I, Mark Sodo, hereby submit this original work as part of the requirements for the degree of Master of Architecture in Architecture (Master of).

It is entitled:
Before the Deluge

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Before the Deluge

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Abstract

Hurricane Sandy caused an enormous amount of damage to the New York City area when it hit the Atlantic coast in 2012. Leaving a number of different neighborhoods underwater, the storm destroyed property and infrastructure and caused hundreds of unfortunate deaths. New York City did not have the proper infrastructure and preventative measures to sufficiently protect itself from a storm as powerful as Hurricane Sandy and is currently vulnerable to the threat of future storms. In its wake, Hurricane Sandy did spark a global conversation and an initiative for design that focuses on the future protection of the city from storms and flooding. Government-issued strategies and open design competitions have received international attention and entries from some of the world’s leading architectural and landscape design firms and are proving to be a step forward in creating a safer New York City.

This thesis explores a park design that looks at mitigation strategies for New York City, combining urban infrastructure and public amenities with the natural ecosystem of a wetland. Wetlands provide the planet with excellent coastal protection, unique biodiversity, and many natural resources and services; by incorporating wetlands into an urban setting, this thesis design can provide an adaptable strategy to combat against powerful storm surges and flooding, as well as introduce both residents and tourists to a new type of natural environment in a number of different recreational and educational activities.

This park design will implement three key strategies in mitigating flooding: a reconstructed flood wall at the edge of the city, used to prevent large tidal surges from penetrating into the city; constructed wetland pools with integrated oyster reefs, that can effectively help filtrate the polluted East river; and an unconstructed natural wetland which will be a habit to many different breeds of plant and animal life that will help attenuate the forces of any surges that pass along the terrain. Additionally, public amenities will be included such as sporting and leisure fields, a wetland-themed museum, oyster bar, boat house and a public swimming area that will utilize the clean and filtered river water.

The culminating design of this park will produce a unique and active location that will not only help protect one of the more vulnerable sections of New York City, but also cultivate conversation and education regarding how wetland ecology and design can become a valuable community asset.
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It was nighttime as Hurricane Sandy made landfall over New Jersey with wind speeds as fast as 75 miles per hour, propelling a bombardment of waves towards the coastal infrastructures of multiple cities within the New York City metropolitan area and up the entire east coast of the United States of America. Within New York City, flood waters penetrated deep into areas of lower Manhattan, turning streets into pools of salt water mixed with sewage and debris, trapping people inside of their apartment buildings, destroying personal and public property, and killing those unlucky enough to get caught within the powerful surges produced from the heavy winds and the inescapable flooding it produced.

Hurricane Sandy was recorded as the country’s second costliest hurricane, with an estimated damage report of $51.8 billion dollars in the New York area alone, including both state and private losses, with an additional $9.1 billion for mitigation and prevention costs.

Houses on the city’s edges cracked apart amid the water’s incredible force. Entire structures were gutted in an instant, furniture, family heirlooms, even cars bobbing away into the night.

For the residents trying to brave it out, the water was inescapable as it rampaged through neighborhoods without mercy, on the verge of swamping the bulk of the city. [1]

One neighborhood in particular, Alphabet City, located to the east of Tompkins Square Park and the East Village, experienced extensive flooding
and damages to the area. Positioned directly along the East River, this neighborhood was hit devastatingly by the surging river and was left almost entirely submerged under water. Damages to the area included: a battered waterfront park along the river’s edge, incapacitating flooding to the Franklin D. Roosevelt East River Drive, the destruction of street-level property, overflowing sewer systems from excess water intake, and an explosion to a Consolidated Edison power transformer, which left nearly 750,000 Manhattanites without electricity as Hurricane Sandy continued to barrage the city with winds and tidal surging.

All of the destruction and death resulting from Hurricane Sandy made abundantly clear the incapability of the city to protect its infrastructure and inhabitants from serious storming and flooding. In a time when weather patterns are changing drastically and sea levels are rising rapidly, it is important for coastal cities to be adequately prepared for the future possibilities of natural disasters.

Many hurricane experts say the Atlantic Ocean and the Gulf of Mexico have begun to spin off more frequent and destructive hurricanes than in previous decades. Tropical storms have been on the rise since 1995, and a record 15 hurricanes made their way into the North Atlantic in 2005. [2]

Hurricane Sandy acted as a hard wake-up call for the entire city and since October 2012, much more attention has been focused on the reinforcement and protection of the coastal
regions within the city. Immediately after the storm, the Special Initiative for Rebuilding and Resiliency evaluated and addressed the aftermath of Hurricane Sandy and created a plan for a long-term focus on repairing and rebuilding the city into a more fortified one from weather and environmental forces. These plans are outlined in their publication made in cooperation with PlaNYC: “A Stronger, More Resilient New York,” released in June 2013.

“A Stronger, More Resilient New York” details 257 specific recommendations to harden infrastructure and protect neighborhoods and 73 percent of the short-term milestones in the report have been met or are near completion. The report details the need for major long-term projects to further fortify the city against climate events, which will require substantial investment and commitment to complete the projects in order to ensure neighborhoods do not remain vulnerable. [3]

“A Stronger, More Resilient New York” explains extensively the thoughts and ideas that the city has in rebuilding the coastal regions within Manhattan and throughout the outer boroughs. These plans range from the re-fortification of existing infrastructures and sea walls, to the construction of larger defense systems such as levees and intermediary flood zones, as well as design initiatives looking at re-purposing land for natural coastal defenses such as reef cultivation or wetland habitats. In addition to this publication, New York City has been undergoing efforts to conceive fantastic, large-scale urban projects that
Fig 01.2 (right) Diagrams from “A Stronger, More Resilient New York,” depicting various strategies for minimizing wave zones.

strive to create excellent designs that create new urban landscapes and programs around the greater New York City area, focusing on protecting the city through different ideas of resilient design.
Rebuild by Design, a competition led by the United States Department of Housing and Urban Development, in cooperation with the Presidential Hurricane Sandy Rebuilding Task Force, calls for proposals from multiple of the world’s leading designers to work with local organizations to re-envision and rebuild the coastal areas around the city.

...formed by local coalitions to develop fundable, implementable solutions that will inform new policies on every level. Rebuild by Design and its partners have demonstrated that by working together in this regional design process, we can achieve ambitious, realistic, more resilient standards of development and infrastructure that respond to communities’ needs within a new, changing world. [4]

$930 million dollars has been awarded to six finalists, which include proposals from teams working with Bjarke Ingles Group, Interboro, MIT CAU + ZUS + URBANISTEN, OMA, PennDesign/OLIN, and Scape Studio, each of which bring highly different and interesting approaches on how to combat the natural threats from storms and shifting environmental conditions.

While each of the six proposals have in different ways influenced and aiding in the research and production of this thesis, two in particular, BIG’s “BIG U” and Scape Studio’s “Project” share many similarities to the desired effects for this project and have been integral in its evolution as a design.
BIG’s proposal, titled The BIG U, consists of a 10 mile redesign around the horn of Lower Manhattan, focusing on refortifying the vulnerable edge where Manhattan meets the harbor. Along these edges, BIG proposes a redesign of berms and elevated park systems that protect against incoming storms and offer both social and environmental benefits. Many of the BIG U’s techniques for storm mitigation serve as double functions: each aspect serves as a mitigation device during times of need while, simultaneously functioning as public spaces and aesthetically pleasing additions to the city. For instance, berm designs take the form of sculptural pieces of art within the fabric of the city and perform as a blockade when water levels breach the city’s sea walls.

Fig 01.3 (left) BIG’s winning proposal “The BIG U.” A diagram showing different activities along the infrastructural path around Manhattan’s lower coast.

Fig 01.4 (right) Renders of the elevated park along the East River.

Fig 01.5 (right) Renders of deployable walls underneath the FDR drive.
Scape/Landscape Architecture approach, while similar in some aspects, is a uniquely different approach to this competition. Their proposal, entitled The Shallows, focuses on creating a textured landscape involving multiple different ecosystems which thicken the space between open waters and vulnerable land mass. Scape’s design heavily relies on oyster cultivation and restoration as a large method for wave attenuation and storm mitigation.

Historically, New York City’s Harbor was ripe with oyster reefs. They productively filtered the waters, added surge protection and were an accessible and abundant food source. After the introduction of industrialization however, the oyster population within the harbor had began to decline.

Burdened by over-harvesting, sewage pollution, and landfill — Manhattan added over 60 acres to its land area with landfill — the oysters of New York harbor were not on a sustainable track. In 1927, the last of the New York oyster beds was closed, primarily because of toxicity. [5]

A large portion of their proposal speaks about the cultural understanding of New York City’s past with oystering and pushes for a deeper understanding of the biology and knowledge which can be generated from their system of culture affecting ecology and vice versa.
Humans are undeniably selfish in our claim over the environment. That is evident in the amount of deforestation we have produced to make room for our cities and towns. We neglect the power of nature and we never expect the outcomes that it can produce. In preparation, we build walls higher and design floodgates and other techniques to try and stop weather forces totally. However, our techniques are largely fallible, in the sense that our designs have enormous potential to fail under extreme conditions or over a quantity of time, rendering us exposed and unprotected against natural disaster. The most effective mitigation techniques need to possess the ability to adapt to the different changing variables of weather and the environment; they need to self-maintain themselves for unexpected conditions, and need to be effective in their abilities to ease and diminish natural forces.

A resilient city is not one that is shielded from climate change all of the time—because, sadly, when it comes to nature’s powerful forces, that is simply not possible. But a resilient city is one that is: first, protected by effective defenses and adapted to mitigate most climate impacts; and second, able to bounce back more quickly when those defenses are breached from time to time. [6]

Earth’s natural defenses have been protecting the planet for millions of years, so it only makes sense to rethink our methods of construction and revisit natural ecosystems as methods for human and city protection. One ecosystem in—particular, has the ability to adapt to changing environmental conditions, to protect coastlines from natural
forces, and has a number of environmental and societal benefits. This ecosystem exists on every continent of the planet, excluding Antarctica, and has been a focus for many contemporary landscape architects all around the world, designing specifically for the interaction between human living and natural ecosystems.

He [Kongjian Yu] addresses the greatest need of our time: transforming human interaction with the Earth from something suicidally indifferent to natural forces into something that responds to those forces with respect and cooperation. Deliberately or through simple disregard, we have tried to impose human needs and wishes on nature, and she is having her revenge in storms, floods, drought, and sterility. At the very moment when we have achieved dominance over all species save the microbial, when we have conquered the planet’s distances and obstacles with our communication and transportation technologies, when more than half of us live in cities that minimize our experience of land, animals, weather and geography – at this very moment we have learned that we must turn back, forgo, yield, and cooperate. We have the opportunity to shift civilization away from two centuries of ignorant self-destruction in the hope that our children’s children will see some restoration of dynamic equilibrium. Both concretely and metaphorically, we must sustain civilization by stewarding what we receive – living things, water, the energies of the sun and wind – not just by
Focusing on resiliency through natural and environmental systems, this thesis explores a response to Rebuild by Design's competition, searching for an answer to the environmental and urban issues in regards to the resilient reconstruction and preparation for future hurricanes and storms, by researching and implementing wetlands as a contemporary park for New York City.
Wetlands are saturated areas of land that play an integral part in the protection of coastal landmasses from the destructive forces of hurricanes and extreme tidal activity. At its simplest form, a wetland acts as a barrier between water and land; as tidal surges move across the environment, friction is created by debris and vegetation within the field and slowing down the moving water and mitigating the impact the surge creates along the coast. Wetlands, however, are far from simple ecosystems; they can provide both the earth, as well as human societies with a number of natural benefits and services, ranging from unique animal habitation to food and material protection, and much more:

Wetlands are sometimes described as “the kidneys of the landscape” because they function as the downstream receivers of water and waste from both natural and human sources. They stabilize water supplies, thus ameliorating both floods and drought. They have been found to cleanse polluted waters, protect shorelines, and recharge groundwater aquifers.

Wetlands also have been called “ecological supermarkets” because of the extensive food chain and rich biodiversity that they support. They play major roles in the landscape by providing unique habitats for a wide variety of flora and fauna. Now that we have become concerned about the health of our entire planet, wetlands are being described by some as important carbon sinks and climate stabilizers on a global scale. [8]
These benefits exist at multiple scales within the global environment too:

Wetlands provide many services and commodities to humanity. At the population level, wetland-dependent fish, shellfish, fur animals, waterfowl, and timber provide important and valuable harvests and millions of days of recreational fishing and hunting. At the ecosystem level, wetlands moderate the effects of floods, improve water quality, protect coastlines from storms, hurricanes, and tsunamis, and have aesthetic and heritage value. At the global level, they contribute to the stability of global levels of available nitrogen, atmospheric sulfur, carbon dioxide, and methane. [9]

If designed appropriately, a wetland in a metropolitan environment can not only be used as an important asset in disaster mitigation, but it can function as a cultural institution with educational resources, amid a new and aesthetically pleasing location within the urban fabric. Wetlands have been shown to be viable and realistic solutions within the surrounding city areas, as seen from existing, well researched and documented designs and proposals. The challenge with this thesis will be how to incorporate a wetland ecosystem into an existing infrastructural monster [New York City], within a relatively narrow site.

Biodiversity in urban areas provides many benefits. First, natural habitats serve the social need for a more aesthetic and healthy environment. Second, living
plant communities modify the physical world in constructive ways: they clean and moderate the microclimate, promote groundwater infiltration, retard flooding and soil erosion, and provide habitat for wildlife. [10]

By focusing on and highlighting the unique characteristics and values that wetlands can offer, a wetland public park, open to a diversity of human interaction, can become a highly unique and enjoyable experience.

Fig 03.2 (right) An image of human interaction with a wetland.
Before the Deluge is an East Village public wetland. In essence, it is a large scale passive mitigation technique that uses a natural landscape to create a relatively flood-proof park within the city. Combining this landscape with public parkland, however, can transform the park into something much more than just a mitigation technique. This park has the ability to provide East Village and the entire metropolitan area of New York with a number of new and intriguing amenities, with an abundance of educational opportunities. If successful, this park has the potential to be a model of flood mitigation that can be utilized along different coastal areas around New York City, as well as in other cities in and out of this country.

This park can be separated into three distinct regions, each with their own unique programmatic amenities and roles in providing coastal protection. The highest level is the carr woodland, comprised of a reconstructed flood wall that symbolically acts as the wooded riparian zone found within natural salt marshes. The carr, in nature, as in this design, is the transitional divide between wet and dry land, rising from the waters, providing habitation for a diversity of life and dissipating water energy upon collision. This area provides preventative protection, stopping storm surges as tall as twenty feet high from penetrating past the park into the neighborhood. Within this section is located most of the community amenities, including tennis and basketball courts, soccer pitches, and areas for lounging, as well as functioning as the main path/bikeway throughout the upper park section.
From the flood walls towards the river, the topography shifts into a steep slope that connects the higher level with the lower wetland areas. Constructed wetland pools, connected by a network of paths at an elevation just above the average level of high tide, provide the city with passive water filtration facilitated by the aquatic plant life. As the river flows northwards, the water passes through a series of different pools, including an oyster reef located at the water intake. Each of these sections effectively filters the water through a combination of different plant life and natural sediments found within the pools. At the end of the progression, the toxic water becomes clean and safe for public interaction, and the water that ran through the constructed wetlands culminates in a large public swimming area for the community. Public access is granted along each of the different pools and provides exhibited information regarding the filtering process and the different plant life. During storms, this entire area can be flooded completely and can be used as additional space to collect water run-off.

The final, lowest section of the park is the unaffected natural wetlands which provide a field of debris that cause friction and wave attenuation during tidal storms. This area allows the park to be adaptable to changing climate patterns as the wetland will be able to shift and grow relative to the depths of the river. Within this field, natural plant and animal life will breed, providing a biodiversity to the park which can be used for exploratory and educational purposes by the general public as well as a number of schools within the surrounding communities.
1. Museum
2. Oyster Bar
3. Boat House
In addition to the park elements, a new mixed-use building will be designed as a welcoming point at the park’s entrance. This structure, like the park itself, will connect the pedestrian public vertically from the upper amenities down to the water’s edge, with a variety of programs including: a museum dedicated to Hurricane Sandy, the strategies of Rebuild by Design, and wetland ecology; an oyster bar with views looking out to the natural wetland and oyster reefs; and a boat house which services a new ferry terminal and kayak rental.

This design provides not only the protection that the city needs but also a strong community and cultural asset. Educational opportunities are abundant through different ecological studies, with activities related to marine biology, ornithology, and wetland conservation. The public fields provide safe grounds for the residents of Alphabet City and make an attractive destination for enthusiasts and tourists.

Fig 04.3  (left) Floor plans for the entrance building.
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