EDGES

Natasha Ruiz
Architecture Department
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Professor Erik Carver

EDGES

RISD Architecture

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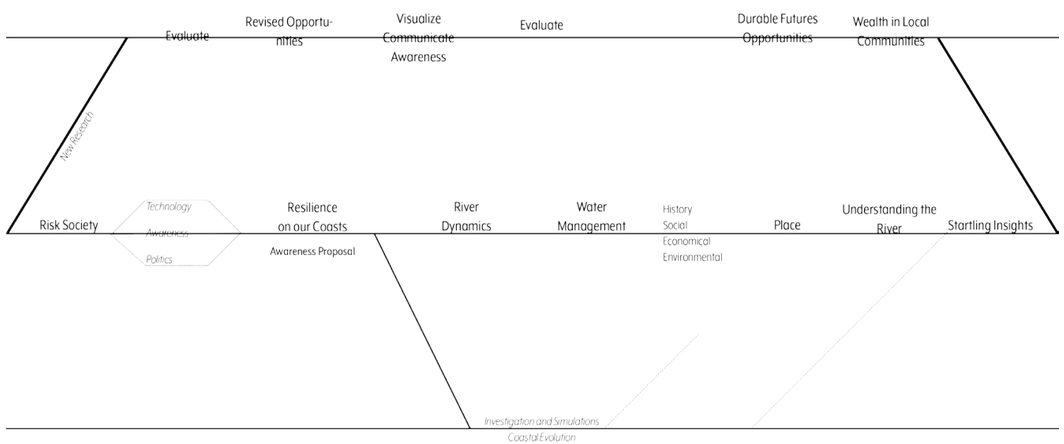
Rhode Island School of Design
Providence, RI

Erik Carver
Critic

Aaron Forrest
Secondary Critic

Jonathan Knowles
Thesis Coordinator

Front Page: Rendering of part of the Hudson River



Double-Edged Nature of **Flood Management**

The subject of water has always been very topical mainly because it is in high demand and short supply. In the upcoming years, our dwindling water supplies will become more precious and those in control of important headstreams will be fought relentlessly over them as they can restrict the flow downstream.

Coastal cities are at the edge of climate change in a few ways, especially for some cities on the US East Coast. This is evident in the sense that people living in coastal cities are putting their lives at greater risk, forcing them to take action and adapt. Some of these cities are also too valuable and we cannot afford not to protect it due to its large population and deeply embedded roots in our history and culture. But as the more grave and pressing matter of climate change prevails, our cities will need to adapt their policies and resilient strategies, which are mainly the responsibility of U.S. Army Corps of Engineers and local governments, and begin to see their rivers as a living corridor.

Even though our strategies are carefully designed for general flood management, we have not fully explored how they could create dynamic neighborhoods that are held together through a blue network. Our cities' water edges need to be designed for the uncertainty and the possibility for a new and meaningful relationship between the built world and the water. But how can we design for an ambiguous, volatile edge while simultaneously confronting an ever-changing set of circumstances, variables and environmental conditions? And how can we use our current strategies differently to create a meaningful relationship with different kinds of urban fabric?

Resilience and adaptation do not always follow the same path, rather is a process. Through a series of processes and investigations, flood zones can become productive grounds with morphological, environmental, economical, social, and potamological prosperity. Using the Hudson River's southernmost tributary as a case study, this research will open up opportunities for flood intervention for both social and environmental formations and propose what a potential future city designed by water could hold. The proposal of this arrangement will begin the shift in power to local communities and implement a new way to communicate the matter to the public by adapting through different mediums at different levels that are at play in order to achieve a future desired sustainable state and moderate inequities within the city.

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OMA Rebuild with Design

Drawing of 500 year flood
Saw Mill River, NY

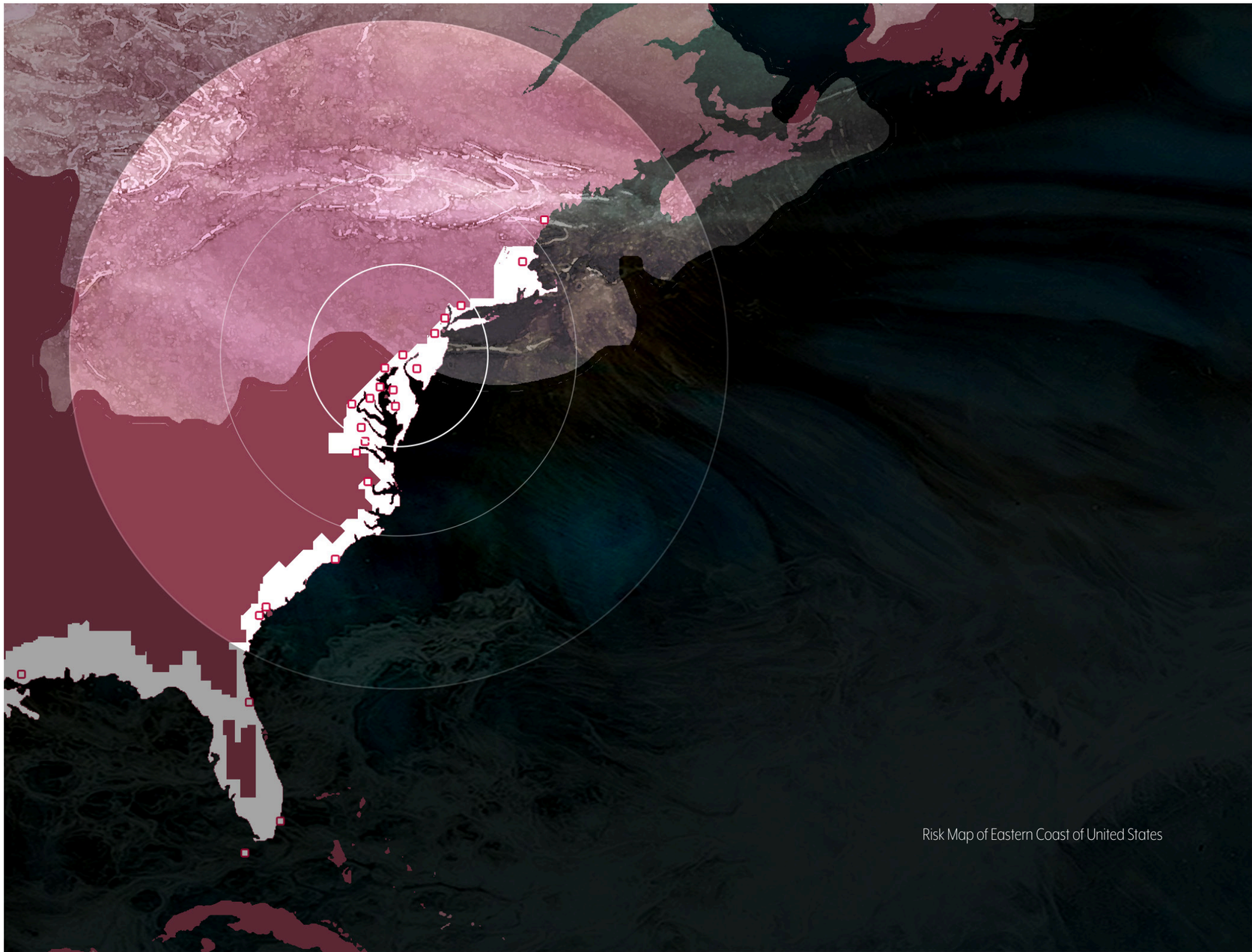
Shifting Baselines

Discover Risk Society

In a modern society there is hierarchy, there is wealth, there is technology, and with time, there can be change. Technological change produces new forms of risk which constantly requires resilience and reflexivity from society in order to coexist with the global, not merely personal, consequences that concern human health and the environment and cross both man-made and natural boundaries.

Although we are all experiencing changes, we experience them unequally. The unequal distribution is also heightened in the changing definitions of reality. The most immediate aggression of the nonhuman agencies today is water and its aggression is attracted to specific places where its reality is changing at a much faster pace. Tidal cities will gradually become more vulnerable to coastal flooding and from monthly to daily high tides. At the same time, they will be more vulnerable to erosion, intense storms, and dwindling natural resources. These waterfronts are incredibly diverse and will face specific types and levels of risk.

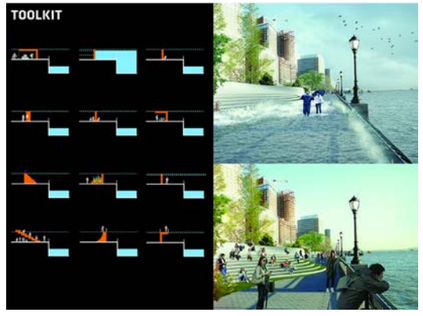
This map shows the areas submerged due to sea level rise (1-6m) as well as the flooding hotspots. By 2100, scientist predict a rise of 1m, but due to many factors, land subsidence being a big indicator, the northeast coast of the United States will experience sea level rise effects sooner than other coastal cities. Tidal flooding would be more frequent as it is predicted to average around 200 tidal floods per year.



Risk Map of Eastern Coast of United States

Above: BIG's NYC Dryline Render
Below: BIG's Resilient Toolkit

Our Technology

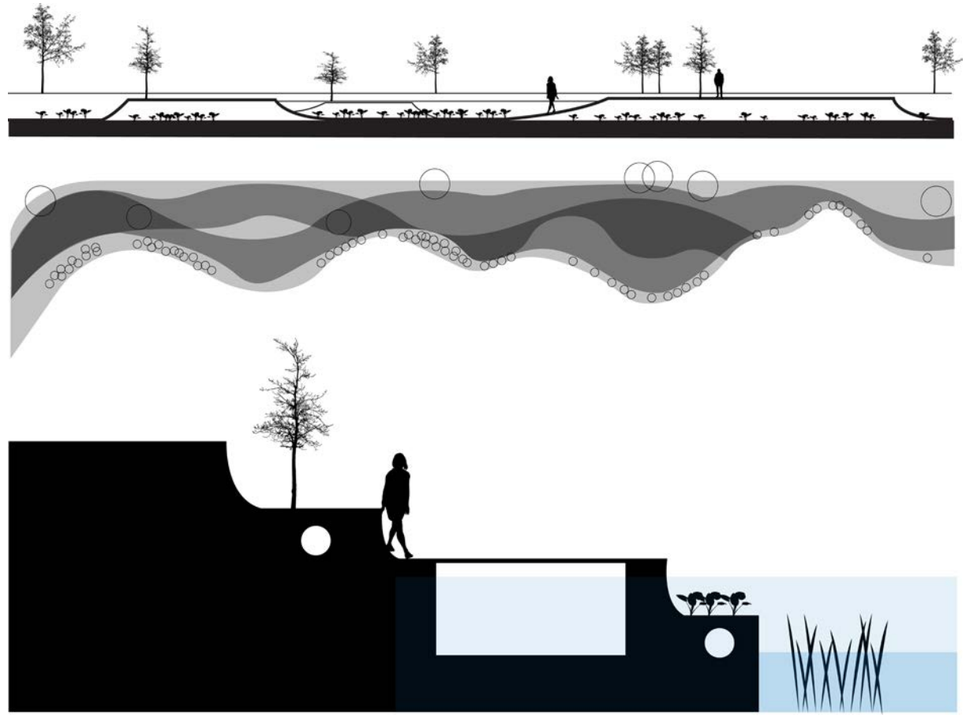


We have denied, defended, neglected, proven, and grown apathetic towards climate change. But dense cities such as New York City, Boston, Providence, Portland, and Washington D.C. are all experiencing a faster change of reality than other coastal cities in North America. New York City dauntingly encompasses a large, existing population located in flood zones, allowing limited space for resiliency and has altered its shoreline and ecosystem throughout its history. Tidal Hudson River contributes even more risk to the population surrounding the bay. Hurricane Sandy brought these risks to attention and since then a variety of actors and stakeholders have been trying to address sea level rise and coastal hazards using resilient strategies at various scales. But they are basing their rigid strategies to temporarily prevent change rather than attempting to recover and shift their reality to coexist with these risks. If we were to change directions of our set techniques and technologies towards a more socially accepted implication that integrates the built and natural environments, we could achieve justice — climate and economical.

As climate change worsens, our current technology will only be able to mitigate risk temporarily. This is because technology simply cannot keep up with our realities' rate of change. Politicians, economists, engineers, scientists, and others are spending time and money to come up with new technological innovations that could stop things from changing, adding to our current, unbalanced resilience strategies.

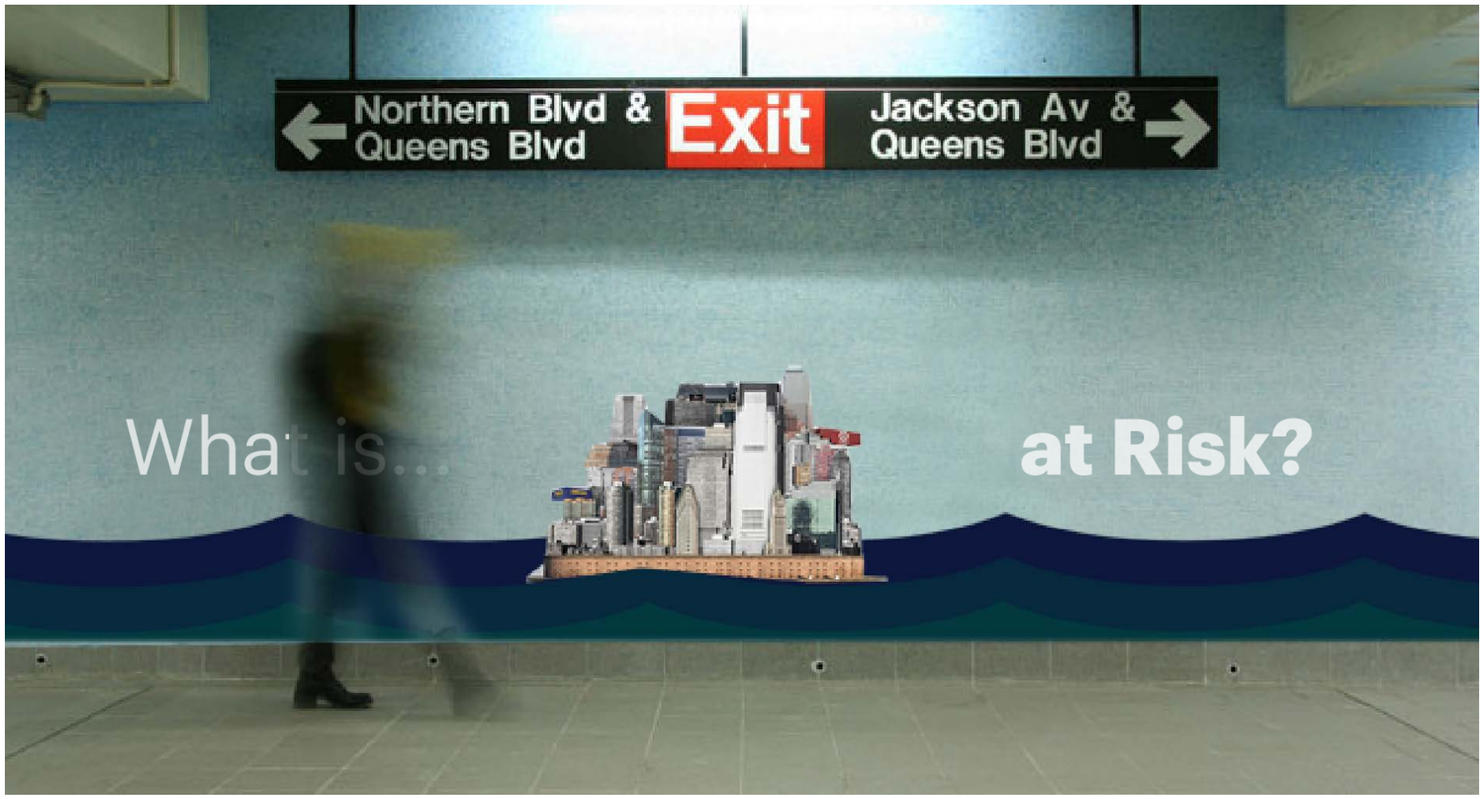
The Dryline, also known as the *BIG U*, is advertised to be able to address New York City's vulnerability to coastal flooding by simply placing a "protective ribbon" in Southern Manhattan. The 12km- long barrier is designed to incorporate public spaces with the high-water barrier. This infrastructure barrier, or seawall, is just a temporary strategy to keep the water out. It only takes into consideration the current 50 year predicted sea level. Although they advertise it as being an innovative green addition to the city, it also doesn't take into account the other factors or impacts the NYC will face. One of them is the increased risk on the surrounding coasts such as in Brooklyn or New Jersey, which will now have to accommodate for the water that's being blocked by the wall. Another, is the potential catastrophic threat the Hudson River portrays on New York City. In an event of a perfect storm, the delusion of flood prevention strategies will become a bigger threat to the city as current structures could breach and flood the city from the river, sea, and by intense rainfall.

The image below is a proposal of a new seawall that doubles as a park, seating, and ramps for people to still experience and get close to the water. Each level is ornamented with plants that will be able to tolerate the amount of saline water exposure in times of flooding or sea level rise. This design was supposed to recover a critical sense of ecology as a specific toolkit. Just as BIG's sea barrier toolkit. The design still proposes a temporary resistance to our predicted futures and doesn't describe the change we need to make because it's the way we use our technology and the way we behave that needs to change parallel with the city.



Interpretation of new Seawall

Spread of Awareness



Use Art | Possible Advertisement for Flood Awareness

Throughout the years, wealth has consistently been able to mitigate risk more easily. Risk strengthens social hierarchies and those deprived from economical, authoritative, or educational wealth attract the unfortunate abundance of risks. The challenge will be recognizing that we cannot manage whole ecosystems; rather, we have to understand the living systems and their history and do the best to protect them. This requires us to shift our baselines– a shift of understanding of the "normal" we have been exposed to from an early age and begin to understand our mistake to sustain things that are already gone.

If we don't understand and trust the past, we will continue to reset the baseline, while if we have more access to knowledge, we can find a more permanent solution and actually sustain our ecosystems. But there is a misconception towards using resiliency in an urban context. Resiliency has only been proved in low-density communities, so when trying to design resilient strategies in a city, such as in New York, we must use strategies and policies that the geography offers by presenting different opportunities and constraints.

Awareness is the key to be able to mitigate risk. With awareness, we can understand realities, react to them, and learn how to coexist with them. Our present day sciences are only empirical, and as we probe deeper into nature, we start to abandon our language based on our direct sensory experiences. But when nature cannot assist man's search for answers, science is capable of expanding and enhancing our sensitivity and allowing us to understand nature and our impact. With all of this in mind, we are participants in the environmental crisis and how we react will define our reality.

I chose to explore the few ways people try to send information out to the public. One of the ways, was through art and forms of advertisement.

The question is, how do we spread awareness and when?

Use Art | Possible Advertisement for Flood Awareness

Use Art | Possible Advertisement for Flood Awareness

I was inspired by current advertisements I kept seeing in different media. I came across OMA's version of Flood Awareness as well as Squad's whose campaign was launched by the Environmental Agency. Overall, the feeling I would perceive by looking at the ads ranged from satire to urgency. The few ads I created played with the effects of humor and seriousness of the subject matter. It obtains subtle uncomfortable statements that criticizes our behaviors and our belief that we are removed from such events. I tried to think of what the "blue line" cliche that was being used in current flood ads and challenged myself to see other ways to develop it. I spent 3 months experimenting how we could use other mediums to express and make people aware thru art. The image to the right, was my intention to bring up a conversation about the heavy metals located in our rivers today and the process the water must undergo in order to end up in a semi-recyclable carton.

At first I began thinking where these ads would be located. Did they exist on billboards people would notice as they waited in traffic? Did they exist as pamphlets people would step on the subway station? Or perhaps does it live on a screen in Times Square only to be suppressed to an ad sponsored by one of the biggest fashion corporations? No. There must be another way but people still overwhelmingly prefer local media as a source of information about flood risk in general.

What is even scarier is that only 10% of Americans believe their homes are at risk of flooding and only 30-40% know their community is at risk of flooding. People are not prepared to face their risks mainly because they do not know they are at risk. Despite the relatively low levels of perceived flood risk, there has been a rise on using at least one form of hazard risk mitigation strategy in order to reduce their risk, safety for themselves and their families.

During a severe flood event, people still do not know enough about flood emergency plans or about flooding to reduce risks.

48% of Americans chose to "protect existing systems"
23% of Americans bought flood insurance
26% of Americans use wet flood proofing in their basements

But every American should be prepared because
everyone lives in a flood zone.

Floating, **Market Square, 2017**

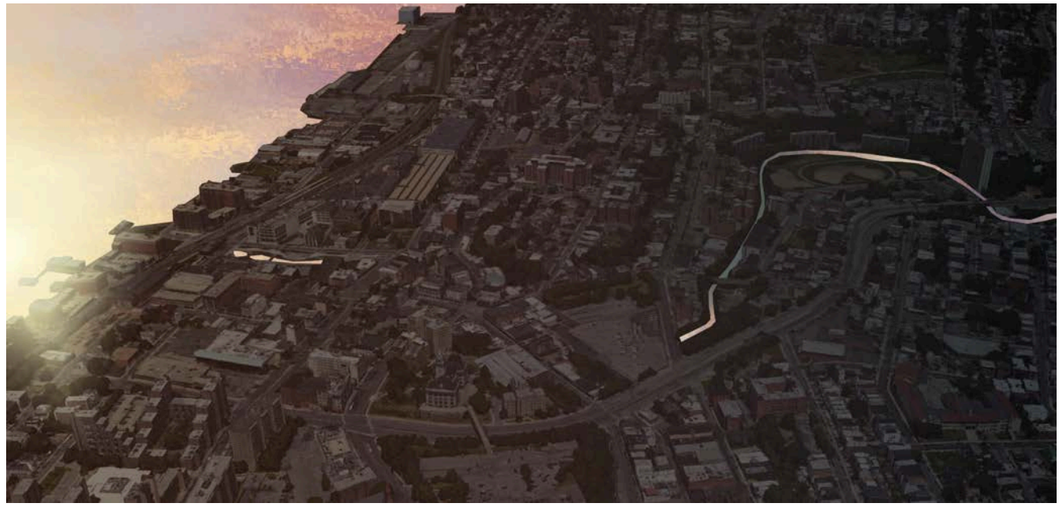
Market Square has been a focal point of gossip, news and meetings since the 17th century. It has a long history and is deeply embedded in the American culture. The square has experienced high hurricane water levels during the Great Storm of 1815 and the Hurricane of 1938 – flood waters reaching up to 13ft. and 8 in. above the mean high water level. As the more pressing matter of climate change urges cities to adapt, some of our historical buildings and sites will become more vulnerable to flooding and someday be located below sea level. The Market Square is currently on a floodplain of both 100 and 500-year flood, bringing to attention the implications that would bring a higher water level.

Today, most people lack the urgency of this existential danger when it comes to water. We live in an irrational state of risk denial and are unaware that we all live in floodplains. To begin to fathom what the future could hold for Providence, this small intervention disguises the cliché of the "blue water line" used in many flood awareness ads, creating a new dynamic line people can inhabit. The intention of introducing a foreign plant to the site was to create a dialog between the water's potential level and potential 100 year flood level in the year 2100 with our ground. The lily pads appear to be floating but could potentially be floating on water at the end of the century.

Use Art | *Floating*, 2017

Use Art | *Floating*, 2017

Water Policies in the United States



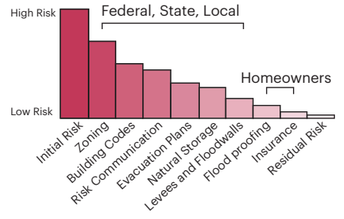
Hudson River's Southernmost Tributary Render

Climate resilience does not have one "silver bullet" solution to manage risk and the strategies used today have to be rethought and designed for uncertainty. In this way, technology has separated society from referring to nature and has prevented our society from advancing. In order to progress and accomplish a true sustainable design, we must challenge policies of management and development, envision a future designed for uncertainty, and shift our ecological baselines.

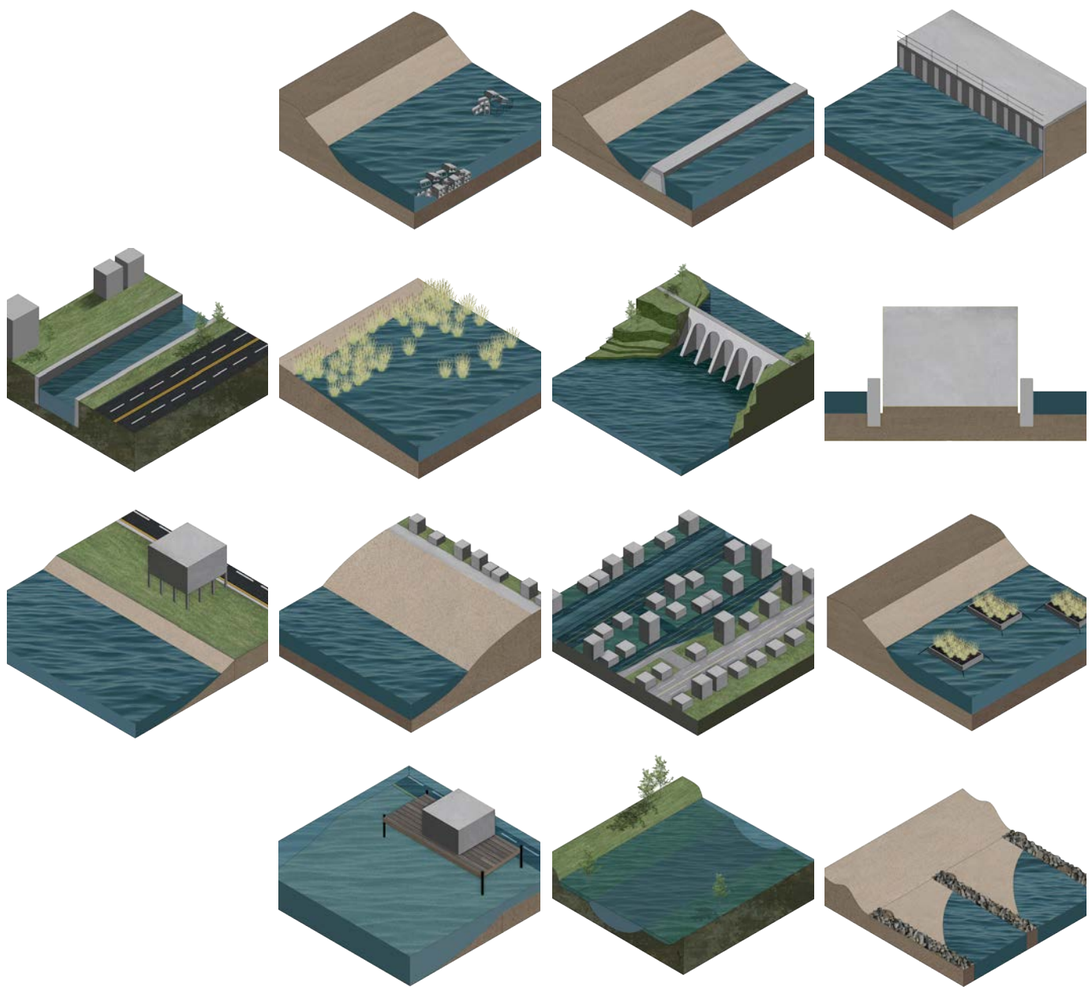
States that have specific laws or regulations that require policymakers or planners to consider sea level rise when creating policy for land use planning or development:
Massachusetts, Rhode Island, Connecticut, New Hampshire.

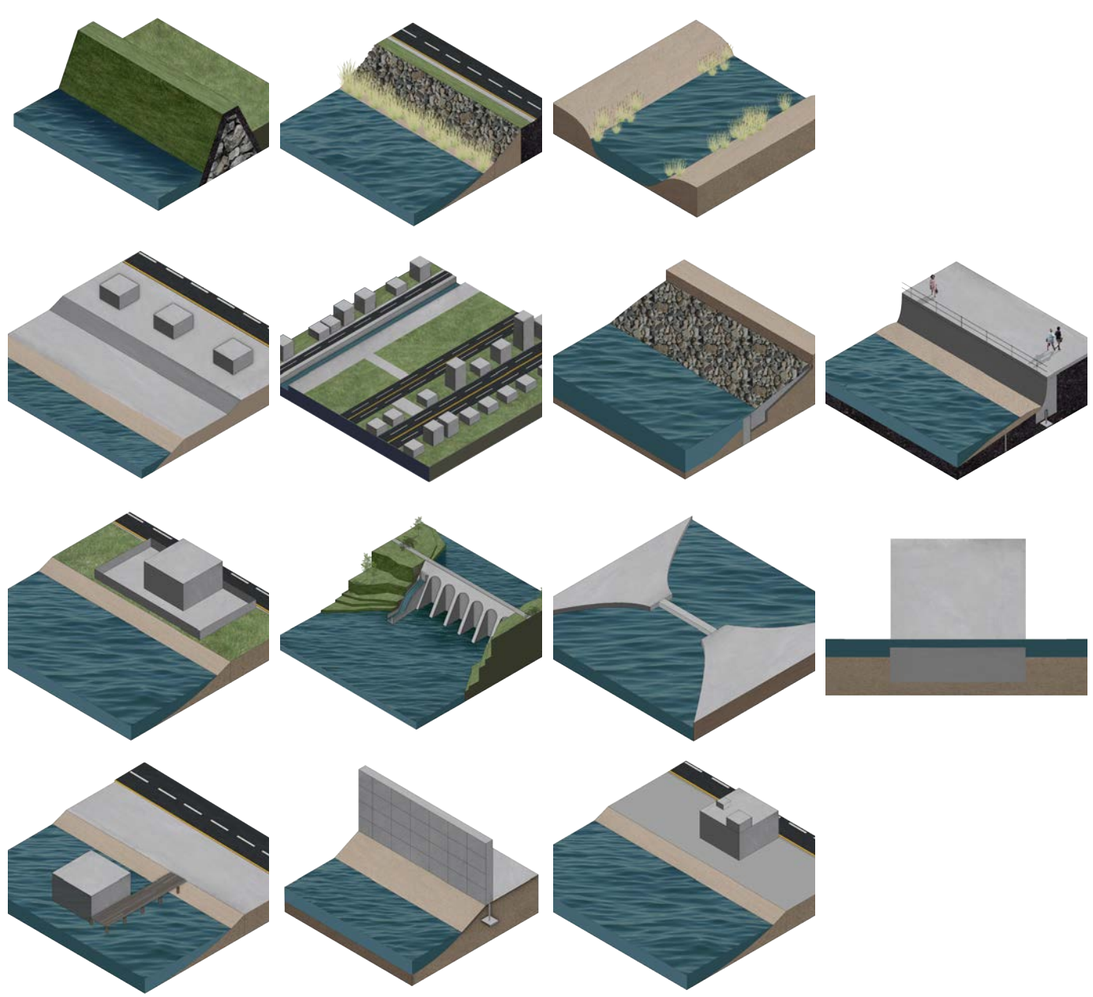
States that have a designated office or unit responsible for coordinating sea level rise adaptation planning across state agencies :
Maryland, Massachusetts, New Jersey, **New York**, Rhode Island, Connecticut.

Actions and Responsibilities



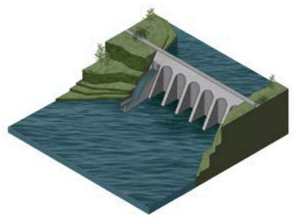
Resilience on our Coasts





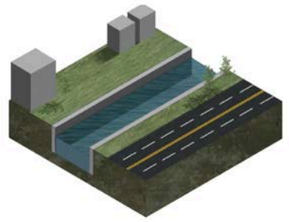
28 Renders of all Resilient Strategies Studied

Spillways
A passage for surplus water from a dam or structure.



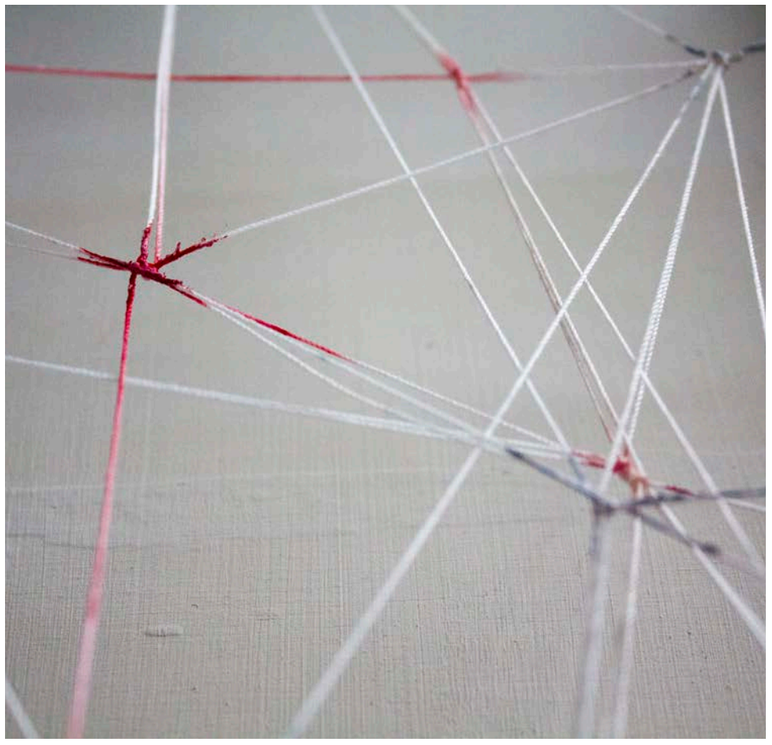
What to do: Structure owner is required to regularly inspect spillways and water impoundment level to reduce chance for failure. Local government provides fund if a consenquence arises and informs the areas near the confluence between the spillway and whichever river it flows into as the discharge.

Channelization
The alteration of a river's course.



What to do: Dredge regularly to maintain sediment accumulation low to reduce local and downstream flooding. If there is enough land, re-engineer the river to become more of a meanering river to allow deposition of sediment and slow down the rate of flow downstream.

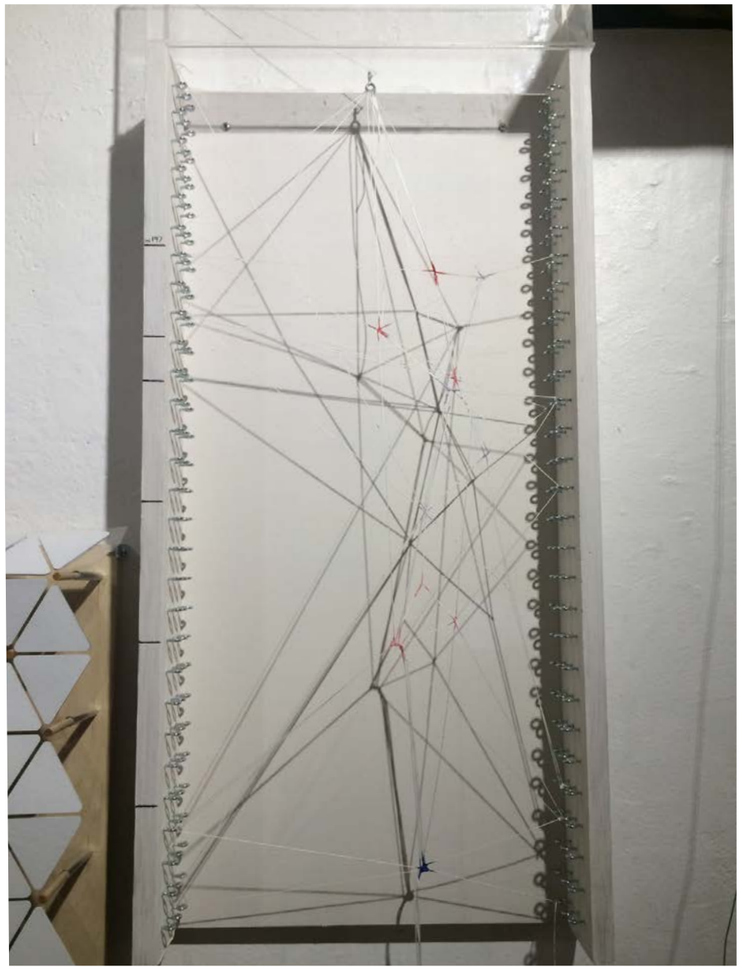
Transform Socially



Above: Example of spread in *"Transform Socially"* book

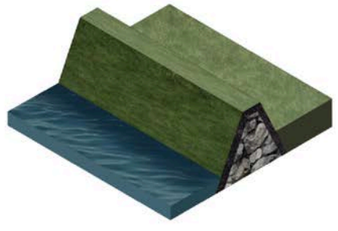
Right: Closeup of Water Sculpture, 2016
string, water, watercolor paint

Opposite: Water Sculpture, 2016
string, water, watercolor paint



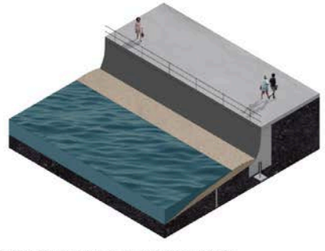
The set allowed for me the chance to create different scenarios and to study each strategy being used today. The scenarios were four extremes of climate change activist cities. Each book had an executive summary of the general worldview on climate change and the different risks they had to face. In each of them I criticized the resilient strategies based on their impacts on the environment and/or city, structural integrity, and ownership. The idea was that each major city along a river or coast would be labeled as one of the four and would follow the directions as stated under each strategy. I color-coded each city from New York City to Troy in the Water Sculpture according to the strategies and positions they held toward climate change. Even though they were colored, the water dripping along the string would wash the color away as a representation of strategies being washed away by the river. No strategy or set of policies are appropriate for the river and therefore the sculpture would bring that issue to light. The usage of string also represents how the river is intertwined with other forces acting on it – is not just one path but many. A river system is complex and should not be represented as a line, which is the case in most maps.

Levees
An embankment built to prevent the overflow of a river.



What to do: Keep levees in current condition.

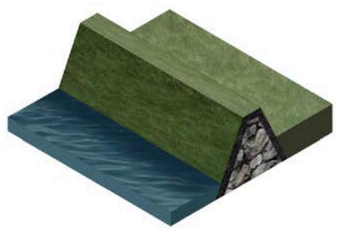
Seawall
Massive stone, rock or concrete structures built parallel to the shoreline that are designed to resist the forces of heavy storm waves and prevent coastal flooding of upland areas.



What to do: Keep seawalls in current condition.

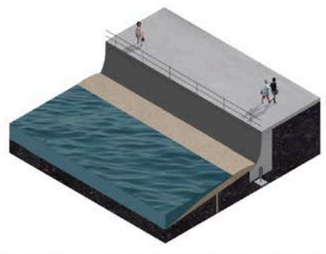
Do Nothing

Levees
an embankment built to prevent the overflow of a river.



What to do: Maintain or construct levees in applicable locations.

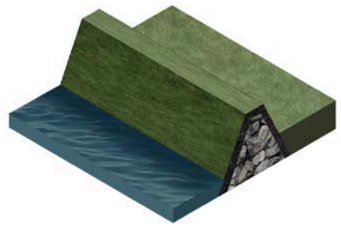
Seawall
Massive stone, rock or concrete structures built parallel to the shoreline that are designed to resist the forces of heavy storm waves and prevent coastal flooding of upland areas.



What to do: Maintain or construct seawalls in areas to protect upland areas.

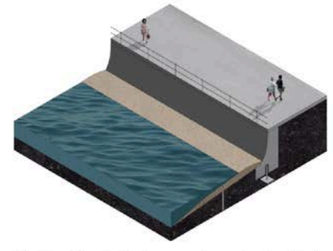
Adapt to Risk

Levees
An embankment built to prevent the overflow of a river.



What to do: Increase concrete floodwalls on top of levees as sea level increases. Regularly check the structural integrity of levees and inform locals located behind if any concerns arise. Design levees to provide protection from 100-year flood for NFIP purposes.

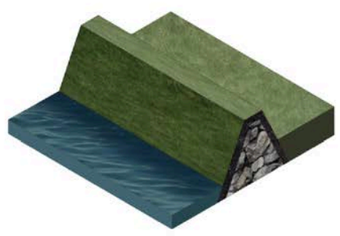
Seawall
Massive stone, rock or concrete structures built parallel to the shoreline that are designed to resist the forces of heavy storm waves and prevent coastal flooding of upland areas.



What to do: Construct seawalls in areas to protect upland areas. Seawalls are typically constructed by the U.S. Army Corps of Engineers as part of a larger flood control project, with a mix of federal, state, and local funding. In order for the Army Corps to build such a project, the U.S. Congress must authorize the funding of a feasibility study that examines the costs of benefits and alternatives. If the study finds there is sufficient reason to move forward, Congress then must authorize funding the eventual

Develop Efficiently

Levees
An embankment built to prevent the overflow of a river.



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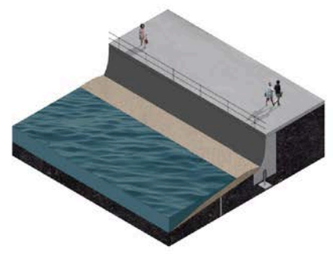

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Transform Socially

Example of the same strategies in the four books

"A Coastal City's Complete Guide to Climate Change" Book Set

"A Coastal City's Complete Guide to Climate Change" Book Set

Opposite: Coded drawing of "healthy" water

PART TWO

So Alive it was Dying

life

/līf/
noun

1. the condition that distinguishes animals and plants form inorganic matter, including the capacity for growth, reproduction, functional activity, and continual change preceding death.

water

/wäder/
noun

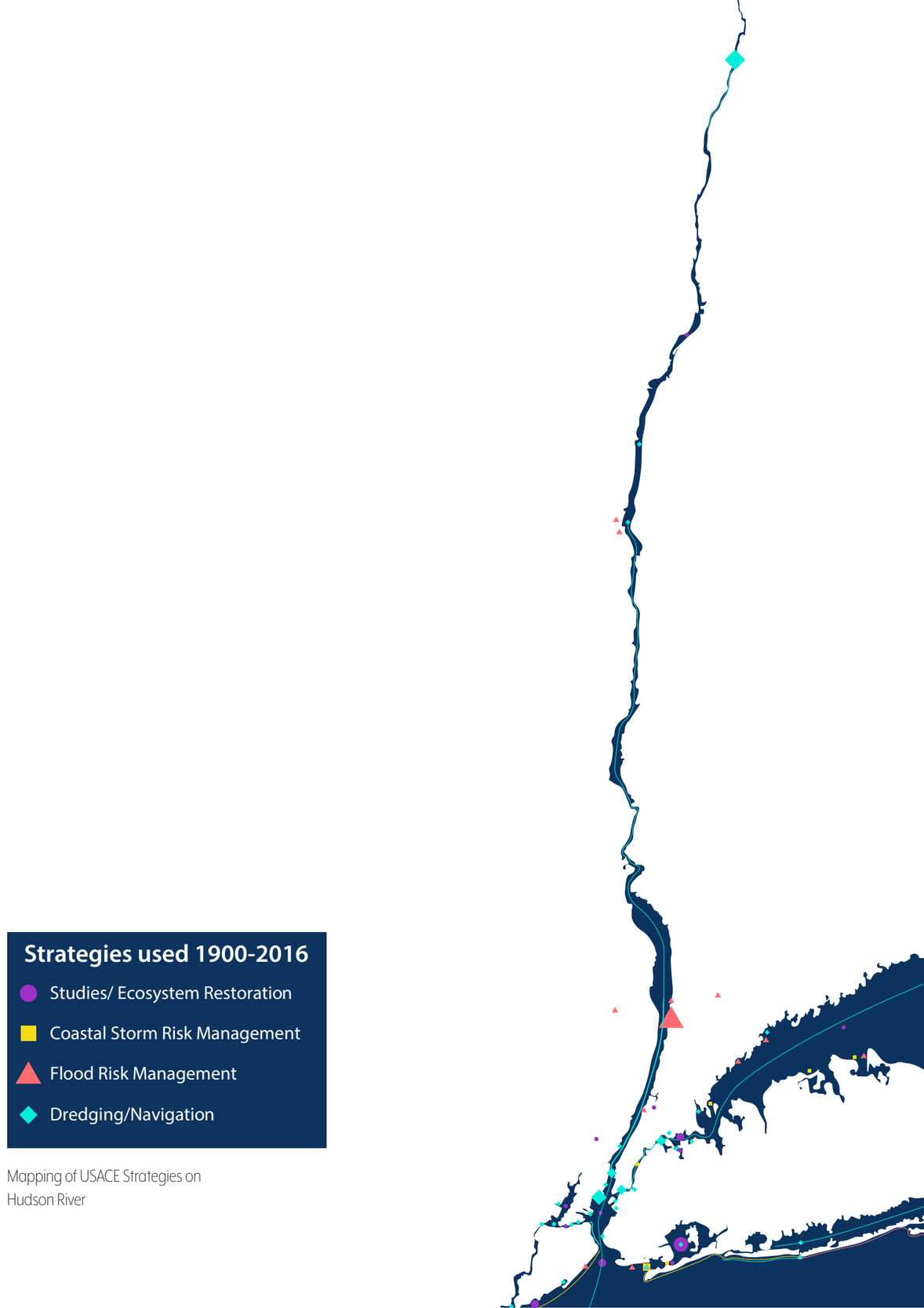
1. a colorless, transparent, odorless, tasteless liquid that forms the seas, lakes, rivers, and rain and is the basis of the fluids of living organisms.

GeoDesign

"It is clear that for serious societal and environmental issues, designing for change cannot be a solitary activity. Rather, it is inevitably a collaborative endeavor, with participants from various design professions and geographic sciences, linked by technology from several locations for rapid communication and feedback, and reliant on transparent communication with people of the place who are also direct participants."
Carl Steinitz, author of *A Framework for GeoDesign: Changing Geography by Design*

GeoDesign is not a profession. It is a process of design creation, simulation, and evaluation in which many people from four main backgrounds collaborate. This is the opposite from what we are taught since day one. We are determined to understand the details within the boundaries of our profession but never question how else it could be different.

On a river, the same strategies are being used on another river across the country. And that may be sufficient for such flood mechanism depending on the scale you record the impacts. But as Galileo Galilei once said, "Many devices which succeed on a small scale do not work on a large scale". Many resilient strategies used on our coasts have not been tested in densely populated areas, some haven't been evaluated at all. We must design and evaluate our design based on a much larger picture than solely on site and design with people outside our field.



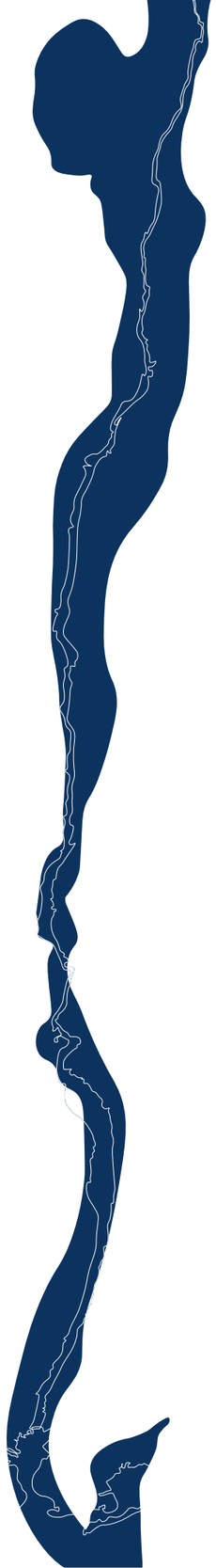
Mapping of USACE Strategies on Hudson River

Place

"At least a decade before Hurricane Katrina, ecologists and hydrologists were warning that the U.S. Army Corps of Engineers' approach to flood control was effectively pushing the lower Mississippi basin toward a catastrophic threshold for change and potential collapse. Through a long-term policy of flood suppression, diking and damming, along with the removal of coastal wetlands and intensive settlement of the floodplains, the natural flood-adaptation mechanisms of the basin were impaired." The catastrophic event that followed only proves how we should be basing our strategies on it's regional effect rather than its immediate effect.

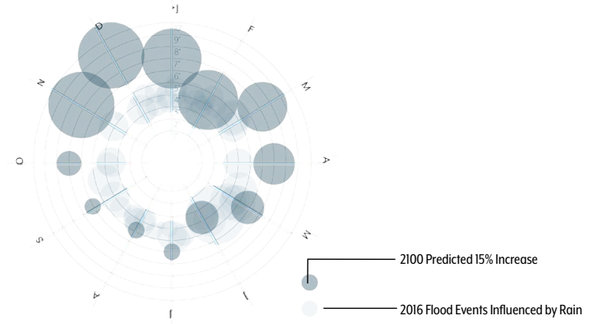
Why the Saw Mill River?

The site for the case study was decided upon various reasons. First, the Saw Mill River is historically known to be prone to flooding and is predicted to receive more rainfall in the years to come than its surrounding lands. Additionally, it is a heavily occupied land with nearly no space for a lot of intervention. And lastly, U.S. Army Corps of Engineers time and time again have relentlessly returned to this river regarding flood management.

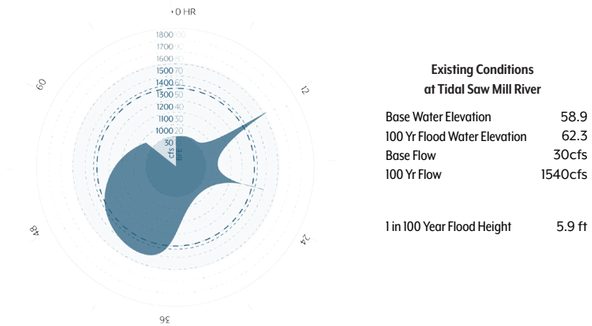


Mapping Hudson River 13,400 years ago

Rainfall Increase



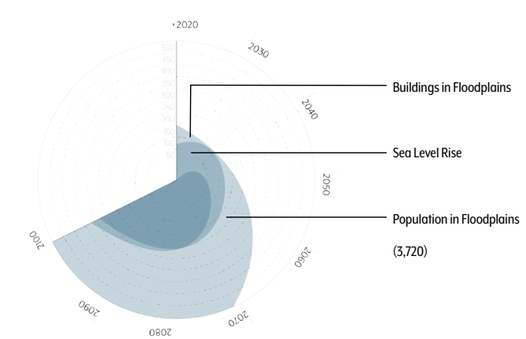
1% Flood Hydrograph



Existing Conditions at Tidal Saw Mill River

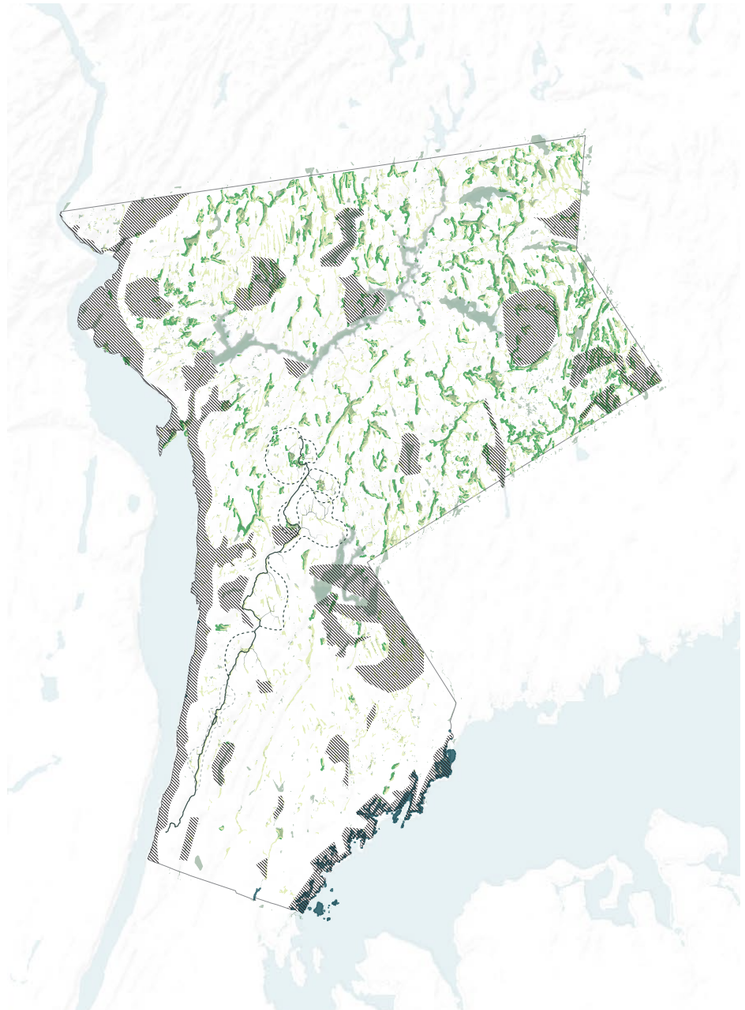
Base Water Elevation	58.9
100 Yr Flood Water Elevation	62.3
Base Flow	30cfs
100 Yr Flow	1540cfs
1 in 100 Year Flood Height	5.9 ft

Risk Increase



Understanding our Rivers

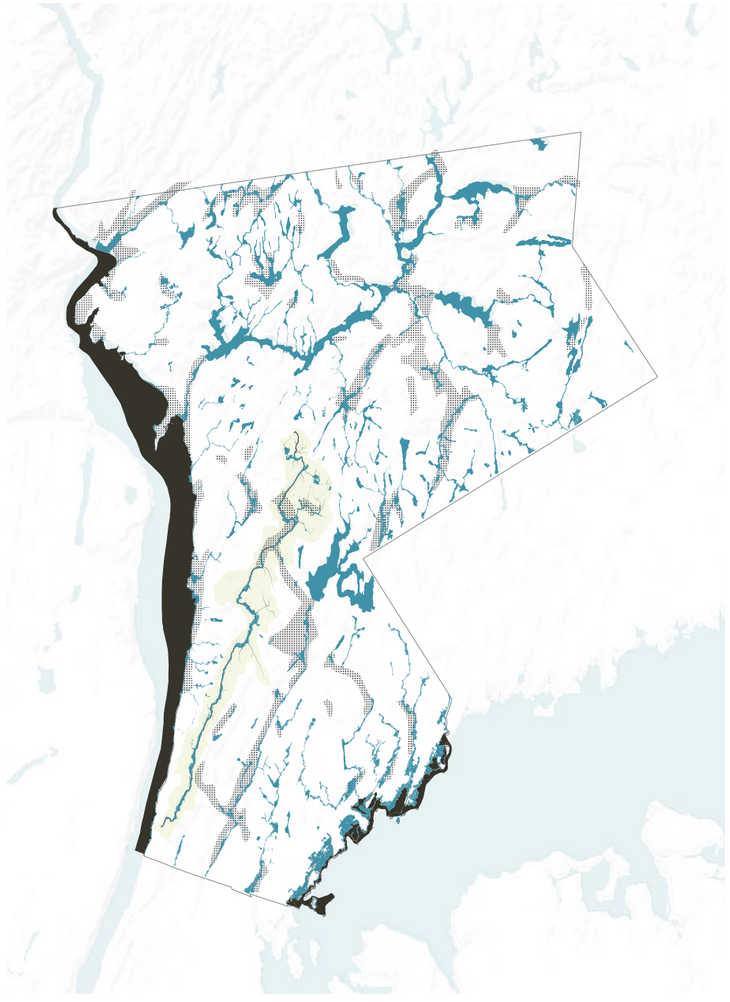
Westchester County 1:250,000



Wetlands

Map Legend

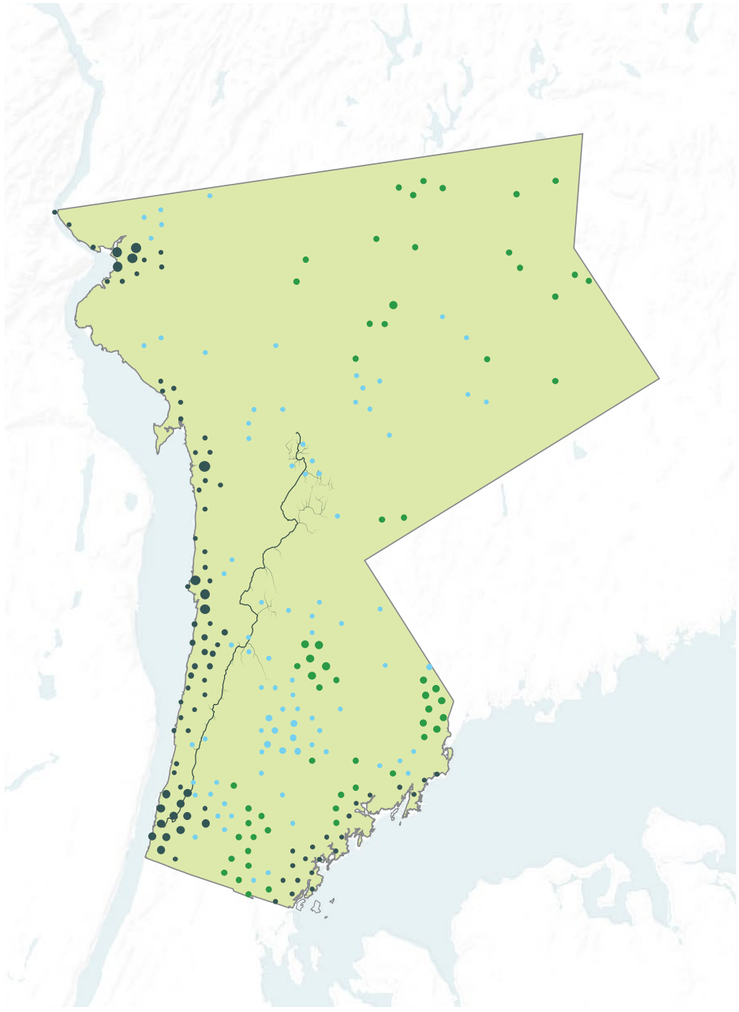
- Tidal Wetlands
- Hydric Soil Wetlands
- Wetland Potential Regeneration
- Lakes
- NYS Regulated Welands
- County Critical Environmental Areas



Morphology

Map Legend

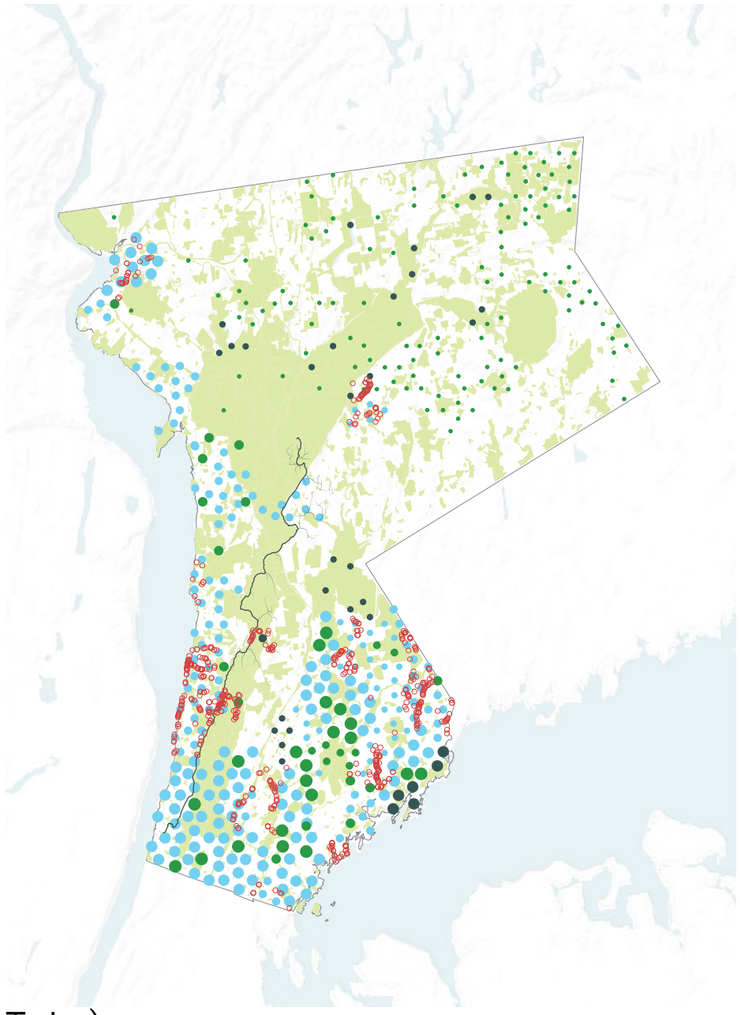
- Floodplain (500 year flood)
- Saw Mill River Drainage Basin
- Storm Surge | Floodplain
- Aquifers



Usage (Precolonization – Dutch Era)

Map Legend

- Fishing Use
- Agricultural Use
- Population Density (Scaled for Comparison)
- Drinking and/or Dumping
- Open Land (Zoning)

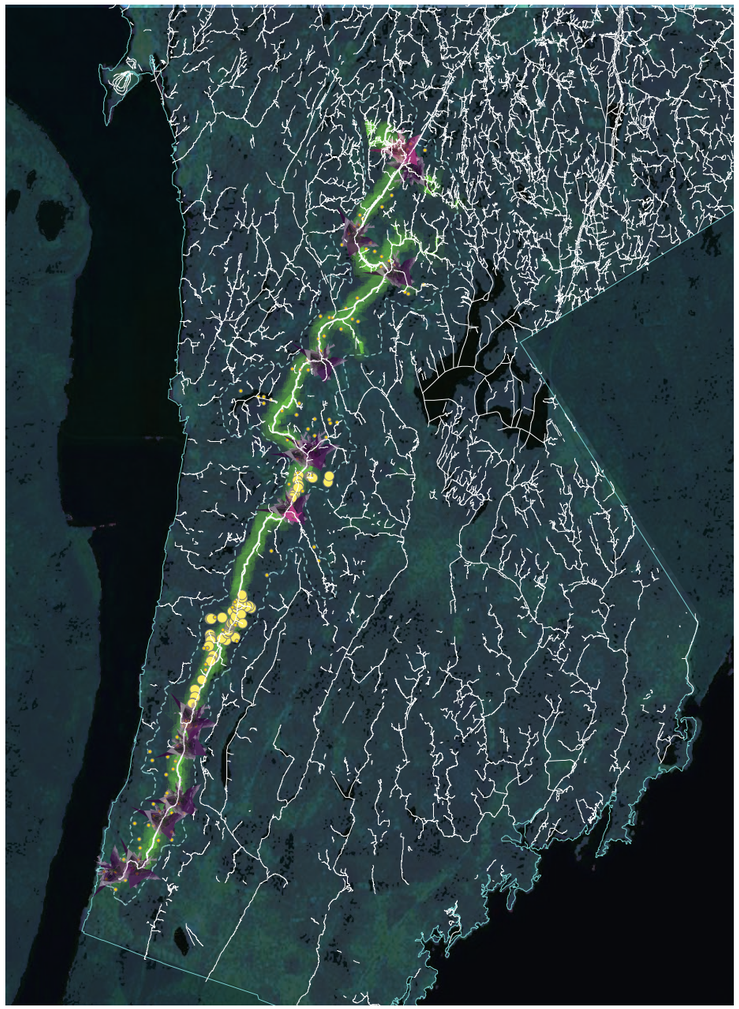


Usage (1800s – Today)

Map Legend

- Fishing Use
- Agricultural Use
- Population Density
- Drinking and/or Dumping
- Open Land (Zoning)
- Identified Outfall

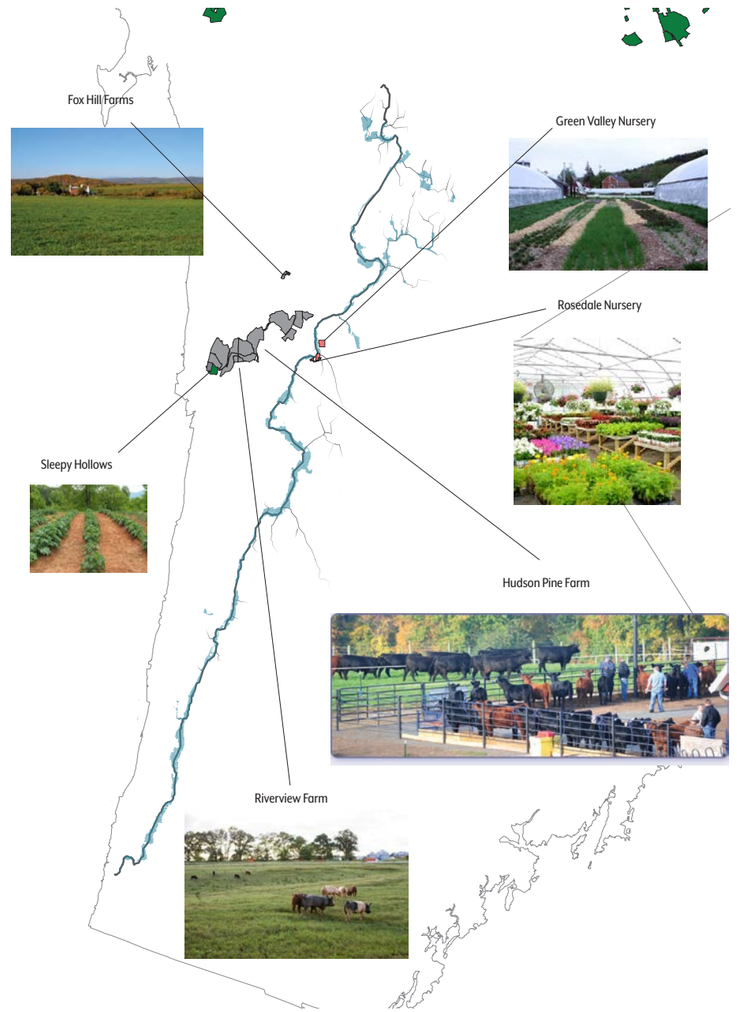
Saw Mill River 1:125,000



Health | Snake-like Yellow Scrawl of Scum

Map Legend

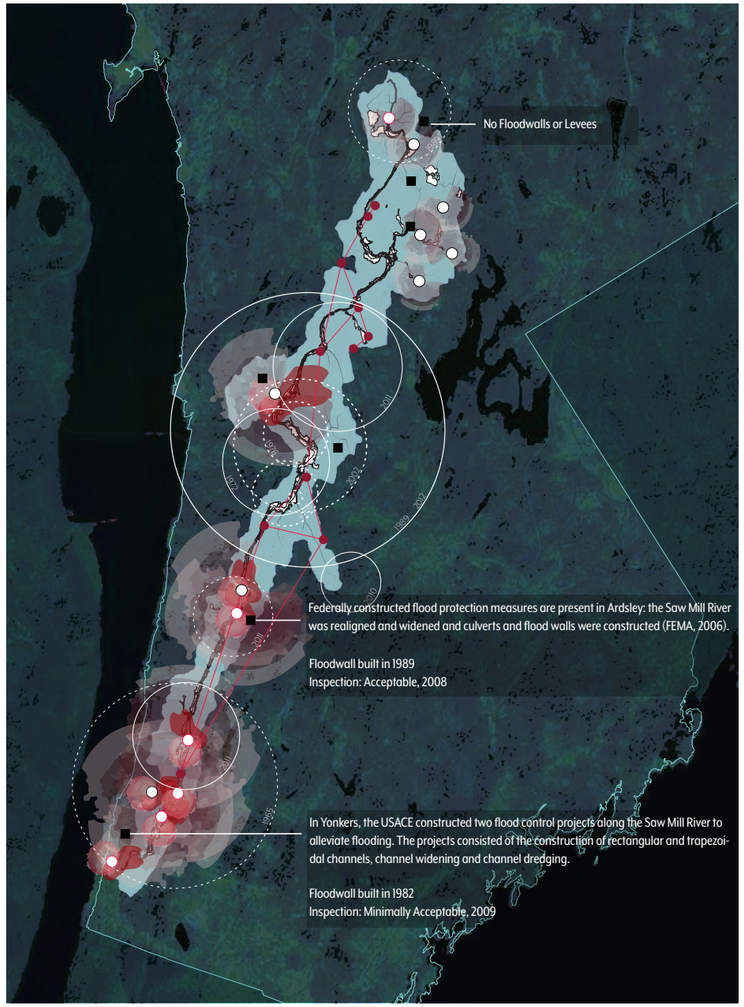
- Outfalls
- Hazardous Waste Generators
- Enterococcus counts > EPA Approval
- Enterococcus counts < EPA Approval
- Weschester County
- River Drainage Basin



Existing Agricultural Land

Map Legend

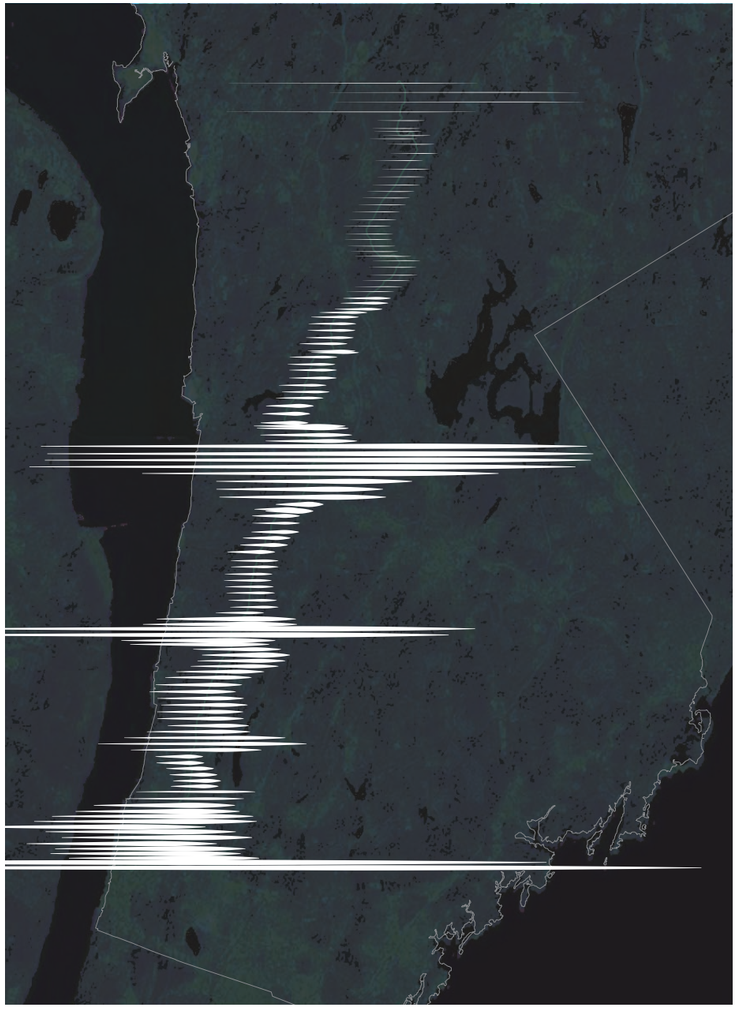
- Livestock
- Crops
- Nursery



Current Measures

Map Legend

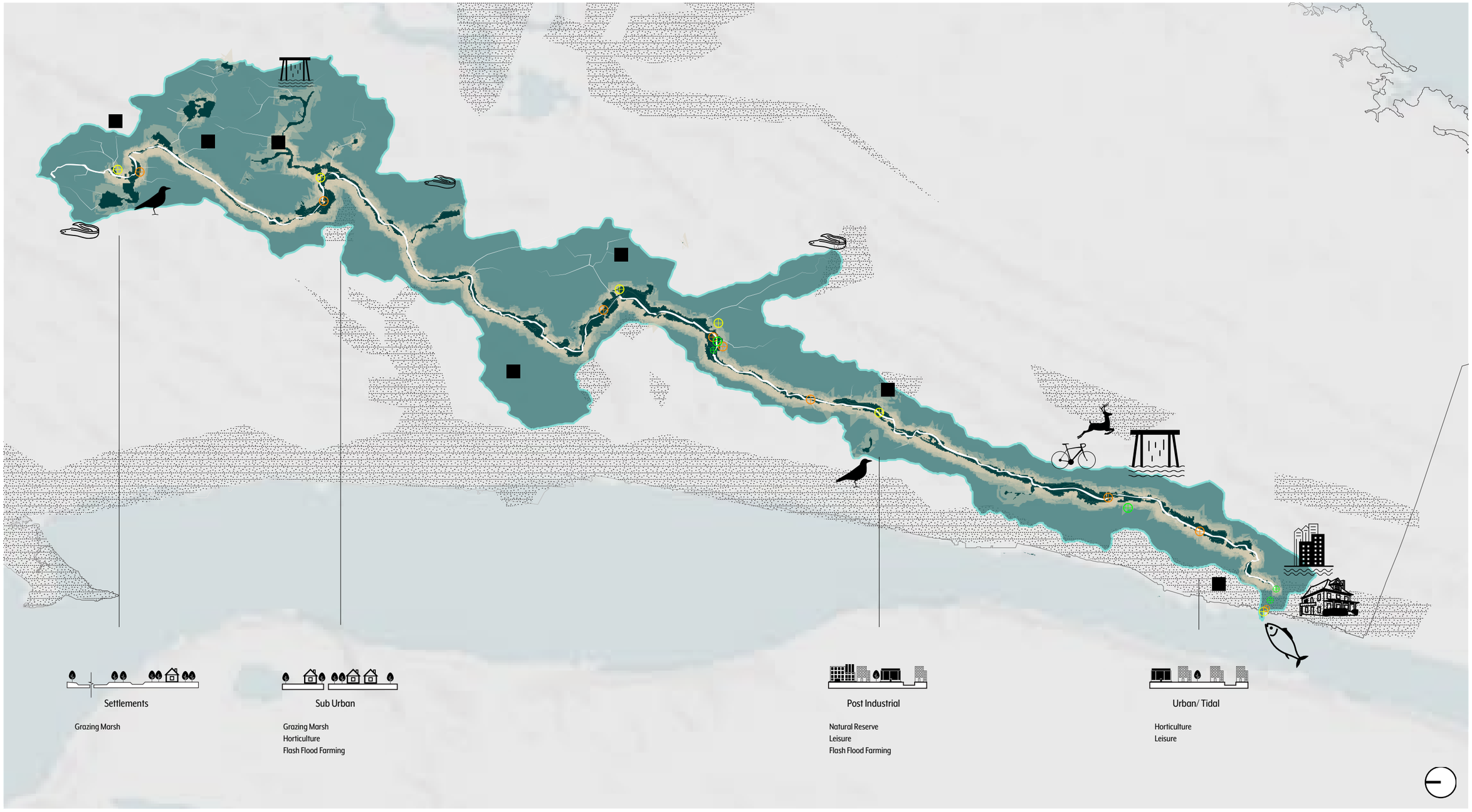
- Incidents recorded (Hurricane Irene)
- Dams
- Prior Studies (Reconnaissance Plan)
- Structural Flood Measures
- Cities
- Prior Studies (US Army Corps of Engineers)



Ecological Stresses

Map Legend

- Length | Time it has existed
- High Stress
- Low Stress



Settlements

Grazing Marsh

Sub Urban

Grazing Marsh
Horticulture
Flash Flood Farming

Post Industrial

Natural Reserve
Leisure
Flash Flood Farming

Urban/ Tidal

Horticulture
Leisure

Structural Measures

Mill and Industry Dams
In 1893, all dams from mills were demolished

Daylighting Yonkers
Construction 2011-2016

River Modification

Channel Construction and Improvements

Underground Flume Improvements

Floodwall

Levee

Raise and Reconstruct 9 Bridges

Channel Relocation and Modification

Flume

Floodwall

Levee

Downstream and Upstream Reach
The Downstream Reach consists of channel and embankment improvements and the Upstream Reach includes a floodwall, channel and embankment improvements,as well as interior drainage.

TheYonkers Project:
Short Term Project
Construction Completed in 1981
Cost Federal $12,500,000
Local $2,550,000

The Ardsley Flood Risk Management Project:
Short Term Project
Construction Completed in 1989
Cost $2,230,000

Prior 1900s
Saw Mill River Covered 1920's
Saw Mill River Covered 1920's
Yonkers
Ardsley

1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003

Non Structural Measures

Ardsley

Utility Changes

Ardsley

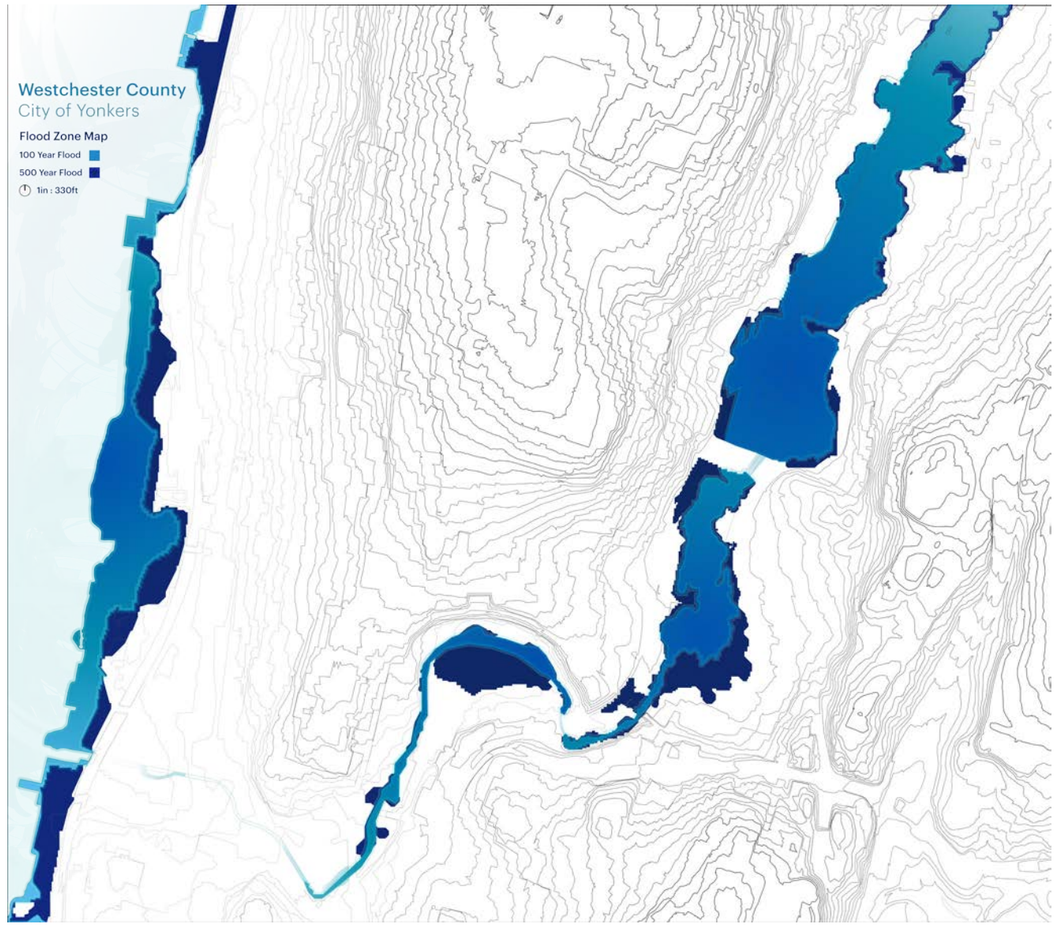
Floodproofing

The Middle Reach
contains non-structural flood proofing of commercial buildings

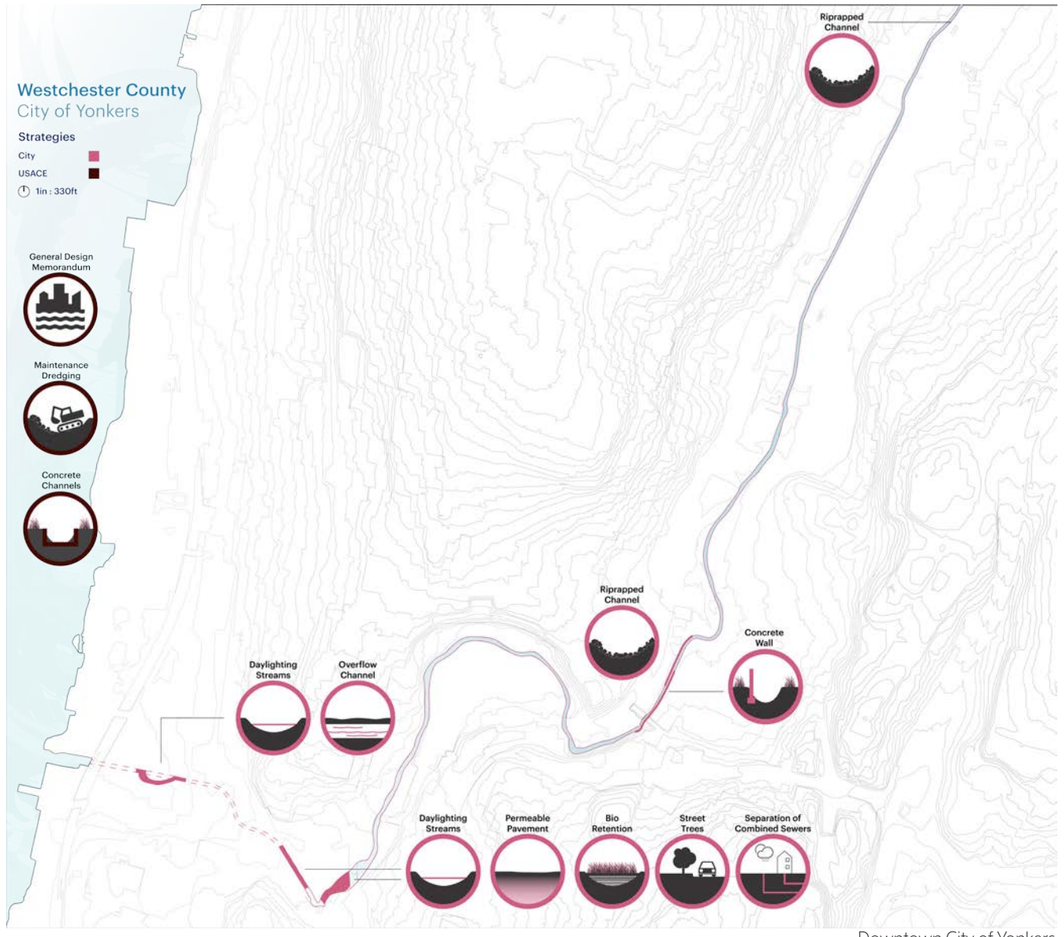
Structural and Non Structural Measures

Map Legend

- US Army Corps of Engineers
- New York State
- Westchester County



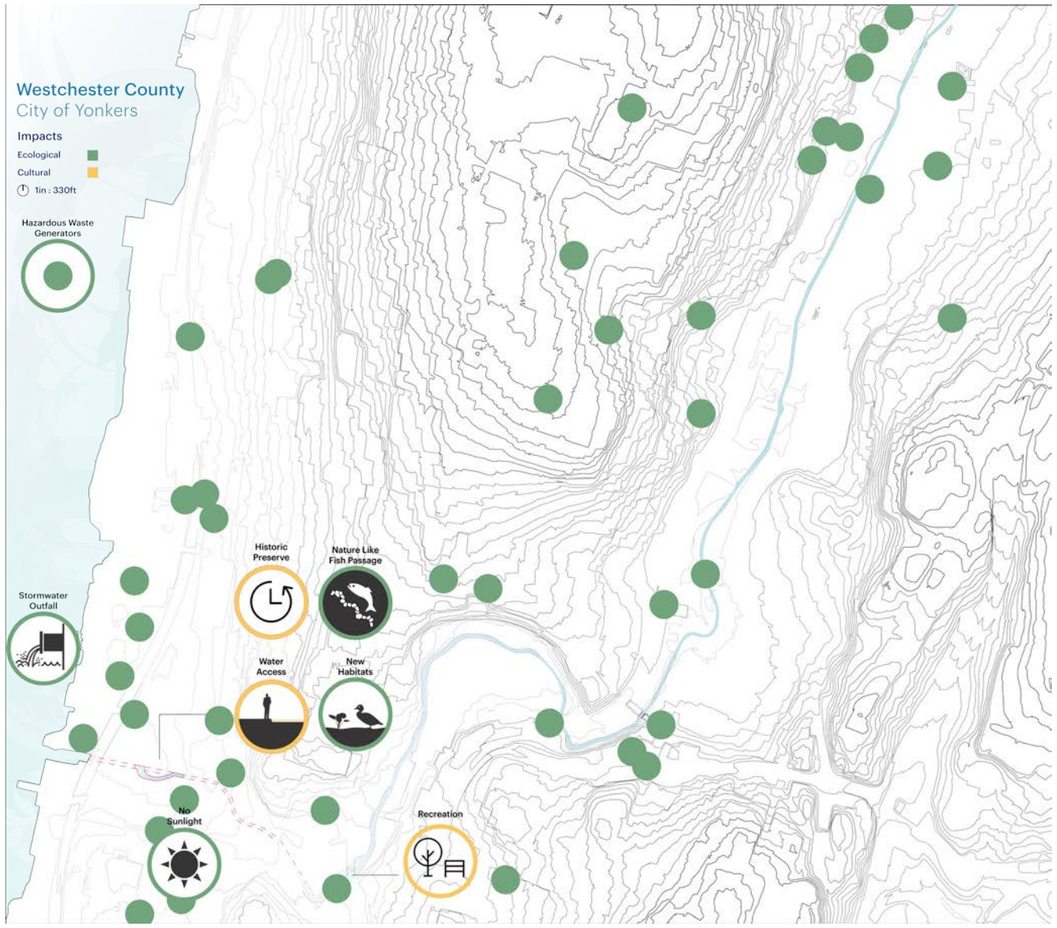
Downtown City of Yonkers
Flood Zone Map



Downtown City of Yonkers
Strategies Map

Current Investments

The following drawings are observations made from recent modifications to the river. The City of Yonkers recently has taken a step towards adapting green infrastructure to their streets as well as gaining an interest on their river. By doing so, they have gained recreational space, popularity, healthier water, and resurfaced fading history. Although they are managing their flood prevention strategies, the last severe flood was Hurricane Irene in 2011. Since then their flooding mechanisms have not been tested neither has the effects of resurfacing and rearranging an old river. The river is still suffering from impairments in its water and still needs more work to be done.

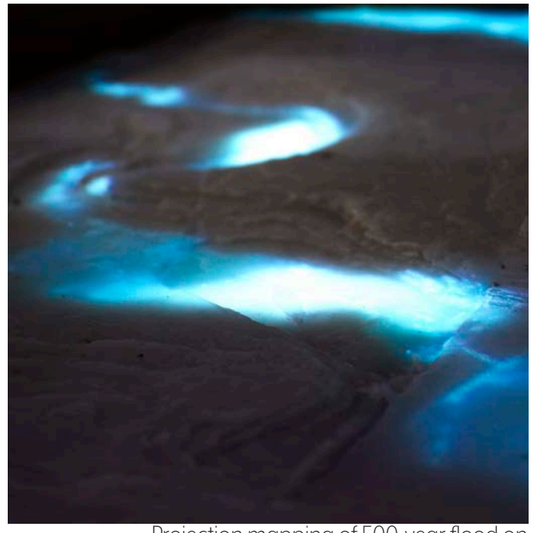


Downtown City of Yonkers
Impacts Map

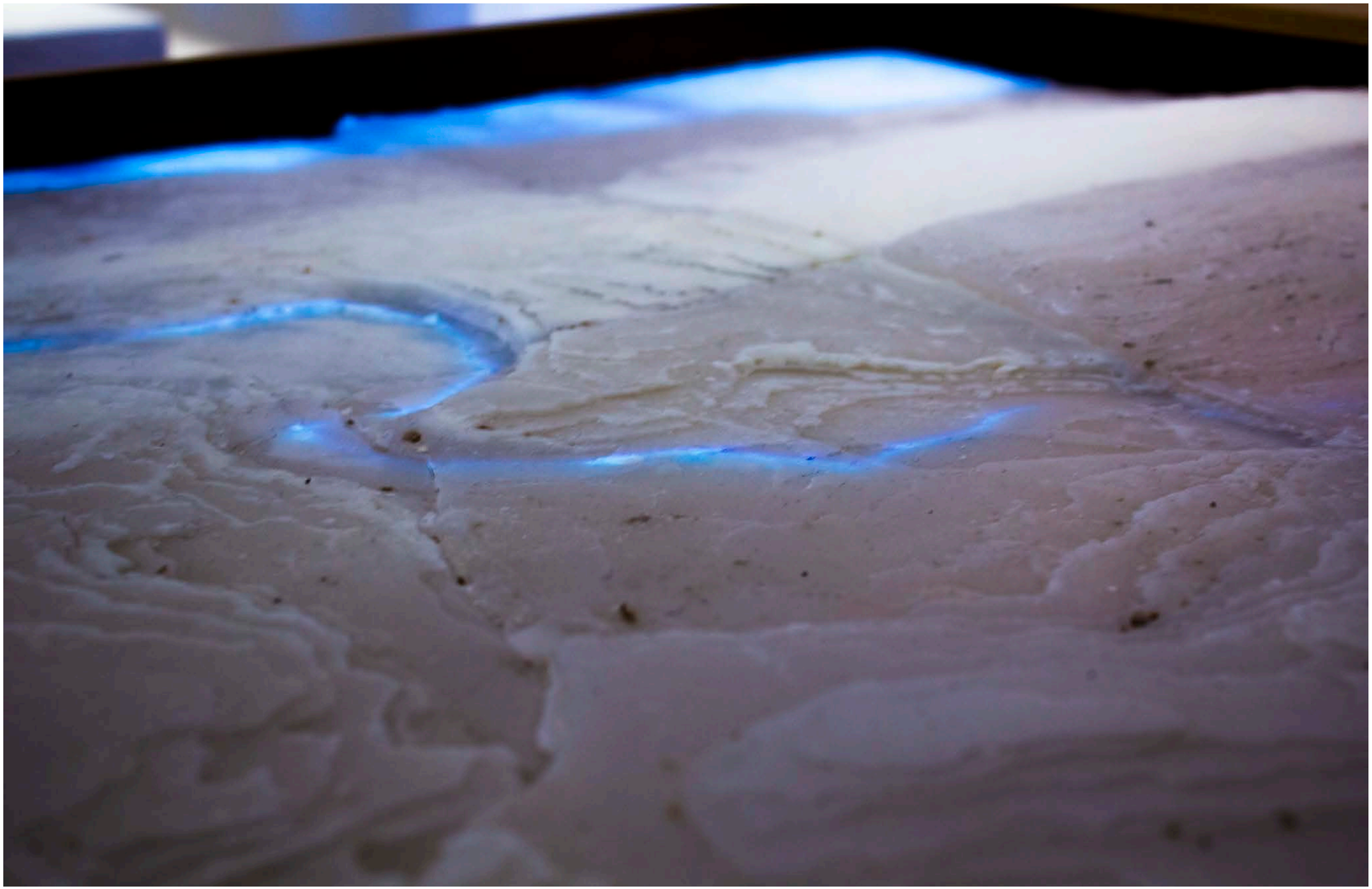
Laser-cut chipboard mold

Pouring on mold

Wax Cast



Projection mapping of 500-year flood on wax model

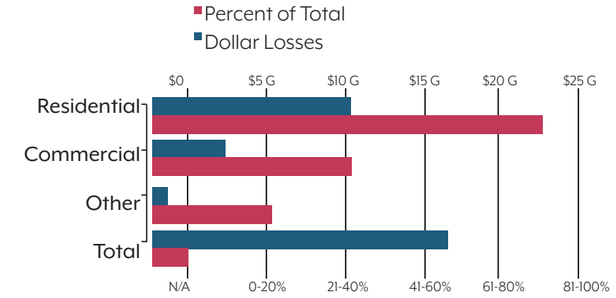


Downtown City of Yonkers Topo Model
wax cast from laser-cut contour model

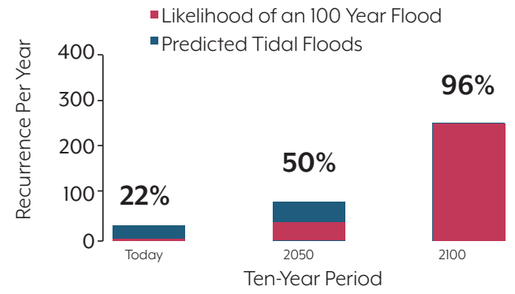
Startling Insights

FEMA Flood Map
Downtown Yonkers

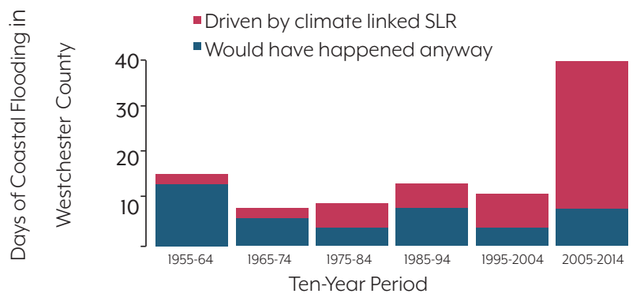
Estimated Losses (1% Event Scenario)



Trend Tidal Floods



Trend Coastal Floods are Increasing



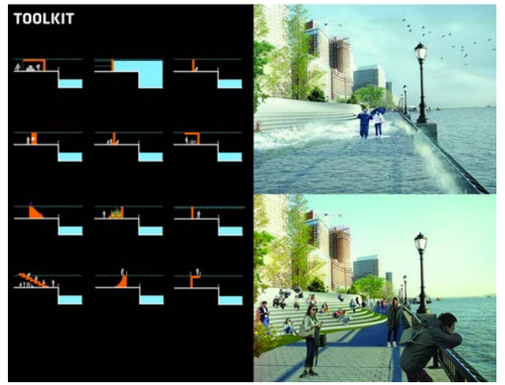
Regional-Scale Field Study

At the regional scale, I learned from the project Room for the River how different countries with different laws and perspectives, put their differences aside and worked together to create a region plan to reduce risks on their lands. They came up with a design toolkit in which described the type of action they would need take in order to create space, moderate flow, eliminate obstacles for the river to have the ability to expand.

They had about 30 site specific projects on the Waal River. The projects were completed in 2016.

Date: 2005-2016
Water: Rhine Delta (the Rhine, the Meuse, the Waal, the IJssel)
Expenses: 2.2 billion euros

Neighborhood-Scale Field Study



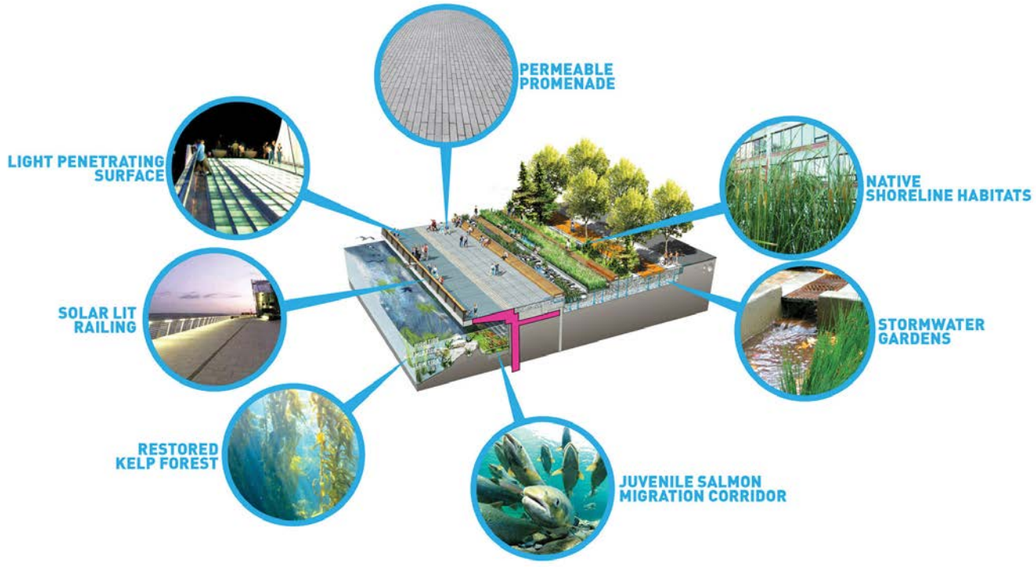
I took a look at the Dryline, or the Big U, more at a neighborhood scale. As I have mentioned before, BIG came up also with their own design toolkit that showed the different public spaces in comparison to the high water level barrier.

Date: 2017-2022
Water: Upper New York Bay and Gowanus Canal
Expenses: C1,778mil; C2, 242mil; C3, 1.92bil

Building-Scale Field Study

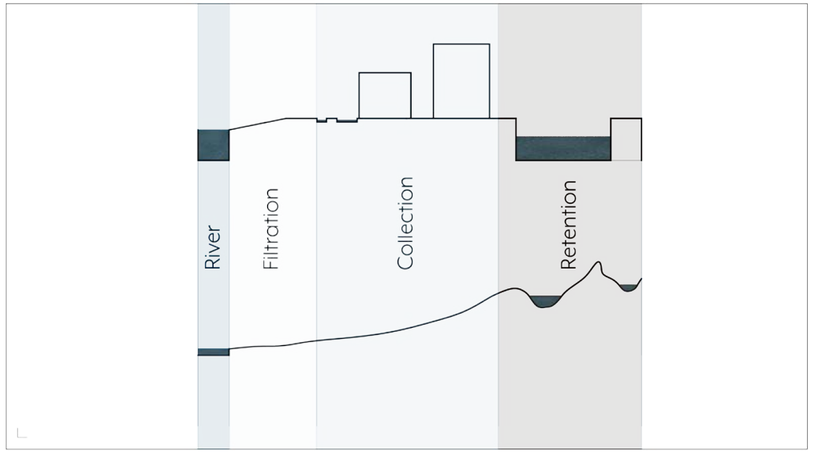
At the building scale, I learned the most from James Corner Central Seattle Waterfront Design Study and more importantly was inspired by their innovative "seawall". The seawall was described as a water barrier but as well as a salmon migration corridor and a visual element to the people on the paths. The walls would be marked so that the passerby could see at what height the tide was.

Date: 2010-2014
Water: Rhine Delta (the Rhine, the Meuse, the Waal, the IJssel)
Expenses: 700mil (entire project)



Durable Futures

ADAPTING THRU MULTIPLICITIES



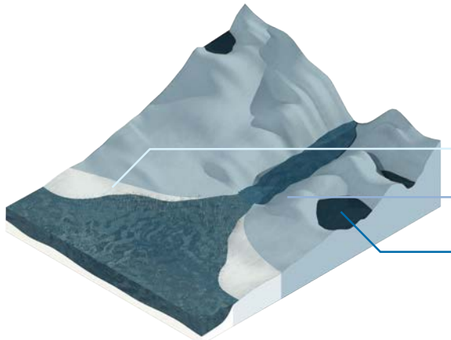
As we address city flooding as a city-wide problem, we must be able to also adapt thru multiplicities. There are a few ways we can apply the adapt thru multiplicities in different ways depending the scale we may be implying. This may mean re-zoning the land by assigning zones specifically for water filtration, collection, or retention fr the entire region. Or perhaps this talks about the three main stresses the tidal city may experiencing. Finally there are ways to adapt thru multiplicities at different design scales. In all three ways this could be read, the core of this was essentially inspired by the way water moves down a mountain. At the very top, water is retained in these pools and as the water goes down it travels through a series of narrow channels in which collect and guide water. As it reaches the bottom the water is filtered through the wet woodlands or wetlands in order to finally reach the river. We must apply the same thinking to out cities.

But how could it be translated from a mountain to a city?

Answer: Our vacant/open spaces become the retention pools of the mountain, our built environment becomes the narrow channels of water collection, and finally our public realm becomes a series of filters for our water and our people.

WHAT IS IT?

REGION



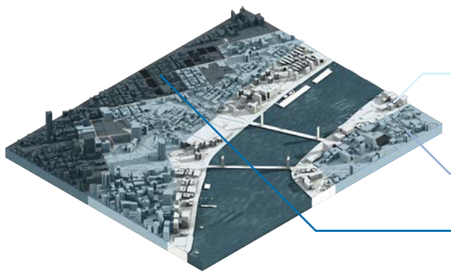
Wetlands/Buffers, Forest Plantations

Managed Realignment, Flood-relief Channels, Wet Woodlands

Water Meadows, Lakes, Reservoirs

Regional-scale Hydroscapes helps manage water by **integrating** it

CITY



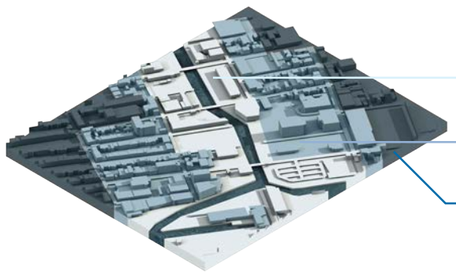
Flood Parks, City Wetlands, Floodplains, Permeable Paths

Artificial Basins, Infiltration Basins, Urban Flood Storage,
Rainwater Harvesting, Floodable Parking Lots

Fountain, Water Squares, Cisterns

City-scale Hydroscapes helps manage water by **purifying** it

NEIGHBORHOOD



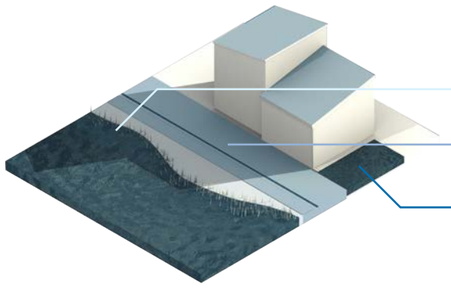
Vertical Flow Reed Bed Systems, Permeable Paths, Swales

Terraced Waterfront, Rills

Floodable Playgrounds and Squares

Neighborhood-scale Hydroscapes helps manage water by **collecting** it

BUILDING



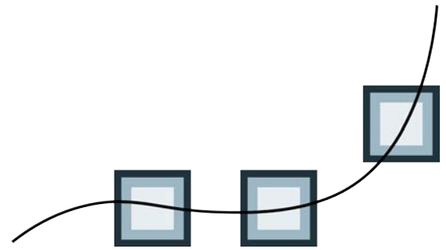
Rain gardens, Permeable Paving, Reed Beds,
Green Buildings, Green Walls, Courtyards

Rills, Moats, Swales

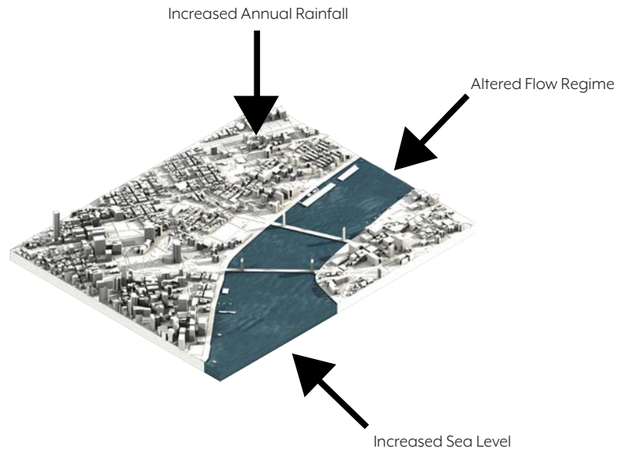
Pools, Ponds, Rainwater Harvesting

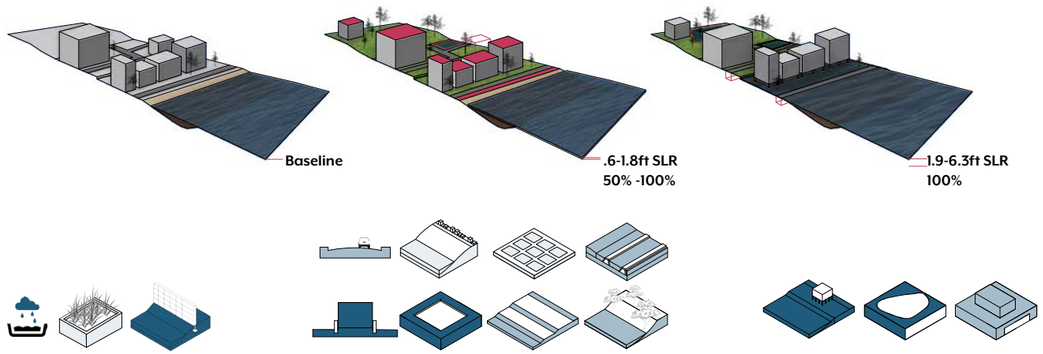
Building-scale Hydroscapes helps manage water by **storing** it

REGIONAL DESIGN



TIDAL URBAN CITIES





This proposal allows for us to accommodate the water from rain,river, or sea, according to their projections respectively. We already know the likeliness of certain types of flood water heights, the probability the sea level will rise at a specific time, and we know what we must protect. All we have to do is accept and plan.

Above is my proposed timeline for the City of Yonkers and the priorities they must focus on for each 50 years in order to be prepared for the 6ft rise of sea level and more intense daily tidal floods.

In the regional masterplan, the current zoning must be translated into the type of action towards the water: filter, collect, or retain. Some buildings will have to be torn down and relocated at high elevation in order to be able to be more intensely filtered and cause less damage on our waterways. Most the existing structures will have to adapt according to their assigned zone. Most of the structures will stay in flood-zones but learn how to coexist and manage regular floods.

Current Zone Map

Goals for Designing and Planning with Water

Regional

Address flooding as a Citywide problem—with multiple watersheds, rivers, and tributaries—that requires a coordinated mitigation effort with solutions unique to each watershed; Infrastructure systems across region will be adapted to continue services and decrease risk to its proximity.

City

Adapt to invite flood water from river and coast within the city to decrease tension on flood mitigation interventions and diminish risk on the population.

Neighborhood

Preserve character of neighborhood while creating a safer environment through the strengthening of cultural, social, and economic resilience.

Building

Buildings will be strengthened against flooding and improve the economy on underfunded communities.

Outreach

Communicate flood risk through artistic interventions throughout the city to educate the public on the issues, actions and timelines at hand.

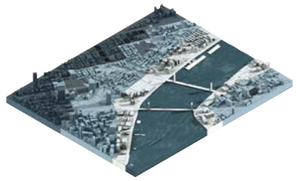
Toolkit

Each water action will mean different things according to the type of design scale chosen. These are in addition to the previous strategies studied in part one of the investigation. Some may overlap or exist in different zones. These actions or strategies will guide and set the tone of how each zone will manage their water.

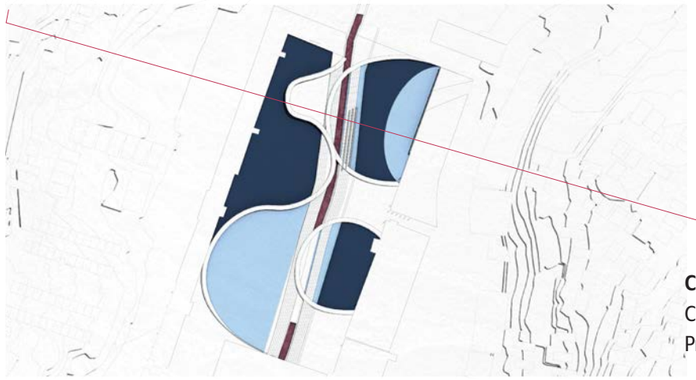
Proposed Regional Zone Map

Wealth of Local Communities

Building-Scale Proposal



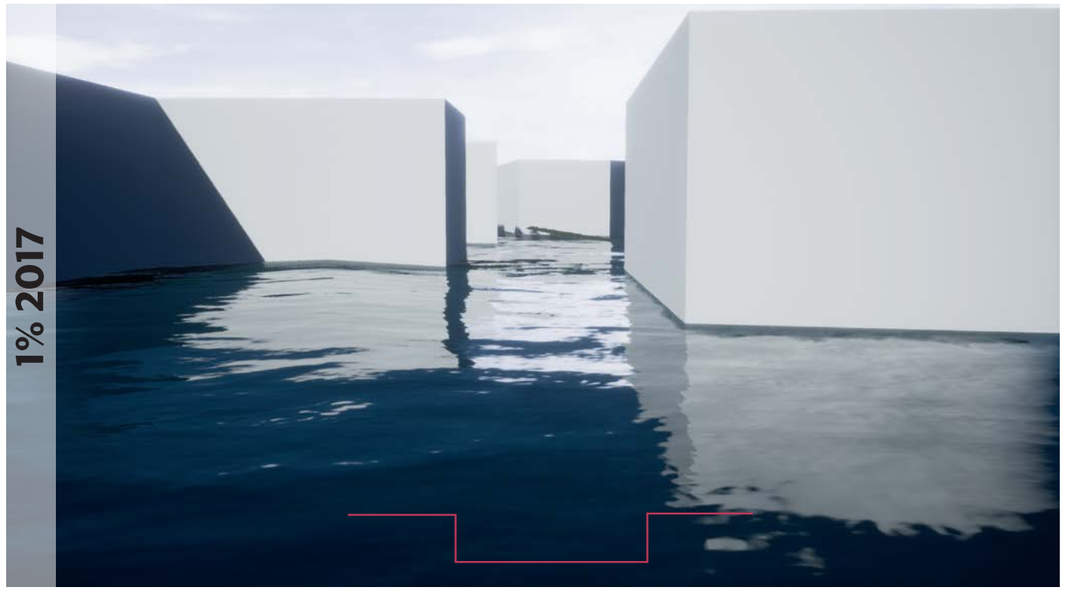
Retain

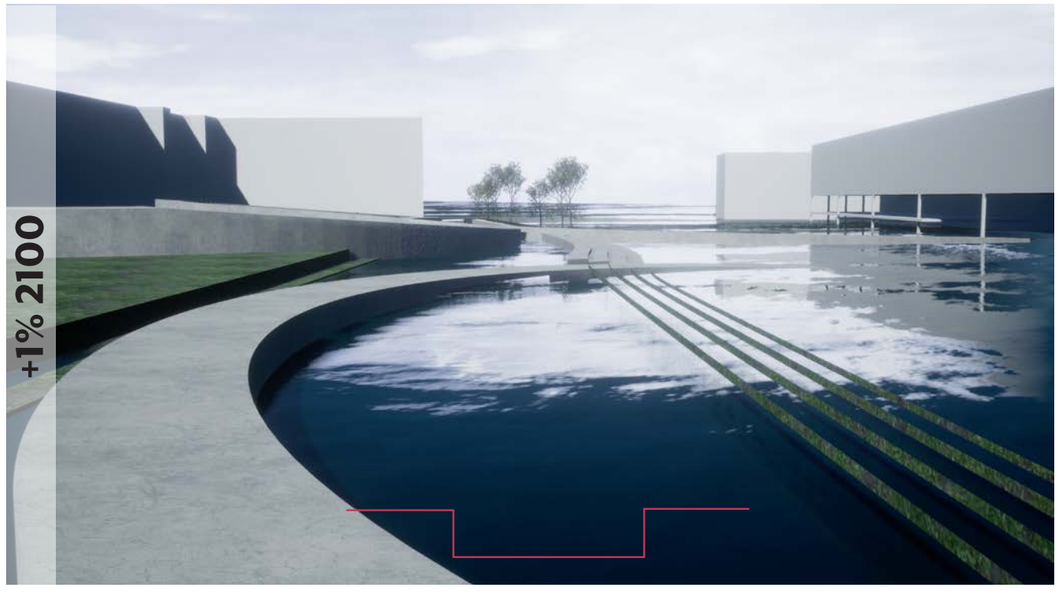


City of Yonker, NY
Communities in Floodplains
Proposal Year 2100

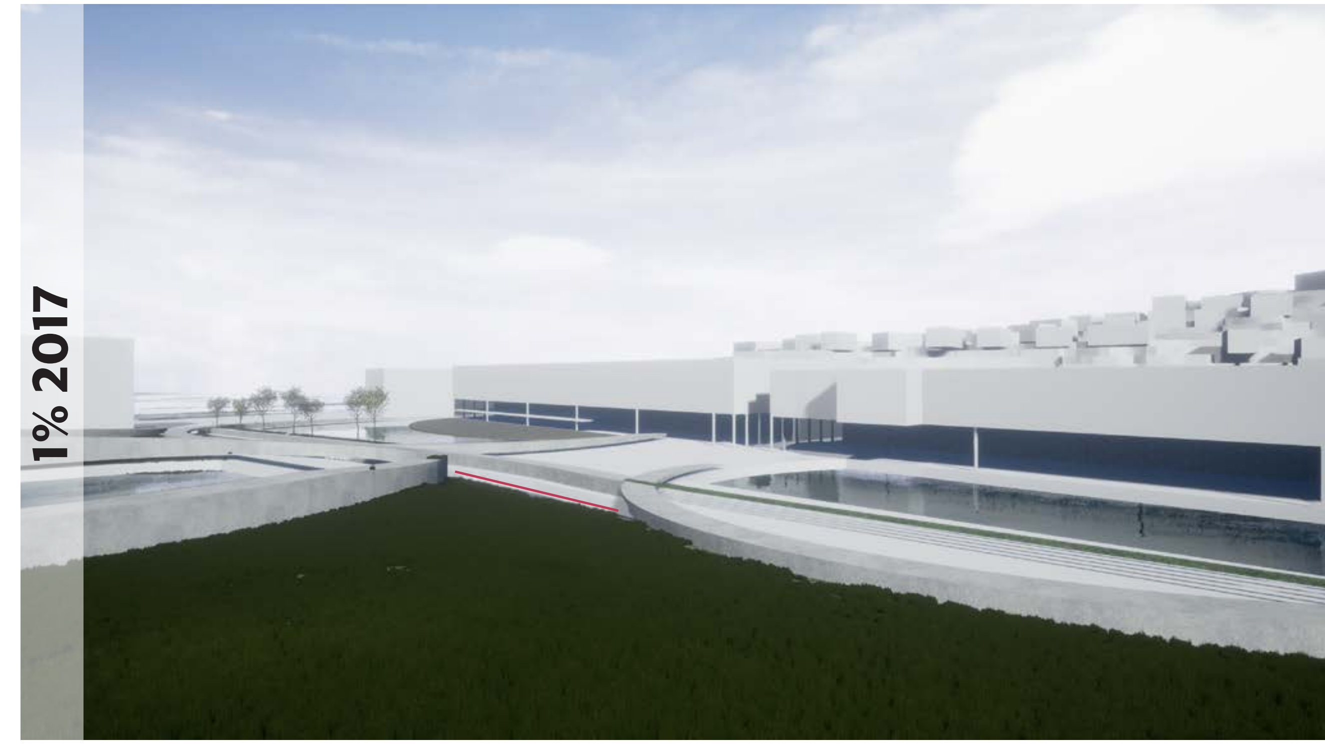
Communities located in our present day floodplains usually experience the most risk. With this proposal the risks would be decreased and will create both environmental and social formations. They also allow flexibility for communities to change over time and change with the water level.

Because this site was designed for water retention as its main objective, three of the spaces will become the three pools of water retention when flooded. These spaces are a floatable community theater, a floodable playground, and a riverine habitat for the native species traveling their way






Proposal 2017


1% 2017


+6ft SLR 2100


+1% 2100

Building-Scale Toolkit

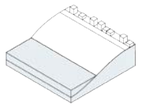
Filter-Tools

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

1cf

Rain Gardens
garden of native plants designed to temporarily soak and hold runoff

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



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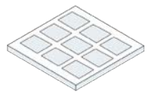
Relocate
relocating existing buildings towards higher ground

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



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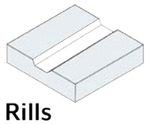
Permeable Paving
materials that allow the movement of stormwater through the surface

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



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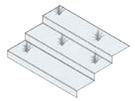
Rills
planted narrow channels that provide drainage pathways through developments

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



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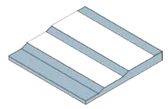
Vertical Reed Bed System
An artificial wetland formed from a series of gravel beds

Collect-Tools

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



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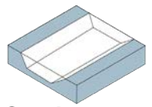
Terraced Waterfront
stepped or graded waterfronts that create space for water to expand

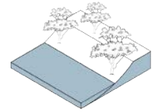
Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



1cf

Swales
planted broad channels that treats runoff

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



1cf

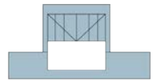
Flood Parks
floodable open spaces with landscape features

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

0cf

Hydropower
potential for small hydropower

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



1cf

Floodgate
adjustable gates used to control the flow of water

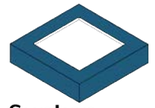
Retain-Tools

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

1cf

Pools
dry and wet pools help control flow and treat runoff

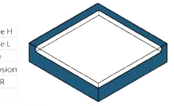
Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



1cf

Sunken Squares
shallow impoundment that is designed retain excess water

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



.5cf

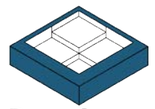
Floating Squares
closed connected system designed to store excess rainwater

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

0cf

Dry Floodproofing
sealing the structure to keep water outside of structure

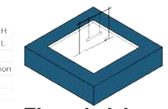
Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



1cf

Deep Squares
multileveled squares that allow large amount of water storage

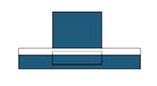
Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



1cf

Floodable Playgrounds
hard ans soft landscape places that can be designed to store variable depths of water

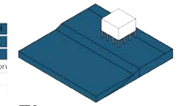
Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



1cf

Wet Floodproofing
allow water to enter the structure

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



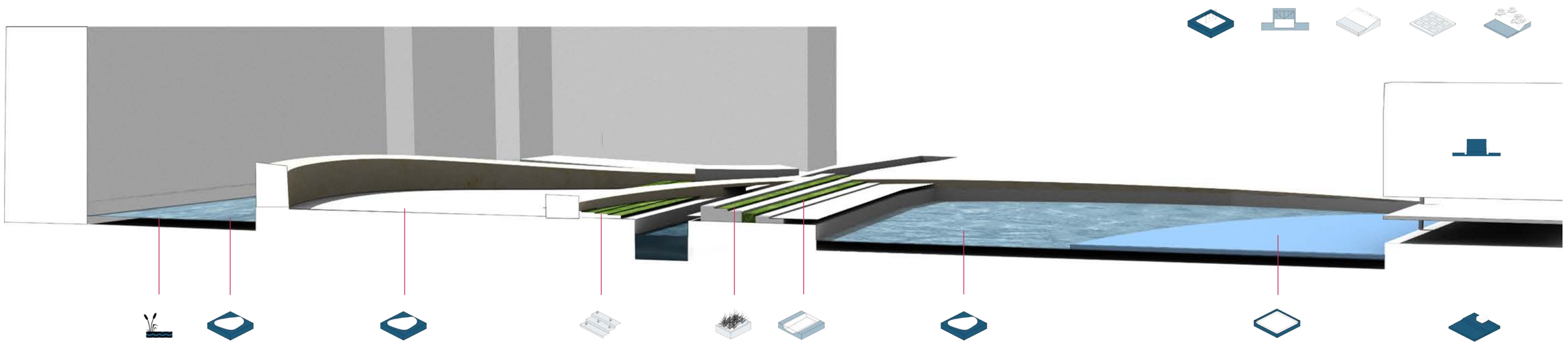
0cf

Elevate on Piles
Building raised above BFE supported by piles

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

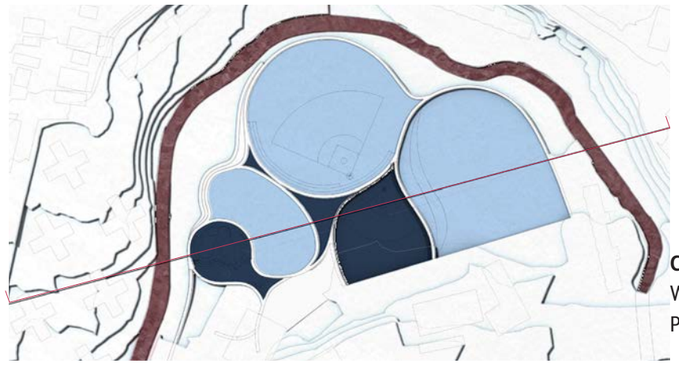
0cf

Riverine Habitat
system of inland wetlands

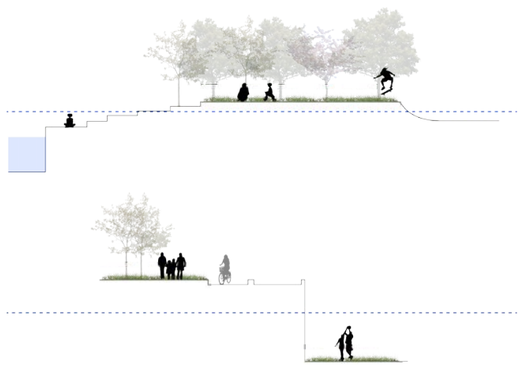


Neighborhood-Scale Proposal

Collect

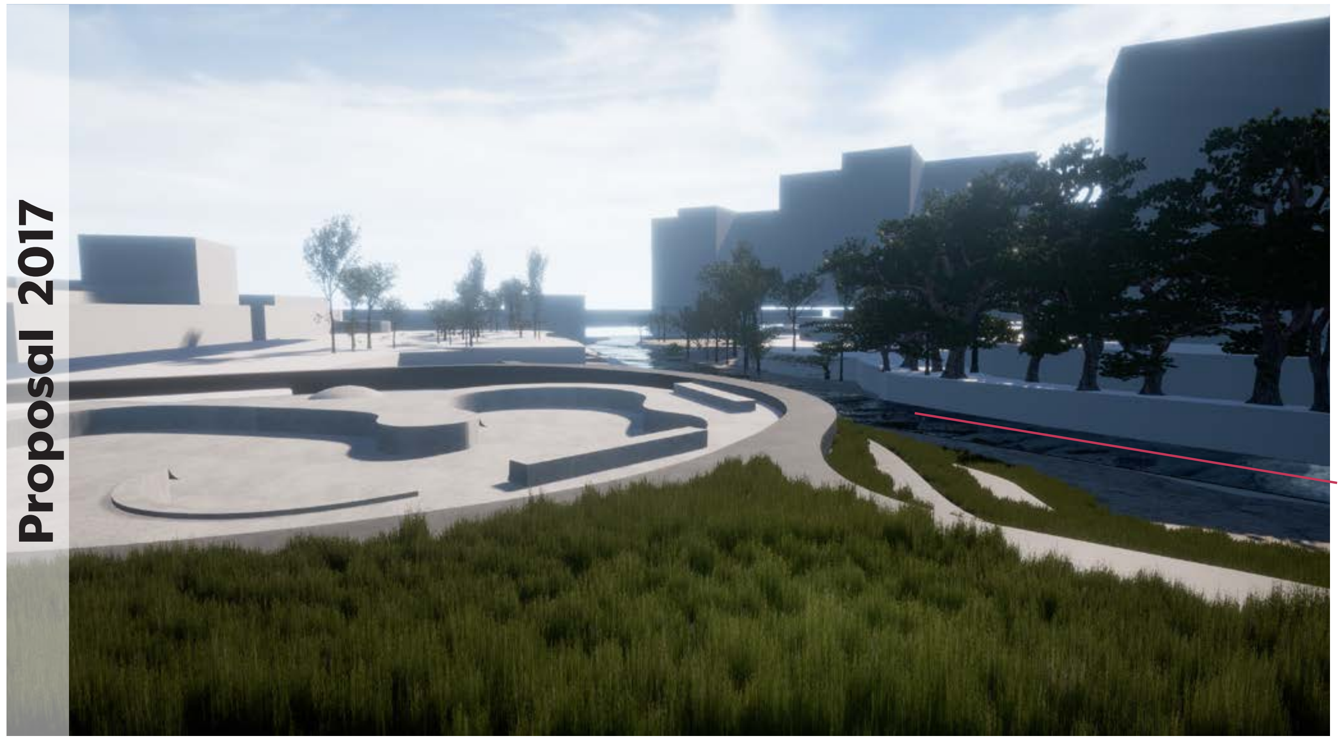


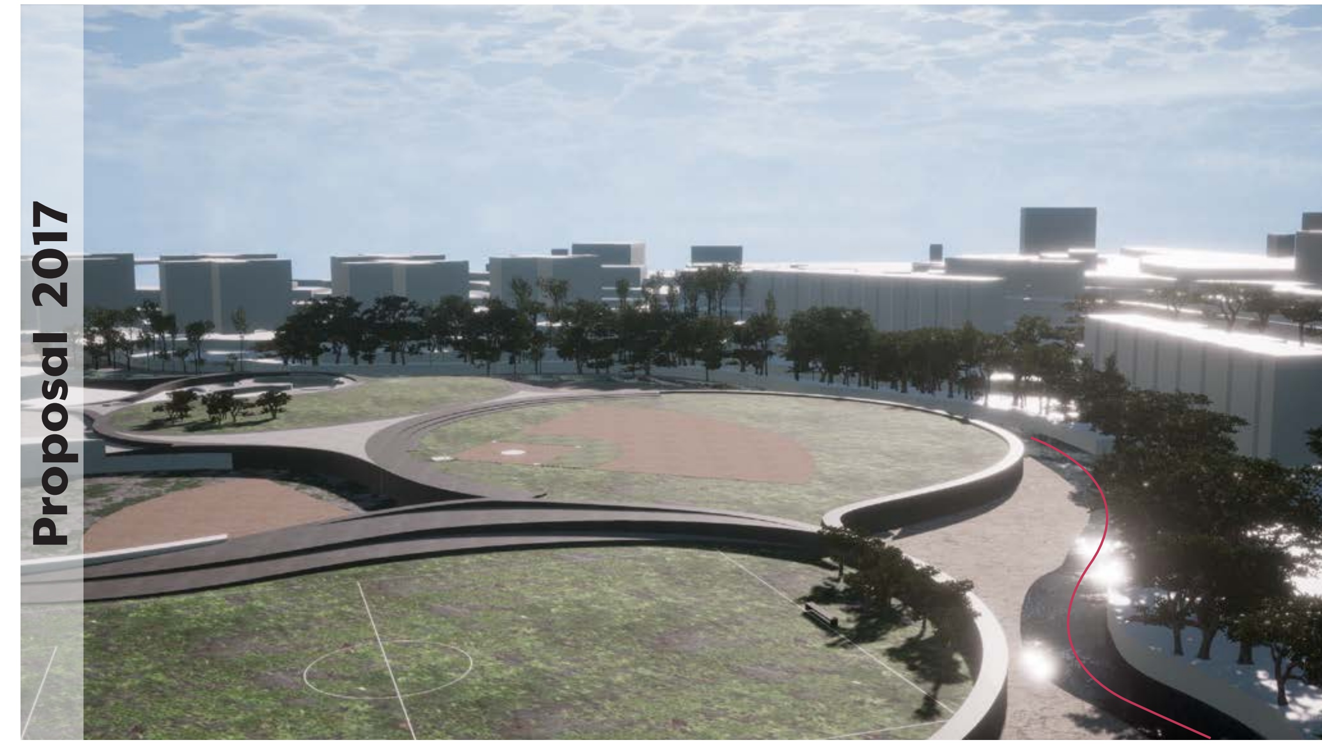
City of Yonker, NY
War Memorial Field
Proposal Year 2100



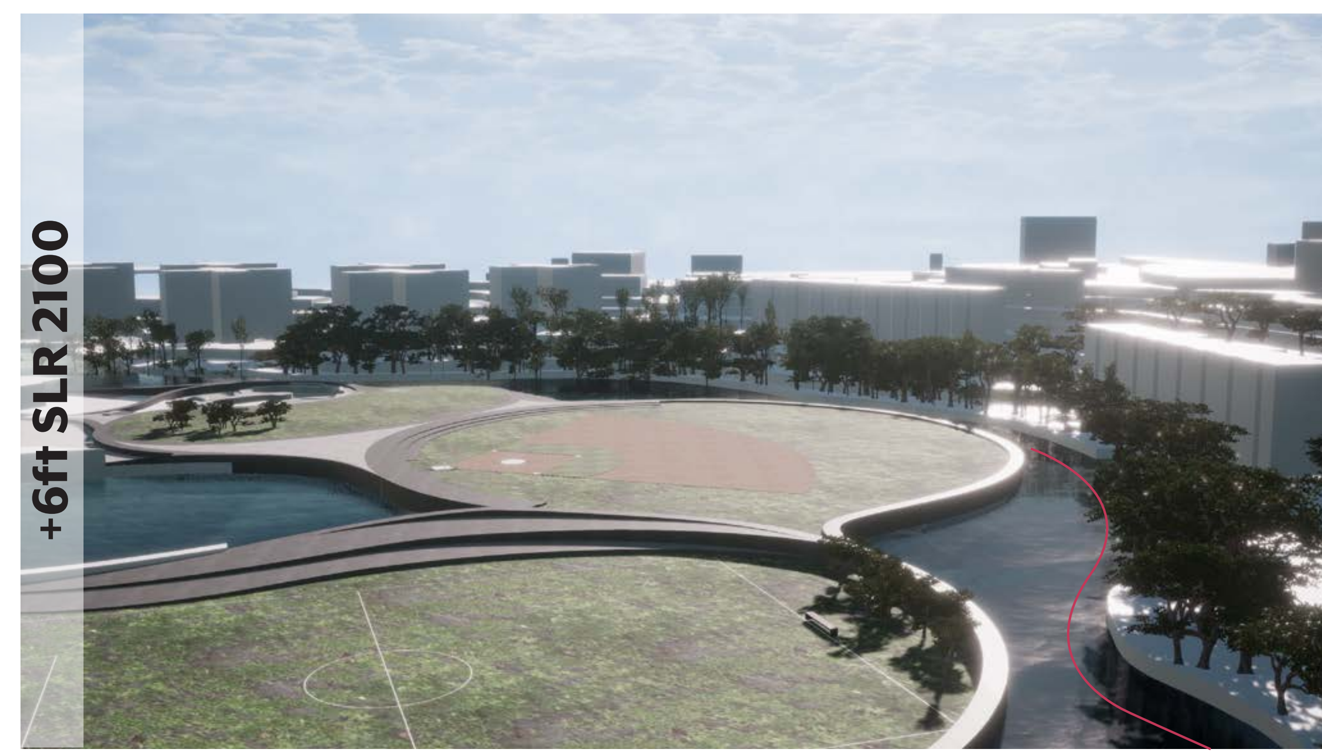
Open spaces can become valuable areas for retention but at a neighborhood scale they can also become areas for collection. War Memorial Field currently has 2 overlapping baseball fields, another on the east side and a soccer field in the middle. It is used today as a flood park for the neighborhood. By redesigning the park to collect and store water, it can also create a place for people to go to before and after a flood or proposed sea level rise.

The little league baseball and skatepark can become areas for water retention during a flood allowing the other areas to stay dry and safe for people to still use. There is a possibility of also using the whole site for underground retention create a more valuable place for water to be stored.


Proposal 2017


Proposal 2017

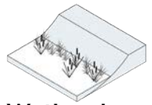

+6ft SLR 2100


+6ft SLR 2100

Neighborhood-Scale Toolkit

Filter-Tools

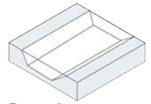
Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



1cf

Wetlands
uses plants and soils to retain and filter water while creating wildlife

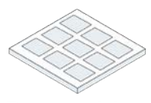
Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



1cf

Swales
planted broad channels that treats runoff

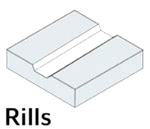
Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



.15cf

Permeable Paving
materials that allow the movement of stormwater through the surface

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



1cf

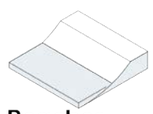
Rills
planted narrow channels that provide drainage pathways through developments

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

0cf

Reef Regeneration
reconstruct reef habitat with recycled material

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

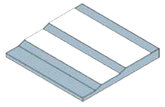


1cf

Beaches
flood buffer with vegetation

Collect-Tools

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



1cf

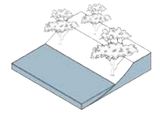
Terraced Waterfront
diverts water away from major settlement

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

0cf

Groins
extrend perpendicular to flow to break waves and catch sand and sediment

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



1cf

Flood Parks
floodable open spaces with landscape features

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

1cf

Urban Flood Storage
car parks, roads and underground structures that store excess water

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

1cf

Floodgate
adjustable gates used to control the flow of water

Retain-Tools

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

1cf

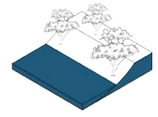
Pools
dry and wet pools help control flow and treat runoff

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

1cf

Sunken Squares
shallow impoundment that is designed retain excess water

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion



1cf

Flood Parks
floodable open spaces with landscape features

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

1cf

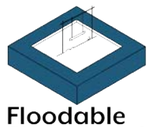
Floodwalls
dry pond that releases water stored at a controlled rate

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

1cf

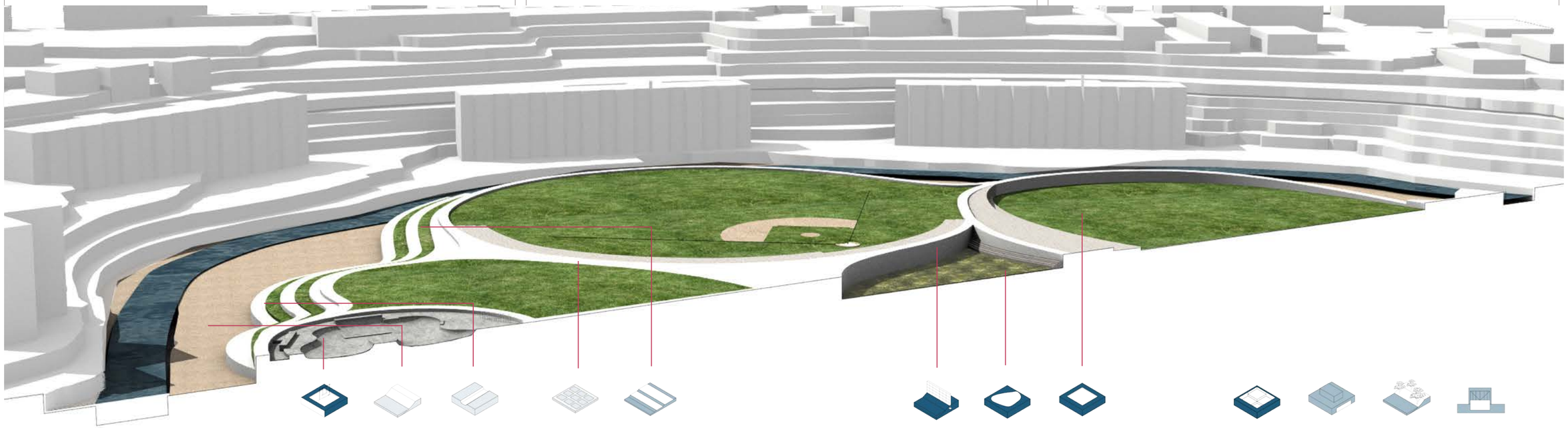
Deep Squares
multileveled squares that allow large amount of water storage

Storm Surge H
Storm Surge L
Wave Force
Sudden Erosion
Gradual SLR
Erosion

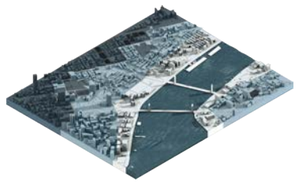


1cf

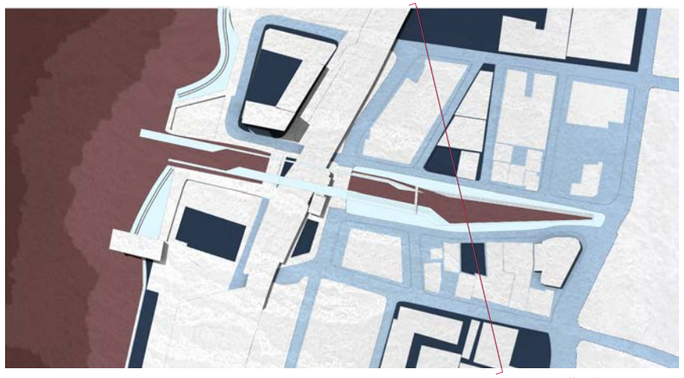
Floodable Playgrounds
hard ans soft landscape places that can be designed to store variable depths of water



City-Scale Proposal



Filter

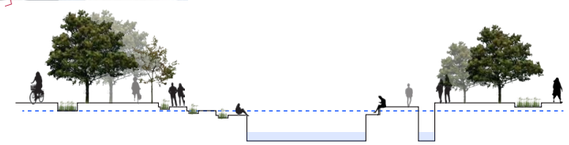


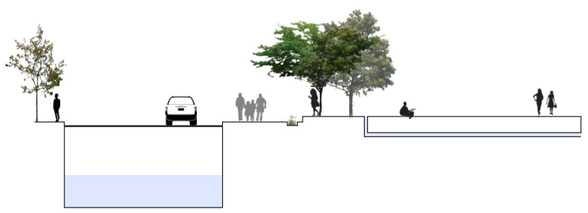
City of Yonker, NY
Hudson River Area
Proposal Year 2100

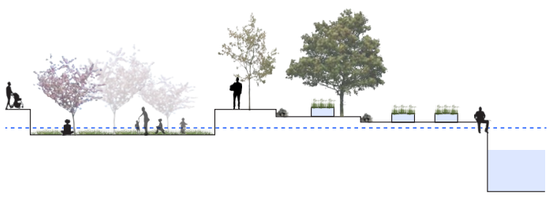
Downtown Yonkers was a tough design proposal because of its dense population, change in elevation, barely any vacant lots near the river, and final destination for both many tourists and for the water traveling to the sea.

Here, the design scale was a city scale, changing the objective to filter water. Yet because of other factor it is also an area for water retention. Rainwater could be harvested on most buildings and on their lots water would be collected and filtered through a series of rain gardens. Under roads, there would be underground structures that could collect excess water from the river at times of flooding. People and water will interact with series of rain-gardens and in water debris catchers and filters.

Rills would travel along side pedestrians on sidewalks and roads would also become canals with a smart street profile.








Proposal 2017

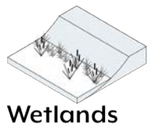

Proposal 2017


+6ft SLR 2100


+6ft SLR 2100

City-Scale Toolkit

Filter-Tools



1cf

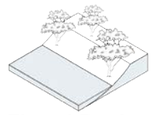
Wetlands
uses plants and soils to retain and filter water while creating wildlife

1cf

Infiltration Basins
shallow impoundment that is designed to infiltrate stormwater into the soil

.15cf

Permeable Paving
materials that allow the movement of stormwater through the surface



1cf

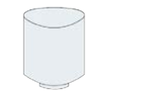
Flood Parks
floodable open spaces with landscape features

1cf

Rain Gardens
garden of native plants designed to temporarily soak and hold runoff

0cf

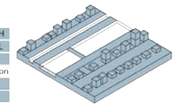
Reef Regeneration
reconstruct reef habitat with recycled material



0cf

Filtration Systems
debris catcher and selected plants to absorb contaminates in water

Collect-Tools



1cf

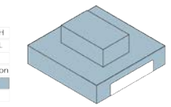
Flood Relief Channel
diverts water away from major settlement

0cf

Green/Brown Roofs
retain water for artificial growing medium

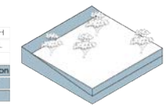
.5cf

Smart Street
designed street profiles according to flood elevations



1cf

Urban Flood Storage
car parks, roads and underground structures that store excess water



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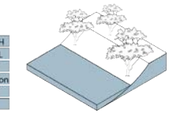
Floodplains
area designed to be regularly flooded



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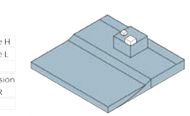
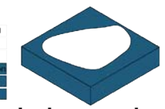
Flood Parks
floodable open spaces with landscape features



0cf

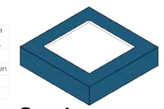
Protect Building Systems
protect electical and mechanical systems from flooding

Retain-Tools



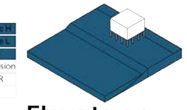
1cf

Lakes and Reservoirs
retain fresh water supply and can obtain control devices to manage runoff



1cf

Sunken Squares
shallow impoundment that is designed retain excess water

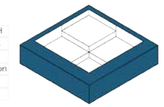


0cf

Elevate on Piles
Building raised above BFE supported by piles

1cf

Artificial Basins
dry pond that releases water stored at a controlled rate



1cf

Deep Squares
multileveled squares that allow large amount of water storage

1cf

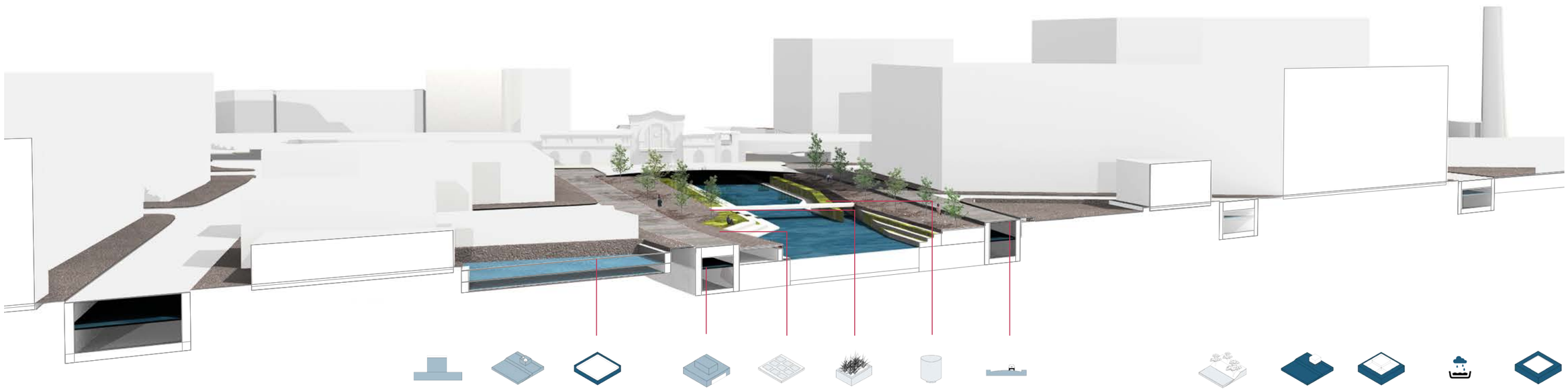
Rainwater Harvesting
reconstruct reef habitat with recycled material

0cf

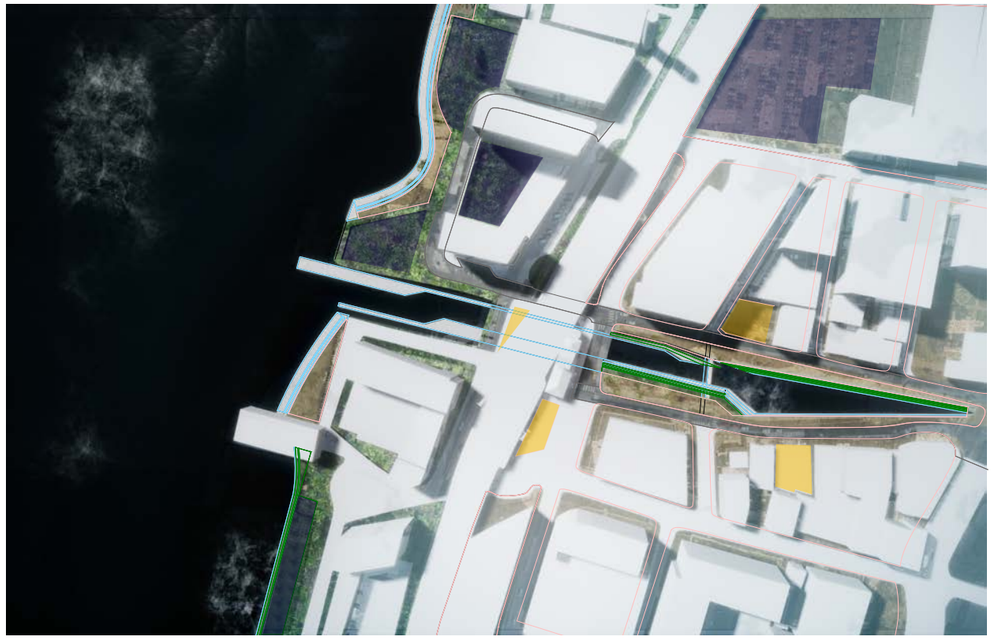
Fountains
rainwater can be used and stored for public features

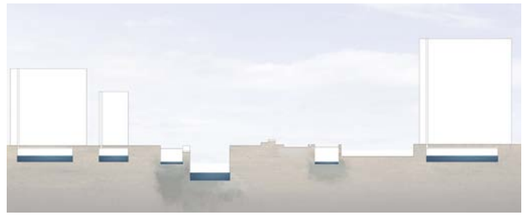
.5cf

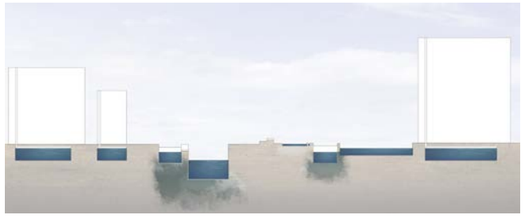
Floating Squares
closed connected system designed to store excess rainwater

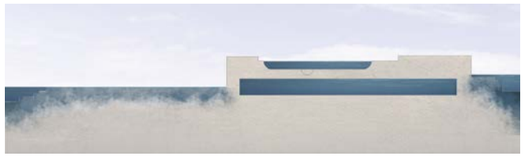


Lessons Learned









As the climate changes, the importance of our relationship with water changes with it. Although there are three different proposed interventions, it is unlikely the same solutions will be used in another city. The goal for the hydroscape toolkits is to level the ability of change across the region in order to make an integrated design solution. The three proposals only show a glimpse of what a resilient system city could look like, one designed after the interconnectedness water creates between towns. By embracing sea level rise, shallow and deep waterways could become areas or collection and retention respectively, and be doubled with infrastructure thus creating a threat into an opportunity. All land cannot be saved and with the land that is saved, ownership and liability become a problem. Critical areas that may be adapted into something different can cause serious stress on the people who found belongingness and attachment to them. There are also environmental consequences with changing and rezoning land. Land in the high flood-risk areas that are incrementally transformed into wetlands could cause damage on native populations, as it could easily become grounds for invasive species. Our technology has not improved sufficiently to change with the environment and work with it. Our water harvesting and water treatment, cooling, and wildlife need different methods that involve less invasive treatment that are found today.

RISD Architecture

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Providence, RI