

# Kingston's Waterfront on the Rise

Climate-adaptive Design Studio

Rondout-East Strand

2018





**Cover Image:**  
*Actipeligo, 2017*  
Yifu Kang  
Xuru Yuan

## Acknowledgments

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We gratefully acknowledge the expertise and assistance given to the CaD studio by staff at a variety of Hudson Valley organizations including Scenic Hudson, NYS Department of State, NYS Department of Environmental Conservation, the Hudson River National Estuarine Research Reserve, Kingston Land Trust, Cornell Cooperative Extension and the Hudson River Maritime Museum.

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Sincerely,

### The CaD team:

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Section 1

# Getting to Know You

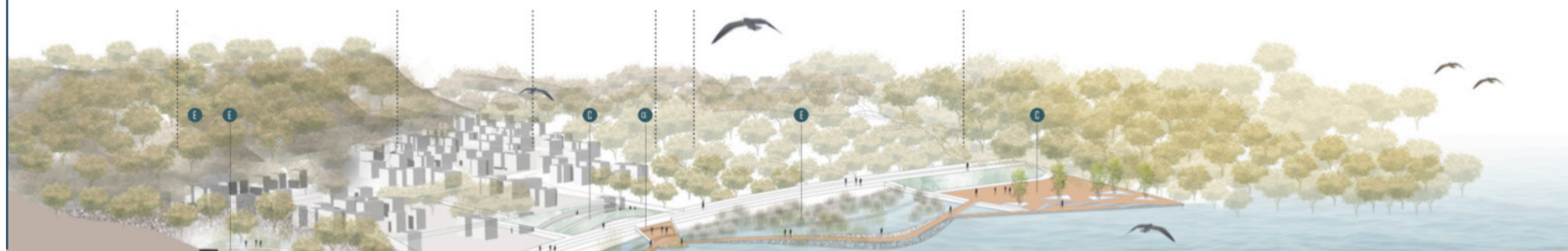
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Building Bonds, 2018  
Lijin Liu  
Shan Ling



## Who We Are

### Climate-adaptive Design (CaD)

*Inspiring change for waterfront communities*

The Climate-adaptive Design (CaD) studio is a semester-long course created by Cornell University Associate Professor Joshua F. Cerra that links landscape architecture and engineering students with Hudson riverfront communities to explore design alternatives for more climate resilient and connected waterfront areas. Community stakeholders are engaged throughout the studio to help inform the design process and support more usable results for the partner municipality.

The CaD studio is an education and research effort made possible by a dynamic partnership between the Department of Landscape Architecture, the NYS DEC Hudson River Estuary Program, the NYS Water Resources Institute and host communities in the Hudson Valley.

### CaD wants to help your community...

- Start the conversation on what change could look like in your waterfront
- Feel inspired and knowledgeable about adapting to climate change, especially by using natural and nature-based solutions
- Apply CaD concepts and principles in planning and decision making
- Access new funding and resources
- Communicate with regulatory agencies
- Increase public awareness and support for climate resilient projects

A vision of the Rondout waterfront in the year 2080

Tuning Up, 2018  
Xining Wan  
Yixuan Li

## What We Learned

- Kingston is a leader in climate resilience
- The Rondout waterfront is confronted by an increased risk of projected flooding from sea-level rise, surge and storm water runoff
- Flooding impacts both human-built and natural systems. For example, the Rondout Creek tidal wetland system, currently 111 acres, is projected to suffer one of the largest potential marsh losses in the Hudson River
- Kingston has an important opportunity to apply forward-thinking, climate-adaptive design approaches to existing and future waterfront projects

## What's Next

- Appoint a coordinator or committee to advance CaD concepts
- Host a public CaD educational event
- Identify design elements for further study
- Secure funding to advance CaD ideas into implementable designs
- Apply for state funding to implement CaD-inspired projects



# The Climate-adaptive Design Program

## Our Vision

We are building a culture of adaptation in the Hudson Valley as a model for inspiring locally-based, climate-adaptive approaches to growth and conservation that catalyze community and ecological capacity to thrive amidst a changing future.

## Our Mission

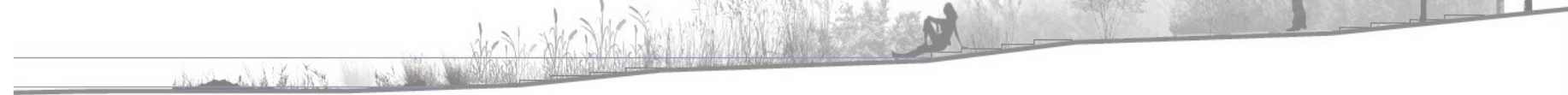
The Climate-adaptive Design studio works with Hudson waterfront municipalities to catalyze action on climate change. An inclusive and constructive design process investigates innovative and nature-based strategies that envision how climate adaptation and resiliency can be incorporated into municipal waterfront futures. Diverse partnerships generate community, research and education benefits as a model for climate-adaptive innovation in the Hudson River Estuary and beyond.

## We are an academic studio that:

- Connects design students with Hudson River communities to envision their waterfront's potential under rapid climate change
- Embraces change, particularly working with nature to adapt to climate change
- Generates design ideas that can be advanced after the studio ends
- Builds capacity for action by enhancing relationships in a community process that invites a diversity of stakeholders
- Explores larger-scale concerns of access, diversity, climate justice and other issues
- Looks anew at a site to develop a range of possibilities while considering challenges and opportunities

## We are not consultants who:

- Focus on an individual's private property
- Provide detailed site-level design
- Provide prescriptive solutions
- Make decisions on the community's future
- Arbitrate or broker community issues



Ponckhockie Generator, 2018  
Andrew Berger  
Carsten Schmidt

# Design Principles



## Design A Destination

Maximize the value of what a waterfront can be



## Design for Flooding

Working with water may be better than working against it



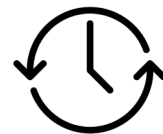
## Design with Community

Waterfronts should be universally accessible and decidedly memorable



## Design with Nature

A healthy Hudson is good for us and the greater ecology



## Design for Change

Build value into waterfronts as they change over time

# The Climate-adaptive Design Studio Process

## 1. Site and Community Engagement

The design process begins with a site analysis to better understand the place that we are working in and meetings with community stakeholders to understand their vision for a future waterfront. This analysis allows us to identify current and future challenges and opportunities.

## 2. Initial Design Concepts Workshop

We then meet with stakeholders and community members during an on-site stakeholder workshop to share our initial ideas and design concepts for additional feedback and insight.

## 3. Design Development

Back in the campus studio, we refine the design concepts based on additional technical information and the feedback gathered during our community and stakeholder meetings, as well as from practitioner and faculty critique. Ultimately, we seek to incorporate the perspectives of many into a diverse cross section of design ideas ranging from the practical to the visionary.

## 4. Open House Dialogues

At the end of the semester we share our final design work with the community to catalyze further discussion about the value of vibrant and resilient waterfront communities.



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# CaD in Kingston

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Actipeligo, 2017  
Yifu Kang  
Xuru Yuan

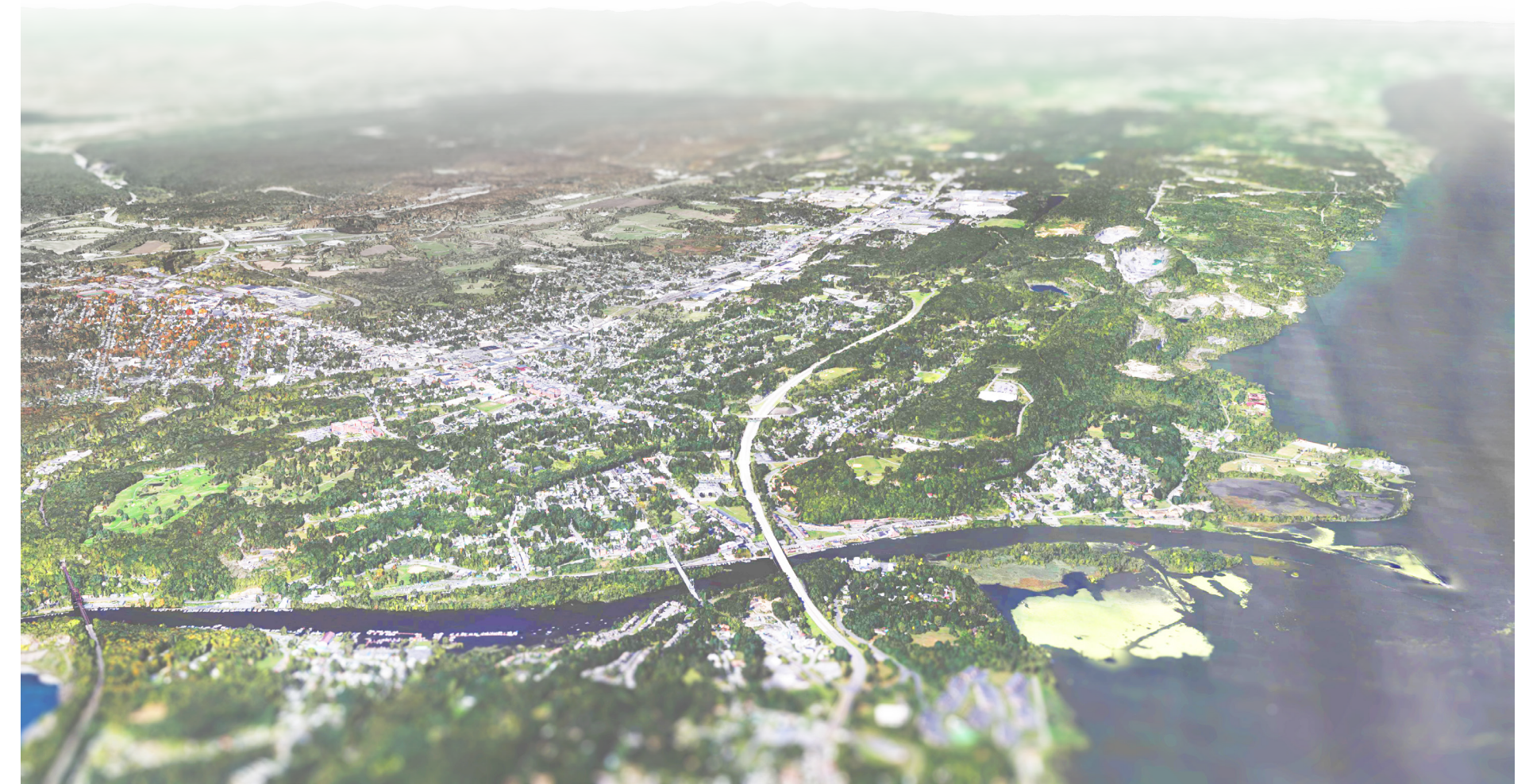


## The City of Kingston

*A Leader in Urban Sustainability and Resilience*

Kingston is a small city of approximately 23,000 people, situated in the mid-Hudson Valley with the Catskill Mountains to the west. The Kingston waterfront is situated at the confluence of the Hudson River and Rondout Creek, a major tributary influenced by the Hudson's tides. While the waterfront brings many assets to the community, hazards related to flooding are a concern.

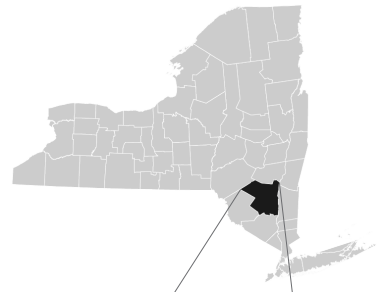
The City of Kingston is one of a handful of municipalities that has achieved silver level certification in the New York State Climate Smart Communities program. The City has been making strides toward a more vibrant and resilient waterfront by participating in the NYS Department of State Local Waterfront Revitalization Program and Waterfront Flooding Task Force as they plan for the future.



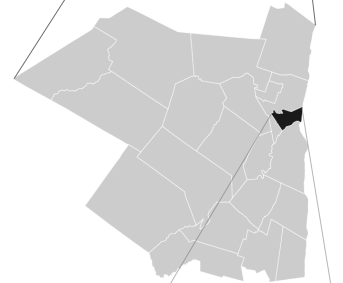
Google Earth, 2019

## Project Study Area

Ulster County, New York State



Kingston is on the west side of the Hudson River in northern Ulster County



East Strand study area is located on the Rondout Creek in the City of Kingston



The CaD studio focused on three different areas of the Kingston waterfront from 2016-2018. This booklet focuses on the area studied during the 2018 CaD studio, which included the section of Rondout Creek waterfront running alongside East Strand Street from the City of Kingston's

wastewater treatment plant to the Central Hudson brownfield redevelopment site near the mouth of the creek, and included the Ponckhockie neighborhood. Student generated graphic images from all three semesters of the CaD studio are included in this publication.

Initial meetings with stakeholders helped student teams identify key themes, challenges and opportunities for the study area:

### Key Themes

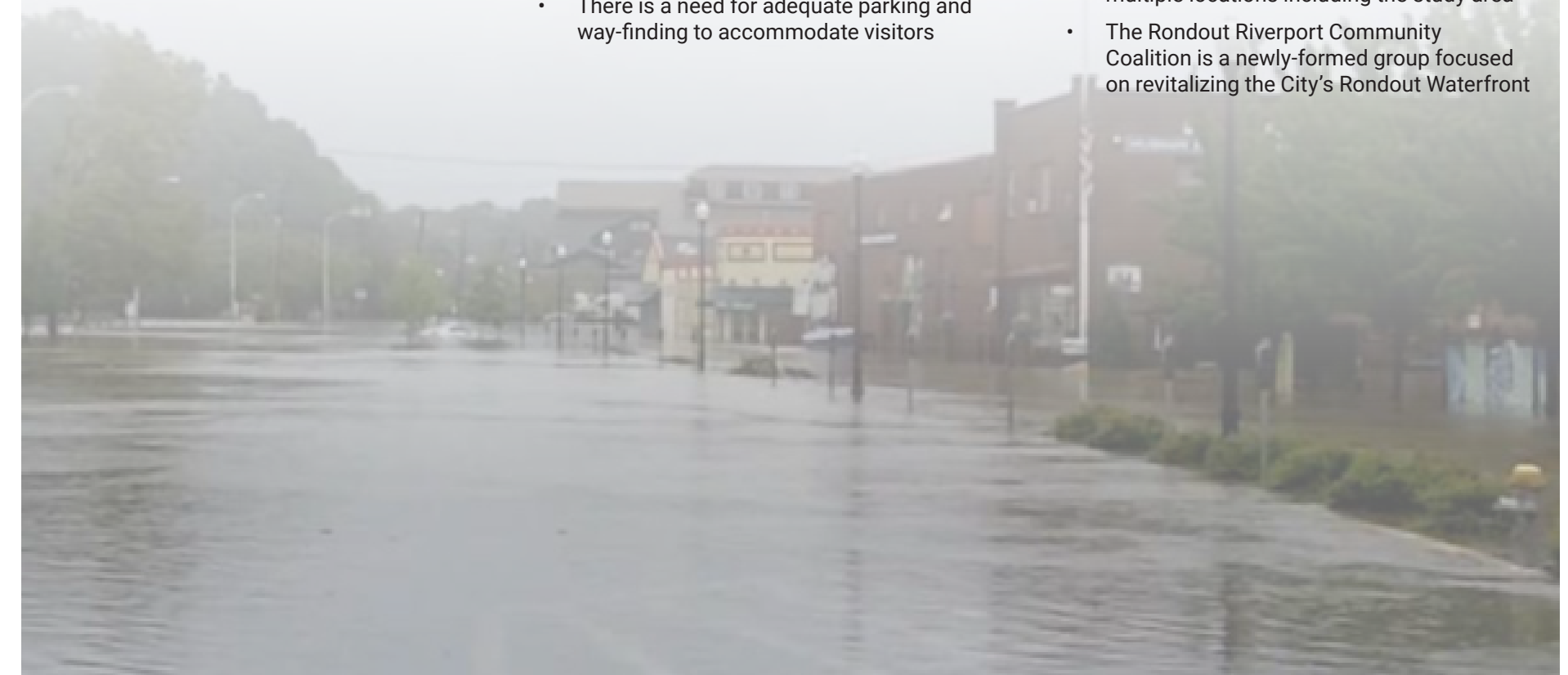
- Enhancing waterfront access and circulation, including elevating key roads
- Encouraging economic development and historic preservation
- Attracting tourists while enhancing amenities for residents
- Improving connections between the study area and the rest of the city

### Challenges

- There is no public access to the waterfront in this section of the Rondout
- Much of the study area is already at flood risk
- Key municipal assets, including the wastewater treatment plant and East Strand Street, are vulnerable to flooding
- New York State official sea-level rise projections indicate that some areas will be inundated in the future
- There is a need for adequate parking and way-finding to accommodate visitors

### Opportunities

- The Central Hudson brownfield site has potential as a waterfront park
- Funding is secured to design a waterfront promenade within the study area
- The Empire State Trail will pass through the study area, providing opportunities to enhance pedestrian access
- The Kingston Land Trust is working with the city to create the Kingston Greenline, a network of parks and complete streets in multiple locations including the study area
- The Rondout Riverport Community Coalition is a newly-formed group focused on revitalizing the City's Rondout Waterfront

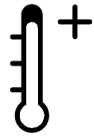


## Climate Risk in Kingston

Our communities face three major climate risks:



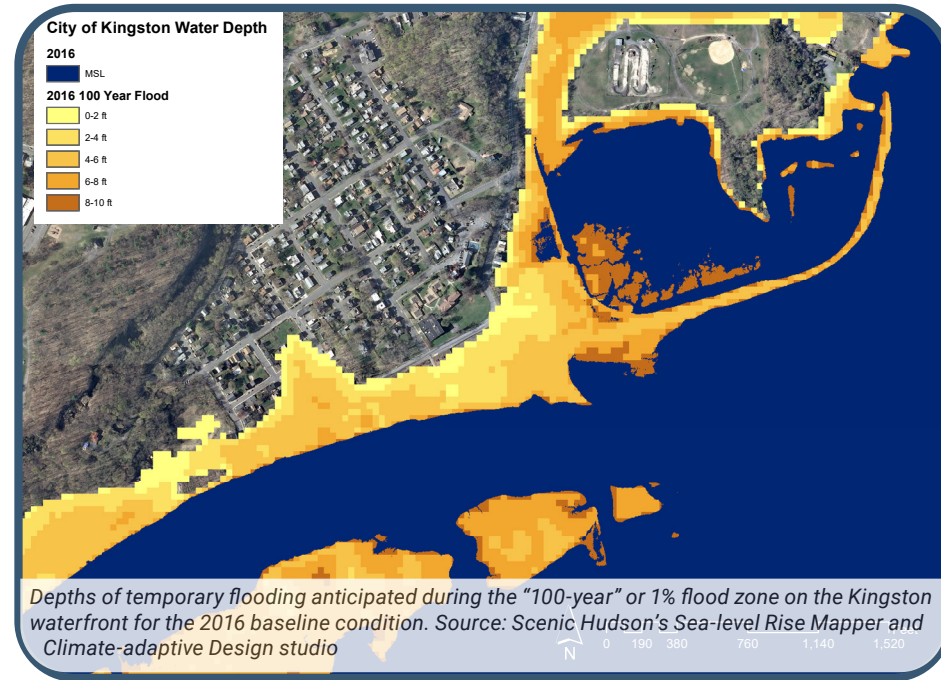
Flooding due to extreme precipitation, stormwater runoff, storm surge and sea-level rise



Temperature extremes impacting seasonal conditions and causing dangerous heat waves

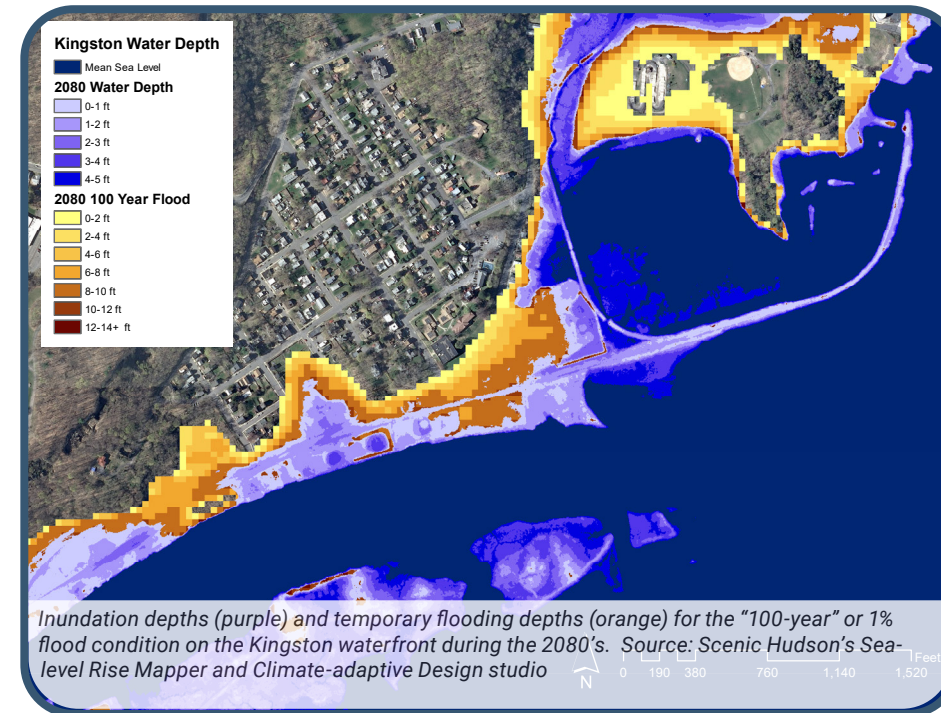


Disrupted precipitation patterns leading to greater likelihood of short term drought



## Flooding and Sea-level Rise

- The 1% or "100-year" floodplain is defined as a waterfront area that has a 1% chance of flooding in any given year, based on historical data
- Added up over time, there is a 25% chance of such a flood happening over the span of a 30-year mortgage, making floodplain properties vulnerable to damage
- These floods are likely to occur more frequently and impact more of the waterfront by the 2050's due to projected sea-level rise and intense precipitation
- NYS has adopted official projections for sea-level rise that are up to 72" higher than current levels in the mid-Hudson Valley

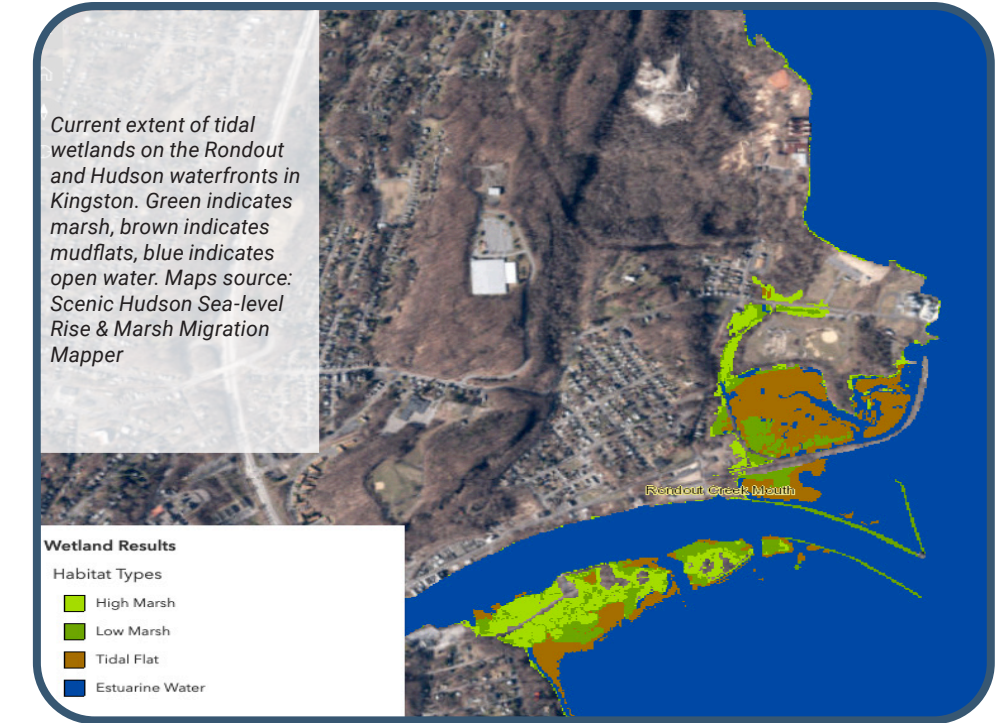


## Protecting Marsh Migration Pathways

The Hudson estuary includes over 7,000 acres of tidal wetlands, which are important for healthy natural and human communities. Tidal wetlands protect shorelines, trap greenhouse gases that contribute to climate change, and help keep water clean. Freshwater, tidal wetlands - like those on the shoreline in Kingston - are globally rare and very valuable to young fish and other animals.

Sea-level rise is influencing where tidal wetlands can flourish, with some mudflats and marshes likely to become submerged by rising waters. If sediment accumulation, or accretion, keeps pace with rising waters, wetlands may persist. Marsh plants may be able to migrate inland to maintain optimal conditions as sea-level rises. In many areas, marsh migration may be at odds with human uses, requiring thoughtful decisions about where communities choose to site and maintain waterfront development.

The Rondout Creek tidal wetland system, currently 111 acres, is projected to suffer one of the largest potential marsh losses from sea-level rise in the Hudson River. Kingston can explore options to protect marsh migration pathways and select areas to limit waterfront development to help maintain these vital habitats.



The Ramshorn Livingston Marsh in Catskill, New York is an example of globally rare freshwater tidal wetlands on the Hudson River



Section 1

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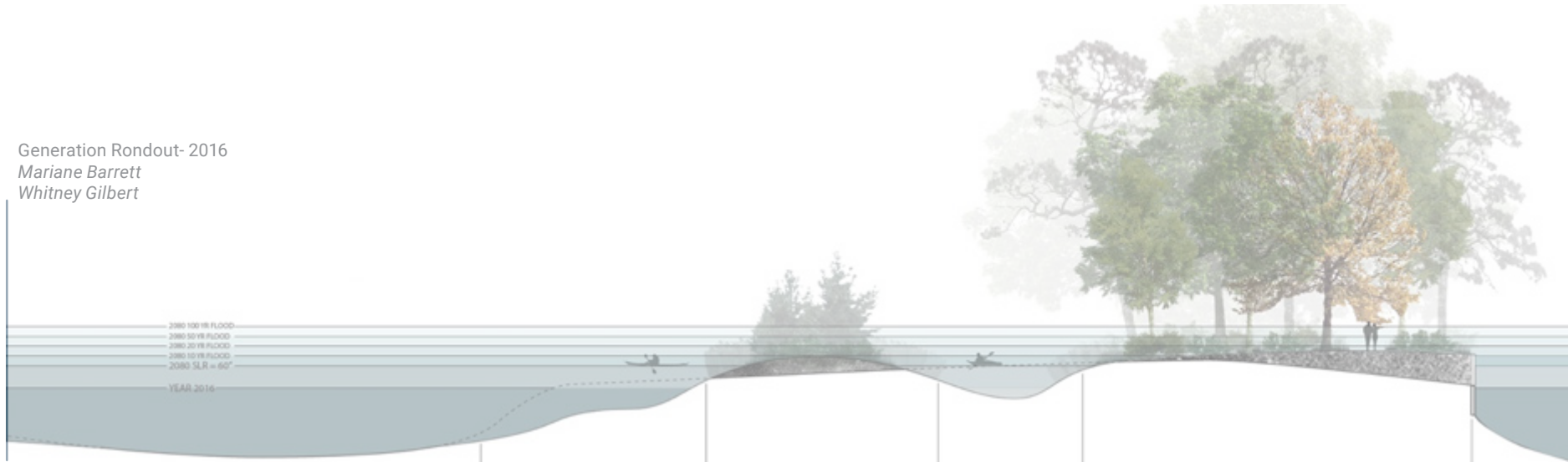
Section 3

# Design Strategies

Section 4

Section 5

Generation Rondout- 2016  
Mariane Barrett  
Whitney Gilbert



## Priority Strategies for Kingston

Eight student teams created comprehensive designs for the study area, which can be viewed in detail at <https://trophic.design/cad/>. Common themes across the designs are described on the following pages and are intended to provide a brief introductions to options that Kingston can explore. The featured design strategies address the following CaD principles:



### Design with Nature

#### Green Infrastructure

Limiting runoff and infiltrating water using natural features rather than pipes.

#### Sustainable Shorelines

Using nature-based approaches to limit shoreline erosion while enhancing ecosystems.

#### Marsh Migration

Protecting inland migration pathways for freshwater tidal marshes.



### Design with Community

#### Resilient Waterfront Parks

Enhancing waterfront access and assets for citizens.

#### Multi-modal Mobility

Improving circulation by expanding options for getting around town.



### Design for Flooding

#### Strategic Relocation and Adaptive Reuse

Reducing water-based hazards and repetitive damage.

## Before You Turn the Page...

Each strategy comes along with **Actions to Take** -some that you can do today, and others that will take more time and planning to implement.

Each strategy also features student work to visualize possible ways they could be used in Kingston.

Five icons flag important facts about each strategy. Descriptions about these types of information are detailed here:



This section describes how the strategy can create benefits both for people and the ecosystems in Kingston.



Click here or go to page 31 to find sources of funding.



Important considerations for each strategy are indicated by this icon.



These numbers correspond to Climate Smart Community Actions that can earn points for your city. Click on the icon or visit page 32-33 to learn more.



For more information about a strategy, explore the resources in this section, located on page 34.



*If you are viewing the LookBook on the computer, click the icon to see more information!*



# Green Infrastructure

Green infrastructure practices maintain or restore the pre-development flow patterns of stormwater at a site by allowing runoff to infiltrate into the soil. On a regional scale, green infrastructure includes preserving and restoring natural landscape features, along with reducing impervious surface cover. At the site scale, green infrastructure includes practices that capture stormwater runoff such as vegetated swales, infiltration planters, green roofs, pervious pavement and rain barrels. These practices allow water to soak into the soil, to be used by plants, or to be reused.

Kingston can consider adding green infrastructure components to new development, as well as retrofitting the existing cityscape with these features. Student design teams recommended the installation of vegetated swales, infiltration planters or rain gardens in the Ponckhockie neighborhood to intercept runoff and help control stormwater flooding.

## Actions To Take

- Become familiar with green infrastructure techniques by reviewing chapter 5 of the *NYS Stormwater Management Design Manual*
- Visit green infrastructure in the Hudson Valley using the *NYS DEC's Green Infrastructure Examples* website to identify locations
- Complete an analysis to prioritize locations that would benefit the most from green infrastructure
- Require new development to conserve existing natural features and use green infrastructure before traditional pipe-and-gutter solutions
- Add vegetated swales, rain gardens and/or permeable pavement to municipal parking lots and properties



Green infrastructure can improve water and air quality, store carbon, enhance habitat diversity, and cool urban areas during hot times of the year



DEC HREP || DEC CSC || DEC WQIP || EFC GIGP



Conserving existing natural features like trees is typically an effective and affordable first step  
Green infrastructure offers many aesthetic and ecological co-benefits compared to traditional gray infrastructure

**CSC**

6.8 Green Parking Lots || 6.9 Complete Streets || 7.8 Shade Structures in Public Places || 7.16 Green Infrastructure for Stormwater Management

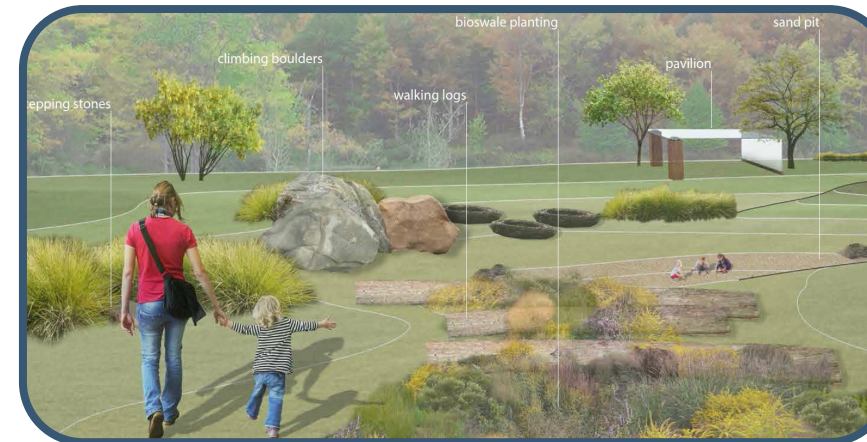


NYSDEC's Stormwater in the Hudson River Valley  
NYS's Stormwater Management Design Manual  
City of Newburgh's Green Infrastructure Guide  
City of Newburgh's Green Infrastructure Feasibility Report



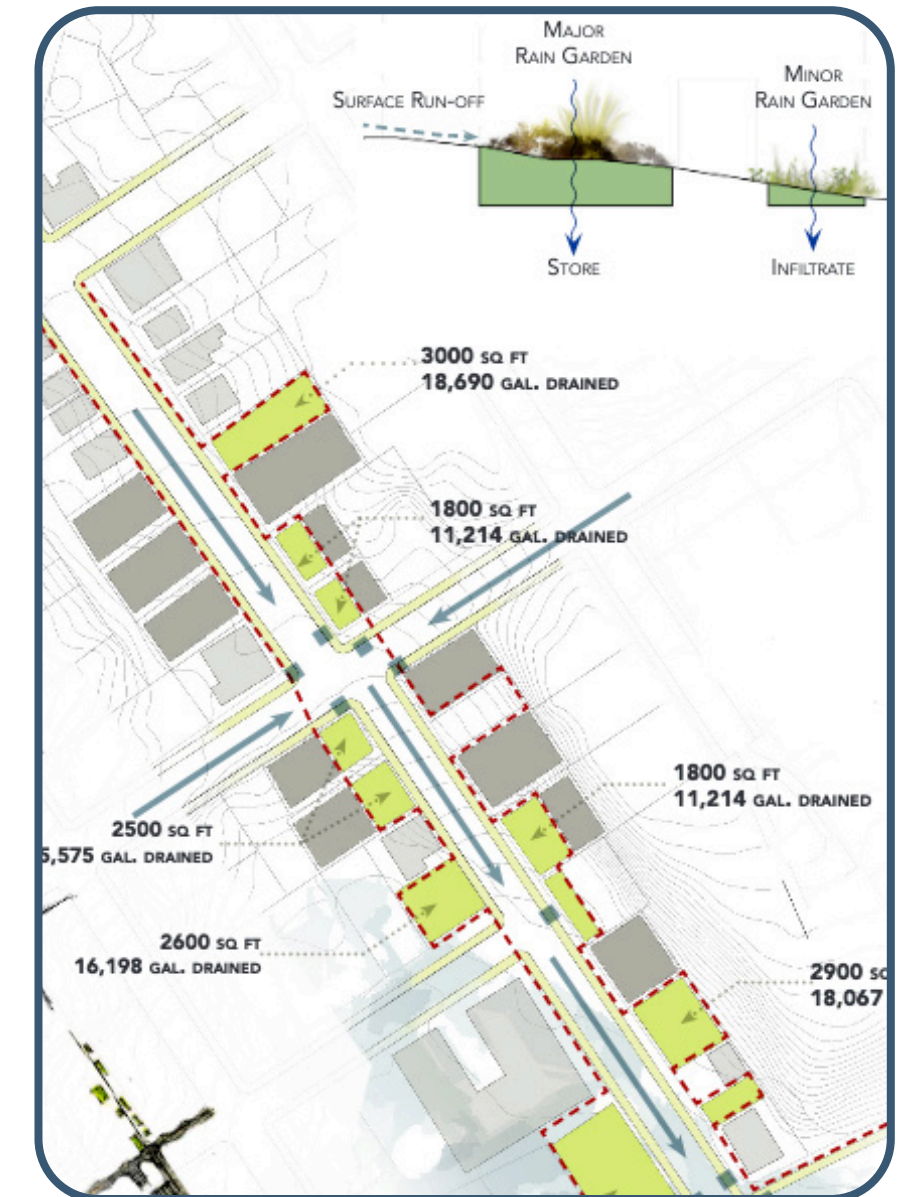
**Beyond stormwater management, urban trees and other types of green infrastructure contribute to the vitality and aesthetics of a neighborhood**

*Kingston Riverway, 2016*  
Mark J. Hirschbeck  
Iliia Savin



**A vegetated swale, a shallow depression that is designed to infiltrate stormwater, is depicted running through a city park**

*Revelatory Kingston, 2016*  
Rachel Liu  
Samuel Packer  
Susan Rhodes



**A stormwater planning concept illustrating possible locations of rain gardens that could be installed over time**

*Revealing Kingston's Waterfront, 2018*  
Sarah Boutata  
Kayla Mosebrook  
Susan Rhodes

# Sustainable Shorelines

Nature-based shoreline techniques provide erosion control using methods that incorporate living material and limit disturbance of existing habitat. These design techniques often provide ecological benefits, recreational assets, and opportunities for water-dependent businesses. In wide, gently-sloped areas, sustainable shorelines can provide pathways for wetland migration as sea levels rise.

Much of the shoreline of Rondout Creek in the study area has been hardened with bulkheads. Previously hardened shorelines that are protecting dense development or key infrastructure may not be suitable for nature-based shoreline techniques, but can still be enhanced with ecological features.

## Actions To Take

- Read *Managing Shore Zones for Ecological Benefits* on the Hudson River Sustainable Shoreline website
- Explore the benefits of living shorelines by visiting the NYS Department of State's *Living Shorelines* page on the Geographic Information Gateway
- Check out shoreline habitats with the *Hudson Valley Natural Resource Mapper*
- Consider resilience, access and ecology in your shoreline planning by using the Waterfront Alliance's *Waterfront Edge Design Guidelines (WEDG)*
- Track changes in your shoreline using the *Rapid Assessment Protocol Manual and Field Sheets* found on the Sustainable Shorelines website
- Consider the need for ongoing monitoring and maintenance



Sustainable shorelines can provide cost-effective erosion control while enhancing aesthetics, ecological function and habitat value of a waterfront area



DEC HREP || DOS LWRP || OPRHP || Hudson Valley Greenway



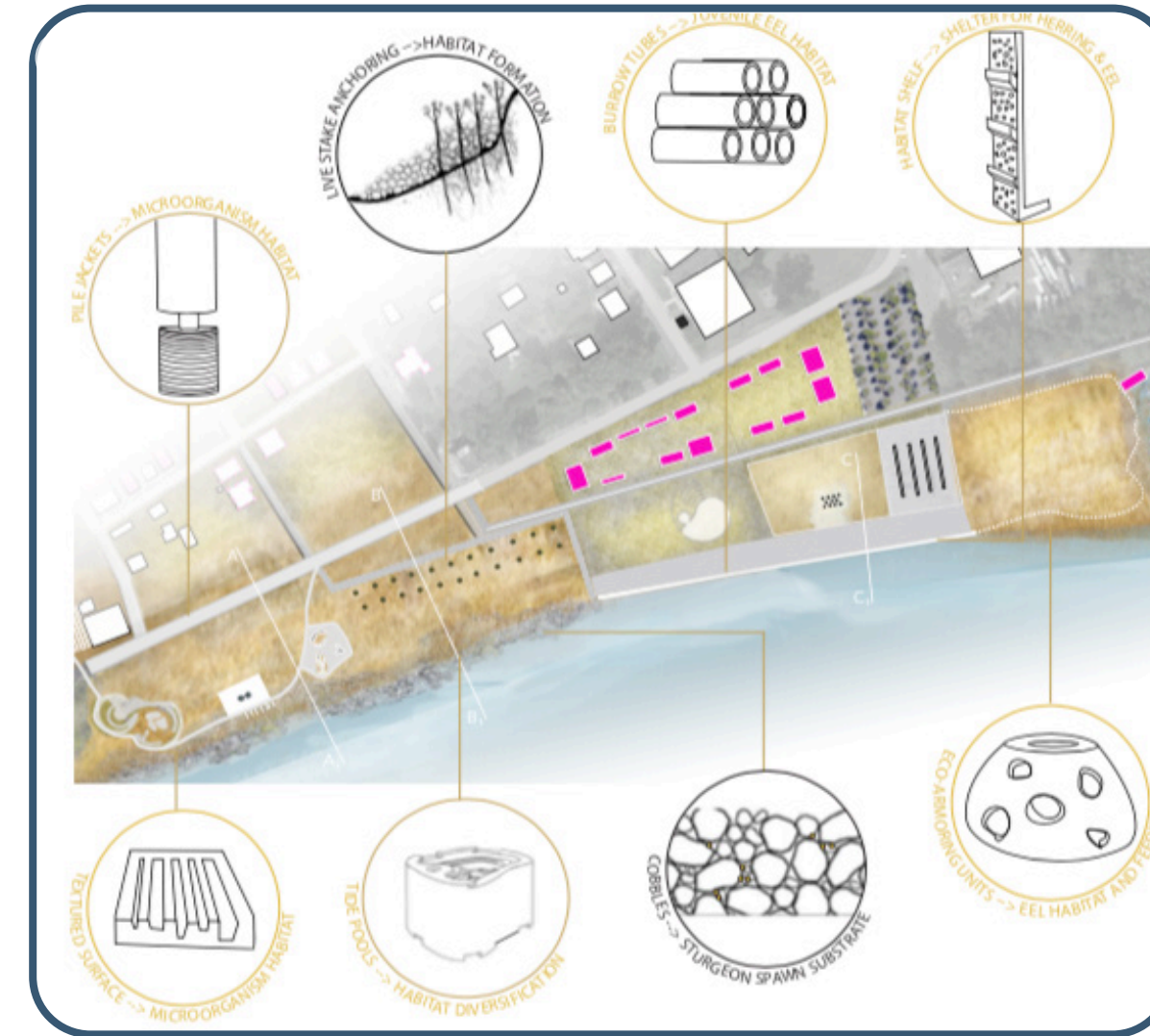
Designing a sustainable shoreline is a methodical and thoughtful practice that considers the needs of people, wildlife and the natural systems upon which we all depend



7.11 Adopt A Floodplain Management Protection Ordinance || 7.12 Conserve, Re-vegetate & Reconnect Floodplains || 7.13 Conserve Natural Areas || 7.18 Use Nature-Based Shoreline Protection



Hudson River Sustainable Shorelines  
NYS DOS Geographic Information Gateway Living Shorelines  
Hudson Valley Natural Resource Mapper  
Waterfront Alliance's WEDG  
Rapid Assessment Protocol Manual and Field Sheets

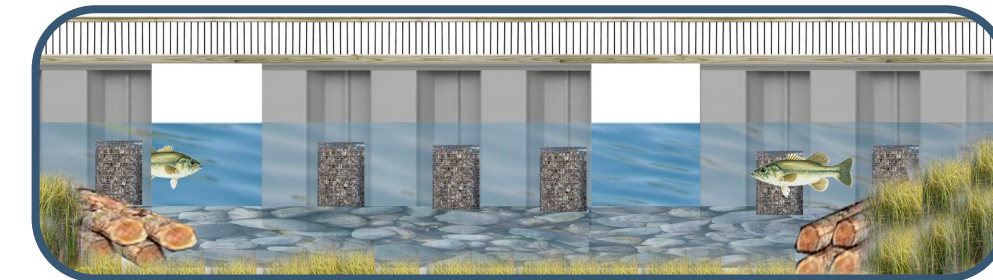


Ponckhockie's Working Waterfront, 2018  
Eve Anderson  
Liz Fabis

Since much of the Rondout Creek shoreline is hardened in the study area, students investigated techniques for adding habitat complexity to bulkheads and sheet pilings. Artificial habitat enhancements include adding textured surfaces to bulkheads and pilings, and adding structures such as shelves and burrow tubes.

Students also investigated ecological enhancement approaches, such as planting live stakes of trees and shrubs in riprap to prevent erosion and enhance habitat.

Ideas for increasing habitat for aquatic organisms include adding cobble surfaces to pilings to provide refuge for fish.



The Edge Effect, 2018  
Jacob Dilson  
Sahar Farmand

# Marsh Migration

Freshwater tidal wetlands are globally rare and serve as our “rain forests” in terms of the habitat diversity and quality they offer our region. They can help to buffer our waterfronts from wave energy, provide clean air and sequester carbon. Climate change threatens to drown out much of our marshes if we do not allow pathways for them to migrate inland with sea-level rise.

Freshwater tidal marshes at the mouth of the Rondout Creek are at significant risk from sea-level rise. Opportunities exist to support the inland migration of marshes in areas around Kingston Point and the East Strand reach of the Rondout. Student teams envisioned possible migration pathways in their long-term design strategies.

## Actions To Take

- ❑ Visit *Protecting the Pathways* to learn more about the importance of tidal wetlands and how to identify wetland pathways
- ❑ Determine if wetland pathways are protected, developed or developable
- ❑ Work with regional land trusts to protect wetland pathways through acquisition and easements
- ❑ Create and adopt a zoning overlay to protect the pathways from development
- ❑ Increase low-impact recreational opportunities for people to enjoy tidal wetlands, like kayak tours and designated viewpoints with interpretive elements that communicate the importance of marshes
- ❑ Manage and restore tidal wetlands by seeking opportunities to remove hard barriers, restore side channels and foster sustainable shorelines



The Rondout Creek tidal wetland system, currently 111 acres, is projected to suffer one of the largest potential marsh losses in the Hudson Valley from sea-level rise



DEC HREP || DEC CSC || DOS LWRP || Hudson River Greenway



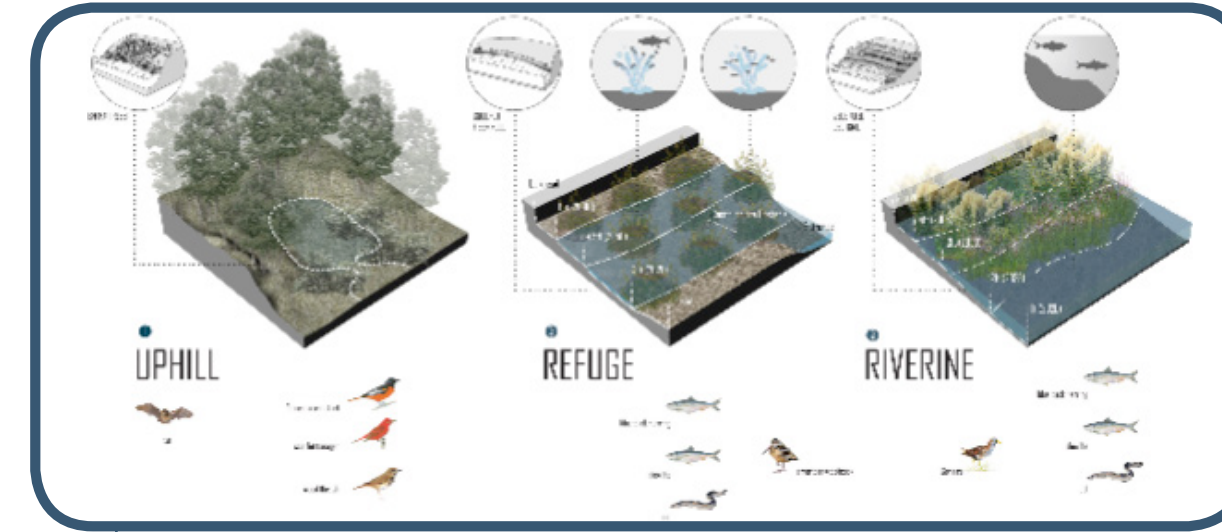
Development and hard shorelines act as barriers to marsh migration pathways, Transfer of development rights (TDR) and buyouts help to strategically relocate existing and future development out of pathways



6.2 Incorporate Smart Growth Principles || 6.19 Preserve Natural Areas With Zoning || 7.12 Conserve, Revegetate & Reconnect Floodplains || 7.13 Conserve Natural Areas || 7.14 Strategic Relocation Of Non-Water Dependent Uses || 7.17 Conserve Wetlands & Forests || 7.18 Use Nature-Based Shoreline Protection



Protecting the Pathways, Scenic Hudson  
City of Kingston’s Open Space Plan and Natural Resource Inventory  
City of Kingston’s Tidal Waterfront Task Force



*Building Bonds, 2018*  
Lijin Liu  
Shan Ling

**Accommodating marsh migration pathways is often compatible with recreational uses of the shoreline**

*Tracing Time, 2017*  
Tess Russwick  
Daisy Hoyt



# Resilient Waterfront Parks

Waterfront parks are an excellent choice for flood-prone areas - providing memorable destinations, harboring recreational opportunities, shoreline access and habitat, while reducing vulnerability and risk. Waterfront parks should be designed with input from end-users to meet the needs of the community and be universally accessible to people of diverse abilities, needs and resources. The park landscape should accommodate floodwaters and be graded to quickly drain after storm events.

The Kingston waterfront includes Block Park, T.R. Gallo Park and Kingston Point Park. The Central Hudson brownfield remediation site currently provides fishing access and has potential as an additional pocket park amenity connecting the Ponckhockie neighborhood with the Rondout promenade project currently underway.

## Actions To Take

- Consult resources such as the *Guidelines for NYC Parks* to analyze the resilience and accessibility of current waterfront parks.
- When establishing new parks and promenades in future flood-prone areas, identify flood-adapted uses and features that can recover quickly from storm impacts
- The design of a floodable park should include recommendation for flood-resilient plants and trees.
- Review policies and procedures of the parks department and revise as needed to require more climate-adaptive and sustainable practices
- Evaluate the feasibility of installation of green infrastructure to capture stormwater when designing or evaluating waterfront parks



Naturalized land cover helps to keep urban areas cooler and allows stormwater to infiltrate while providing habitat for wildlife and health benefits for people.



DEC HREP || DEC CSC || EFC GIGP || DOS LWRP || OPRHP || Hudson River Valley Greenway



The term “green gentrification” describes inequities caused by environmental improvement projects. Greening of urban areas may increase local property values, which displaces lower-income residents. Municipalities can protect residents by enacting rent control laws, increasing affordable housing availability and working with a Community Land Trust to promote home ownership.



7.12 Conserve, Re-vegetate & Reconnect Floodplains || 7.14 Strategic Relocation Of Non-Water Dependent Uses || 7.16 Green Infrastructure for Stormwater Management || 7.18 Nature-Based Shoreline Protection



Design and Planning for Flood Resiliency: Guidelines for NYC Parks  
High Performing Landscape Guidelines: 21st Century Parks for NYC  
Naturally Resilient Communities



Actipeligo, 2017  
Yifu Kang  
Xuru Yuan

**A floodable playground and floating dock.**



Blue: Kingston's New Green, 2017  
Parth Divekar  
Sara Vandenbroek



Waterfront Park & Promenade - Hunter's Point South, Long Island City



Blue: Kingston's New Green, 2017  
Parth Divekar  
Sara Vandenbroek

# Multi-modal Mobility

Providing access for pedestrians, bicycles, wheelchairs, motorized vehicles and public transportation enhances mobility and promotes site accessibility. Adequate wayfinding signage improves waterfront experiences for residents and visitors. Alternative access routes for flood-prone roadways are an important aspect of a multi-faceted transportation system.

The Kingston East Strand area is a great place to pursue multi-modal transportation options for providing waterfront access to walkers, bikers and boaters. Stakeholders identified the need to connect the East Strand and Ponckhockie neighborhoods to the rest of the city via pedestrian and motorized access. The trolley line is a popular feature that appeared as an integral part of several alternative design concepts.

## Actions To Take

- Continue to develop the Kingston Greenline and Complete Streets initiatives
- Connect with county, regional and state initiatives that support local efforts
- Consider flood risk, potential inundation, and long-term viability as part of a feasibility study for waterfront trails, roadways and rail lines
- To improve resilience of roadways, consider participating in the *Culvert Prioritization Project* to help assess culvert size and orientation to maximize flood resilience and aquatic passage
- Consider the potential to incorporate water access for pedestrians and boaters when designing waterfront improvements
- Incorporate way-finding and informational signage into roadway and trail improvements to help visitors stay oriented, informed and engaged



In addition to improving circulation and mobility for many types of users, a complete streets approach incorporates natural features such as shade trees for cooling and green infrastructure for stormwater management.



DEC CSC || EFC GIGP|| DOT STIP



Examine sea-level rise projection maps to identify roadways that may become inundated or more frequently flooded in the future and consider options for alternative access



6.9 Complete Streets Policy || 6.10 Facilitate Bicycling & Walking || 6.12 Increase Public & Alternative Transport Modes || 6.13 Implement Safe Routes To School Program || 6.14 Implement Traffic Calming Measures



NYS DOT – Complete Streets  
NYS Water Resources Institute Culvert Prioritization Project  
Tompkin’s County Way-finding & Interpretive Signage Plan

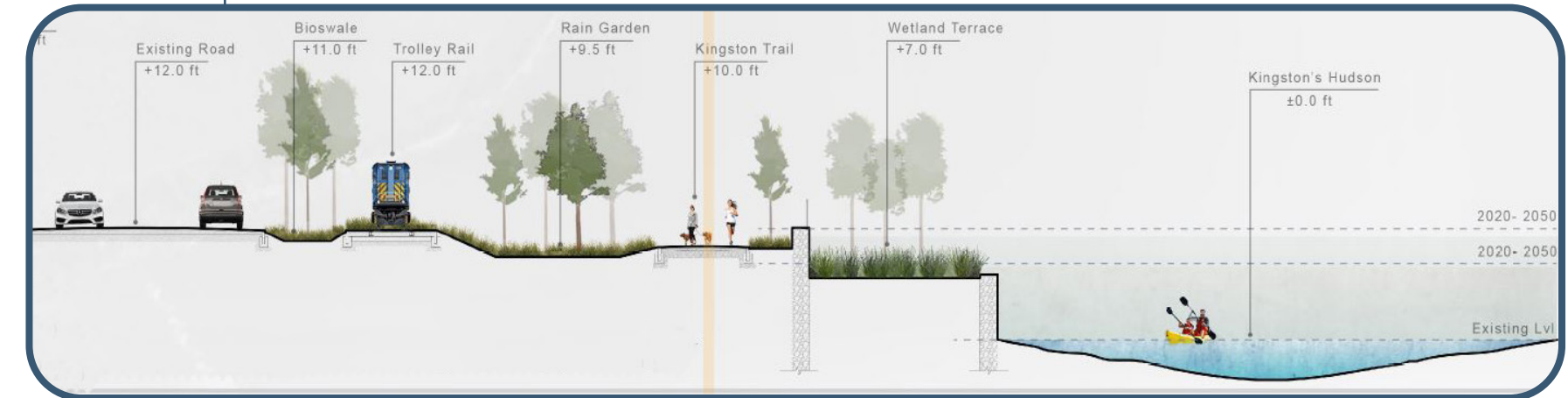


*Tuning Up, 2018*  
Xining Wan  
Yixuan Li

**This graphic illustrates multi-modal transport; including pedestrian, bicycle, vehicular, trolley and boat access to the Kingston waterfront**

**A vision of a future shoreline, which incorporates water access, walkability and natural features into the waterfront transportation system. In this project, students proposed retrofitting nature-based solutions into existing infrastructure.**

*Blue: Kingston's New Green, 2017*  
Parth Divekar  
Sara Vandenbroek



# Strategic Relocation & Adaptive Reuse

Key assets at high risk for damage or permanent loss under current and projected flooding and sea-level rise should be relocated out of the flood zone. Alternatively, some structures may be repurposed to minimize loss or adapted to reduce flooding and inundation impacts. These kinds of interventions may benefit from enhanced zoning ordinances, policy measures or incentive programs to facilitate the transition of waterfronts to more adaptive and resilient uses and features.

The City of Kingston can begin exploring options for funding strategic relocation of at-risk infrastructure and properties now to be prepared for future flooding. Options such as FEMA buy-outs and Transfer of Development Rights may provide solutions for repetitive loss properties.

## Actions To Take

- Read more about strategic relocation from the resources referenced in this guide
- Identify municipally-owned assets that are at high risk from flooding
- Identify properties that have been repetitively damaged from flooding
- Explore potential for Transfer of Development Rights (TDR) to steer development toward safe locations
- Create a plan for the relocation of municipally-owned assets, (see Ulster County Hazard Mitigation Plan) to improve funding options through FEMA
- Identify partnerships and funding opportunities to relocate municipally-owned assets and assist private property owners with relocation efforts



Transitioning residences, businesses, infrastructure and services out of the flood zone reduces risk. Returning floodplain functions provides benefits to people, wildlife and waterways.



DEC HREP || DEC CSC || DOS LWRP || FEMA || HUD CDBG



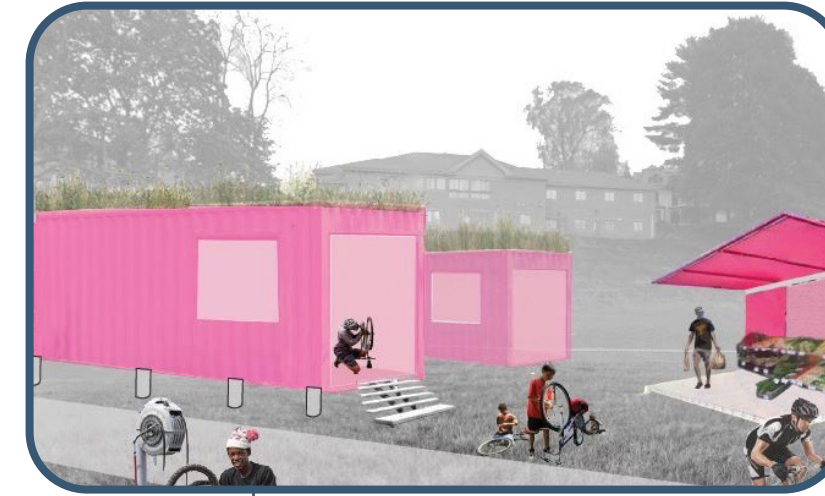
A fair and equitable approach to strategic relocation is critical to its successful implementation.



7.14 Strategic Relocation Of Non-Water Dependent Uses



Climigration Network  
NYS Governor's Office of Storm Recovery Buyout & Acquisition Programs  
NYS Department of State Transfer of Development Rights Technical Bulletin

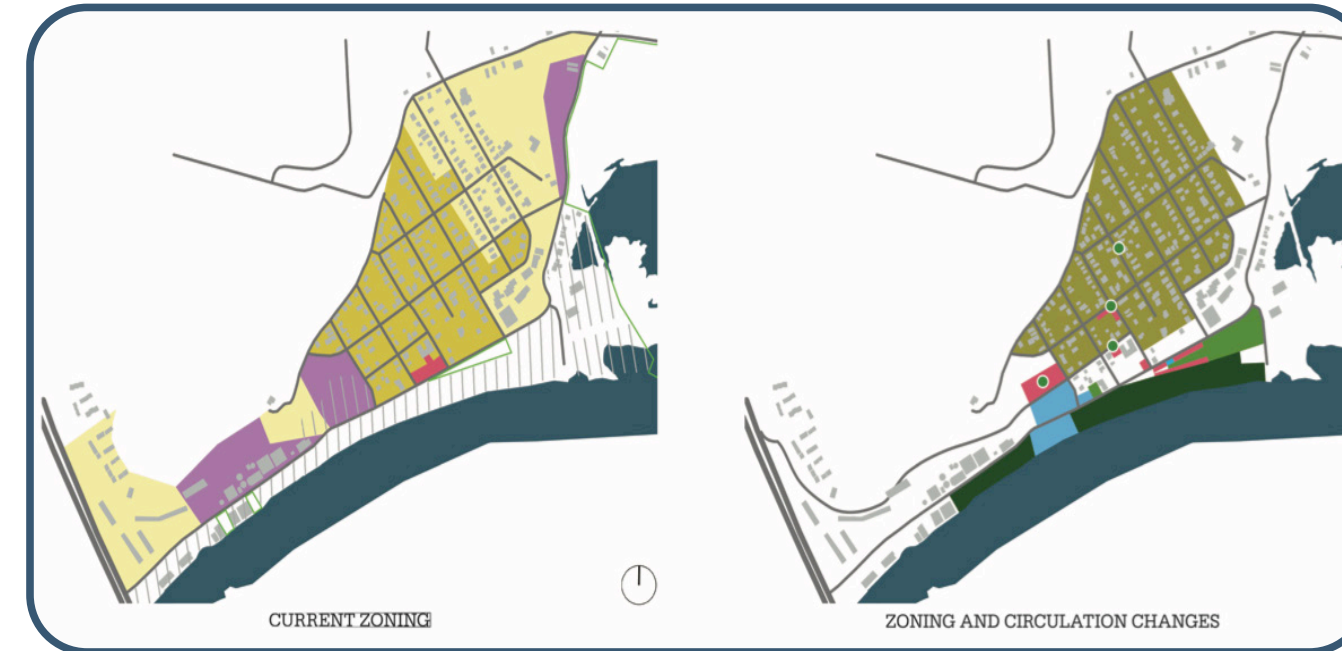


*Ponckhockie's Working Waterfront, 2018*  
Eve Anderson  
Liz Fabis

**Mobile development modules are structures that can be moved upland as flooding becomes more frequent**

**An imaginative vision of future reuse of oil tanks at Kingston Point**

*Set Into Motion, 2017*  
Thackston Crandall  
Veronica Chan



*Re-Zip, 2018*  
Houston Harris  
Joaquin Brito, Jr.

**Students analyzed existing zoning and roadway circulation and made suggestions to provide secondary road access in flood-prone areas and increase green space in flood zones**

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- Section 5

# Looking Ahead



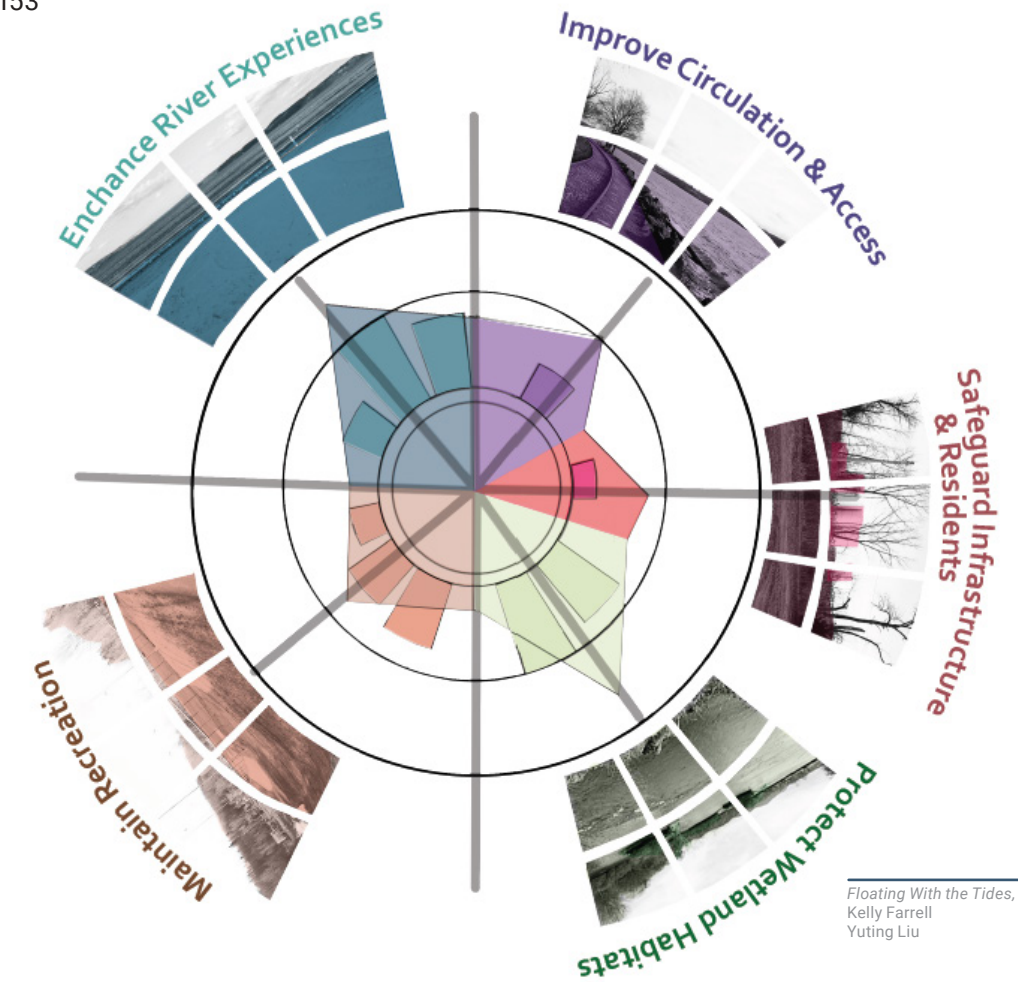
## Actions To Take

- Appoint a committee to advance CaD concepts
- Host a public event to display CaD materials and inform residents of the CaD design principles
- Seek to apply CaD design principles to current projects
- Identify CaD design ideas for further study and seek funding to advance designs toward implementation
- Seek opportunities to increase local knowledge and capacity for increasing resilience
- Consider pursuing Climate Smart Community certification or strive for a higher level of certification

## Keep in Touch!

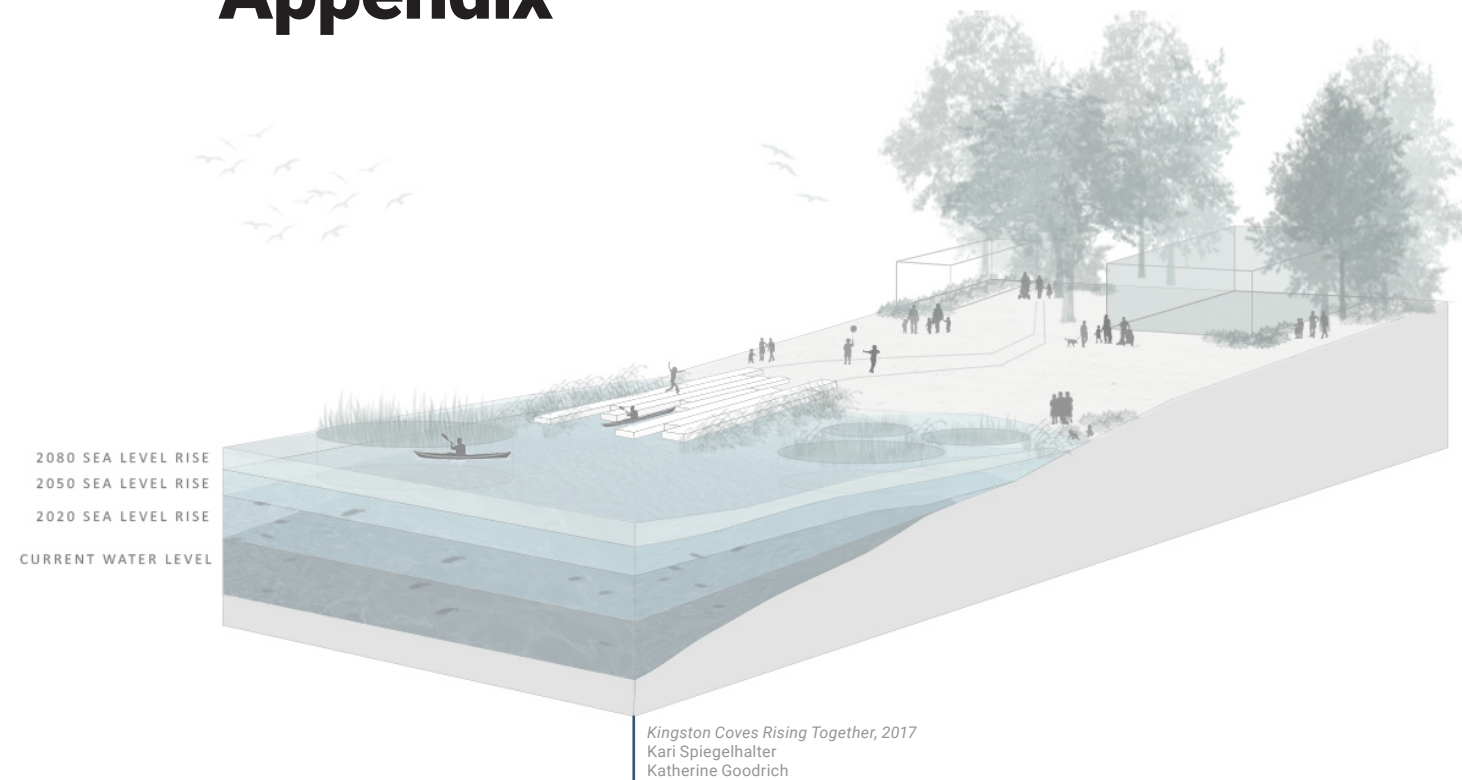
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# Appendix



## Funding Opportunities

State and federal agencies offer financial assistance to municipalities and non-profit organizations for activities building resilience to waterfront flooding, sea-level rise and other climate risks.

Agency	Assistance Program	Grant amounts, required match	Municipal Planning	Resilient Structures	Emergency Management	Collaboration and Public Outreach	Waterfront Economy	Floodplain protection
Department of Environmental Conservation (DEC)	<a href="#">Hudson River Estuary Program (HREP)</a>	\$10,500-\$50,000, 15% match	•	•			•	•
	<a href="#">Climate Smart Communities (CSC)</a>	\$10,000-\$2M, 50% match	•	•				•
	<a href="#">Water Quality Improvements Program (WQIP)</a>	25-60% match		•				•
	<a href="#">Trees for Tribes</a>	N/A						•
Environmental Facilities Corporation (EFC)	<a href="#">Wastewater Infrastructure Engineering Planning</a>	≤\$100,000, 20% match	•	•				
	<a href="#">Clean Water Revolving Loan Fund</a>	N/A	•	•				•
	<a href="#">Green Innovation Grant Program (GIGP)</a>	10-60% match						•
Federal Emergency Management Agency (FEMA)	<a href="#">Hazard Mitigation Assistance (HMA)</a>	Over \$3M, 25% match	•	•				
	<a href="#">Public Assistance</a>	N/A			•			
	<a href="#">Community Rating System (CRS)</a>	N/A			•	•		
Department of State	<a href="#">Local Waterfront Revitalization Program (LWRP)</a>	15-25% match	•	•		•		
	<a href="#">New York State Energy Research and Development Authority (NYSERDA)</a>	≤\$250,000, no match	•	•		•		
Other	<a href="#">NYS Office of Parks, Recreation and Historic Preservation (OPRHP)</a>	≤\$500,000, 25-50% match					•	•
	<a href="#">US Housing and Urban Development (HUD)</a>	\$50,000 - \$900,000, 0-5%	•	•			•	
	<a href="#">Empire State Development</a>	80% match for soft costs		•			•	
	<a href="#">Hudson River Greenway</a>	\$5,000 - \$10,000+					•	•
	Open Space Funding Options	N/A						•



## Relevant Climate Smart Community Actions

Get points and funding projects related to CaD concepts through the state’s Climate Smart Communities certification program. See related actions below and learn more at <http://climatesmart.ny.gov/>.

### Pledge Element 6: Reduce greenhouse gas emissions through use of climate-smart land-use tools

6.1	Develop and adopt a comprehensive plan with sustainability elements
6.2	Incorporate smart growth principles into land-use policies and regulations
6.3	Adopt a renewable energy ordinance
6.4	Establish green building codes
6.5	Create resource-efficient site design guidelines
6.6	Incentivize renewable energy and energy efficiency projects
6.7	Adopt land-use policies that support or incentivize farmers’ markets, community gardens and urban and rural agriculture
6.8	Adopt green parking lot standards
6.9	Adopt a complete streets policy
6.10	Implement strategies that support bicycling and walking
6.11	Install electric-vehicle infrastructure
6.12	Implement strategies that increase public transit ridership and alternative transport modes
6.13	Implement a Safe Routes to School program
6.14	Implement traffic calming measures
6.15	Adopt and enforce an anti-idling ordinance
6.16	Implement transportation technology solutions
6.17	Develop a natural resource inventory
6.18	Develop a local forestry or tree planting project or program
6.19	Preserve natural areas through zoning or other regulations

### Pledge Element 7: Plan for adaptation to unavoidable climate change

7.1	Conduct a vulnerability assessment
7.2	Develop a climate resilience vision and associated goals
7.3	Review existing community plans, policies and projects to identify climate adaptation strategies and policies or projects that may decrease vulnerability
7.4	Develop climate adaptation strategies
7.5	Incorporate climate resiliency vision, goals, and strategies into local plans and projects
7.6	Update the multi-hazard mitigation plan to address changing conditions and identify specific actions to reduce vulnerability to natural hazards
7.7	Develop and implement a heat emergency plan
7.8	Require shade structures and features in public spaces
7.9	Open new or expand existing cooling centers
7.10	Create or update a watershed assessment to identify flooding and water quality priorities
7.11	Adopt a floodplain management and protection ordinance to reduce vulnerability to flooding and erosion
7.12	Conserve, revegetate and reconnect floodplains and buffers in riparian areas
7.13	Conserve natural areas for species migration and ecosystem resilience
7.14	Facilitate a strategic relocation of uses that are not water dependent from flood prone areas
7.15	Promote community flood prevention strategies through the National Flood Insurance Program Community Rating System
7.16	Use green infrastructure to manage stormwater in developed areas
7.17	Conserve wetlands and forests to manage stormwater, recharge groundwater and mitigate flooding
7.18	Use natural, nature-based or ecologically enhanced shoreline protection
7.19	Extend areas in which the two foot freeboard requirement applies
7.20	Require consideration of sea-level rise in planning coastal development
7.21	Right-size bridges and culverts and remove unnecessary and hazardous dams
7.22	Develop or enhance early warning systems and community evacuation plans
7.23	Implement a water conservation and reuse program
7.24	Encourage xeriscaping
7.25	Implement a source water protection program

## Design Strategy References

Design Strategy	Source	URL
<b>Green Infrastructure</b> <i>Use nature to quickly get water back into the ground</i>	Stormwater Management in the Hudson Valley	<a href="http://www.dec.ny.gov/lands/58930.html">www.dec.ny.gov/lands/58930.html</a>
	New York State Stormwater Management Design Manual	<a href="http://www.dec.ny.gov/chemical/29072.html">www.dec.ny.gov/chemical/29072.html</a>
	City of Newburgh's Green Infrastructure Guide	<a href="http://tinyurl.com/NewburghGreen">tinyurl.com/NewburghGreen</a>
	City of Newburgh's Green Infrastructure Feasibility Report	<a href="http://tinyurl.com/NewburghFeasibility">tinyurl.com/NewburghFeasibility</a>
<b>Sustainable Shorelines</b> <i>Consider nature-based approaches before hard structural features for erosion protection</i>	Hudson River Sustainable Shorelines	<a href="http://tinyurl.com/SustainableShorelines">tinyurl.com/SustainableShorelines</a>
	NYS DOS Geographic Information Gateway Living Shorelines	<a href="http://opdgig.dos.ny.gov/index.html#/storyTemplate/11/1/1">http://opdgig.dos.ny.gov/index.html#/storyTemplate/11/1/1</a>
	Hudson Valley Natural Resource Mapper	<a href="http://www.dec.ny.gov/lands/112137.html">www.dec.ny.gov/lands/112137.html</a>
	Rapid Assessment Protocol Manual	<a href="https://tinyurl.com/RapidAssessmentProtocol">https://tinyurl.com/RapidAssessmentProtocol</a>
<b>Marsh Migration</b>	Waterfront Edge Design Guidelines (WEDG)	<a href="http://wedg.waterfrontalliance.org/resources/#manual-and-guidelines">http://wedg.waterfrontalliance.org/resources/#manual-and-guidelines</a>
	Scenic Hudson's Protecting the Pathways	<a href="http://www.scenichudson.org/wp-content/uploads/legacy/protecting-the-pathways.pdfw">http://www.scenichudson.org/wp-content/uploads/legacy/protecting-the-pathways.pdfw</a>
	City of Kingston's Open Space Plan & Natural Resources Inventory	<a href="http://www.kingston-ny.gov/nri">www.kingston-ny.gov/nri</a>
	City of Kingston's Tidal Waterfront Flooding Task Force	<a href="http://www.kingston-ny.gov/waterfrontfloodingtaskforce">www.kingston-ny.gov/waterfrontfloodingtaskforce</a>
<b>Resilient Waterfront Parks</b>	Design and Planning for Flood Resiliency: Guidelines for NYC Parks	<a href="http://tinyurl.com/NYCParks-DesignforFloods">tinyurl.com/NYCParks-DesignforFloods</a>
	High Performing Landscape Guidelines: 21st Century Parks for NYC	<a href="http://tinyurl.com/NYCParksSustainableDesign">tinyurl.com/NYCParksSustainableDesign</a>
	Naturally Resilient Communities	<a href="http://nrcsolutions.org/">nrcsolutions.org/</a>
<b>Multi-modal Mobility</b>	NYS DOT Complete Streets	<a href="http://www.dot.ny.gov/programs/completestreets">www.dot.ny.gov/programs/completestreets</a>
	NYS WRI Culvert Prioritization Project	<a href="http://tinyurl.com/CulvertAssessment">tinyurl.com/CulvertAssessment</a>
	Tompkins County Way-finding and Interpretive Signage Plan	<a href="https://tinyurl.com/rtafgdw">https://tinyurl.com/rtafgdw</a>
<b>Strategic Relocation &amp; Adaptive Re-use</b>	Climigration Network	<a href="http://www.climigration.org/">www.climigration.org/</a>
	NYS DOS Transfer of Development Rights Technical Bulletin	<a href="http://www.dos.ny.gov/lg/publications/Transfer_of_Development_Rights.pdf">www.dos.ny.gov/lg/publications/Transfer_of_Development_Rights.pdf</a>

## More Information on Climate Change in the Hudson River Valley

Websites	URL
Resources for resilience	<a href="http://tinyurl.com/resilienceres">tinyurl.com/resilienceres</a>
Hudson River Sustainable Shorelines	<a href="http://hrnerr.org/hudson-river-sustainable-shorelines">hrnerr.org/hudson-river-sustainable-shorelines</a>
NY Climate Smart Communities	<a href="http://climatesmart.ny.gov/">climatesmart.ny.gov/</a>
Hudson River Estuary Program grants	<a href="http://www.dec.ny.gov/lands/5091.html">www.dec.ny.gov/lands/5091.html</a>
Adaptation Clearinghouse	<a href="http://adaptationclearinghouse.org/">adaptationclearinghouse.org/</a>
NY Community Risk and Resiliency Act (CRRRA)	<a href="http://www.dec.ny.gov/energy/102559.html">www.dec.ny.gov/energy/102559.html</a>
Estuary Program's Climate Resilience webpage	<a href="http://www.dec.ny.gov/lands/39786.html">www.dec.ny.gov/lands/39786.html</a>
CaD studio Designs fromr host communitis	<a href="https://trophic.design/cad/">https://trophic.design/cad/</a>
<b>Interactive Maps</b>	
Hudson River Flood Mapper	<a href="http://www.ciesin.columbia.edu/hudson-river-flood-map/">www.ciesin.columbia.edu/hudson-river-flood-map/</a>
Protecting the Pathways, Scenic Hudson	<a href="https://arcg.is/1jbXG4">https://arcg.is/1jbXG4</a>
Sea-level Rise Mapper, Scenic Hudson	<a href="http://scenichudson.org/slr/mapper">scenichudson.org/slr/mapper</a>
NYS Department of State Geographic Information Gateway	<a href="http://opdgig.dos.ny.gov/index.html#/map/resilience">http://opdgig.dos.ny.gov/index.html#/map/resilience</a>
<b>Publications</b>	
Financing waterfront resilience fact sheet	<a href="http://tinyurl.com/finres">tinyurl.com/finres</a>
Revitalizing Hudson Riverfronts, Scenic Hudson	<a href="http://tinyurl.com/CSCvideoSLR">tinyurl.com/CSCvideoSLR</a>
New York City's Urban Waterfront Adaptive Strategies	<a href="http://goo.gl/7swlpa">http://goo.gl/7swlpa</a>
Flood Adaptation Strategies for Hudson Riverfront Communities	<a href="http://www.slideshare.net/hrepclimate/flood-adaptation-strategies">www.slideshare.net/hrepclimate/flood-adaptation-strategies</a>
NYSERDA's Responding to Climate Change in New York ClimAID	<a href="http://www.nyserda.ny.gov/climaid">www.nyserda.ny.gov/climaid</a>
<b>Videos</b>	
Sustainable Shorelines	<a href="http://tinyurl.com/CSCvideoSS">tinyurl.com/CSCvideoSS</a>
Planning for Sea-level Rise	<a href="http://tinyurl.com/CSCvideoSLR">tinyurl.com/CSCvideoSLR</a>
Climate-adaptive Design	<a href="http://tinyurl.com/CSCvideoCAD">tinyurl.com/CSCvideoCAD</a>