartments identified in the BIG U proposal.

The final BIG U proposal recommended three separate but coordinated flood protection projects called “compartments” that spanned from the Battery to East 23rd Street. Each compartment recommended a combination of structural (deployable flood walls and artificial embankments known as berms) and nature-based approaches for reducing flood and storm surge risks. It was envisioned that each of the flood-risk-reduction components would serve the additional purpose of creating recreational amenities and enhancing connectivity with the waterfront. Some compartments also called for broad deployment of green infrastructure approaches to manage flood risks behind the flood control structures during heavy rainfall events. Each compartment can be isolated from adjacent areas, and would offer both flood protection and amenities tailored to each neighborhood’s social, recreational, and economic needs. The three independent-but-linked compartments included the following:

- Compartment 1, Montgomery to 23rd Street including East River Park**—This compartment was proposed to run north from Montgomery Street to East 23rd Street. One section of this compartment focused on East River Park. The proposal called for the construction of a berm system to provide flood and storm surge protection for the FDR Drive, adjacent public housing campuses, and the surrounding neighborhood. The berm would also double as and improve recreational space. In a second northern section adjacent to Stuyvesant Cove running north to 23rd street, the proposal called for deployable flood walls under the elevated FDR Drive. The proposal called for increased public access to the waterfront through pedestrian bridges in the southern section crossing the FDR Drive and improvements to the north-south bikeway throughout.

- Compartment 2, Two Bridges/Chinatown**—The Two Bridges compartment looked at flood protection for the Chinatown neighborhood and the southern portion of the Lower East Side, where there is limited open space between the waterfront and adjacent development. It called for the construction of multi-use flood shields and deployable flood-protection walls attached to the underside of the FDR Drive to protect the community, while also serving as recreational platforms, benches, and skate parks and providing better waterfront connectivity. The compartment would run from Montgomery Street to the Brooklyn Bridge. When not deployed to protect the FDR Drive, the proposal envisioned that flood protection walls would retract to provide an artistically decorated ceiling and lighting to the East River Esplanade, as well as potential market space protected from cold and snowy conditions during the winter. The area is currently dark and underutilized, which acts as a barrier between the community and the waterfront. This project compartment would transform the space and link the two sides of the elevated highway.

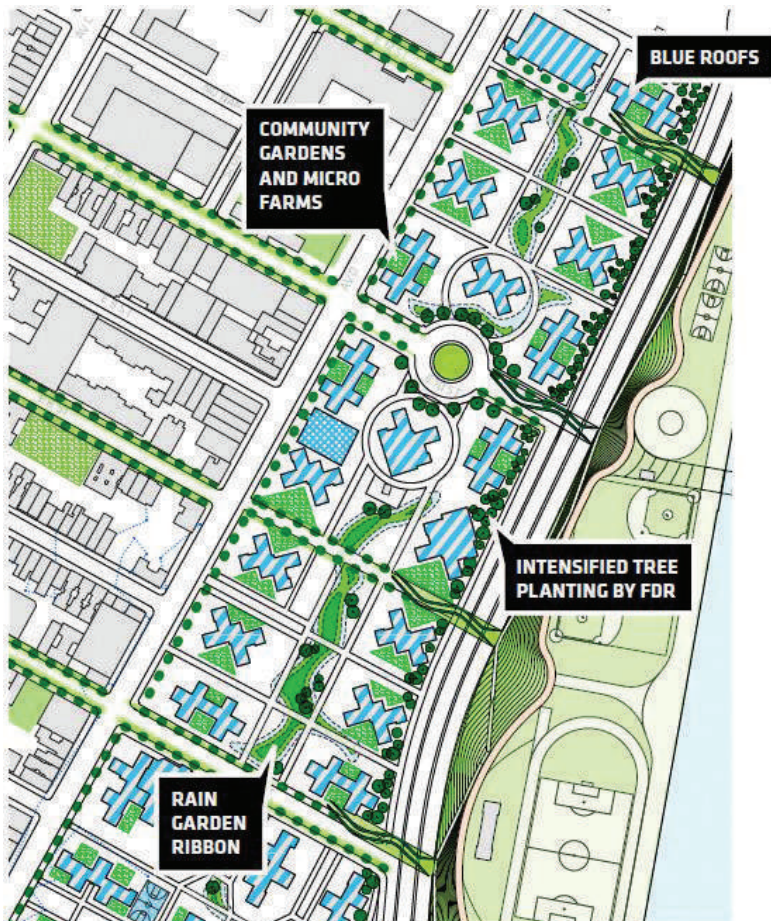


BIG U Deployable Flood Walls

In areas with site constraints, where development closely abuts the waterfront, the BIG U proposal called for the use of deployable flood walls, depicted here.

- Compartment 3, The Battery to Brooklyn Bridge**—Compartment 3 would provide flood protection to the Financial District, from the Brooklyn Bridge to the Battery, with raised landscaped berms that would also create recreational space and include elevated bike and foot paths. In this compartment, the proposal also called for the creation of waterfront public spaces to enhance tourism (including a Battery Maritime Museum, and a museum of climate change that doubles as flood protection and includes an “inverse aquarium” showing visitors water levels and projections for sea-level rise in the harbor).

The proposal also called, in general terms, for improvements to public housing campuses that were damaged by Sandy including the installation of green infrastructure approaches for managing stormwater runoff, cooling the city, and improving air quality. Proposed green infrastructure interventions included bio-swales, rain gardens, and street plantings in the campuses. Due to site-specific constraints of building flood protection in the Two Bridges areas, the design also envisioned “wet feet” retrofits, a flood-accommodation strategy where the ground floor of public housing structures would be designed to flood. The proposal also called for the installation of an electric co-generation plant in public housing campuses to provide power in the event of future outages.



BIG U Green Infrastructure

The BIG U proposal called for deployment of green infrastructure throughout public housing campuses to manage stormwater and reduce flood risks.

The design team estimated that costs to implement Compartment 1 would be \$418 million.² The city was awarded \$335 million in RBD funding to build this compartment and has contributed \$170 million in city funding to implement the project. The city was also awarded an additional \$176 million through the National Disaster Resilience Competition to build additional compartments and contributed an additional \$27 million from city funds.

THE PROJECT

New York City intends to use its RBD funding to construct Compartment 1 (known as the East Side Coastal Resiliency project or ESCR). The city is analyzing different project alternatives spanning north from Montgomery Street to East 23rd Street (and one alternative extending to East 25th Street). The ESCR includes two project areas; each area has different waterfront conditions that require different interventions to address site-specific and technical constraints. Project Area 1 extends from Montgomery Street in the south and runs north along East River Park to East 13th Street. Project Area 2 extends from East 13th Street and runs north to East 23rd/25th Street.



East Side Coastal Resiliency Project

This aerial rendering depicts the flood risk reduction and recreational improvements that will be integrated into the East River Park

Project Area 1 focuses on the East River Park and Pier 42. The city is assessing a protective berm system in this area that will double as storm-surge protection and enhance the recreational and natural elements of the existing community park. This part of the project will protect the Lower East Side neighborhood, home to much of the city's affordable housing and the location of several major public housing campuses. The project will also enhance community access to the waterfront and the recreational and open space amenities provided by the park, which are currently largely blocked by FDR Drive. Existing fenced in pedestrian bridges over the FDR Drive will be enhanced or upgraded to make more pedestrian friendly access points to the park. Although the budget does not currently allow for additional access points, the city is developing the project design to anticipate and allow for future additional bridges, if funding becomes available. The ESCR project also envisions better integration of natural and recreational elements into the park and berm system, including bike paths, nature walks, playgrounds, and playing fields.

In Project Area 2, there is much less space between the waterfront and adjacent development to build flood protection. In this area, the city is considering integrating a landscaped berm into Stuyvesant Cove Park to allow the park to double as flood protection and other flood closures (such as swing gates or roller gates that would be open under normal conditions but could be manually closed in the event of an extreme weather event to provide flood protection).³ The berms and flood walls will be integrated into the waterfront areas around Stuyvesant Cove Park and in streets, which were entry points for flood waters during Hurricane Sandy. Finally, this section of the project will also provide protection to a Con Ed East River generating facility, which provides power in this part of the city. The ESCR project will integrate with and provide redundancies for flood protection upgrades that Con Ed is building with its own funds at its 13th street complex.

The project also envisions a continuous north-south walking path and bikeway throughout all segments of the ESCR project.



BIG U: Stuyvesant Cove

In other areas with site constraints, like Stuyvesant Cove, the city is proposing to integrate flood protection structures into right-of-ways that will double as benches and other recreational improvements.

LEGAL AND POLICY CHALLENGES

Funding gap and resilience value—Given the available funding, the city must make difficult choices about how to allocate the funding to maximize the resilience benefits that the project is intended to achieve while also delivering the co-benefits envisioned by the proposal. The BIG U proposal sought to achieve multiple resilience benefits: reducing flood risk, improving recreational amenities and waterfront access, enhancing natural systems, and improving water and air quality. However, an optimal project that would deliver all of these benefits would cost much more than the funding that was allocated. To provide the maximum level of flood protection (to the 100-year flood event plus sea-level rise) within the allocated budget, the city would have to limit expenditures on other project components envisioned to improve access, recreational amenities, and integrate natural elements into the park and berm system. As a result, the grantee is having to work with the community to make hard choices about how to scale and scope the project and how to balance the trade-offs between maximizing flood protection and providing other environmental and recreational benefits.

FEMA certification for the berm system—The city must also navigate federal requirements on the mandated level of flood protection for the berm system.⁴ HUD is requiring that projects involving structural flood protection (e.g., berms, levees) pursue FEMA levee certification.⁵ FEMA certification also requires the city to address interior drainage flooding that could be exacerbated by a new berm system (by trapping water behind the berm and reducing drainage) and to have a long-term plan for operations and maintenance of the berm system. This process has been challenging for the city because FEMA is unable to provide definitive guidelines on how the berm-system and drainage and retention systems will need to be designed in order to receive certification. The grantee is managing this challenge by maintaining active dialogue and coordinating with FEMA regularly throughout the project design process. Ultimately if the grantee is not able to get the berm system certified by FEMA, HUD can also waive this requirement so long as the grantee made a “good faith effort” to pursue certification.

PATHWAYS FORWARD AND LESSONS LEARNED

Scoping and scaling—The BIG U proposal showed the benefits of designing projects in discrete compartments that can be phased in over time as additional funding becomes available. While the grantees are finding that additional work has been needed to transform the proposal’s concepts into technically feasible projects, the grantee has been able to develop each of the individual compartments into concrete projects that can be implemented incrementally. In fact, parts of the BIG U proposal were used to inform development of the city’s winning proposal for the National Disaster Resilience Competition (NDRC), which will bring in additional resources to support construction of the Two Bridges compartment.

Designing to avoid legal barriers—Design teams can develop projects that can be more easily implemented by state and city agencies if they anticipate legal barriers and design projects to purposefully reduce or avoid those barriers. With the BIG U proposal, the design team purposefully crafted the conceptual design of the flood protection so that it would not require in-water components or fill in order to avoid triggering state and federal permitting hurdles.⁶ While the proposal included some in-water elements (ferry, bath, and fish docks) to provide recreational benefits, these elements of the proposal could be scaled back to ease permitting for the flood protection elements. This ability to avoid permitting requirements has made the project easier to implement given the quick timelines that the grantees are under to construct the project and expend the available funds.

Land ownership—Design teams can also facilitate implementation by considering the ownership of lands needed to implement a project. Implementation of the ESCR compartment has been eased because of common city ownership and control of the lands needed to construct the berm projects. Because the project can be built mostly on city-owned lands, the grantee does not have to go through time-consuming and expensive efforts to acquire additional lands through purchase or use of eminent domain, which can be politically controversial. The city is also leveraging Con Ed investments in the region by ensuring the flood protection investments that Con Ed is making to protect its facilities are integrated with the city's investments.

Holistic resilience strategies—All of the grantees, including New York City, are having to consider alternative pathways for implementing unfunded components of projects. The funding gap has limited the ability of the grantees to holistically address their risks across the range of impacts they are likely to see under existing conditions and with climate change. Because Sandy was a storm-surge driven flood event, the ESCR focused on building flood structures to protect against storm surges. However, coastal flooding can block outfalls, preventing proper drainage when surge events are accompanied by heavy rainfall events, which can exacerbate interior flooding. While the grantee is working with the New York City Department of Environmental Protection to address interior drainage, there is not enough RBD money to implement these improvements. Thus to build the holistic resilience approach envisioned by the project, city agencies are having to try to find and cobble together other sources of funds, from a variety of programs, often with no clearly viable sources available. To achieve the comprehensive resilience vision called for by the proposal, the grantees will need to find other sources of funding and other mechanisms (regulatory or incentives) to implement unfunded components and future phases of work.

Green vs. gray infrastructure solutions—To address interior drainage flooding, the city is exploring gray infrastructure solutions like storage tanks and pumps. While gray infrastructure solutions (both for flood protection and stormwater management) may be easier to implement from an engineering and design standpoint, they do not provide the community with the same environmental and social co-benefits that are provided by using green infrastructure and natural systems. Although the BIG U proposal did not sufficiently address interior drainage needs, it did call for broad deployment of green infrastructure solutions across public housing campuses throughout the project area because of the multiple benefits that could be provided by these types of interventions. For example, building from the ideas generated in the BIG U proposal, the New York City Housing Authority (NYCHA) has developed a plan to better manage stormwater on NYCHA campuses throughout the city. Adjacent to the ESCR project, NYCHA proposes to open up public housing campuses to surrounding neighborhoods and install a suite of green and gray interventions that would store or retain up to 8-inches of stormwater during a 24-hour rainfall event, reducing flood risks on NYCHA campuses and in the surrounding area during heavy downpours.⁷ Although Sandy was mostly a storm-surge driven flood event, intense precipitation events are anticipated to become more frequent and more intense with climate change in the New York region. The interventions proposed by NYCHA could preemptively address threats that will become more pronounced in the future. These improvements would also provide myriad co-benefits by making public housing campuses safer and more inviting for residents and neighbors; providing recreational and green space; and using natural systems to manage stormwater, improve water quality, and reduce urban heat islands. NYCHA, however, is experiencing difficulty identifying appropriate funding sources to support these investments and these options are not being pursued as part of the ESCR project due to a lack of RBD funds. Some of these social and environmental co-benefits may be lost in implementation of the project, if green infrastructure is not pursued as a mechanism for managing stormwater.

Maximizing co-benefits—Large-scale flood control projects can and should be designed to cost-effectively maximize social, environmental, and recreational co-benefits. The final BIG U proposal, and the funded compartment, demonstrate that flood-protection structures (such as berms and deployable barriers) can enhance more holistic community well-being by providing flood protection during episodic extreme weather events and also everyday recreational and social benefits during normal conditions. For example, by integrating natural systems, bikeways, walking paths, access points and other amenities into the design of flood protection systems, project designers can increase the overall community benefits provided by a flood-protection project. However, when grantees are developing and choosing among project alternatives, funding constraints require them to maintain a clear vision of the multiple benefits they seek to provide with the project. Projects can also be designed to allow for additional amenities to be phased in over time as additional funds become available.

Building on existing plans—The BIG U proposal demonstrated how planning (pre- and post-disaster) can strengthen disaster recovery efforts. The BIG team benefited and drew from robust planning documents prepared by the city both before and in the immediate aftermath of Sandy, including strategies identified by the New York City Special Initiative for Rebuilding and Resiliency (SIRR) in its *2013 A Stronger, More Resilient New York* plan and other planning documents developed for certain segments of the waterfront and specific neighborhoods (e.g., *America's Chinatown* (2004)). The clarity of the BIG U proposal and the city's post-Sandy climate resilience efforts demonstrates how plans can improve and provide a comprehensive vision for a city's disaster recovery process.

Public engagement—The BIG U proposal also demonstrates the benefit of robust civic participation. Different designs were vetted with community groups and the ultimate proposal incorporated a vision that was supported by and informed by the communities and neighborhoods that will benefit from these investments. The design teams also plugged into existing community groups to facilitate public engagement. As the city moves to implement the project, it is benefitting from the networks that were developed by the design team during the RBD competition. This sustained engagement both during the competition and in finalizing the project design has created significant public support for and public input in the project design, even as it evolves.

CONCLUSION

The BIG U project is demonstrating how cities can incorporate flood defenses into city lands and parks while enhancing the recreational and ecological benefits provided by these spaces. Berms and flood walls will be integrated into parks and right-of-ways demonstrating ways to build flood protections in dense urban environments where site constraints require creative design approaches. Once constructed, the East Side Coastal Resiliency project will demonstrate how communities can develop resilience approaches that both reduce risks during extreme storm events and provide everyday benefits to residents seeking recreation, access to the water, natural amenities, and places to socialize.

CHAPTER 2 END NOTES

- 1 BIG Team, *The BIG “U”, Rebuild by Design, Promoting Resilience to Sandy through Innovative Planning Design & Programming at 7* (2014) (hereinafter “BIG U Proposal”), available at: <http://www.rebuildbydesign.org/our-work/all-proposals/winning-projects/big-u>
- 2 *The BIG U proposal* at 214.
- 3 *East Side Coastal Resiliency (ESCR) Project, Environmental Impact Statement Draft Scope of Work* at 16-17 (October 30, 2015), http://www.nyc.gov/html/cdbg/downloads/pdf/resiliency_draft_scope_of_work.pdf
- 4 In addition to the HUD requirements, other federal, state, and local rules are currently being developed, that may affect the required level of flood protection that the berm system must provide as the project moves into permitting, design, and construction: (1) the Federal Flood Risk Management Standard (FFRMS, adopted pursuant to President Obama’s amendments to Executive Order 11988), will require federal projects to be built to withstand the 100-year flood event plus at least two feet. (2) New city and state regulatory requirements may also require projects to be designed with sea-level rise in mind, when finalized.

New York authorizes local governments to administer programs to improve and protect coastal resources and to manage watershed and estuaries through the Waterfront Revitalization and Coastal Resources Act. New York Department of State, Office of Planning and Development, *Local Waterfront Revitalization Program*, <http://www1.nyc.gov/site/planning/applicants/wrp/wrp.page>. New York City has adopted a Local Waterfront Revitalization Program (NY-WRP), and the city recently updated its WRP to require development and redevelopment projects to consider and mitigate risks from the effects of future climate change including sea-level rise. The WRP was approved by the city council in December 2014, and was reviewed and approved by state and federal agencies in 2016. NYC Planning, *2012 WRP Revisions – Summary of Proposed Revisions*, http://www1.nyc.gov/assets/planning/download/pdf/applicants/wrp/revisions/wrp_revisions_summary.pdf.

Additionally, in 2014, the state legislature enacted the Community Risk and Resilience Act (CRRA, A06558/S06617-B), which calls on state agencies to consider sea-level rise and other climate change impacts in state permitting and funding programs. The NY-DEC is charged with adopting a set of sea-level projections, which will then need to be updated every five years. Once adopted, future climate change risks will need to be considered in a variety of state permitting and funding including the following relevant provisions of the NY Code: smart growth public infrastructure criteria (ECL Art. 6); state assistance for local waterfront revitalization programs and coastal rehabilitation projects (ECL Art. 54 title 11); and uniform procedures for major permits (ECL Art. 70). This may mean that RBD projects in New York and New York City may have to comply with new permitting requirement, which requires projects to be designed to account for state-developed sea-level rise projections. The BIG U project will likely comply with these requirements as the project was and is being designed to account for future sea-level rise.

- 5 In its notice of funding HUD imposed special requirements on projects involving flood control structures. The Notice provided: “HUD expects the grantee or a subrecipient, contractor, or subgrantee to take responsibility for operating and maintaining any levee, floodwall, or other flood control structure or system funded under the RBD allocation. Grantees must identify the entity(ies) that will own, operate, and maintain any levee or levee/breakwater system. Any levee or levee/breakwater system funded under the RBD allocation must be technically sound. The grantee must certify in its Action Plan Amendment that it, or the local authority assuming ownership of a levee, will take action to ensure the levee is certified and meets FEMA standards at 44 CFR 65.10 and is subsequently accredited by FEMA, which allows for flood maps to be re-drawn accordingly.” *Third Allocation, Waivers, and Alternative Requirements for Grantees Receiving Community Development Block Grant (CDBG) Disaster Recovery Funds in Response to Hurricane Sandy*, 79 Fed. Reg. 62182-01 (Oct. 16, 2014)

Pursuant to the National Flood Insurance Program (citation 42 U.S.C. 4001 et seq.), the Federal Emergency Management Agency (FEMA) has responsibility for mapping areas of special flood hazard where special floodplain management provisions apply and for assessing and certifying levee systems that provide protection against a 1-in-100 flood event. FEMA has developed regulations for how it certifies levees and remaps areas protected by levees. Areas protected by levees can be remapped so that they are no longer considered “special flood hazard areas” where land-use regulations and flood-insurance purchase requirements are triggered. See 44 C.F.R. 65.10.

- 6 The Army Corps of Engineers has permitting authority over discharges of dredge or fill materials into waters of the United States, including wetlands, under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. The State of New York has also adopted its own program for regulating activities in intertidal areas, the New York Tidal Wetlands, and State laws apply in addition to Corps permitting requirements. N.Y. Environmental Conservation Law § 25-0101 (McKinney). Almost all activities which would alter wetlands or adjacent areas (extending up to 300 feet from the wetland boundary, 150 feet within New York City) out extend out to a water depth of six feet require a permit from the New York State Department of Environmental Conservation (NYDEC).

Under the state's Tidal Wetlands Act, any construction, reconstruction, or expansion of structures or any movement of earth material or subdividing of land all require a permit. N.Y. Environmental Conservation Law § 25-0401 (McKinney). And dredging, filling, and construction of berms in intertidal areas are all considered "presumptively incompatible uses" and, as a result, must overcome that presumption by demonstrating that the activity will be compatible with the area and will protect, preserve, and enhance tidal wetlands before NYDEC can issue a permit. The disposal of dredge materials in intertidal marshes is designated an incompatible use that NYDEC cannot permit. 6 NYCRR 661.9; see also NYDEC, *Tidal Wetlands Permit Program: Do I Need a Permit?* (2015), <http://www.dec.ny.gov/permits/6359.html>.

- 7 The City of New York, *Lower Manhattan Protect and Connect, National Disaster Resilience Competition Phase 2 Application* at 53-54 (Oct. 2015), available at: http://www.nyc.gov/html/cdbg/downloads/pdf/NDRCApplication_Exhibits_10%2029%2015_3.pdf.

Living Breakwaters

Staten Island
New York City



BACKGROUND

Located in the mouth of the New York Bight (at the confluence of the Atlantic Ocean, Long Island Sound, and Hudson River systems), Staten Island experienced the brunt of Sandy's storm surge and wave forces. Storm-driven waves were funneled in from the Atlantic Ocean and piled onto the shores of southern Staten Island, causing damaging coastal erosion and the destruction of many homes.

While historically the waters off of the southern shore of Staten Island were home to extensive natural oyster reefs that helped dampen storm surges, these oyster reefs were degraded and destroyed over time by overharvesting, dredging, and pollution. Similarly, historic wetlands in the area, which used to provide a natural buffer during storm events, were filled to accommodate development in the area. The Living Breakwaters proposal provided a strategy for rebuilding the natural protections generated by oyster reefs, tidal wetlands, and beaches to create a layered system that engages the water and increases ecological resilience.

THE PROPOSAL

The Living Breakwaters proposal envisioned the restoration and construction of multiple layers of natural and nature-based flood protection. This included breakwaters and living shorelines, which when combined would reduce risks for communities along the southern tip of Staten Island. The breakwaters would create habitat for fish, mollusks, and

COMPETITION DESIGN TEAM

SCAPE / Landscape Architecture PLLC, Parsons Brinckerhoff, Stevens Institute of Technology, Ocean and Coastal Consultants, SeArc Consulting, The New York Harbor School, LOT-EK, MTWTF, and Paul Greenberg

PROJECT AREA

The Tottenville Reach from the southern tip of Staten Island to Butler Manor Woods facing Raritan Bay

GRANTEE

New York State, Governor's Office of Storm Recovery (GOSR)

AMOUNT AWARDED

\$60 million

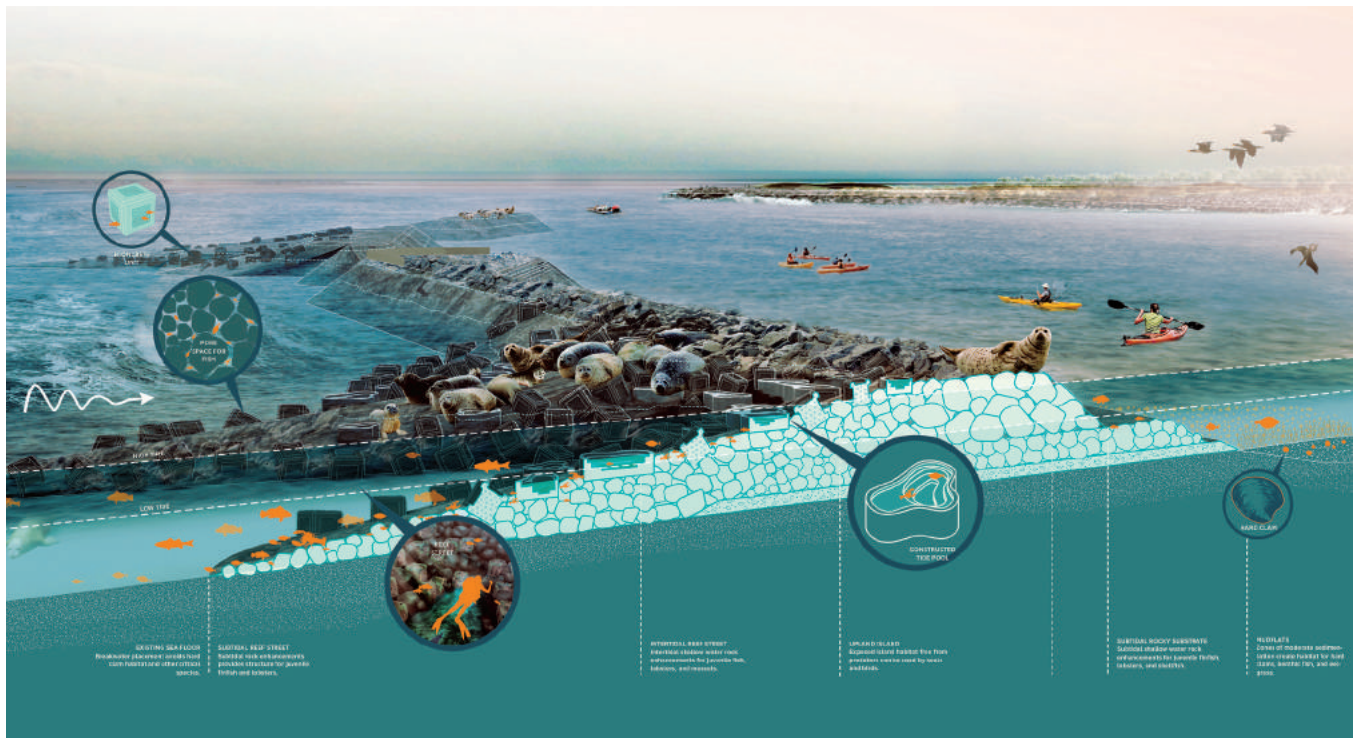
PROPOSAL LINK

<http://www.rebuildbydesign.org/our-work/all-proposals/winning-projects/ny-living-breakwaters>

PROJECT WEBSITES

<http://stormrecovery.ny.gov/living-breakwaters-tottenville>; <http://stormrecovery.ny.gov/LBWCAC>

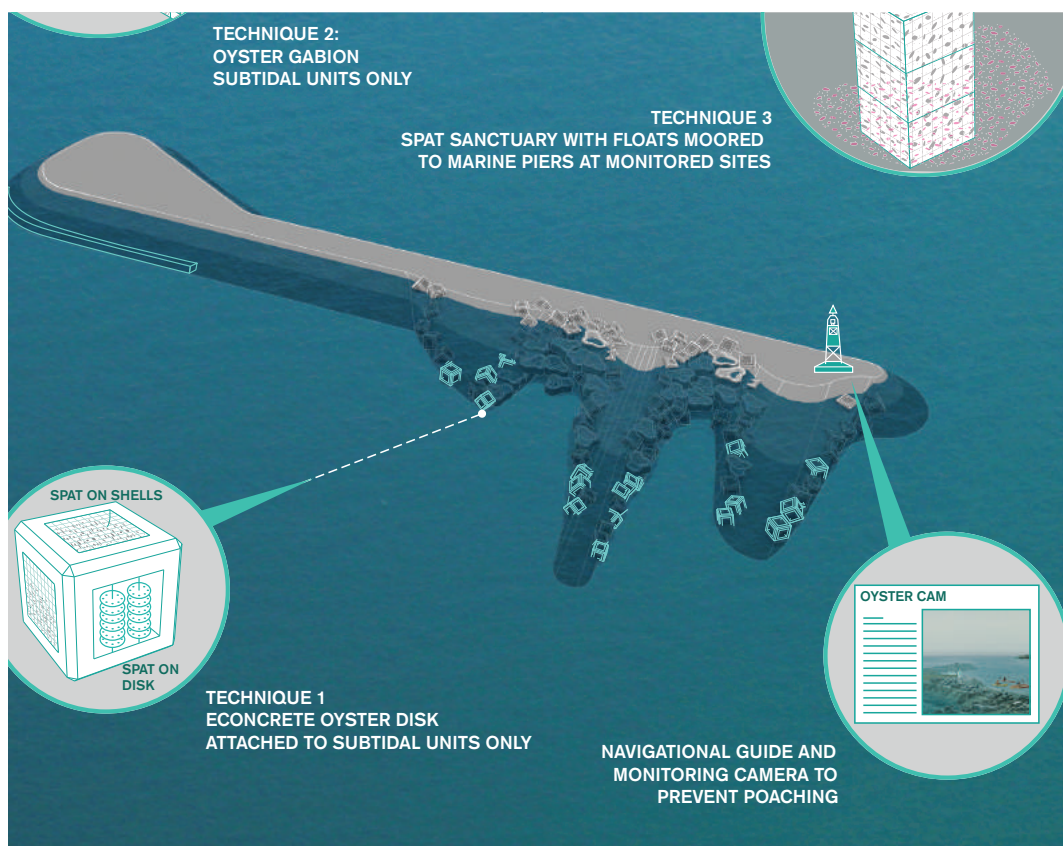
other marine life; dampen storm surges; and reduce or reverse coastal erosion. The proposal also called for recreational and educational amenities to increase community access to the waterfront, educate students and visitors about coastal processes, and increase waterfront recreational opportunities.¹



Living Breakwater

This picture depicts the ecosystem benefits that a living breakwater can provide.

For the first line of defense, the proposal called for the construction of “living breakwaters” (i.e., a breakwater designed not only to attenuate waves but to create habitat for oysters, juvenile fish, and other marine life). Traditionally, breakwaters are rocky, sloped structures in the water column that break a wave’s momentum and prevent the destructive wave forces from battering the shoreline. Breakwaters also have the potential to trap sediment and create wider beaches behind them. The proposal called for a breakwater sited approximately a quarter mile offshore and stretching from Great Kills to Tottenville on the southern tip of Staten Island, fronting the Raritan Bay. The proposal suggested a phased approach for constructing breakwaters along the Staten Island shore: Phase 1 at Tottenville Reach, Phase 2 from Crescent Beach to Great Kills Harbor, and Phase 3 from Lemon Creek to Prince’s Bay. It envisioned a mix between exposed, intertidal, and sub-tidal breakwaters. The breakwaters would be strategically placed to protect parks, marinas, and coastal development from wave action, while maintaining tidal connectivity and preserving and enhancing coastal ecosystems. The design team estimated that a living breakwater system in this region could result in a significant reduction in wave height, substantially lowering risks to waterfront neighborhoods in this part of Staten Island. The “living” aspect of the breakwater would be achieved by integrating the creation of habitat, such as oyster reefs and habitat for juvenile fish, to enhance coastal ecosystems and potentially improve water quality.



Restoring Oyster Reefs

This picture shows how oyster reefs can be restored to enhance ecosystems and dampen storm surges.

At the water's edge, the proposal envisioned layering beach dune systems and living shorelines to further protect coastal neighborhoods and ecosystems from erosion and wave action. Inland, the proposal suggested that "non-structural measures," such as elevating homes, could be used as a complimentary strategy to further reduce risk and enable communities to withstand flooding.

Finally, the Living Breakwaters proposal called for the development of community facilities along the shore called "Water Hubs." These hubs would provide space for classes, monitoring activities, and storage of recreational equipment like kayaks. They could also serve as temporary emergency response centers. The project envisioned these structures to be used by local schools and community groups to connect local residents to the harbor and help promote environmental education. The proposal suggested that the Billion Oyster Project and New York Harbor School could also use the hubs to support the group's oyster restoration efforts throughout New York Harbor.

The design team recommended a first phase pilot in the Tottenville Reach of Staten Island and estimated a cost of approximately \$74 million to construct the pilot. The grantee was allocated \$60 million to implement this project.²



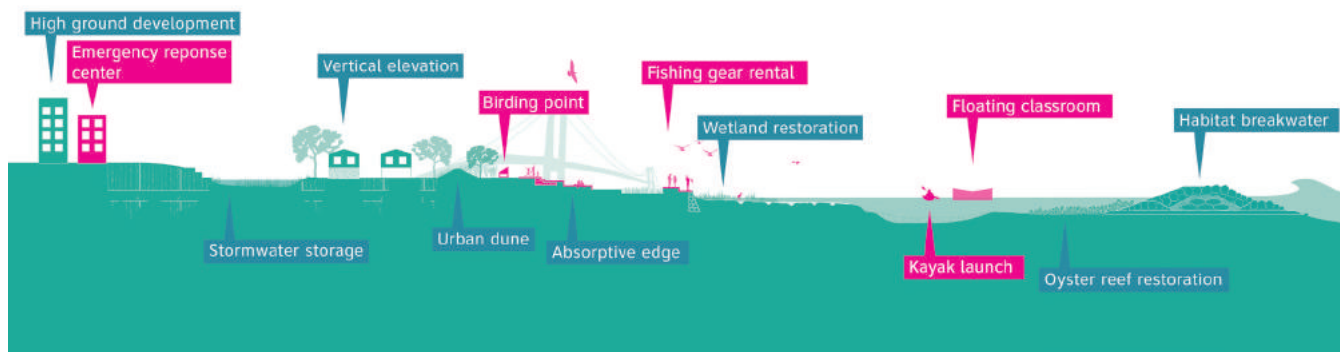
Water Hub

The Living Breakwaters proposal suggested the construction of "Water Hubs" to enhance social resilience, facilitate monitoring, and provide space for public education.

THE PROJECT

The grantee is working to implement the awarded component of the proposal along the coast of Tottenville from the southern tip of the island, known as Ward's Point, to Butler Manor Woods. The grantee is proposing to construct breakwaters using rock and bio-enhanced concrete, some of which will be seeded with oysters to encourage habitat growth over time.³ The breakwater will serve to dampen wave action and prevent shoreline erosion. It will provide ecosystem benefits through the restoration of oysters and creation of in-water habitat to support a range of marine species. Additionally, the breakwaters will create calm, near-shore waters, and protect and allow for the accretion of beaches, which will enhance recreational opportunities and better connect residents and visitors with the waters of the Raritan Bay. The grantee also seeks to build the onshore Water Hub to provide space for the community and programs that can educate the public about oyster reef restoration efforts and coastal processes.

The project is being aligned with other recovery efforts in Staten Island including the Tottenville Shoreline Protection Project. This project is exploring a variety of shoreline interventions that could reduce risk to upland residential communities and prevent erosion. The interventions are designed to suit different shoreline conditions, including wetland enhancement, shoreline plantings, berms, beach nourishment, and a hardened dune system. The proposed dune system would be hardened with a stone core and sand cap and stabilized with plantings to prevent erosion.⁴ The project will also create a continuous trail system from the proposed Water Hub in the east running along the shoreline to existing trails through Conference House Park on to the west. The Shoreline Protection Project is being funded with \$6.75 million of CDBG-DR funding through the NY Rising Community Reconstruction Program.⁵



Living Breakwaters: Multiple Lines of Defense

The Living Breakwaters proposal called for a multiple lines of defense strategy utilizing breakwaters, living shorelines, dune restoration, and home elevation to reduce flood risks.

Currently, the grantee is developing schematic designs and beginning the environmental review process for both projects (a final Environmental Impact Statement scoping document was published on April 1, 2016). The environmental analyses will cover both the Living Breakwaters and the Tottenville Shoreline Protection projects (described above). The consultant design team is developing and examining different design and engineering alternatives for placement and design of the breakwaters and other project elements.

LEGAL AND POLICY CHALLENGES

Permitting of hybrid green-gray coastal defenses—Because the project involves hybrid, green-gray approaches and in-water structures, the grantee is navigating complicated federal and state permitting requirements.⁶ To obtain permits for the project, the state has to coordinate with a variety of federal and state agencies including the US Army Corps of Engineers, National Marine Fisheries Service, the US Environmental Protection Agency, the US Coast Guard, and the New York Department of Environmental Conservation. Part of the challenge is trying to address where to place the breakwater. The permitting process requires the grantee to balance the need to site the living breakwater in ways that provide the greatest wave attenuation benefits and ecological and habitat benefits, while also complying with regulatory requirements to minimize impacts to navigation and ecosystems, including displacement of clam habitat. The shoreline protection components of the project (living shorelines, marsh restoration), will likely require environmental mitigation to receive a permit even though the project will provide a net ecological benefit. State and federal regulators should use the learnings from this project and post-implementation monitoring to inform environmental mitigation requirements and provide credit to “self-mitigating” projects (i.e., ecological enhancement projects).

Oyster reef restoration in contaminated waters—A second challenge is addressing the public health concerns resulting from restoring a live population of oysters in contaminated water. Oysters can be an “attractive nuisance” because people might harvest the oysters, eat them, and become sick. In considering the design of the project, the grantee is thinking about mechanisms for reducing these risks, including monitoring and public awareness campaigns.

Baseline data and long-term monitoring—During the competition phase, the grantee did not have access to sufficient baseline data when they began studying the feasibility of the proposed project components because much of this data did not exist. As a result, early stages of work had to focus on extensive data collection such as site testing, and surveys of shoreline and geological conditions, topography, and bathymetry. The grantee also had to develop wave models to simulate local, long-term wave conditions based on regional wave and wind

data and local bathymetry. Data collection had to be done over many seasons in order to assess shoreline change based upon seasonable variability. The data collection and analysis will be critical to determining the design and feasibility of the Living Breakwaters project and, ultimately, for obtaining permits for the project. These extensive data collection efforts, however, are time-consuming and expensive, and can be challenging for disaster recovery projects, like the RBD projects, which are under quick implementation timelines.

Long-term monitoring—Monitoring will also have to continue after the project is constructed to evaluate the project’s effectiveness, but there is no existing source of funding to support this work. Because this project is designed to achieve multiple benefits (risk reduction, environmental, social), it has been challenging for the grantee to develop a monitoring program that measures the success of the project across multiple performance criteria. For example, the grantee is trying to figure out how to monitor and track the social benefits of the project (e.g., visitors to the beach, benefits to fishing communities, etc.), which is not currently part of the monitoring program but is an important resilience value of the project. To overcome this challenge, the grantee is working with nonprofits and academic partners in the early stages of project design. The goal is to better position these partners to craft competitive applications to bring in other federal grants to support long-term monitoring of the project.

Long-term ownership, operations and maintenance—Another challenge is determining the long-term ownership, operation, and maintenance for the project, including the breakwaters, restoration efforts attached to it, and other amenities like the Water Hub. While the Governor’s Office of Storm Recovery (GOSR) is the grantee and is charged with implementing the project, GOSR was created with the purpose of managing the state’s Sandy recovery efforts and this agency will sunset after the state’s disaster recovery funding is spent. As a result, GOSR must find a public or private entity to take ownership of the project and take on the long-term commitment to operate and maintain these assets.

PATHWAYS FORWARD AND LESSONS LEARNED

Intergovernmental coordination—Interagency, Technical Coordinating Teams (TCTs) that were convened to facilitate Sandy recovery projects are helping to facilitate implementation of the Living Breakwaters project. HUD convened TCTs, which included officials from city, state, and federal regulatory agencies. These agencies have worked together since early in the process to ensure that the project will meet each agency’s permitting requirements before decisions about design and placement of the breakwater are finalized. The TCT was instrumental in helping the grantee determine what baseline data to collect at the outset of the project to help ensure that the grantee has the proper data to obtain permits at later stages of project implementation. It is hoped that this early coordination will streamline and ease the permitting process. The grantee is also managing coordination with New York City through a Memorandum of Understanding (MOU), which sets forth the requirements for developing the onshore components of the project. The MOU includes processes for coordinating the review of project design drawings and for developing design standards. Finally, the grantee has regular check-ins with elected officials in the area to inform them of new developments in the project and to discuss Sandy recovery more generally. The grantee finds these check-ins to be useful because they create an opportunity for conveying information about the project, receiving regular feedback from elected officials, and getting ahead of any potential problems.

Anticipating permitting barriers—The Living Breakwaters project showed the benefit of designing a project to minimize permitting barriers. The design team purposefully proposed known methods, like breakwaters and living shorelines, for attenuating waves and controlling erosion. The project enhanced and combined these traditional methods to create an incrementally, innovative project that could both reduce risks and provide environmental and social benefits. By proposing known methods, it was hoped that the grantee would have an easier

time translating the project from concept to construction. It was also hoped that regulators would have an easier time permitting methods that had been tested in other locations (even if never combined). However, the proposed hybrid approach is still proving difficult for regulators. While breakwaters have been used to attenuate wave action and protect harbors, and reef creation and restoration have been used to deliver ecological benefits, there is no precedent for combining these methods to provide a multi-benefit solution and no precedent for this type of project in New York Harbor. As a result, state and federal regulators (in this region) are having to evaluate this type of approach for the first time based upon the site-specific conditions presented in this area of the coast, which includes both sensitive habitat and important shipping channels. To ensure that this project facilitates future efforts of this kind, regulators will need to use the lessons from this project to reform state and federal regulatory programs.

Environmental review—In developing projects intended to provide multiple benefits, it is important to include a description of all the multiple benefits that the project is intended to deliver in the “statement of purpose and need” within the environmental review documents for the project (e.g., EIS Scope of Work).⁷ The purpose and need statement sets the baseline that the grantee uses to identify reasonable project alternatives and to select the preferred alternative. The purposes and needs identified set the comparative criteria that regulators will review when approving the project and evaluating the alternatives analyzed. It also establishes the comparative criteria used by courts in the event that the EIS is legally challenged for deficiencies. All of the RBD projects are being designed to achieve multiple benefits: risk reduction, ecological enhancement, and social resiliency, among others. For this reason, the grantee had to craft the purpose and need statements in their EIS Scope of Work to clearly articulate these multiple benefits. This then determined what alternatives were selected for analysis in the EIS and helped the grantees reject for consideration any alternatives that would not deliver the specified benefits. For example, with the Living Breakwaters project, the grantee could reasonably reject a project alternative that would involve building a sea wall along the coast because such a project alternative would not deliver the intended environmental benefits (e.g., improved habitat and ecosystems) or social resilience benefits (e.g., increased public access to the coast and recreational opportunities).

Community engagement—The grantee has convened a Citizen Advisory Committee (CAC) of non-elected officials to inform project implementation. The grantee is keeping the CAC up-to-date on the evolution of project alternatives as they move through the process. The design team and grantee are using innovative methods to generate interest in the project such as hosting shoreline walks and interactive design meetings. The grantee credits the deep and meaningful relationships fostered by the community-engagement process as a critical factor to the project’s success because the CAC has served as an important ally and advocate. RBD has shown that collaborative community engagement processes not only strengthen a project but also ease implementation.

Building upon pre-disaster plans—Similar to other projects, the Living Breakwaters project shows that post-disaster recovery efforts can build and improve upon pre- and post-disaster plans and assessments. Living Breakwaters used several existing plans as a foundation for the proposal, including the Comprehensive Coastal Protection Plan included in the *Stronger, More Resilient New York Plan*; the *New York Rising Staten Island Concept Plan*; and the *New York and New Jersey Harbor Comprehensive Restoration Plan*. These plans and assessments provided a foundation for the resilience vision that was built out and refined in the conceptual design phases of the competition.

Opportunities for innovative partnerships—The grantee is also looking to leverage other funding sources and is exploring financing strategies to supplement funding for some components of the project, including the Water Hubs and other components not eligible for CDBG-DR funds (e.g., educational and stewardship projects and long-term monitoring and maintenance of the project). The Water Hub is proving to be a more important component than the grantee had originally anticipated. The structure will be needed to facilitate oyster restoration activities and to monitor and assess the performance of the living breakwaters over time in terms of both the habitat creation and flood-risk reduction benefits of the project. In weighing the tradeoffs, the grantees decided to allocate the available funds to build improvements that will reduce flood risks (i.e., the Living Breakwaters), rather than to build a structure to support monitoring and other recreational activities. The grantee is also looking to develop government or philanthropic sources to build the Water Hub. However, they are finding that government sources are cash-strapped and available government budgets are already allocated. The grantee is also having difficulty raising funds from philanthropic sources given the tight timeline for project implementation.

CONCLUSION

The Living Breakwaters project will provide an important demonstration for using nature-based approaches for reducing flood risks in a waterbody with sensitive habitats, degraded waters, and important navigational interests. It is hoped that this approach will provide a test case for regulators who can improve and refine permitting requirements so that these approaches can be replicated along Staten Island and throughout the region. The project will also help to demonstrate the ecological, social, and economic benefits that can be provided by restoring natural ecosystems as a method for reducing flood risks.

CHAPTER THREE END NOTES

- 1 SCAPE/LANDSCAPE ARCHITECTURE et al., Living Breakwaters, available at: <http://www.rebuildbydesign.org/our-work/all-proposals/winning-projects/ny-living-breakwaters>.
- 2 The design team estimated that the Phase I Tottenville Pilot would cost approximately \$58 million to construct with \$12 million in maintenance costs and would provide benefits in \$263 million in avoided potential losses, creation of 52 acres of habitat for 32 different species, and generation of \$15 million in annual economic revenue. The design team calculated that the project would have a benefit-cost ratio of 1.59, not factoring in the ecological and recreational benefits brought by the project.
- 3 *Coastal and Social Resiliency Initiatives for Tottenville Shoreline, Staten Island, NY, Environmental Impact Statement Final Scope of Work* at 6-7 (Apr. 1, 2016) (hereinafter “EIS Final Scope of Work”) available at <http://stormrecovery.ny.gov/living-breakwaters-tottenville>.
- 4 EIS Final Scope of Work at 6-7.
- 5 EIS Final Scope of Work at p. 4
- 6 The Army Corps of Engineers has permitting authority over activities that could obstruct navigability under Section 10 of the Rivers and Harbors Act, and discharges of dredge or fill materials into waters of the US under Section 404 of the Clean Water Act. Large-scale habitat restoration and coastal defenses projects, like the Living Breakwaters project, can trigger lengthy individual permit requirements. The Corps individual permit process requires lengthy site-specific review, public notice and comment, public interest review (33 C.F.R. 320.4(a)(1) (2010)), consultation with other federal agencies (such as EPA, NMFS and FWS), and compliance with other federal requirements including the Endangered Species Act (16 U.S.C. § 1532(19)), Magnuson-Stevens Act (16 U.S.C. § 1801 et seq.), and the National Historic Preservation Act (16 U.S.C. § 470 et seq.). The Corps individual permitting process can add time to the permitting of projects, particularly innovative projects that can have impacts on navigability, aquatic and estuarine habitats, threatened or endangered species, fisheries and essential fish habitats, or water quality. Projects that involve Essential Fish Habitat trigger review by NOAA’s National Marine Fisheries Service and US Fish and Wildlife Service.

State agencies also have permitting authority over projects in intertidal areas under state water quality, wetlands, and coastal management statutes. The New York Department of Environmental Conservation (NYDEC) and New York Department of State (NY-DOS) have regulatory authority over coastal protection and wetland restoration. NYDEC administers programs to improve and protect New York’s natural resources and the environment including managing the state’s watersheds and estuaries; and NYDOS administers the state’s Waterfront Revitalization and Coastal Resources Act (the New York law that was enacted to ensure that state activities and local government activities were consistent with the federal Coastal Zone Management Act). NYDEC administers the Tidal Wetlands Act, which will be triggered by RBD projects involving restoration of near-shore habitats. Any construction, reconstruction, or expansion of structures or any movement of earth material or subdividing of land all require a permit (N.Y. Environmental Conservation Law § 25-0101). Dredging, filling, and construction of berms in intertidal areas are all considered “presumptively incompatible uses” and, as a result, must overcome that presumption by demonstrating that the activity will be compatible with the area and will protect, preserve, and enhance tidal wetlands before NYDEC can issue a permit. The disposal of dredge materials in intertidal marshes is designated an incompatible use that NYDEC cannot permit (6 NYCRR 661.9).
- 7 CEQ Guidelines Section 1502.13 [The statement of purpose and need “shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action.]

Living with the Bay

Nassau County
New York



BACKGROUND

Nassau County is on the western end of Long Island and borders the New York City borough of Queens. The county is characterized by suburban development and has a population of approximately 1.4 million people. It spans the width of Long Island, extending from the barrier islands fronting the Atlantic Ocean to the south and to the Long Island Sound to the north.

This county encompasses a diverse geography, including oceanfront barrier islands, bay, marshy lowlands, and uplands traversed by streams and rivers flowing into the bay. As a result, the county faces flood risks from both storm surge and inadequate drainage. Fronting the Atlantic Ocean, two barrier islands (Long Beach and Jones Beach Island) protect Long Island from storm surge; however, one of the county's biggest cities, Long Beach, is located on Long Beach Island.

The county also includes a diversity of local governments. Within Nassau County, there are two cities (Long Beach and Glen Cove), three towns (Hempstead, North Hempstead, and Oyster Bay), and 64 incorporated villages.

The county was greatly affected by Hurricane Sandy with 10 percent of the homes in the region experiencing flood damages and 11 million people losing power. The region also experiences flooding from rain-driven events. Stormwater runoff and pollutants have caused the region's waterways and coastal ecosystems, such as tidal wetlands and marshes, to be significantly degraded.

COMPETITION DESIGN TEAM

Interboro Partners, Apex, Bosch Slabbers, Deltares, H+N+S, Palmbout Urban Landscapes, IMG Rebel, Center for Urban Pedagogy, David Rusk, NJIT Infrastructure Planning Program, Project Projects, RFA Investments, TU Delft Faculty of Architecture

PROJECT AREA

Mill River, Nassau County on Long Island, New York

GRANTEE

New York State, Governor's Office of Storm Recovery (GOSR)

AMOUNT AWARDED

\$125 million

PROPOSAL LINK

<http://www.rebuildbydesign.org/our-work/all-proposals/winning-projects/ny-living-with-the-bay>

PROJECT WEBSITE

<http://stormrecovery.ny.gov/living-bay>

THE PROPOSAL

The “Living with the Bay” proposal focused on the communities in Nassau County that were hardest hit by Superstorm Sandy—communities south of Sunrise Highway (also known as Highway 27) and fronting the Atlantic Ocean. The proposal recommended a holistic approach to rebuilding coastal and riverine ecosystems to provide natural flood protections for the region. It called for a “buffered bay” approach to protect against the region’s multiple water-based threats: sea-level rise, storm surges, stormwater, and wastewater. Sandy’s storm surge caused most of the damages suffered during the storm. However, regular stormwater runoff and wastewater overflows have caused flooding and have degraded river systems and the bay.



"Slow Streams" Interventions Along the Mill River

This picture depicts an aerial restoration of the Mill River in Nassau County, NY.

The proposal broke the county into different geographical areas: the Ocean Shore (fronting the Atlantic Ocean), the Barrier Island, Marsh, Lowlands, and the Uplands. For each area, the proposal suggested the application of different interventions (described below) that when combined would create an overall “buffered bay” to increase the region’s resilience.

- **Ocean Shore, Sediment Flow**—The Ocean Shore interventions included using sediment management such as beach nourishment and the creation of a sand engine.¹ The sand engine would use natural sediment transport processes to build up beaches along the barrier island and beach nourishment and dune creation would be used to buffer storm surges.
- **Barrier Island, Smart Barrier**—The barrier island interventions called for the installation of a protective landscaped dike system integrated with recreational space to provide protection from storm surges for the City of Long Beach, the most populous town in the county. The proposal also called for the construction of a water-retention park to manage stormwater and better connect the community to the water.
- **The Marsh, Eco-Edge**—In Hewlett Bay, the proposal called for marsh restoration to provide natural flood protection. The proposal called for marshes to be restored with additional grade to promote adaptation to future increases in sea level. New marsh islands would be created to reduce wave action, enhance bay ecology, and introduce new recreational opportunities for residents.
- **The Lowlands, Eco-Edge**—Along the water’s edge, the proposal called for ringed levees, closeable dams and storm gates to be built to provide protection from storm surges. The proposal also called for infrastructure and homes to be elevated.
- **Uplands**—In the uplands, the proposal called for a combination of approaches:
 - A “Slow Streams” approach, which would use a combination of green and gray stormwater management interventions to delay and store water before it is drained to the bay. These interventions would both reduce flood risks from interior flooding and improve water quality in the bay. Riverfront parks and stormwater swales would be constructed along rivers and creeks to provide more room for the water to flow. The use of a sluice gate was suggested to reduce flooding from storm surges. (A sluice gate is a kind of floodgate that can be opened during regular conditions to allow for normal streamflow, but can be closed during storm events to provide protection from storm surge.). Greenways and bike lanes would be constructed in riverfront parks to increase recreational opportunities and access to the bay.
 - The proposal also called for the development of a “Green Corridor” that would build green infrastructure improvements and bike lanes along Sunrise Highway. “High and dry” mixed-use development was also called for along the highway to provide opportunities for the development of affordable and resilient housing near transit centers.

For the first phase of implementation, the design team suggested that the grantee consider implementing a range of projects to test different interventions across a diversity of sites. The recommended pilot projects included installing a sand engine at Jones Inlet (the opening between the barrier islands of Long Beach Island and Jones Beach Island); building a dike and water-retention park in the City of Long Beach; enhancing wetlands and building ringed-levees at the Freeport Waterfront; and installing sluice gates and river improvements on the Mill River at Rockville Centre and East Rockaway.

The design team estimated that the capital expenditures needed to construct all of the components called for by the proposal would cost approximately \$961 million and \$177 million for just the components along the Mill River.² The grantees were allocated \$125 million to implement the Slow Streams component of the proposal.

THE PROJECT

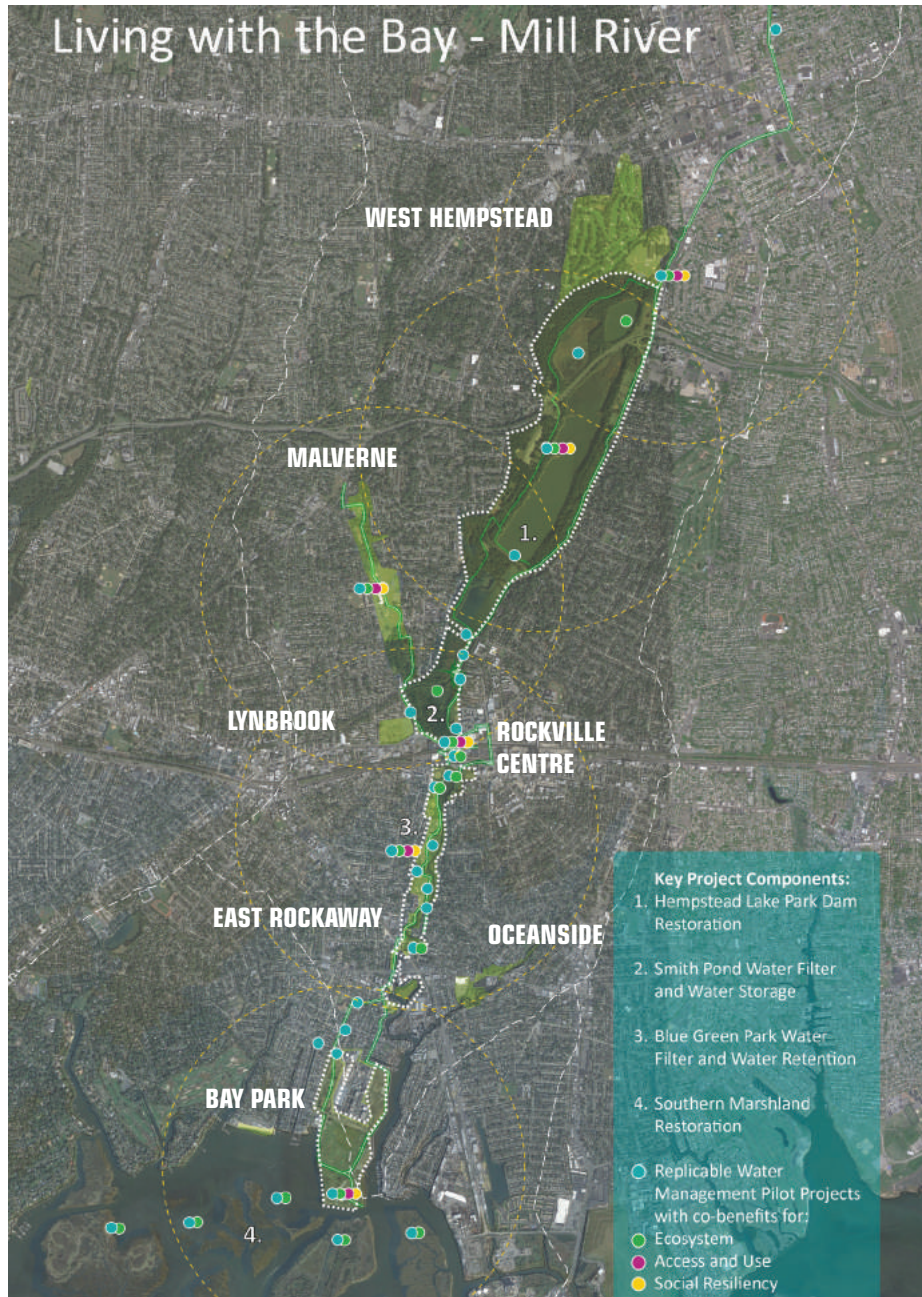
With the RBD funding, the grantee is focusing on implementing the “Living with the Bay Program,” which includes a series of projects along the Mill River from Hempstead Lake State Park to Bay Park. The Mill River runs north to south through the county and has over time been converted into a drainage basin to channel stormwater out to Hewlett Bay. The river is tidally influenced up through Smith Pond. Stormwater runoff and wastewater overflows have not only polluted the river, but the runoff is also contributing to environmental degradation of the river system and the bay. Degradation of bay marshlands and barrier islands has reduced the storm surge protection provided by these natural systems.

This project has changed substantially from the concept described in the RBD proposal, but has maintained several key elements from the original proposal. The grantee (in partnership with the design team, NYS Office of Parks, Recreation, and Historic Preservation, and HUD, and in consultation with relevant municipalities) has reassessed the range of interventions proposed and scoped the project to focus on the Mill River based upon the available funding and the locations of low- and moderate-income (LMI) communities in the county. They have expanded the project northward to include Hempstead Lake State Park, which will allow for a greater focus on water storage capacity and water management at an earlier point in the watershed. The project design was redirected from a focus on storm-surge protection to a more comprehensive watershed approach that will link a series of interventions in the upland to manage stormwater and improve drainage, with additional interventions extending southward to the bay to provide protection against storm surge.

Currently the grantee is considering implementing projects in three sections along the Mill River, integrating all portions into one green “ecosystem” with a connected greenway running from Hempstead Lake State Park along the river to the bay. The program will include the following components:

- **Upper Section**—The first component focuses on Hempstead Lake State Park, where an existing dam will be reconstructed and reinforced. Hempstead Lake and the Northwest and Northeast ponds will be dredged and restored to improve water quality and enhance stormwater storage capacity. The grantee expects that sediment in this portion of the lake is contaminated so restoration work will focus on cleaning out pollutants and trash that have accumulated in these water bodies. A greenway corridor will also be constructed around the lake and will include bike paths and trails providing better connectivity between neighboring communities and the recreational opportunities that will be offered by the restored lake. An educational boating center and ADA-accessible boat launch will also be constructed. This will provide opportunities for a K-12 educational and citizen science program to teach students and the public about the RBD project, allowing them to do water quality testing and monitor trash removers that will be installed in these upper watershed ponds. The grantee is also anticipating installing a fish ladder and is optimistic that the restoration work will facilitate return of alewife and other fish species to the Mill River.
- **Middle Section**—At Smith Pond in the middle section of the river, the river turns from a freshwater system to salt water. Projects along this middle section of the river (which runs through the highly urbanized areas of the Town of Hempstead to the Villages of Rockville Centre and Malverne to Smith Pond) will also be implemented to restore the river system, improve stormwater management, and to dampen storm surge. Dredging and restoration work will occur at Smith Pond, which has become filled with silt and invasive species causing water to back up into the community during heavy rain events. This work will slow streamflow, improve water quality, increase storage capacity, and vastly enhance connectivity of the water system. This will allow for the installation of fish ladders, bringing back fish runs to the river and allowing fish to swim continuously from the bay upstream to Hempstead Lake. The grantee also proposes to continue the greenway in this section to connect

with sections constructed in the upper river. A continuation of the greenway will include restoring a full trail around Smith Pond, and will provide access from a public housing site to recreational fields along the river. The grantee is also working with the NYSDOT to figure out alignments for continuing the greenway across Sunrise Highway down to the bay. A blue green water retention park will be installed in an underutilized storage site in the Village of Rockville Centre and will include bioswales to increase stormwater storage and retention. Check valves (i.e., backflow preventers) will be installed in this segment as a relatively inexpensive structural solution for managing flooding during extreme high tides and storm surge events. The grantee is also trying to leverage Hazard Mitigation Grant Program (HMGP)³ funding to develop mitigation projects at East Rockaway High School, including repairing a bulkhead, retrofitting football fields to double as stormwater parks, and linking the greenway to the High School.



Living with the Bay Program Sections

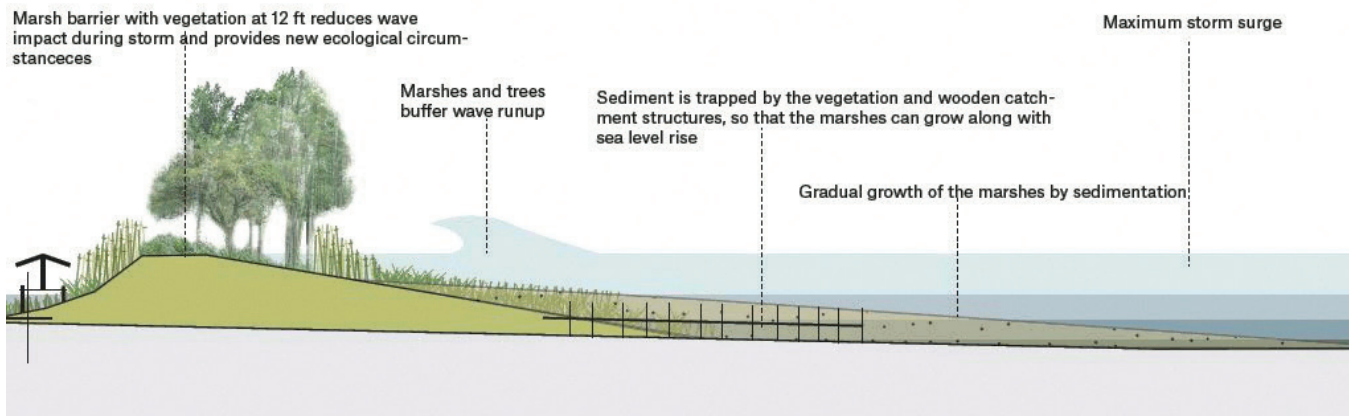
This map depicts the three sections of interventions that will be implemented along the Mill River.

- **Lower Section**—Where the Mill River empties into the Hewlett Bay, the grantee proposes using coastal restoration approaches to dampen storm surges. The grantee is considering a variety of techniques and a series of interventions to build living shorelines around Bay County Park and to restore marshlands and barrier islands in the bay. This part of the program will also leverage funds that were allocated to restore and protect the Bay Park Sewage Treatment Facility from flooding with a new 17-foot berm. The grantee is working with the county to integrate a bike lane into the berm as an opportunity for extending the greenway all the way from Hempstead Lake to Bay County Park. The grantee is also leveraging NY Rising funds⁴ in this area to elevate roads and structures and to install check valves and other drainage system improvements to provide storm surge protection for neighborhoods adjacent to the bay. The grantee would like to integrate a “blueway” into this component of the project, which will create kayaking opportunities in streams feeding into the bay. The grantee is still working with their contractors to assess the optimal strategy for enhancing marshlands and barrier islands and developing interventions that will allow the barrier islands to naturally regenerate over time.

LEGAL AND POLICY CHALLENGES

Flood protection structures—To provide storm surge protection for the uplands, the grantee originally looked at funding a sluice gate along the Mill River as called for by the proposal (previously described). This component encountered multiple financial, technical, political, and regulatory barriers. The sluice gate called for a large gray infrastructure project with a big physical presence (800 yards wide) and with a significant visual impact. Additionally, there was concern about limitations in the flood protection benefits and possible impacts to downstream communities. It was determined that the gate would not benefit all communities, and could in fact harm those at the southern portion of the Mill River. The grantee determined that restoring and revitalizing the dam at Hempstead Lake State Park and incorporating smaller check valves in tidally influenced portions of the river would deliver more flood-risk-reduction benefits to communities along the Mill River. Restoring the dam is also an easier solution from a regional coordination standpoint because the dam is operated and maintained by the state and will not, as a sluice gate would have, require a local entity to determine when to open and close it.

Wetland restoration—The wetland restoration and natural defense components of the project will require permits from the US Army Corps of Engineers, New York State Department of Environmental Conservation (NYSDEC) under the state’s Tidal Wetland Act, and consistency review from New York Department of State under the state’s Waterfront Revitalization Act.⁵ Living shoreline and marshland restoration projects often require the placement of fill and other natural materials, such as low-rock sills, to allow for the establishment of plantings. Living shorelines also often require dredging or grading, which can cause impacts to habitat. Many of these activities are considered “presumptively incompatible” under New York’s Tidal Wetlands Act and will require a permit from NYSDEC.⁶ For presumptively incompatible uses, the applicant must show that the proposed activity is compatible with the area and will preserve, protect, and enhance tidal wetlands.⁷ Thus the grantee will need to navigate federal and state permitting requirements to implement these components of the project. State and federal regulators should commit to applying the lessons learned from permitting these RBD projects to eliminate or reduce legal barriers to future living shoreline projects.



Marsh Restoration in Hewlett Bay

This image shows how marshes and barrier islands can be restored to buffer storm surges.

Stream restoration—The areas surrounding Hempstead Lake and Northwest, Northeast, and South ponds all include freshwater wetlands. Any dredging activities will require a permit under the state’s Freshwater Wetland Act.⁸ The US Fish and Wildlife Service also plays a role in permitting activities that could affect fish passage. Since the project is anticipated to provide significant benefit by bringing back fish species to the Mill River, the grantee does not anticipate that FWS permitting will present an obstacle to the project. However, it is a hurdle that the grantee will have to manage under the tight timelines for implementing the project.

Meeting LMI requirements—At the outset of implementation, the grantee encountered difficulty demonstrating benefits to low- and moderate-income (LMI) residents in the county, a requirement of the CDBG-DR funding.⁹ For large infrastructure projects that provide benefits to a whole community or region, grantees are required to meet HUD’s rules for showing “area benefit” to LMI residents. Grantees must use census tract data of the areas that will benefit from the project and show that 51 percent of the residents are low and moderate income.¹⁰ It is difficult for grantees to meet the 51 percent area-benefit calculus for projects that will have widely distributed benefits throughout a whole community or region. To address this challenge, the state expanded the Mill River project area northward so the project would benefit public housing developments in Rockville Centre and the Town of Hempstead. However, by extending the project inland, the grantee faced challenges demonstrating that the project areas actually experienced damage during Sandy.¹¹ As a result, early phases of the project had to focus on data collection efforts to show that Sandy caused stormwater flooding in this part of the county.

Long-term operations, maintenance and monitoring—A challenge that all of the grantees are facing is how to find sources of funding for the long-term operations, maintenance, and monitoring of the project. The state estimates that they will need about 2 to 5 percent of the project cost to pay for long-term maintenance of the facilities built with the RBD funding. New York has identified several different ways that they can support long-term operations and maintenance of these investments. First, the grantee is entering into agreements with the individual municipalities that are benefitting from these investments and those municipalities are agreeing to assume long-term operations and maintenance responsibilities. Second, the grantee is exploring options for generating user fees for some of the facilities that will be developed through this project. For example, with the Mill River project, the boathouse or greenway could be a good source for charging user fees to support long-term maintenance. However, HUD regulations limit the ability of grantees to develop program income through CDBG-funded projects.¹² To bring in user fees, the grantees will need to work with HUD to craft agreements transferring ownership to entities in ways that will allow them to charge user fees as a way of offsetting operations and maintenance costs. Finally, to support long-term monitoring, the state is also looking at partnerships with

academic institutions in the area. These institutions may be able to obtain grants to monitor the efficacy of these innovative projects overtime. It is hoped that if partners are brought into the process early to help collect baseline data and develop monitoring plans, these partners may be more competitive in applications for federal grants to support continued long-term monitoring of the project.

PATHWAYS FORWARD AND LESSONS LEARNED

Feasibility—To implement the project, the grantee had to re-conceptualize the proposed design for a variety of reasons. To identify a suitable project that could be implemented with the RBD funding, the grantee had to do significant additional analyses to determine what components of the proposal could feasibly be implemented given limited and constrained funding while reflecting municipal, state, and community priorities. The proposal included a diversity of components across a varied physical geography and multiple jurisdictions. As a result, the grantee had to start, from the early stages of design, to reconsider and revise the proposed concept. This challenge will often arise when state and local governments seek to implement projects based upon ambitious and innovative conceptual designs with limited funding. However, it is particularly challenging when, as is the case with all the RBD projects, the grantee is under tight timelines to spend the funds to construct the project. In developing future competitive design competitions, funders should provide those charged with implementing the projects ample time to iterate on the design and to develop feasible projects that can be implemented with community input and available budgets.

Leverage—The grantee has strategically sought to leverage other disaster recovery funding to implement additional project components. The grantee is linking their RBD projects with projects that are being supported with EPA and other CDBG-DR funds to retrofit and protect the Bay Park Sewage Treatment Plant, which flooded and discharged untreated wastewater into the bay during Sandy. The state is also working with other entities in the region, like the local high school, to apply for HMGP funding to implement additional green infrastructure and greenway components along the Mill River. This demonstrates the opportunity grantees have to patch together multiple funding streams from different sources to implement a more comprehensive resilience solution that provides multiple community benefits. However, this exercise can be challenging because it requires grantees to have a mastery of a variety of federal funding streams and to align them when programs have different time schedules and different administrative requirements.

Public-private partnerships—The state is also seeking to leverage public and private partnerships to support additional components of work. It is developing relationships with business enterprises to give green firms the opportunity to show off new technologies and test products as part of the Mill River project. For example, the state is exploring opportunities to work with a solar company to provide solar lighting and charging stations along the greenway.

Green infrastructure—The proposal called for broad scale deployment of green infrastructure to better manage stormwater in the region and to address water quality issues. However, to deploy green infrastructure at the scale called for by the proposal, local jurisdictions in the region would need to implement projects or require green infrastructure on private property through land-use regulations (such as zoning ordinances or stormwater regulations). In Nassau County, given the number of individual jurisdictions and the size and capacity of the jurisdictions, a regional plan for green infrastructure may be a useful way for facilitating a more comprehensive inter-jurisdictional approach for deploying green infrastructure on a broader scale throughout the county. Such a plan could be led by the county, but will likely still require implementation at the municipal level because the county lacks the requisite land-use authorities to implement such programs on its own. Additionally, local governments will need to commit to the long-term operations and maintenance of these investments. To facilitate

local buy-in, the state is using the carrot of the RBD funding to get local governments in the county to commit staff to be trained on the operation and maintenance of green infrastructure. Additional planning dollars or technical support may be needed to facilitate broader uptake of green infrastructure strategies among the cities and villages in the county.

Build social resilience—The state worked with HUD to ensure they could use a portion of the CDBG funds to implement the social resilience components called for by the program and to build local capacity.¹³ Up to two percent of the total budget for this project will be allocated to support: (1) development of a continuing education and certificate program for local government staff to help them learn how to incorporate green and gray infrastructure techniques and operate and maintain these investments; (2) development of curriculum plans and teacher training opportunities in the science and ecology fields for students in grades pre-K-12 to allow teachers and schools to learn about the RBD projects and develop “hands on” and “on-site” learning opportunities; (3) development of academic research opportunities for university and college students to support long-term monitoring of stormwater investments; (4) development of curriculum and job training programs for “restoration economy” jobs to service construction and long-term maintenance of the RBD projects; (5) creation and maintenance of a data “warehouse” where data collected to implement and monitor the project can be housed and accessed by the public for research, visualizations, and more.

Affordable housing & upzoning—The proposal also described the value and need to link resilience approaches with considerations of affordable housing. The lack of affordable housing and damage to the housing stock made it difficult for low- and moderate-income residents to return to safe and affordable housing in the county after Sandy. To address this challenge, the Living with the Bay proposal called for upzoning along Sunrise Highway to provide places for development of “high-and-dry” affordable housing near a “green” transportation corridor and transit. To implement these proposed measures, the proposal called for targeted zoning changes to allow for increases in allowable densities (i.e., upzoning) along Sunrise Highway to allow for medium density mixed-use zoning with requirements for affordable housing units. The proposal suggested that the new development could also be a source of tax revenues to finance green infrastructure and other improvements along the highway corridor, including bike lanes. However, local action would be required to enact the necessary zoning changes. As a result, these proposed changes have been tabled. This occurred because the state needs to focus on implementing the capital improvement components of the projects in order to meet the tight timelines for expending the CDBG funding. However, these ideas (like proposals for “high-and-dry” affordable housing) could be targeted for longer-term implementation. Because these components will require local action and buy-in, states or federal agencies may need to provide additional technical assistance and support to help local governments enact these types of land-use changes.

Regional coordination—The Living with the Bay program also poses unique regional coordination challenges. The project spans multiple small local governments with limited capacity. To minimize the need for regional coordination, the grantee has limited the project sites to areas managed by a couple of key government landowners: State Parks, key municipalities, and the county. Once the project is constructed, some of the green infrastructure and other components (like check valves) will require local governments to assume responsibility to own, operate, and maintain these investments over time. Interventions, like check valves, will require that all local governments in the region participate to ensure that the interventions are being installed in the areas needed to provide optimal flood protection for these neighborhoods. The state is addressing these regional coordination challenges in a couple of ways: First, the state is convening an Executive Steering Committee (ESCs) and Citizen

Advisory Committee (CACs) to ensure open lines of communication and active coordination with both elected officials and citizens in the region. The grantee is also exploring opportunities to provide incentives and other tools to get local buy-in and to build local capacity to operate, maintain, and hopefully scale these resilience projects and investments over time.

Land-use changes—To achieve the comprehensive resilience approach envisioned by the proposal, local government action across the county will also be needed. The proposal called for a range of activities (like broad scale deployment of green infrastructure and zoning changes) that would require actions by local governments using the full suite of local powers (spending, taxation, regulation). Implementation of these activities will be challenging because New York is a “home rule” state, meaning that municipalities have primary authority to make decisions about land use and other local actions. Additionally, in New York, there are no regional governance structures to ensure that local land-use decisions are made with consideration of the effects on neighboring jurisdictions.¹⁴ Therefore, to encourage future implementation of these proposed legal and policy changes after the project is complete, state or federal agencies will need to find ways to provide technical assistance and incentives to local governments to increase coordination and to encourage implementation of additional resilience measures.

CONCLUSION

Once constructed, the Living with the Bay program will demonstrate how communities can implement a comprehensive watershed approach for reducing flood risks and managing stormwater from inland river systems down to tidal wetlands and marshes. This project also demonstrates the need for and challenges of coordinating across jurisdictional lines to implement comprehensive resilience approaches, particularly with smaller jurisdictions that have fewer resources and less technical capacity. By convening local stakeholders, offering trainings, and providing incentives, the state is learning how to build the capacity of smaller municipalities. This is important for both the long-term operation and maintenance of these types of projects and also the local adoption of green-infrastructure practices for managing flood risk and water pollution more broadly throughout the region.

CHAPTER 4 END NOTES

- 1 Sand engines or sand motors were developed by the Dutch as way to efficiently nourish beaches using natural sediment dynamics and shoreline processes. A large amount of sand is deposited in areas of the coast where wind and wave currents will distribute the sand naturally along beaches.
- 2 Interboro Team et al., *Living With the Bay: A Comprehensive Regional Resiliency Plan for Nassau County's South Shore* at 275, (Mar. 25, 2014) [*hereinafter Living With the Bay proposal*], available at: <http://www.rebuildbydesign.org/our-work/all-proposals/winning-projects/ny-living-with-the-bay>.
- 3 Section 404 of the Stafford Act also created the Hazard Mitigation Grant Program, which after a presidentially declared disaster provides state and local grantees with funding to undertake projects to mitigate future damage. Section 404 allows for a wider variety of fundable mitigation projects than the PA program, and the projects do not have to involve a facility that was damaged during the disaster. Hazard mitigation activities are defined as “any cost effective measure... which will reduce the potential for damage to a facility from a disaster event.” Eligible activities include: acquisition, elevation, retrofits, vegetative management, stormwater management, and some structural flood control projects. State and local grantees must have adopted a FEMA-approved Hazard Mitigation Plan (HMP). In general, the federal share is 75% for hazard mitigation activities. 42 U.S.C.A. § 5170c; see also 44 C.F.R. § 206.2.
- 4 The New York Rising Community Reconstruction Program (NY Rising) is a program created with the New York Governor’s Office of Storm Recovery (GOSR) to provide planning and implementation support and to help with rebuilding and resilience-building efforts in communities affected by Irene, Lee and Sandy. Funds for these projects come from New York State’s regular allocation of CDBG-DR funding. Funds are being used to support resiliency planning, to elevate homes and infrastructure, to buy-out storm-damaged structures, among other projects. <http://stormrecovery.ny.gov/>.
- 5 Every component of the project South of Sunrise Highway is within the State’s coastal zone and would be subject to New York’s Coastal Management Plan - Article 42 Waterfront Revitalization of Coastal Areas and Inland Waterways, Section 920 and implementing regulations found at 19 NYCRR Part 602.
- 6 6 NY ADC 661.5
- 7 6 NY ADC 661.9
- 8 Stream disturbance, excavation, and fill in navigable waters requires a “Protection of Waters” permit and Water Quality Certification under section 401 of the Clean Water Act.
- 9 Seventy percent of CDBG entitlement grants have to benefit low- and moderate-income (LMI) communities.
- 10 24 C.F.R. § 570.208.
- 11 CDBG-DR funds must be directed to the most “impacted and distressed” disaster affected areas. Sandy Relief Act, Pub. L. No. 113-1, 127 Stat. at 38 (Jan. 29, 2013).
- 12 Program income is defined at 24 C.F.R. § 570.500(a) as “gross income received by the recipient or a subrecipient directly generated from use of the CDBG funds...” HUD provides rules for how grantees must account for program income at 24 C.F.R. § 570.504 and how close-out agreements must be structured to allow entities to generate program income to support the long-term operations and maintenance of a CDBG-funded facility after the closeout of the CDBG grant.
- 13 Education is not explicitly allowed as an eligible use of CDBG funds under 42 U.S.C. § 5305. Therefore, the grantee had to work with HUD to ensure that these activities would be eligible for assistance under provisions allowing for the provision of public services and economic development activities.
- 14 Counties are municipal corporations authorized by state law that were created with the purpose of administering local affairs. McKinney’s County Law § 3. Counties can adopt home rule charters or operate pursuant to the New York County Law and determine their own organizational structures and rules for providing services to residents within their borders. Counties cannot generally pass ordinances, and a county’s powers encompass but do not necessarily supersede those of the cities, towns, and villages within them. *Local Government Handbook*. Albany, NY: Dept. of State, 2009. Although there is a regional planning commission for Nassau and Suffolk counties, the commission merely plays a technical assistance role for the counties and towns in the region and has no authority to change local land-use regulations or conduct regional planning with any legal effect.

Resist, Delay, Store and Discharge

Hoboken
New Jersey



BACKGROUND

Hoboken, New Jersey is a densely developed city that houses critical infrastructure and serves as a transportation hub for the greater New York City metropolitan region. Situated along the western edge of the Hudson River, much of Hoboken is low-lying and very vulnerable to flooding. The city's waterfront was built on filled marshland that is below the normal high-tide elevation.¹ Approximately 94 percent of the city is covered with impervious surfaces (roads, buildings, parking lots), which causes stormwater to be funneled rapidly to the combined sewer system and to overflow during heavy rainfall events, discharging untreated wastewater into the Hudson River and flooding basements and streets.² As a result, the city faces flood risks from both storm surge and heavy rainfall events.

Hurricane Sandy, which occurred at high tide, exposed the city's current flood risks and emphasized the need for the city to build its resilience to future flood risks that will be exacerbated by increasing precipitation and sea-level rise as a result of climate change. Many parts of the city experienced record flooding during Sandy. Certain areas were inundated with several feet of floodwater, causing over \$100 million in damages to private property.³ As a result of the storm, 1700 homes were damaged, many residents were without power for nearly two weeks,

COMPETITION DESIGN TEAM

OMA, Royal Haskoning DHV, Balmori Associates, HR&A Advisors, AMO

PROJECT AREA

Hoboken and adjacent portions of Jersey City and Weehawken, NJ. The flood-risk-reduction and green-infrastructure improvements are being considered for areas between the Hudson River (to the east); Baldwin Avenue in Weehawken (to the north); the Palisades (to the west); and the intersection of 18th Street, Washington Boulevard, and 14th Street in Jersey City (to the south).

GRANTEE

State of New Jersey, New Jersey Department of Environmental Protection and the Governor's Office of Recovery and Rebuilding

AMOUNT AWARDED

\$230 million

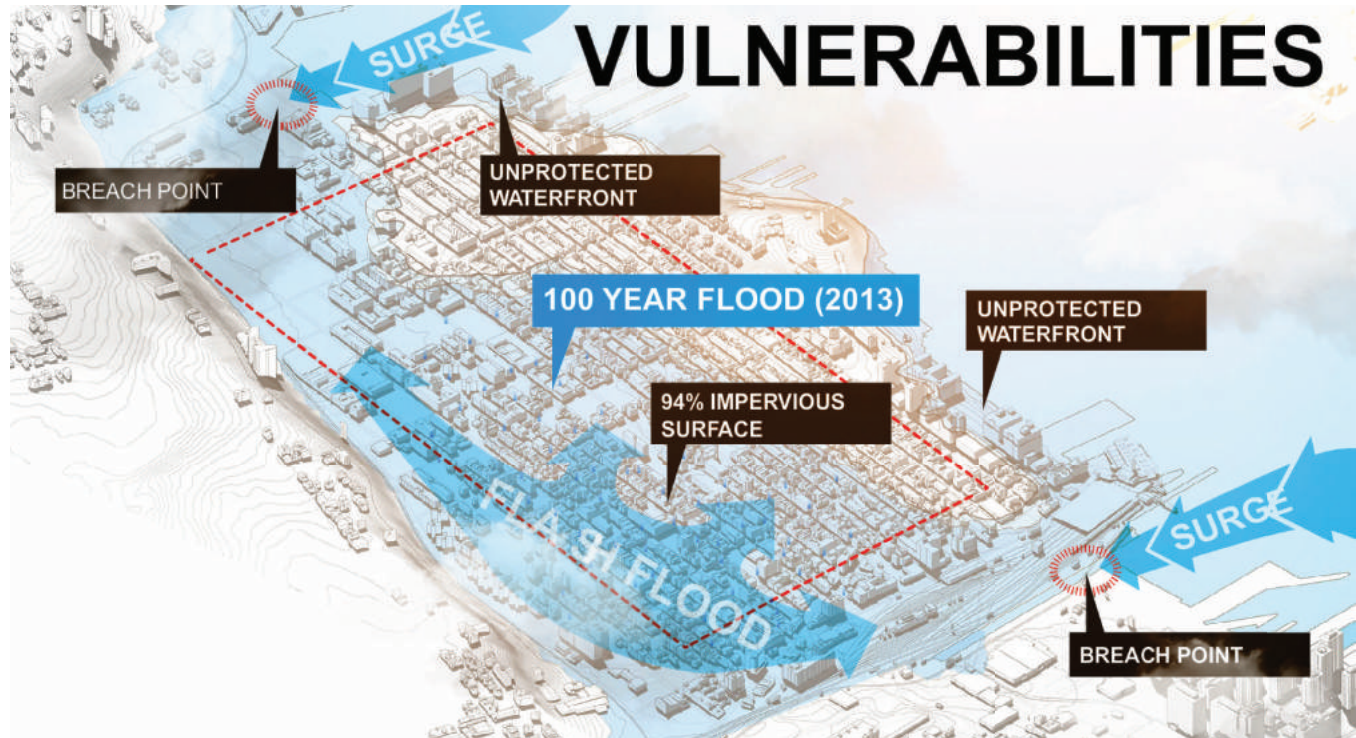
PROPOSAL LINK

<http://www.rebuildbydesign.org/our-work/all-proposals/winning-projects/nj-hudson-river-project-resist-delay-store-discharge>

PROJECT WEBSITE

<http://www.nj.gov/dep/floodhazard/rbd-hudsonriver.htm>

and transportation infrastructure was damaged. For example, the Hoboken PATH transit station, a critical link for commuters between New Jersey and Manhattan, was severely damaged when storm waters poured through the station's elevator shaft, flooding electrical equipment, tracks, and platforms.⁴ It took three months to fully restore PATH service on the weekdays between Hoboken and Lower Manhattan, and closures dramatically affected commuters and businesses in the region.⁵



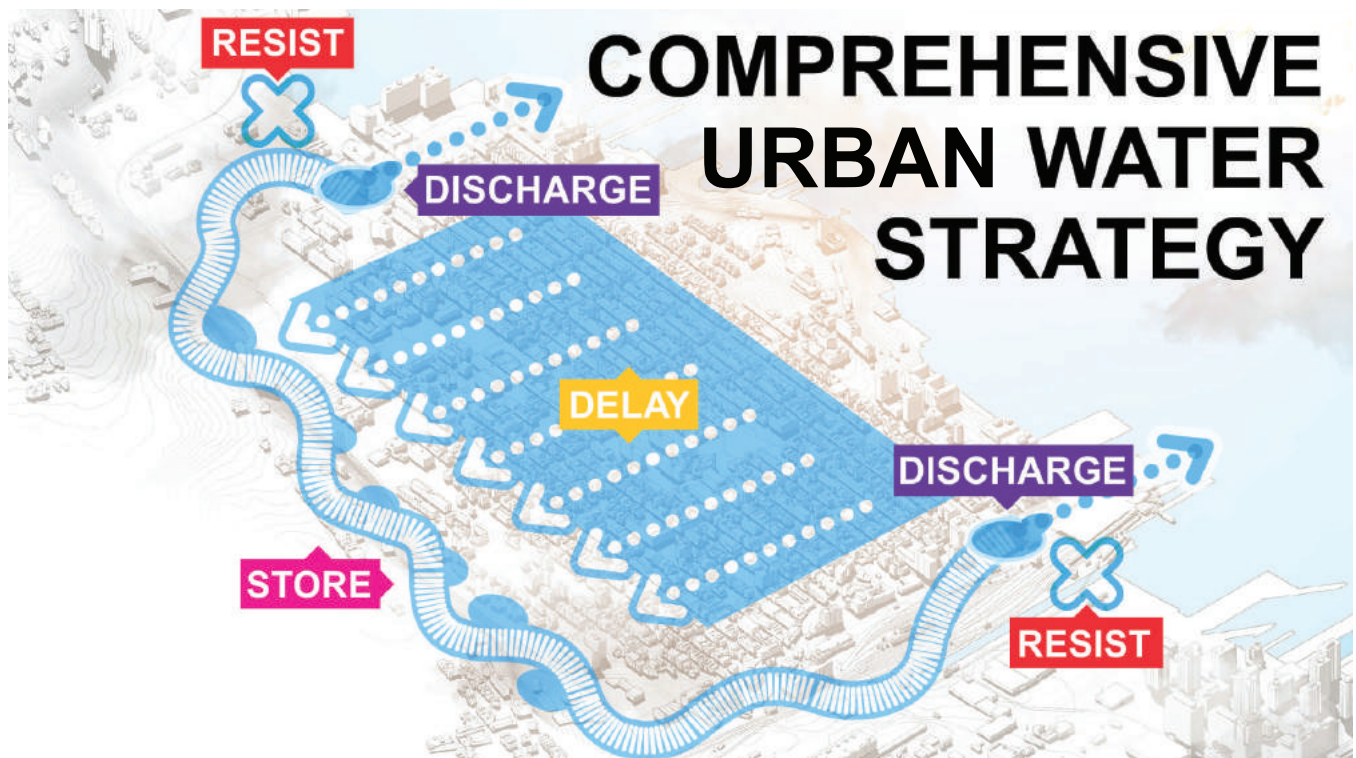
Hoboken: Flood Impacts from Hurricane Sandy

This map shows flood vulnerabilities for the City of Hoboken, including breach points where Sandy's storm surges entered the city.

The design team estimated that the total cost to fully implement the proposed approach would be approximately \$470 million. The State of New Jersey was awarded \$230 million to implement the project.

THE PROPOSAL

The Hoboken Proposal—*Resist, Delay, Store, and Discharge*—called for construction of a comprehensive water management strategy for reducing the city's flood risk, including: engineered and landscape-based coastal defenses (or *resist* strategies) to reduce storm-surge flooding, and green and gray infrastructure approaches to manage (*delay, store, and discharge*) stormwater runoff and excess rainwater during heavy rainfall events. When combined, the four lines of defense would reduce flood risks for residential and commercial development as well as critical regional transportation assets.



Resist Delay Store Discharge Proposal

This map shows where the competition design team proposed locations for resist, delay, store, and discharge strategies across Hoboken and parts of Jersey City and Weehawken.

Resist

The resist strategy called for both green and gray coastal defenses in the southern areas of Hoboken Yards and in the northern areas of Weehawken Cove (the two main entry points for Sandy’s storm surge). The resist components of the proposal were called for to protect critical infrastructure from a 500-year flood event, including Hoboken Station and the wastewater treatment facility. Along Weehawken Cove, the proposal called for habitat restoration and the development of a “wetland park” integrated with structural flood protection devices, such as levees and bulkheads, and other recreational amenities.

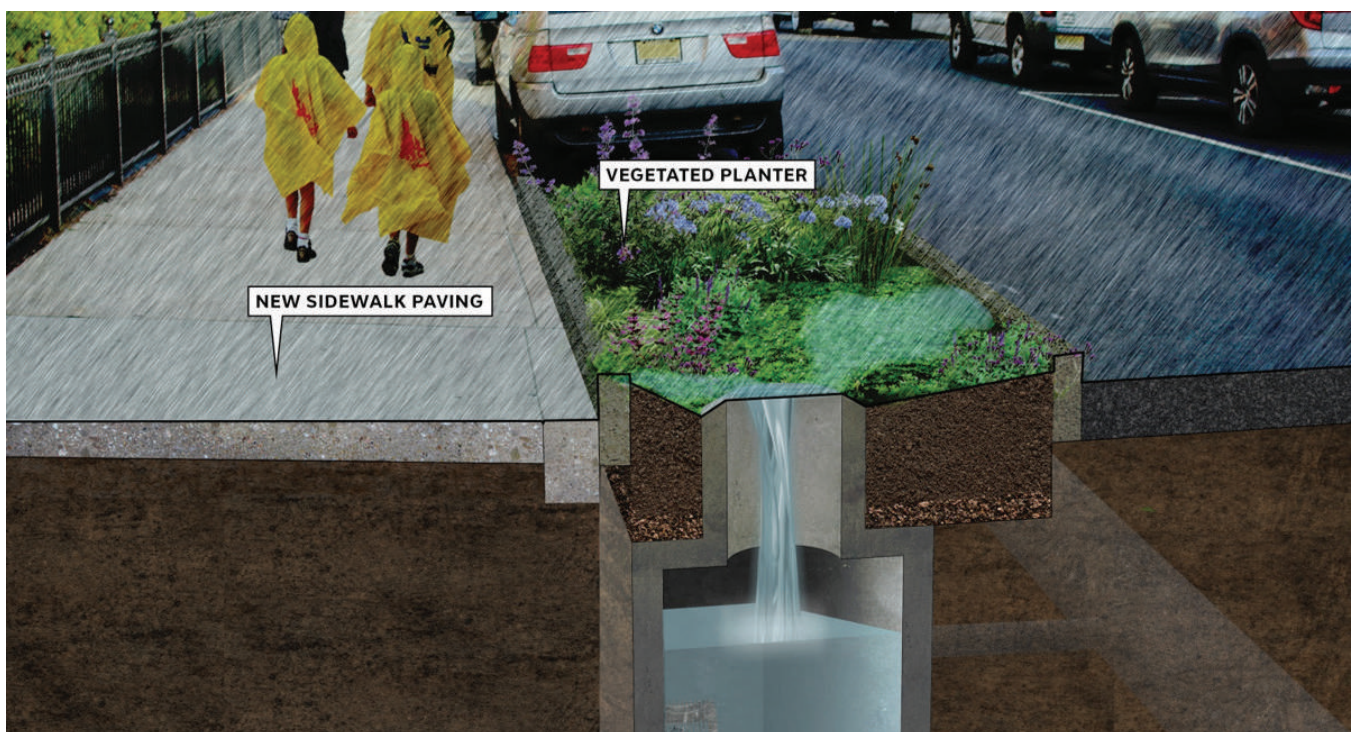
Delay and Store

The delay and store components of the proposal called for the use of green infrastructure to manage stormwater and reduce rain-driven flooding. The proposal described a suite of green infrastructure practices for managing stormwater, including:

- green roofs or vegetation installed on rooftops to detain rain water;
- bioswales or vegetated areas alongside roads or integrated into roadside landscaping to allow rainwater to infiltrate and filter pollutants;
- reclamation of developed land for parks and open space to reduce the total amount of impervious surfaces in the city;
- permeable pavements on parking lots and other surfaces to allow water to infiltrate into the ground;
- curbside bumpouts with vegetation to reduce the amount of pavement along roadways; and
- rain gardens and stormwater harvesting mechanisms, such as rain barrels.

The proposal called for deployment of green infrastructure through both capital-improvement demonstration projects and legal and policy changes. Demonstration projects would be used to test different green-infrastructure approaches and their effectiveness, including a green roof on Hoboken’s City Hall that would serve as a model for other projects in the city. Then policy and regulatory changes would be put in place to encourage or require broader deployment of green infrastructure approaches on both public and private lands. The policy changes suggested included development of:

- design guidelines for city projects to ensure effective design and construction of green infrastructure practices on public lands and right of ways;
- incentives for property owners to install more green infrastructure on private lands;
- regulatory requirements in the zoning code to require certain levels of stormwater retention; and
- a Green Street Steward⁶ program to help ensure that proper maintenance of green infrastructure projects are incorporated into city streets and rights-of-way.



Delay and Store Strategies: Hybrid Green-Gray Infrastructure

This is a rendering of how green infrastructure can be integrated into city streets in Hoboken

The proposal called for a phased deployment of the green infrastructure strategies. In a first phase of implementation (the first five years), the city would implement demonstration projects and adopt policy changes to encourage or require green infrastructure, including zoning changes. However, the proposal acknowledged that the full-scale deployment of green infrastructure needed to address the city’s rain-driven flooding would occur over a 20+ year period. During this time, the city would scale up its green infrastructure practices and transition to a “blue-green city.”

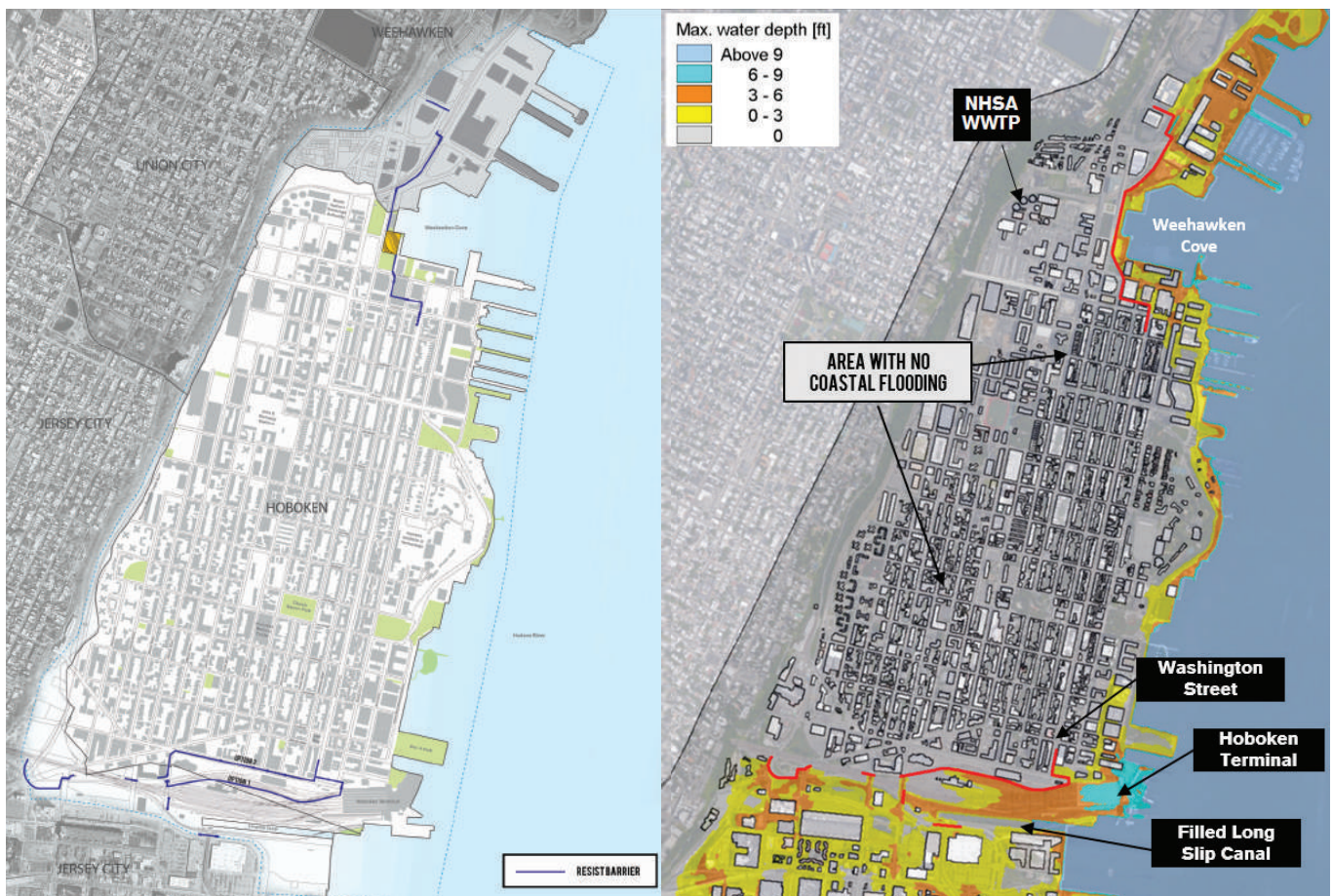
Discharge

The discharge strategy relies primarily on traditional gray infrastructure solutions including the installation of pumps and alternative drainage routes to remove excess stormwater from the system, channeling it through treatment facilities before discharging the water into the Hudson River.⁷

THE PROJECT

The current priority for the State of New Jersey is to use its RBD money to fund the resist strategies (what is now being called the “Hudson River Project”) to protect against storm surges. The project area will include Hoboken and parts of Jersey City and Weehawken. The ability of the grantee to fund construction of any of the delay, store and discharge strategies will depend on the total budget needed to complete the feasibility assessment, design, environmental analysis, and construction of the resist components.

The Hudson River Project underwent a feasibility study to ensure sound engineering for the flood-risk-reduction measures, and environmental review. The state solicited comments on and evaluated five conceptual designs. From the concepts and public comments, the state developed three alternatives, each with different resist component alignments that will provide different levels of storm surge protection. Alternative 1 is a waterfront alignment of the flood defenses that would provide the greatest level of flood risk reduction, but that would have the highest cost and the greatest impacts on waterfront views and access. Alternatives 2 and 3 have inland alignments of the flood defenses that would be less costly and would have less impact on views and access. All three alternatives have the same delay, store, and discharge elements to address interior flooding. These elements will look at green and gray infrastructure solutions for two large-scale sites and smaller-scale improvements that can be incorporated into public rights-of-way. The state announced Alternative 3 as their preferred alternative in fall of 2016 and expects to complete environmental review by spring of 2017.



Resist Alignment 3

This map shows the alignment of "resist" structures for Alternative 3.

The state is also integrating its investments in the Hudson River Project with resiliency investments that are being made with Sandy funding granted to New Jersey Transit from the Federal Transit Administration (FTA). New Jersey Transit (NJ Transit) is using FTA disaster recovery dollars to implement several projects to build flood resilience around Hoboken Station. NJ Transit is filling an old shipping canal (“Long Slip Canal”) in the area, which was a major conduit for floodwaters during Sandy. It is also making flood resilience retrofits to the intermodal ferry and rail terminal along the Hudson River. Finally, NJ Transit is implementing a microgrid project. The NJ TransitGrid, as the project is known, is a first-of-its-kind in the nation microgrid, which will help supply resilient power to key NJ Transit facilities and critical portions of several rail systems. The microgrid will allow transit operations to continue during storms or other times when the centralized grid is down. The project will include a new natural gas power plant to power substations that provide electricity to train tracks, and will incorporate distributed energy sources, including different renewable sources, to power a variety of facilities and stations.⁸

LEGAL AND POLICY CHALLENGES

Size and alignment of flood defenses—In considering the size and alignment of the flood defenses, a challenge the grantee is facing is the funding gap. The amount of funding available is not sufficient to build the full suite of resist, delay, store and discharge approaches called for by the proposal. As a result (and to comply with NEPA), the grantee considered multiple alignments and combinations of approaches as they assess different project alternatives. The resist components of the Hudson River Project have also been the subject of substantial public input and debate, and the public has raised concerns about potential impacts on waterfront access, views of New York City, and property values.⁹ Some comments expressed a desire for the state to focus more on frequent interior flooding and the delay, store, and discharge components of the proposal, instead of the resist components. These commenters wanted to see the funds used to address “everyday events,” rather than measures taken to prevent against another extreme Sandy-type surge event. After receiving input on the five concepts initially developed, the state proposed three different project alternatives. The three different resist alternatives each offered different levels of storm-surge protection. When it chose which alternative to implement, the state balanced concerns of the public about access and views with the amount of funds available and the desire to provide the maximum level of flood protection, among other factors.

Scoping and scaling—Another challenge with implementing the proposal is it cannot be easily compartmentalized (like some other winning RBD proposals). This is because the design requires all the different components be implemented—resist, delay, store, and discharge—to most effectively reduce flood risks from both storm-surge driven flooding as well as rain-driven flooding. The effectiveness of the green infrastructure components (the delay and store components) depend on broad deployment throughout the watershed in appropriate locations, to achieve the scale needed to effectively manage stormwater and reduce interior flooding. As a result, other pathways for implementing the delay and store components will need to be explored to ensure that interior-flooding problems are also addressed. The city is considering regulatory and incentive-based approaches to encourage or require use of green infrastructure on public and private lands. As examples, the city could consider the approaches that others cities are implementing to require or encourage the use of green infrastructure. For example, Seattle and Binghamton, NY have used zoning codes and stormwater ordinances to require private development to retain a certain amount of stormwater onsite.¹⁰ And Philadelphia is using subsidies, grants and rebates to encourage more stormwater retention and green infrastructure practices in private developments.¹¹ State, federal and other partners could help Hoboken adopt similar models to ensure a broader deployment of green infrastructure practices throughout the city.

Regional Coordination—Although the majority of the project area is in the City of Hoboken, it extends into parts of Jersey City and Weehawken and requires the grantees to coordinate among the three municipalities in the region. Coordination among municipalities can be challenging because each city has its own individual interests, and the project will have differential impacts and benefits to residents. Additionally, the project will affect the duties and responsibilities of each city’s agencies, including emergency management, operations and maintenance, and public works. To address the need to ensure early and frequent coordination, the state convened an Executive Steering Committee (ESC) for the project, which is chaired by the commissioner of New Jersey Department of Environmental Protection and includes the mayor of each of the cities in the project area. The ESC has monthly face-to-face meetings, which provide a forum for airing problems and negotiating solutions.

Nature-based flood defenses—The proposal called for a “wetland park” in Weehawken Cove that was intended to provide natural flood defenses to waterfront neighborhoods. However, these elements of the proposal are not being pursued because the natural defenses envisioned could not attenuate wave action enough to protect critical facilities along the waterfront. Additionally, the proposed restoration efforts would have been extremely costly to implement. Given the limitations of the total budget, the grantee is prioritizing project alternatives that provide the greatest amount of flood-risk-reduction benefits. Additionally, there is potential contamination in the project area,¹² which would have raised permitting challenges because of concerns that restoration activities would stir up polluted sediment. Finally, the proposal suggested that restoring wetlands along the waterfront would help the city address water quality impacts from combined sewer overflows,¹³ but the degree of ecological benefits that would flow from restoration was uncertain. Often, the ecological benefits of a nature-based project (like improved water quality or habitat) can be difficult to quantify given existing data and tools, which makes it challenging for project proponents to characterize and communicate these non-monetary benefits when evaluating the trade-offs between green and gray approaches.¹⁴

PATHWAYS FORWARD AND LESSONS LEARNED

Leveraging pre-existing plans—The *Resist, Delay, Store, and Discharge* proposal drew from and built upon existing plans developed by the city and sewerage authority, which strengthened the proposal and enhanced the ability of the grantee and the city to implement the proposal’s recommended approach. For example, the proposal drew from the Hoboken Green Infrastructure Strategic Plan, released in 2013, which detailed a range of green and gray infrastructure approaches for managing the city’s stormwater and preventing combined-sewer overflows. These included similar approaches detailed in the RBD proposal, including above-ground detention, infiltration, and retention using various green infrastructure strategies, and changes in local policies (e.g. zoning requirements/incentives, and design guidelines for green infrastructure on public lands and rights-of-way).¹⁵ By leveraging an existing plan, the city will be better prepared to implement the additional delay and store components called for by the proposal. The city’s Green Infrastructure Plan also provides studies and analyses that will help inform implementation of the proposal, it:

- described a multitude of federal, state, local, and foundation funding that could be drawn upon to support implementation of the city’s green infrastructure program;
- identified a way that the city could raise funds to implement green infrastructure projects through creation of a Stormwater Trust Fund where developers pay in-lieu fees (in-lieu of complying with the regulatory requirements) and the fees could be used to fund green infrastructure on public lands and in rights-of-way;¹⁶
- identified specific neighborhoods, and even specific buildings and parcels, as candidates for a first round of green infrastructure demonstration projects; and

- identified specified green infrastructure practices appropriate for different Hoboken neighborhoods based on the depth of the soil above bedrock, location of higher risk populations, and other criteria.

Critically, the Strategic Plan identified potential pilot and demonstration projects for public housing campuses in multiple areas of the city to target green infrastructure investments in low-income areas. Based upon these pre-existing plans and the vision inspired by the RBD proposal, the city and sewerage authority are working to make zoning changes to encourage use of green infrastructure on private lands.¹⁷

Residual flood risks behind flood defenses—The RBD proposal suggested that by building flood defenses to the 500-year flood protection level, the city could exempt its entire area from flood insurance purchase and regulatory requirements imposed by the NFIP.¹⁸ However, despite the construction of flood defenses, buildings behind those defenses could still face residual flood risk in the event of overtopping during severe storms. Resilient design and construction should continue to be encouraged through city land-use regulations or building codes to ensure layers of flood risk protection. By combining green and gray flood defenses with flood-resilient buildings, the city’s resilience will not be reliant on any single line of defense.

Tax Increment Financing—The proposal suggested that Hoboken explore the possibility of financing green infrastructure projects through the use of Tax Increment Financing.¹⁹ Because of high real estate values, access to transit, and development pressures in the New York metropolitan area, Hoboken has high potential to generate additional property taxes with the RBD investments. The city can use Tax Increment Financing (“TIF”) to capture increased property values (or the tax increment) generated by the RBD projects and use that value to finance infrastructure improvements or additional resilience projects, like green infrastructure. TIFs allow local governments to finance capital projects without raising property tax rates or exceeding municipal debt limits. To do so, the city would need to pass an ordinance designating each area as a “Revenue Allocation District”²⁰ in compliance with the New Jersey TIF enabling statute (the Revenue Allocation District Financing Act²¹ passed in 2002). TIF is one strategy that grantees can explore as a pathway for funding future phases of work to fill the funding gap.

CONCLUSION

The Hudson River Project, once constructed, will demonstrate how cities can build flood defenses that provide multiple ecological and recreational benefits in a dense, highly developed, urban landscape. The project has also successfully catalyzed interest and engagement from city officials and the public. While the RBD funds will be used primarily to build protections against storm surges, the City of Hoboken is exploring other financial, legal, and policy pathways for scaling up investments in green infrastructure throughout the city as a strategy for managing stormwater overflows and interior flooding.

CHAPTER 5 END NOTES

- 1 Deborah Bailin, Union of Concerned Scientists, *Hoboken's Post-Sandy Resilience: Learning from the Past, Rebuilding for the Future* 4 (Jan. 2014) [hereinafter *Hoboken's Post-Sandy Resilience*], available at: <http://www.ucsusa.org/sites/default/files/legacy/assets/documents/center-for-science-and-democracy/hoboken-case-study-final.pdf>.
- 2 *Hudson River Project Final Scoping Document* at 14 (Nov. 2015), available at: <http://www.nj.gov/dep/floodresilience/docs/rbd-hudson-river-final-scoping-document.pdf>.
- 3 *Hoboken's Post-Sandy Resilience* at 6.
- 4 Matt Flegenheimer, *In a Hobbled Hoboken, Overbooked Buses, Unfamiliar Ferries and Long Lines*, NY Times (Nov. 18, 2012) <http://www.nytimes.com/2012/11/19/nyregion/hoboken-commuters-find-new-routines-as-restoration-of-path-service-lags.html>.
- 5 *Hoboken to World Trade Center PATH Service Restored on January 30*, <http://www.hobokennj.org/2013/01/hoboken-to-world-trade-center-path-service-restored-on-january-30/>.
- 6 Although the proposal does not explain what the Green Street Steward program is, for purposes of this report, we assume that it is patterned after a program of the same name in Portland, OR. In the Portland program, residents volunteer to help maintain green infrastructure by cleaning trash out of installations, clearing debris, and doing some watering and weeding. More information is available at <http://www.portlandoregon.gov/bes/52501>.
- 7 Kathryn Brenzel, *Hoboken Plans to Curb Flooding with \$11.7 Million Storm Pump*, NJ Advance Media (Dec. 22, 2014), available at: http://www.nj.com/hudson/index.ssf/2014/12/hobokens_119_million_pump_to_curb_chronic_flooding_mayor_says.html.
- 8 Georgetown Climate Center, *New Jersey TransitGrid*, <http://www.georgetownclimate.org/resources/new-jersey-transitgrid-microgrid-project-to-help-power-nj-transit>; NJ Transit, *NJ TransitGrid Overview*, <http://njtransitresilienceprogram.com/nj-transitgrid-overview/>. NJ Transit received over \$400 million from the Federal Transit Administration to develop this project.
- 9 See *Summary of Public Comments on Five Concepts for Rebuild By Design – Hudson River*, available at: <http://www.state.nj.us/dep/floodhazard/docs/rbdh-five-concepts-summary-of-comments.pdf>.
- 10 For example, Seattle's Stormwater Code imposes retention requirements on residential properties that vary according to several factors, including the type of sewer system or water body to which the site discharges and the size of the land disturbance or impervious surface on that site. Seattle, Wash., Stormwater Code ch. 22.805.050; ch. 22.805.080.B.2. (2009). Binghamton, NY, requires property owners seeking permits for construction to submit an Urban Runoff Reduction Plan (URRP) to show how they will manage stormwater after construction. The URRP must show how the development will manage a 10-year, 24-hour storm event and include green infrastructure techniques. City of Binghamton, NY Code of Ordinances § 227-10.
- 11 The Philadelphia Water Dep't, *Stormwater Incentives Grant Manual* (July 2014).
- 12 *Hudson River Project Final Scoping Document*, at 25.
- 13 A combined sewer overflow occurs when combined sewer systems (which collect all forms of wastewater together in the same pipe, including rainwater runoff, sewage, and industrial) cannot handle the volume of wastewater in the system. This typically occurs during heavy rainfall events, and the combined sewer system overflows, causing the excess water to be discharged directly into nearby water bodies rather than proceeding through the wastewater treatment plant first. Combined sewer overflows are a concern because the discharge of untreated wastewater can result in significant pollution to water bodies. See U.S. EPA, *What are Combined Sewer Overflows (CSOs)?*, <http://www3.epa.gov/region1/eco/uep/cso.html>.
- 14 See generally, Scarlett & Boyd, Resources for the Future, *Ecosystem Services* (2011).
- 15 See generally, *Hoboken Green Infrastructure Strategic Plan* (Oct. 2013) available at: <http://www.hobokennj.org/docs/communitydev/Hoboken-Green-Infrastructure-Strategic-Plan.pdf> (last visited June 27, 2015).
- 16 Public rights-of-way are easements granted or reserved for public use for transportation purposes, such as sidewalks and roadway.
- 17 See *Summary of Public Comments on Five Concepts for Rebuild By Design—Hudson River* 8, available at <http://www.state.nj.us/dep/floodhazard/docs/rbdh-five-concepts-summary-of-comments.pdf>.

- 18 See discussion in the summary chapter of this report. FEMA levee certification can be used to justify remapping of a community's floodplain maps. Areas protected by FEMA-certified levees are not subject to flood insurance purchase requirements or minimum floodplain regulations. This has a significant financial benefit for protected property owners, because it means that they would no longer have to carry flood insurance. However, communities should note that areas behind certified levees face residual flood risk as levees can fail and be overtopped. FEMA, *Levees—Frequently Asked Question*, http://www.fema.gov/media-library-data/20130726-1803-25045-4819/st_broomelv.pdf.
- 19 OMA, *Resist Delay Store Discharge: A Comprehensive Urban Water Strategy* 20-21 (2014).
- 20 NJ Stat. Ann. § 52:27D-462. The state must also approve the designation of a district based on the submission of planning documentation to the Department of Community Affairs.
- 21 NJ Stat. Ann. § 52:27D-459 *et seq.*

New Meadowlands

Meadowlands
New Jersey



BACKGROUND

The Meadowlands region of New Jersey was historically a freshwater delta where the Hackensack River connected with the upper bay of the Hudson River. Centuries ago, the area was drained and dammed to allow for farming, increasing the area's vulnerability to flooding and sea-level rise. The region includes portions of fourteen different municipalities, and includes a regional governance entity formerly called the New Jersey Meadowlands Commission that was recently consolidated with the New Jersey Sports and Exposition Authority.¹

During Hurricane Sandy, storm surge along the Hackensack River overtopped berms protecting the Meadowlands communities, and water spilled in for hours flooding the majority of properties in the basin. The towns of Little Ferry and Moonachie were most affected. More than 80 percent of these two towns were underwater with water depths of 38 inches in some areas.² Many residents of the two towns were displaced for a significant period of time after the storm. In the aftermath, state and local officials and stakeholders in the region began to study the possibility of developing a comprehensive regional approach for reducing flood risks.

COMPETITION DESIGN TEAM

MIT + CAU + ZUS + URBANISTEN, Deltares, Volker Infradesign, 75B

PROJECT AREA

Meadowlands region—the first pilot area includes the communities of Little Ferry, Moonachie, Carlstadt, Teterboro, and portions of South Hackensack.

GRANTEE

State of New Jersey, New Jersey Department of Environmental Protection and the Governor's Office of Recovery and Rebuilding

AMOUNT AWARDED

\$150 million

PROPOSAL LINK

<http://www.rebuildbydesign.org/our-work/all-proposals/winning-projects/nj-meadowlands>

PROJECT WEBSITE

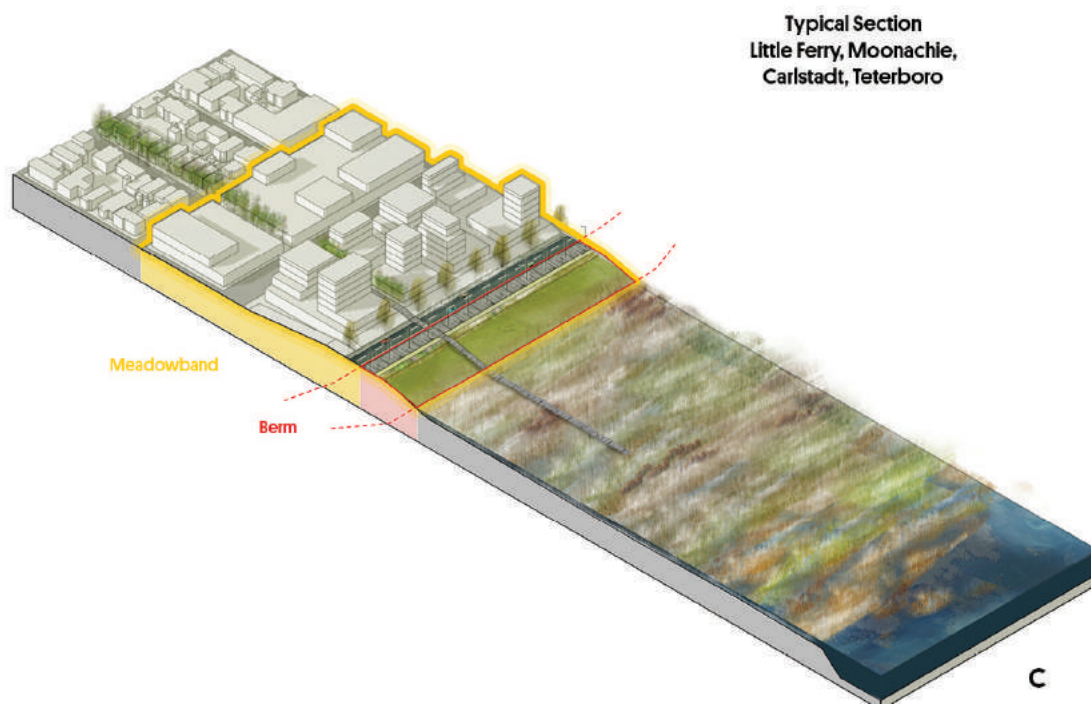
<http://www.nj.gov/dep/floodhazard/rbd-meadowlands.htm>

THE PROPOSAL

To rebuild and protect the region from storm surges, the New Meadowlands proposal called for an integrated and linked system of berms (the “Meadowband”) with restored wetlands (the “Meadowpark”) to provide flood protection for the fourteen towns in the Meadowlands region of New Jersey. The proposal also called for flood protection berms to be integrated with transit improvements to enhance multi-modal interconnectivity in the region and to increase access to the public recreational spaces that would be enhanced by restoring the wetlands.

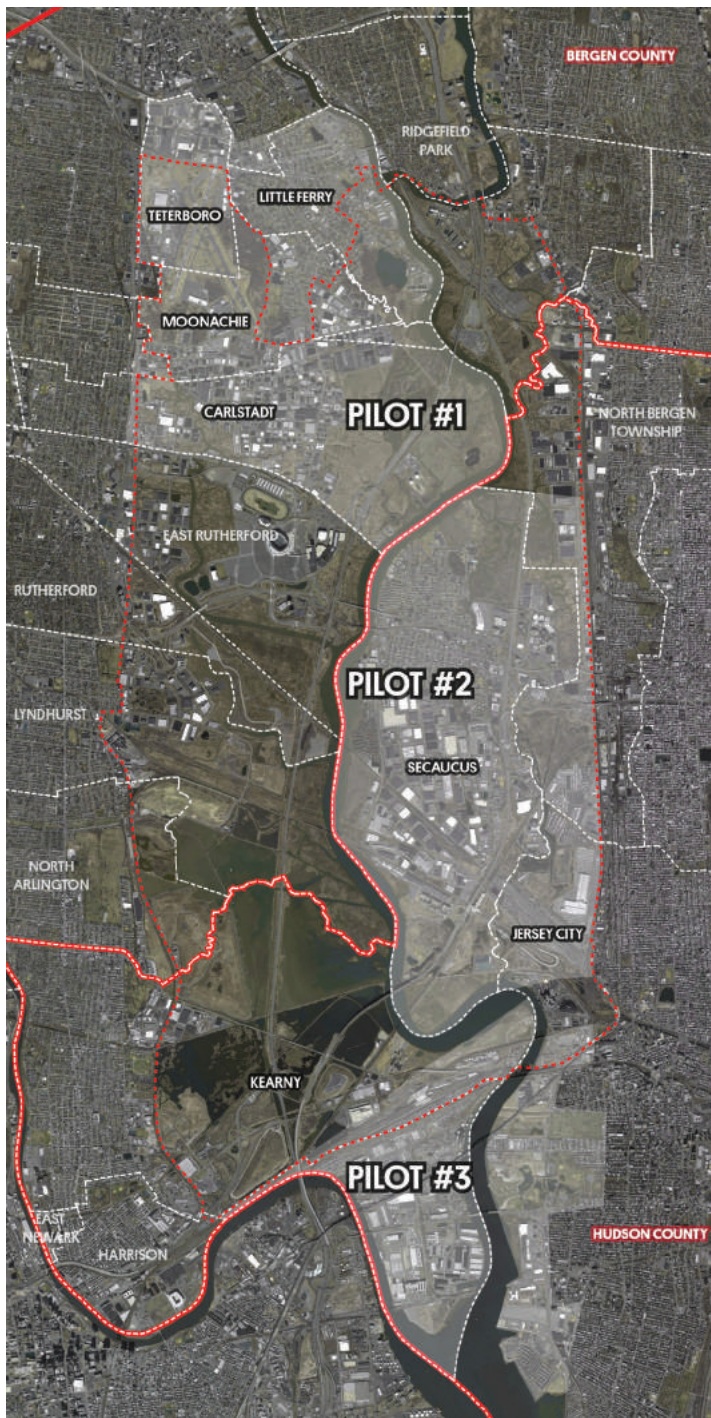
The proposals included two key components:

- **The “Meadowpark”** — The Meadowpark component called for the restoration of the region’s wetlands to rebuild biodiversity and provide recreational opportunities for the community. A series of green berms were proposed to provide protection from flooding and storm surge. These berms would integrate with a large natural reserve of tidal wetlands and freshwater basins.
- **The “Meadowband”** — Surrounding the Meadowpark, the proposal called for a berm system to provide flood protection for the region. The berm would provide flood protection from a 500-year flood event, with vital infrastructure protected against a 1-in-2000-year flood event. The proposal also called for allowing additional density of land uses (i.e., upzoning to allow multi-family apartments and mixed-use development in areas that previously only allowed single-family homes) along the Meadowband with requirements that newly developed houses and businesses be designed resiliently to accommodate future flood risks. To increase multi-modal transportation options in the region, the proposal envisioned a street covering the berm and integrating a bus rapid transit (BRT) line. The proposal suggested that new development and increased population densities would provide additional tax revenues, which could support the investments in transit.



A Cross Section of the Meadowband and Meadowpark

This cross section depicts how the proposal suggested to use a combination of berms and wetlands restoration to enhance flood resilience in Meadowlands communities.



New Meadowlands: Proposed Pilot Areas

This map depicts the three pilot sites included in the New Meadowlands proposal for a first phase of implementation.

The proposal called for a first phase of implementation at three pilot sites in the Meadowlands area: the northern edge (Little Ferry, Moonachie, Carlstadt, Teterboro, and South Hackensack), the eastern edge (Secaucus and Jersey City), and the southern tip (South Kearny and Jersey City).

The design team estimated that implementation of all the proposed components would cost between \$3.5 to 4 billion. The State of New Jersey received \$150 million to fund implementation of the northern edge component of the New Meadowlands proposal.

THE PROJECT

The New Jersey Department of Environmental Protection (NJDEP) is currently studying the feasibility of cost-effective risk-reduction strategies for the project area, while also advancing an environmental impact statement as required by the National Environmental Policy Act. To assist NJDEP in this process, the state awarded a competitively-bid contract to AECOM and its team of sub-consultants.³ NJDEP recently submitted to HUD a proposed Notice of Intent to prepare a draft Environmental Impact Statement,⁴ which includes three design alternatives to address the flooding issues in the project area.

At this stage, the grantees are still conceptualizing what strategies will provide the most cost-effective flood protection for the project area. The state's consultants will be looking at the following three alternatives:

- **Alternative 1** will analyze structural flood protections from storm surges and riverine flooding as well as interventions such as levees, berms, pump stations, floodgates and other green and gray infrastructure improvements that can provide a “FEMA certifiable” level of protection for the project area.
- **Alternative 2** will analyze stormwater drainage projects to reduce flooding from higher frequency rain-driven flood events and will look at interventions such as pump stations, green infrastructure, water storage areas, and enhancing and increasing public open space.
- **Alternative 3** will analyze a hybrid approach using a combination of interventions, blending both structural storm-surge protection and local drainage improvements to reduce flood risks in the project area.

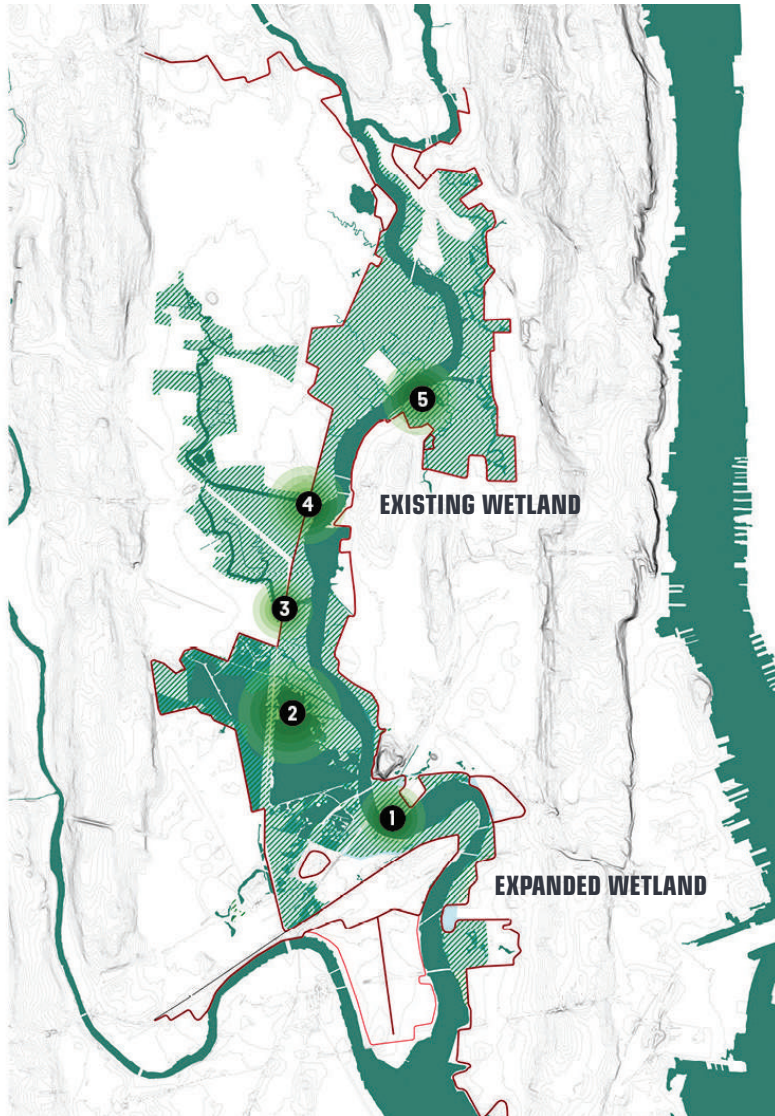
LEGAL AND POLICY CHALLENGES

Funding gap—The biggest challenge for the Meadowlands project has been the funding gap between the original proposal (\$3.5 to \$4 billion to implement the full proposal) and the \$150 million allocated by HUD to implement the RBD project. This funding gap required the grantee to make difficult decisions about how to scale and scope the project, what components to fund, and where to site those components. This challenge is exacerbated by the tight timeframes for spending the CDBG-DR funds, which has made it difficult to raise supplemental funds to support additional work.

Land acquisition—To construct a large-scale system of berms, the grantee must own or have rights to significant acres of land on which to construct the berm system. The Meadowlands proposal showed the importance of land ownership as grantees move from project concept to implementation. One of the more ambitious components of the proposal—the idea for a berm system incorporating a BRT line—was not pursued because it was infeasible and too costly to acquire the lands needed to build a berm system large enough to support a bus line. The lands needed are all privately owned. If landowners are unwilling to sell, the state's only option is utilizing their eminent domain powers to acquire the target areas needed for siting the berm. Eminent domain, however, is controversial, time-consuming, and expensive and, as a result, many state and local entities are reluctant to use this power to acquire lands.

Wetland impacts—The size of the berm needed to provide the desired levels of flood protection is also proving problematic because the whole project area is developed within inches of the wetlands. Aside from acquiring privately owned uplands, the state's only option for constructing the berm system would be to fill wetlands, and the state's ability to do so is restricted by both state and federal laws.⁵ These site constraints are limiting the options for how and where the state can align the berm system.

Contamination—The wetland restoration components of the proposal are also proving problematic because of contamination, Superfund sites,⁶ and polluted waters. Several Superfund sites are located in the project area and have contributed to contamination and pollution in the Hackensack River. This river feeds into the Meadowland’s system of preserved wetlands where the proposal called for restoration efforts to create and enhance a “Meadowpark.” Regulatory entities, however, have expressed concerns that restoration activities could stir up contaminated sediments, posing public health, environmental, and water quality concerns. To provide pathways to restore wetlands in urban environments where contamination is common, regulatory entities should conduct studies and develop guidance. This guidance should outline methods to manage contaminated sediment while allowing restoration that can provide long-term environmental and social benefits.



Proposed Wetlands Restoration

The New Meadowlands proposal called for the restoration and enhancement of wetlands throughout the Meadowlands as a strategy for reducing flood risks and providing ecosystem and recreational benefits. The numbers indicate where the design teams assessed the adaptability of wetlands based upon soil accretion.

Regional coordination—Regional coordination also poses a challenge to implementation of the project. The grantee must coordinate a broad diversity of small jurisdictions across a large geographic area. New Jersey is a “home rule” state and the Meadowlands area has fourteen individual jurisdictions, which presents challenges for implementing a regional approach to reducing flood risks. While the design team had hoped that the existence of the Meadowlands Commission (a regional entity) would present a vehicle for coordinating across local governments in the region, regional coordination has remained a challenge. The Commission does not supersede local authority and, thus, coordination among the individual jurisdictions is still needed to develop a viable project.

Land-use changes—The proposal also called for upzoning and resilient mixed-use or multi-family development projects around the Meadowband. The proposal envisioned that upzoning could generate property tax revenues to support future phases of work and justify transit investments. However, these proposed land-use changes are not being pursued for a couple of reasons. First, in New Jersey local governments are delegated the powers to adopt land-use regulations. As a result, implementation of any of the land-use measures included in the proposal would require local action. In addition, members of the community were opposed to increases in density in this region, which has made these zoning changes and this source of potential revenue infeasible.



Meadowlands Before and After

This picture and rendering illustrate how a berm system would be integrated with wetland restoration projects to enhance flood resilience and the land-use changes called for by the proposal.

Procurement—State procurement rules slowed the grantee’s work at the outset of the process. The State of New Jersey has time-consuming state procurement rules that require approvals from several different government agencies, and it takes between 8 to 12 months for an agency to accept bids on a contract and select a contractor.⁷ As a result, it took a year from HUD’s allocation of funding (October 2014) for the grantee to hire a contractor who could start design, feasibility analyses, and environmental review (October 2015). Although state procurement rules are put in place to ensure fiscally sound use of public dollars, lengthy procurement processes can pose particular challenges for implementing disaster-recovery projects where federal funds must be obligated and expended under quick timelines. Although HUD authorized the use of non-competitive processes (i.e. “sole-source” contracts) to streamline procurement for implementation of the RBD projects,⁸ New Jersey rules are more limited. In order to justify the award of a sole-source contract, the grantee had to show that no other qualified vendor could provide the services under New Jersey procurement rules.⁹

PATHWAYS FORWARD AND LESSONS LEARNED

Regional Coordination—To implement these resilience projects across a broad geographical region with multiple local, state, and public stakeholders, the grantee is developing innovative methods for coordination and engagement. In the Meadowlands region, to ensure active participation by key stakeholders in the project area, NJDEP established an Executive Steering Committee (ESC) that includes leadership from NJDEP, the mayors and other representatives from the municipalities of Moonachie, Little Ferry, South Hackensack, Teterboro and Carlstadt, representatives from the New Jersey Sports and Exposition Authority (formerly the NJ Meadowlands Commission¹⁰) and the US Department of Housing and Urban Development (HUD). The ESC also developed a Citizen Outreach Plan, which outlines how the general public, municipal officials, community organizations, and the academic community will engage and collaborate with the NJDEP in the planning, design, and implementation processes for the New Meadowlands project. In addition, a Citizen Advisory Group (CAG) was formed, consisting of interested members of the public from the five municipalities representing a diverse group of individuals. Participants in the CAG helped to identify the unmet needs of the community as the grantee began scoping the project.

Leverage—Because of the project’s funding gap, the grantee, the region, or the individual localities will need significant additional resources if they are to implement the Meadowpark components of the proposal. State programs set up to acquire flood-prone properties and to restore wetlands could be one potential source of funding. In New Jersey, the state explored opportunities to leverage funds from the New Jersey Blue and Green Acres programs and wetland mitigation banks. The New Jersey Green Acres program was created to fund the preservation of open space land;¹¹ and the Blue Acres program was created to facilitate buyouts of flood-prone properties and the preservation of natural floodplains.¹² Funds can be used to acquire lands from *willing sellers* for purposes of preserving natural floodplains or acquiring properties with storm-damaged structures. Mitigation banks¹³ can also be a source of revenue to fund wetland restoration work.¹⁴ When a development project will impact wetlands, mitigation banks allow developers to pay a fee to offset or mitigate impacts.¹⁵ Those fees are then used by a wetland mitigation bank in the region to acquire, restore, or enhance other wetlands and thus are a good funding source to support wetland restoration work. To create or leverage a wetland bank, grantees need to consider a number of legal and regulatory issues: (1) mitigation banks need to adhere to state and federal mitigation banking rules;¹⁶ (2) some activities are ineligible for wetlands mitigation funding; for example trails and boardwalks are ineligible uses of mitigation fees;¹⁷ and (3) in areas with contamination, all contaminated areas need to be identified and project proponents need to show that there is no ecological risk posed by the restoration project.¹⁸ While the state is exploring the potential to leverage these existing state programs, it is unclear—at this stage in the grantee’s process—whether these programs will provide viable sources of funding for future phases of work.

CONCLUSION

The New Meadowlands proposal provided an ambitious vision for combining structural and nature-based approaches for protecting development and restoring coastal ecosystems. The implementation challenges the grantees are facing expose the need for further exploration of ways that contaminated coastal ecosystems in urban environments can be restored to provide long-term ecological and flood-risk reduction benefits, while also mitigating short-term risks to public health and water quality.

CHAPTER 6 END NOTES

- 1 *Land Use Regulations*, New Jersey Meadowlands Commission. The Meadowlands Commission was consolidated with the New Jersey Sports and Exposition Authority by legislation passed in 2015 and is now known as the NJSEA.
- 2 S.P. Sullivan, *What caused the Meadowlands deluge? No single berm is a smoking gun in Sandy's wake*, NJ.com. (Jan. 12, 2013., updated on May 21, 2014), available at http://www.nj.com/bergen/index.ssf/2013/01/no_silver_bullet_to_prevent_sandy-level_flooding_in_little_ferry_moonachie.html.
- 3 This team includes HDR, Inc., Dewberry Engineers, Matrix New World Engineering, HR&A Advisors, Robinson Aerial Surveys, Remora Consulting, Reichman Frankle, and Stevens Institute of Technology.
- 4 *Notice of Intent to Prepare a Draft Environmental Impact Statement (EIS) and Notice of Early Public Review of a Proposed Activity in a 100-year Floodplain and Wetlands for the Rebuild by Design Meadowlands Flood Protection Project in Bergen County, New Jersey*, 81 Fed. Reg. 39940 (Jun 20, 2016) available at <http://www.nj.gov/dep/floodresilience/docs/rbdlm-noi-fed-reg2016-14524.pdf>.
- 5 Under New Jersey's Wetland Act, NJDEP regulates development affecting wetlands with the goal of avoiding, minimizing, and reducing filling of wetland. N.J.S.A. 13:9A-4. NJDEP coordinates its review of permits with the Army Corps of Engineers that also regulates development affecting wetlands pursuant to Section 404 of the Clean Water Act. The Corps individual permit process can be quite lengthy (up to three years) because it requires public notice and comment, public interest review, consultation with other federal agencies (such as Environmental Protection Agency, National Marine Fisheries Service and the Fish and Wildlife Service), and compliance with other federal requirements including the Endangered Species Act (16 U.S.C. § 1532(19) (1982)), Magnuson-Stevens Act (16 U.S.C. § 1801 et seq.), Historic Preservation Act (16 U.S.C. § 470 et seq.).
- 6 "Superfund sites" refer to sites that are contaminated with hazardous substances or pollutants and have been designated as sites needing clean up under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (or CERCLA or the Superfund Act). 42 USC § 9601 et seq.
- 7 State law requires public advertisement and bidding before awarding of any "architectural, engineering or land surveying contracts" (defined as "those services, including planning, environmental, and construction inspection services required for the development and construction of projects, within the scope of the practice of architecture, professional engineering or professional land surveying...") over \$25,000. N.J.S.A. 52:34-9.2, 52:34-9.4, 52:34-9.7. Agencies rank at least the top three most highly qualified firms (assuming at least three qualified firms have expressed interest or submitted a proposal as solicited by the agency) and attempt to negotiate a contract with one of these firms, in order of their rank. N.J.S.A. 52:34-9.5 – 9.6. For any contracts anticipated to be over \$10 million, the contracting agency must notify the Procurement Division of the Office of the State Comptroller at least 30 days prior to any advertisement or solicitation of proposals. N.J.A.C. 17:44-3.1. Within 20 business days of completing the bidding process and awarding a contract over \$10 million, the contracting agency must also submit documents and information on the award to the Procurement Division for review. N.J.A.C. 17:44-3.4.
- 8 HUD, *Summary of Federal Register Notice Regarding Rebuild by Design Projects 5* (Oct. 16, 2014); ["Grantees are specifically authorized by HUD to engage in non-competitive, sole-source procurement of the design teams or members of the design teams."].
- 9 The New Jersey Office of the State Comptroller defines "sole source provider contract" as "a contract awarded for goods or services when the provider is the only available source of the goods or services," N.J.A.C. 17:44-1.2, and for any sole service provider contract valued at more than \$2 million, the contracting agency must provide justification including an explanation regarding the lack of other vendors that can provide comparable services. N.J.A.C. 17:44-3.8(b).
- 10 The Meadowlands Commission was originally formed to conserve wetlands (around 8,400 acres have been preserved or enhanced), to coordinate land-use decisions, and to provide resources to municipalities and businesses in the region. N.J.S.A. 13:17-6. <http://www.njmeadowlands.gov/>. ("The NJMC District Zoning Regulations (N.J.A.C. 19:4-1.1 et. seq.) provide for the orderly and comprehensive development of the Hackensack Meadowlands District, consistent with the carrying capacity of the land and the preservation of critical wetland areas in accordance with the Master Plan of the NJMC, while preserving the ecological balance between natural and open areas and development. The purposes of the District Zoning Regulations are listed at N.J.A.C. 19:4-1.2(a).")
- 11 New Jersey Department of Environmental Protection, *Green Acres Program*, <http://www.nj.gov/dep/greenacres/>.

- 12 New Jersey Department of Environmental Protection, *Blue Acres Floodplain Acquisitions*, http://www.nj.gov/dep/greenacres/blue_flood_ac.html.
- 13 Under the New Jersey Freshwater Wetland Protection Act, impacts to wetlands caused by regulated activities must be mitigated. Mitigation can be achieved by creating, restoring, or enhancing other wetlands, making a monetary or land contribution, or by purchasing a mitigation bank credit. A wetlands mitigation bank is a site where wetlands or associated uplands/aquatic resources are created, restored, or enhanced by a site operator, who is awarded mitigation credits that may be sold to regulated entities. A wetlands mitigation bank can be created by a public entity, such as a county or municipality, or by a private company. Once a wetlands mitigation bank project is proposed, NJDEP determines the number of mitigation credits the project would be awarded, as well as the service area for the bank. Once approved, a wetlands mitigation bank may sell wetlands mitigation credits to regulated public or private entities in its service area. NJDEP Division of Land Use Regulation, *Mitigation*, <http://www.nj.gov/dep/landuse/mitigate.html>.
- 14 The Meadowlands site is in the service area of two existing Wetlands Mitigation Banks. The two existing wetlands banks in the Meadowlands region include the Kane Wetland Mitigation Bank and MRI-3. The Kane Wetland Mitigation Bank is located on land owned by the Meadowlands Conservation Trust, is run by a private operator, and may only sell credits for transportation projects by NJ Transit, Port Authority, the New Jersey Department of Transportation (NJDOT), and New Jersey Transit Authority. The MRI-3 Mitigation Bank is located on a 51 acre site in Carlstadt, NJ, and is run by a private firm.
- 15 Authorized by the New Jersey Freshwater Wetlands Protection Act (NJSA 13:9B-13—13:9B-14, NJSA 7:7A), the Coastal Zone Management Rules (NJAC 7:7E), and Coastal Permit Program Rules (NJAC 7:7), among other statutes and implementing rules governing development proposals affecting freshwater and tidal wetlands and coastal areas; see also http://www.nj.gov/dep/landuse/download/mit_040.pdf.
- 16 New Jersey mitigation bank regulations (N.J.A.C. 7:7A-15.23) and the Hackensack Meadowlands Reclamation and Development Act. If the proposed site falls under federal jurisdiction, federal mitigation banking rules would apply. 33 CFR 325, 332 and 40 CFR 230.
- 17 NJDEP regulations state that “an improvement to a public facility which is intended for human use, such as a ... nature trail, or boardwalk does not constitute mitigation.” N.J.A.C. 7:7A-15.4.
- 18 Id.

Hunts Point Lifelines

South Bronx
New York City



BACKGROUND

Hunts Point in South Bronx, New York is an approximately 1,000-acre area peninsula surrounded on three sides by the East and Bronx rivers and defined topographically by an upland central ridgeline and surrounding ring of lowlands. Hunts Point is the site of a critical food supply hub for the New York region; it houses the Hunts Point Food Distribution Center that helps to feed 22 million people in the greater New York City metropolitan region. The distribution center is made up of three cooperative wholesale markets (produce, meat, and fish) and five private warehouse facilities that together include over 100 public and private wholesalers, provide approximately 8,500 jobs, and generate over \$5 billion in revenue.¹ Many of the facilities of the distribution center are located in the low-lying areas of the Hunts Point peninsula and the center is, therefore, vulnerable to flooding and power outages during severe storms.

Hunts Point was minimally affected by Hurricane Sandy, due to the storm's arrival to the area during low tide. However, it is an area of the city that is highly vulnerable to flooding and its flood risks will increase as sea levels rise. Had the storm hit a couple hours later, critical assets on the peninsula could have been damaged by flooding. Key industrial facilities and critical infrastructure on the peninsula are located in the floodplain. The fish market,

COMPETITION DESIGN TEAM

PennDesign/OLIN, HR&A Advisors, eDesign Dynamics, Level Infrastructure, Barretto Bay Strategies, McLaren Engineering Group, Philip Habib & Associates, Buro Happold

PROJECT AREA

The Hunts Point peninsula in the South Bronx, New York City.

GRANTEE

New York City, Mayor's Office of Recovery and Resiliency

AMOUNT AWARDED

\$20 million in RBD allocation, supplemented with additional \$25 million CDBG-DR from the city

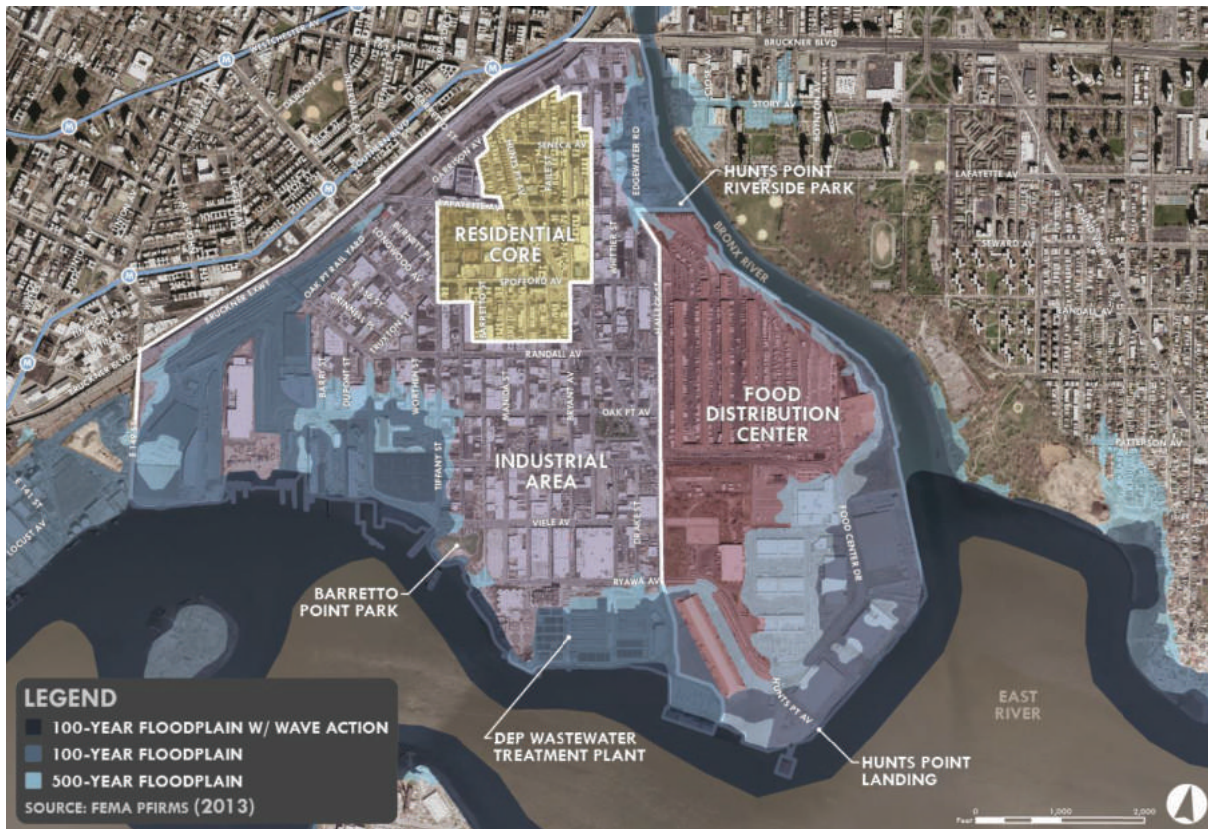
PROPOSAL LINK

<http://www.rebuildbydesign.org/our-work/all-proposals/winning-projects/hunts-point-lifelines>

PROJECT WEBSITE

<http://www.huntspointresiliency.nyc>

which supplies one-half of New York City’s fish supply; three of the largest food distribution businesses; and the Hunts Point Wastewater Treatment Plant all lay within the area’s 100-year floodplain. Other food distribution facilities are located within the 500-year current or future floodplain.



Hunts Point Peninsula: Flood Vulnerabilities

This map depicts areas of the Hunts Point peninsula that are vulnerable to the flooding during the 100- and 500-year flood events.

The area’s physical vulnerability exacerbates economic and social vulnerabilities in the community as well. The unemployment rate in Hunts Point is 20 percent, and South Bronx as a whole is the poorest congressional district in the US.² Some local stakeholders are concerned that aging facilities in these areas may push the large wholesale markets to leave Hunts Point as they look to invest in newer facilities. And while the residential neighborhoods of Hunts Point are located upland and are therefore less vulnerable to flooding, some of the residents depend on jobs in the industrial low-lying areas and would be economically harmed if these businesses are forced to close due to flooding.

THE PROPOSAL

The *Hunts Point Lifelines* proposal looked at different ways to build the resilience of the Hunts Point peninsula, including measures to enhance flood protection, build economic resilience, enhance transportation and other infrastructure, and create redundancies using maritime routes. The design team looked at options for protecting critical assets in the region including the Food Distribution Center, local businesses, and the wastewater treatment plant. To do so, the proposal called for four integrated components, called “Lifelines”:

- **Lifeline 1: Integrated Flood Protection:** This lifeline called for the combination of a protective levee, wetland system, and an integrated greenway, that would protect critical assets from a 100-year flood event and also allow for integration of additional protective measures to account for future sea-level rise. “Levee labs” would be created to support additional research and to develop innovative flood protection approaches and to scale up flood resilience investments in the region. The central goal of this component was to keep the food distribution center online and operational during a storm and to allow continued access for the 20,000 trucks that travel to and from the center weekly. The proposal also envisioned alignment of the flood protection measures with future phases of the “South Bronx Greenway” (a project that has been planned since 2005 and is being designed to create safer connections between residential neighborhoods, the waterfront, and commercial areas). In addition to the flood protection measures, this lifeline also called for the incorporation of habitat restoration and green infrastructure approaches for managing stormwater behind flood protection structures.



Proposed Hunts Point Levee

This rendering depicts the proposal's call for flood protection to be integrated with recreational amenities like bike lanes.

- **Lifeline 2: Livelihoods:** This lifeline focused on jobs and alleviating the poverty that exacerbates the vulnerability of residents in Hunts Point, acknowledging that the jobs provided by local businesses and the food distribution center in the region are critical to the economic resilience of the community. The proposal called for robust community engagement in the development of resilience measures. It also called for local hiring and the use of local labor to develop the infrastructure projects called for by the proposal and to promote economic development in the region.



Livelihoods

This rendering depicts the proposal's long-term vision for growing and modernizing the regional Food Distribution Center

- **Lifeline 3: Cleanways:** This lifeline called for infrastructure improvements (called “Cleanways”) to enhance and “green” transportation throughout the region. The Cleanways would improve truck access routes and provide safer crossings across truck routes to allow pedestrians to access the waterfront. It also called for improved pedestrian access to public transit and to the new Metro North train station proposed for the area. Green and gray infrastructure would be installed to capture and filter stormwater and protect roads from flooding during heavy rain events and storms. This lifeline also called for the development of a clean Tri-Gen Power generating station, a low-carbon power source to serve the region’s power supply demands that could function as a microgrid if power in the rest of New York City goes down.



Proposed Hunts Point "Cleanway"

This rendering depicts the proposal's call for integrating bike lanes and green infrastructure to turn major transportation corridors in the Hunts Point region into "Cleanways".

- **Lifeline 4: Maritime Emergency Supply Lines:** The fourth lifeline envisioned new pier infrastructure and a maritime base that would provide for continued operations during emergency situations even if roads, tunnels, and bridges were incapacitated. This lifeline called for a Maritime Emergency Supply Chain logistics base to be built to coordinate intermodal transport, ensure uninterrupted distribution routes, and maintain supply chains via maritime routes during emergencies throughout the East Coast.

Throughout the whole planning process, the design team emphasized site-specific, community-driven design. The design team engaged local business owners, union members, and neighborhood advocates, among others in planning charrettes and community meetings to develop the *Hunts Point Lifelines* proposal and to clarify community resilience priorities for the region.

The design team estimated that the costs to implement phase one of the measures proposed in all four lifelines would total \$816 million.³ The Hunts Point project was awarded \$20 million in RBD funding and the city reallocated an additional \$25 million in CDBG-DR funding to support a feasibility assessment and for implementation of a pilot project.

THE PROJECT

The Hunts Point Lifelines project was not selected for full implementation, but funding was provided to continue planning and to support implementation of a pilot project. Upon issuing the award, HUD did not specify a component of the proposal for the city to implement coming out of the RBD competition. Instead the city was allocated \$20 million in federal funds for continued analysis, study, planning, and community engagement, and to develop an unspecified resiliency pilot project. HUD, however, has required that the pilot project, identified through additional studies completed with the RBD funding, provide “independent resiliency benefit” even if additional phases of work are not completed.⁴

To identify topics for further study and implementation, the city convened an Advisory Working Group (AWG) of members from government, business, and the community several times over 6 months in 2015. The city leveraged funds from NYC Economic Development Corporation to contract with the Interaction Institute for Social Change for this stakeholder engagement. The engagement process built upon the ideas generated by the *Hunts Point Lifelines* proposal with the purpose of identifying resilience priorities of the local stakeholders. This AWG made recommendations for resilience priorities to inform the selection of pilot projects that the city could explore through additional feasibility studies.⁵

Through this process, two priority categories were recommended by the AWG: flood-risk-reduction and resilient energy.⁶ Based on these recommendations, as well as HUD requirements, the city announced it would advance feasibility studies in both priority categories and selected to pursue a resilient energy pilot project. The city plans to seek additional funding for a flood-risk-reduction project and for a longer-term resilient energy project depending on the results of the feasibility studies.⁷

The city has hired a consulting team to advance the two feasibility studies to help the city identify detailed options that can be pursued for future implementation.⁸ The consulting team started stakeholder engagement and technical analysis in the summer of 2016. This analysis will build off the ideas put forth in the *Lifelines* proposal to evaluate a range of project options for reducing flood risks and increasing energy resilience in the region. The purpose of these analyses will be to define implementable projects that reflect local stakeholder priorities. The feasibility analyses will look at 15 to 20 different options for each resilience priority. Each option will be assessed for technical, legal, environmental, and financial feasibility and stakeholder benefits to winnow down a list of projects that could be pursued for implementation, subject to the availability of funding and the findings of the studies. The flood analyses will look at projects that could be implemented in the region to reduce flood risks from both coastal and inland flooding. A preferred energy resilience pilot project will then be selected and moved into future phases of design, environmental review, and permitting with the existing allocation of RBD and CDBG-DR funding.

As part of the resilient energy feasibility study, the city also leveraged the results of a microgrid feasibility study for Hunts Point, which was conducted separately by a consultant with a grant from the New York State Energy Research and Development Authority (NYSERDA). This study, which was completed in Spring 2016, explores opportunities for creating a district energy facility that could provide resilient power to the Hunts Point Food Distribution Center and certain critical community facilities.

LEGAL AND POLICY CHALLENGES

Funding gap—The biggest challenge with the Hunts Point project is the funding gap. The project has received \$45 million in combined contributions from RBD and the city’s CDBG-DR allocation, but it was estimated that it would cost over \$800 million to implement the initial scope of work envisioned by the *Lifelines* proposal. With the currently available funding, the grantee will only be able to complete a pilot project in Hunts Point. To complete future phases of work building on ideas in the *Lifelines* proposal, other sources of funds will need to be found. (More details are provided below on how the city is seeking to leverage other funding sources to fund other resilience initiatives in the Hunts Point region).

Public expectations—The funding gap has also created challenges with the level of public expectations that were raised during the design process. The RBD design teams were asked to “think big” and come up with visionary and innovative approaches for increasing community resilience. The grantee, however, must now seek to implement a smaller-scale project while tempering community expectations that were raised during the design process.

Feasibility—Many of the options put forth in the *Lifelines* proposal will not be feasible to implement given physical, funding, regulatory, and legal constraints. For example, in order to construct a waterfront berm the city would have to acquire easements over the lands that would be needed to construct the proposed alignment of the berm system. The goal of the feasibility study is to determine what elements might be possible and build on the ideas put forth in the *Lifelines* proposal while evaluating them through technical analyses for risk and vulnerability, unmet energy needs, infrastructure conditions, and regulatory requirements.

PATHWAYS FORWARD AND LESSONS LEARNED

Leverage—Because of its large funding gap, the Hunts Point project best demonstrates the “crazy quilt”⁹ of funding sources that state and local officials must patch together to implement a comprehensive resilience approach for a community or region. The city is looking at a number of other projects and studies that are already occurring in the region to support the implementation of additional resilience measures in Hunts Point. A few examples of ways the city is leveraging other funds include the following:

- The city is incorporating findings from a NYSEDA-funded preliminary feasibility study for a microgrid in the region. The implementation of a microgrid project could also potentially be partially funded through this same competitive NYSEDA program, which offers support for feasibility studies as well as future phases of work including engineering and design, project build out, and monitoring.¹⁰
- The POINT Community Development Corporation (The POINT CDC) and the New York City Environmental Justice Alliance (NYC-EJA) were also recipients of support from the Kresge Foundation to engage local residents to develop a comprehensive climate resiliency agenda for the South Bronx.¹¹ The agenda will focus on strengthening the physical and social resiliency of the South Bronx Significant Maritime and Industrial Area (SMIA), which includes the entire area of Hunts Point that is vulnerable to flooding and houses significant industrial assets, like the Food Distribution Center. The POINT CDC and NYC-EJA have engaged members of the RBD design team to facilitate continued conversations with the community.
- The city is also trying to integrate planning and implementation with ongoing initiatives in the region including the Bronx River Plan (which looks at opportunities to implement greenways and restore the Bronx River and enhance parks),¹² and the NYC Department of City Planning’s Resilient Industry Study (which is a city-wide assessment of the vulnerability of industrial areas and strategies for increasing the resilience of businesses, employees, and nearby communities).¹³

- The City Department of Environmental Protection (DEP), which operates the Hunts Point Wastewater Treatment Plant, is also developing a suite of resiliency initiatives for prospective deployment at facilities citywide and evaluating where to implement initiatives based on available funding and facility vulnerability.
- Concurrently, NYCEDC is advancing a city capital-funded \$150M modernization effort for the Food Distribution Center, which will complement the CDBG-DR resiliency pilot-project and other neighborhood resiliency measures.

Mitigating other risks posed by climate change—As part of the feasibility study the grantee is doing a full risk and vulnerability assessment of how climate change will affect the region including increasing temperatures and inland and coastal flood risk. This vulnerability analysis will be used to assess the efficacy of different projects for reducing the full range of risks posed by different climate threats. It is hoped that this analysis will also provide a single centralized data set that can be used to inform decisions for increasing the resilience of the Hunts Point neighborhood in the future.

Community engagement—The Hunts Point proposal demonstrates the value of robust community engagement and community-driven design. The design teams engaged with schools, community organizations, labor unions, local businesses, and other advocates early and throughout the competition process. Key community stakeholders were interviewed and the design teams lead several public planning meetings. To inspire interest and excitement about the project, the design team hosted a public meeting and an event they called a “Slam Bake,” where local chefs and amateur cooks competed to cook dishes sourced from the area’s wholesalers. In implementing the project, the city built upon these initiatives and relationships developed during the competition, as well as long-standing relationships the city has with local stakeholders through the past decade of implementation of the Hunts Point Vision Plan. Rather than propose a pilot project to study, the city conducted additional public engagement with local stakeholders to inform resilience priorities. Local stakeholders and the AWG continue to inform the ongoing feasibility analyses of project alternatives. The city has also established an Engagement Strategy Team of local community organizations to guide engagement and outreach activities throughout the project. The city is providing stipends to a Neighborhood Outreach Team of local residents to implement an inclusive engagement process by organizing educational and interactive activities throughout the community.¹⁴ Finally, the grantee is working with the Interaction Institute for Social Change, who is on the consulting team, to develop innovative approaches for engaging diverse groups to involve in the process (for example they want to get more young people involved).

CONCLUSION

The grantee is demonstrating creative ways to leverage limited implementation funds to advance future phases of work. The city contributed additional resources and is also leveraging other state, federal, and philanthropic funding sources to support other components of work in the Hunts Point region. The project also demonstrates how state and local agencies can use community-driven processes to work with residents in setting resilience priorities.

CHAPTER 7 END NOTES

- 1 PennDesign / OLIN, et seq., *Hunts Point Lifelines: Briefing Book* at 5 (Apr. 6, 2014), available at: <http://www.rebuildbydesign.org/our-work/all-proposals/winning-projects/hunts-point-lifelines> [hereinafter *Hunts Point Lifelines proposal*].
- 2 *Hunts Point Lifelines proposal* at 26
- 3 *Hunts Point Lifelines proposal* at 134.
- 4 HUD, *Third Allocation, Waivers, and Alternative Requirements for Grantees Received Community Development Block Grant (CDBG) Disaster Recovery Funds in Response to Hurricane Sandy*, 79 Fed. Reg. 62182 (Oct. 2014).
- 5 New York City Economic Development Corporation, *Hunts Point Resiliency*, available at: <http://www.huntspointresiliency.nyc>.
- 6 Hunts Point Resiliency Implementation Advisory Working Group, *Advisory Working Group Recommendations to the Senior Advisor to the Mayor for Recovery, Resiliency, and Infrastructure, New York City Office of the Mayor* (Sep. 30, 2015), available at: http://www.nycedc.com/sites/default/files/filemanager/Hunts_Point_Resiliency_Working_Group_Recommendations_FINAL.pdf.
- 7 “Hunts Point Resiliency Report Back” (Presentation, December 11, 2015), available at http://www.nycedc.com/sites/default/files/filemanager/2015_12_11_Hunts_Point_Resiliency_Report_Back.pdf.
- 8 “NYC Economic Development Corporation Releases RFP for Hunts Point Resiliency Project.” Rebuild by Design. December 17, 2015. <http://www.rebuildbydesign.org/news-and-events/updates/nyc-economic-development-corporation-releases-rfp-for-hunts-point-resiliency-project>; “Hunts Point Peninsula Resiliency Evaluation and Pilot Project,” Dec. 16, 2015, available at https://www.nycedc.com/sites/default/files/files/rfp/qa-documents/HP%20PREPP%20Info%20Session%201.5.16_FINAL.pdf.
- 9 Ed Thomas & Sarah K. Bowen, *Post-Disaster Reconstruction: The Patchwork Quilt* (2008), available at: https://www.floods.org/PDF/Post_Disaster_Reconstruction_Patchwork_Quilt_ET.pdf [This special edition report produced for the National Floodproofing Conference in New Orleans, Louisiana describes the “patchwork quilt” of funding sources that communities need to piece together in order to implement a comprehensive disaster-recovery process.]
- 10 New York State Energy Research and Development Authority (NYSERDA), *NY Prize*, available at: <http://www.nyserda.ny.gov/All-Programs/Programs/NY-Prize>.
- 11 New York City Environmental Justice Alliance, *Community Resiliency, NYC Climate Justice Agency: Strengthening the Mayor’s OneNYC Plan*, available at: http://www.nyc-eja.org/?page_id=711.
- 12 Bronx River Alliance, *Bronx River Ecological Restoration and Management Plan* (2007) and the *Bronx River Greenway Plan* (2006); available at http://www.bronxriver.org/puma/images/usersubmitted/greenway_plan/.
- 13 New York City Planning, *Resilient Industry*, available at: <https://www1.nyc.gov/site/planning/plans/resilient-industry/resilient-industry.page>.
- 14 New York City Economic Development Corporation, *We’re Hiring! Join our Neighborhood Outreach Team*, available at: <https://medium.com/hunts-point-resiliency/were-hiring-join-our-neighborhood-outreach-team-b29fc72a8f76#.ixuc0wmhy>.

Appendix A—Image Credits

Ch 1—Summary of Lessons Learned

Flood Risk in the New York and New Jersey Region – MIT CAU + ZUS + URBANISTEN team; Social Vulnerability to Flooding – PennDesign/OLIN; Figure 3: Structural or “Gray” Coastal Defenses – (1) Alaina Owens, Integration and Application Network (IAN), University of Maryland Center for Environmental Science (UMCES) (ian.umces.edu/imagelibrary/) (2) ARCADIS (3) Jane Thomas, IAN, UMCES (4) Jessica Grannis (5) Jane Thomas, IAN UMCES; Figure 4: Nature-based or “Green” Coastal Defenses – (1) Jessica Grannis (2) Jane Thomas, IAN UMCES (3) SCAPE Team (4) Tim Carruthers, IAN UMCES; Figure 5: Green Infrastructure Approaches – (1) Jessica Grannis (2) ASLA (3) Jessica Grannis; Figure 6: Land-Use (or “Non-Structural”) Approaches – (1) Jane Thomas, IAN UMCES (2) Jessica Grannis (3) Flood Control America (4) dbhousemovers.com

Chapter 2—The BIG U

BIG U Compartments – BIG Team; BIG U Deployable Flood Walls – BIG Team; BIG U Green Infrastructure – BIG Team; East Side Coastal Resiliency Project – Courtesy of the City of New York; BIG U: Stuyvesant Cove – Courtesy of the City of New York

Chapter 3—Living Breakwaters

Living Breakwater – SCAPE Team; Restoring Oyster Reefs – SCAPE Team; Water Hub – SCAPE Team; Living Breakwaters: Multiple Lines of Defense – SCAPE Team

Chapter 4—Living with the Bay

“Slow Streams” – Interboro Partners Team; Living with the Bay Program Sections – Courtesy of New York Governor's Office of Storm Recovery; Marsh Restoration in Hewlett Bay – Interboro Partners Team

Chapter 5—Resist, Delay, Store and Discharge:

Hoboken: Flood Impacts from Hurricane Sandy – OMA Team; Resist Delay Store Discharge Proposal – OMA Team; Delay and Store Strategies – Dewberry/SCAPE, Courtesy of New Jersey Department of Environmental Protection; Resist Alignment 3 – Dewberry/SCAPE, Courtesy of New Jersey Department of Environmental Protection

Chapter 6—New Meadowlands

A Cross Section of the Meadowband and Meadowpark – MIT CAU+ZUS+URBANISTEN; New Meadowlands: Proposed Pilot Areas – MIT CAU+ZUS+URBANISTEN; Proposed Wetlands Restoration – MIT CAU+ZUS+URBANISTEN; Meadowlands Before and After – MIT CAU+ZUS+URBANISTEN

Chapter 7—Hunts Point Lifelines

Hunts Point Peninsula: Flood Vulnerabilities – Courtesy of New York Economic Development Commission, OneNYC; Proposed Hunts Point Levee – PennDesign/OLIN Team; Livelihoods – PennDesign/OLIN Team; Cleanway – PennDesign/OLIN Team

Appendix B—Glossary

TERM OR ACRONYM	DEFINITION
100-year flood	A flood event that has a 1 percent probability of being equaled or exceeded in any given year. Also known as the “base-flood”
500-year flood	A flood event that has a 0.2 percent probability of being equaled or exceeded in any given year.
ADA	The Americans with Disabilities Act (42 U.S.C § 12101 et seq.)
Base flood elevation or BFE	Elevation of flood waters from the 100-year flood, as determined by statistical analysis for each local area.
Bioswales	Vegetated channels for treating and retaining stormwater, which are often placed along roads or parking lots.
Breakwaters	Rocky, sloped walls in the water column that disrupt waves
BRT	Bus rapid transit
Bumpout	A curb extension that protrudes into the street (often at the end of a block or mid-block) that includes plants, soils and stones to help treat and retain stormwater runoff from streets and sidewalks.
CAC or CAG	Citizen Advisory Committee or Citizen Advisory Group— advisory bodies that the grantees or convening to engage with the public on the design and implementation of the RBD projects.
CDBG-DR funding	Community Development Block Grant —Disaster Recovery funding
CEQ	White House Council on Environmental Quality
CERCLA or the Superfund Act	Comprehensive Environmental Resource, Compensation and Liability Act of 1980 (42 U.S.C. § 9601 et seq.)
Competition design teams	Teams of design and engineering firms that developed the RBD Proposals
Corps, Army Corps, or USACE	U.S. Army Corps of Engineers

TERM OR ACRONYM	DEFINITION
CWA	Clean Water Act (33 U.S.C. § 1251 et seq.)
EIS	Environmental Impact Statement required under the National Environmental Policy Act (NEPA)
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act (16 U.S.C. § 1531 et seq.)
ESC	Executive Steering Committee—committees that the grantees are establishing to coordinate with officials in the communities where the RBD projects are being constructed.
ESCR	East Side Coastal Resiliency project
FEMA	Federal Emergency Management Agency
FFRMS	Federal Flood Risk Management Standards
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map—the official map of a community prepared by FEMA that shows special flood hazard areas and base flood elevations.
Freeboard	Additional amount of height above the base flood elevation to provide a margin of safety and account for uncertainties in the determination of flood elevations
FTA	Federal Transit Administration
FWS	U.S. Fish and Wildlife Service
GOSR	New York Governor’s Office of Storm Recovery
Grantees	State and local recipients of the CDBG-DR funding allocated for RBD Projects—New York, New Jersey, and New York City
Green infrastructure	This report uses the definition of “green infrastructure” adopted by EPA to include strategies that use vegetation, soils, and natural processes to manage stormwater.
Green roofs	Vegetation installed on rooftops
HMGP	Hazard Mitigation Grant Program created by the Stafford Act (42 U.S.C. § 5170c)

TERM OR ACRONYM	DEFINITION
HUD	U.S. Department of Housing and Urban Development
Living Shorelines	Nature-based approaches that combine restoration of natural features (such as wetlands) with some structural measures (such as low rock sills) to dampen storm surges and reduce erosion on waterfront properties while maintaining tidal connectivity. <i>See</i> Nat'l Oceanic and Atmospheric Admin., <i>Guidance for Considering the Use of Living Shorelines</i> (2015).
LMI	Low- and moderate-income
LWRP	Local Waterfront Revitalization Program implemented pursuant to New York State's Waterfront Revitalization Act
Magnuson Stevens	Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801 et seq.)
Natural defenses or "green" defenses	This report uses the "Green" or "natural" defenses refer to approaches that restore, mimic, and enhance natural coastal features to reduce coastal flooding and erosion risk, including beach nourishment, dune management, living shorelines, and wetland restoration.
NEPA	National Environmental Policy Act (42 U.S.C. § 4321)
NDRC	National Disaster Resilience Competition
NFIP	National Flood Insurance Program created by the National Flood Insurance Act of 1968 (42 U.S.C. § 4001 et seq.)
NHPA	National Historic Preservation Act (16 U.S.C. § 470 et seq.).
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NJMC or NJSEA	The New Jersey Sports and Exposition Authority, formerly called the New Jersey Meadowlands Commission
NJ Transit	New Jersey Transit Authority
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration

TERM OR ACRONYM	DEFINITION
“Non-structural” or land-use measures	Non-structural approaches rely on changes in land use (zoning code and building codes) to ensure that new development and redevelopment is more resilient to the impacts of flooding.
NYCEDC	New York City Economic Development Corporation
NYC-EJA	New York City Environmental Justice Alliance
NYCHA	New York City Housing Authority
NYDEC	New York Department of Environmental Conservation
NYDOS	New York Department of State
NY Rising	The New York Rising Community Reconstruction Program is a program created with the New York Governor’s Office of Storm Recovery to help with rebuilding and resiliency efforts in communities affected by Irene, Lee and Sandy.
NYSDOT	New York State Department of Transportation
NYSERDA	New York State Energy Research and Development Authority
PA	The Public Assistance Program created by the Stafford Act (42 U.S.C. § 5172)
PACE	Property Assessed Clean Energy
POINT CDC	The POINT Community Development Corporation
Rain garden	A rain garden is a depressed area in the landscape that uses plants and landscaping to reduce and soak up runoff from roofs, driveways, streets, and other impervious surfaces. Rain gardens involving special drainage systems or soils are called “bioretention”.
RBD	Rebuild by Design
RBD Plan	Implementation strategies for future phases of the RBD Projects, including potential funding sources and financing mechanisms.
RBD Projects	Projects to be implemented on the ground with the CDBG-DR funding as described in RBD Proposals
RBD Proposals	The six winning proposals selected from 140 applications during the RBD competition

TERM OR ACRONYM	DEFINITION
RHA	Section 10 of the Rivers and Harbors Act (33 U.S.C. § 403)
Sandy funding	Funds appropriated through the Hurricane Sandy Disaster Relief Appropriations Act, including the portion of CDBG-DR funds which were used to pay for implementation of the winning RBD projects.
Sandy Relief Act	Disaster Relief Appropriations Act of 2013, Pub. L. No. 113-2, 127 Stat. 4 (H.R. 152, 113 th Cong., Jan. 23 2013)
Sandy Task Force	The President's Hurricane Sandy Rebuilding Task Force
SIRR	New York City Special Initiative for Rebuilding and Resiliency
Sole source procurement	Sole source procurement is where a contract is entered into without competitive bidding based upon a justification that only one person or company has the skills or expertise needed to fulfill the contract.
Stafford Act	The Robert T. Stafford Disaster Relief and Emergency Assistance Act governs presidential disaster relief declarations and the administration of federal disaster relief funds (42 U.S.C. § 5121 et seq.).
Stormwater	Surface water runoff from impervious surfaces resulting from rainfall or snowmelt
Structural or "gray" coastal defenses	This report uses the term "structural" or "gray" coastal defenses terms to refer to the use of engineered structures to decrease shoreline erosion, dampen wave action, and protect against flooding, including levees, storm surge barriers, sea walls, revetments, groins, and breakwaters.
TCT	Technical Coordinating Committees – interagency bodies to coordinate federal, state, and local regulatory agencies and other decisionmakers.
TIF	Tax Increment Financing – is a method of financing a project or development in a designated geographic area based on the anticipated increase in property tax assessments that will be generated by the project.
Upzoning	The term upzoning is an informal term of art that means a zoning changing allowing for more intense uses or additional density on a parcel or in a particular area.

