Poughkeepsie's Waterfront on the Rise

Climate-adaptive Design Studio

City of Poughkeepsie

2021







Cover Image:

Flood//Land Dom Malacaman (BSLA '22)

Acknowledgments

We humbly acknowledge that the Hudson Valley is the ancestral homeland of the Lenape and the Mohican people. We acknowledge that these nations were removed from the land through forced dispossession that caused tremendous hardship. We honor their ancestors past and present, as well as future generations. We respect the relationships that exist between indigenous people and the land and waterways. The Mohican name for the river - Muhheahkunnuk - means "great waters which are constantly in motion", a poetic description of the tidal estuary. We strive to achieve such a deep understanding and reverence for the river in the CaD studio. We understand that this acknowledgement is just a small step in the process of building a more inclusive and equitable space for all.

We would like to express our deep appreciation for the dedication and input from the City of Poughkeepsie, especially City Administrator Marc Nelson and Development Director Natalie Quinn. The CaD studio would not have been possible without the insights of the Poughkeepsie stakeholders who participated in the process, providing guidance and feedback to the students.

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 Environmental Conservation, the Hudson River National Estuarine Research Reserve, Cornell Cooperative Extension of Dutchess County, and the Mid-Hudson Children's Museum.

We would also like to thank the students who participated in the Fall 2021 LA7010 CaD studio, whose work is displayed here, including: Sophie Bellemare, Lydia Macklin Camel, Lauren Cruvellier, Andrew Curtis, Kate Flaherty, Allan Greller, Dom Malacaman, Yvette Pollack, Sirui Qiu, Monica Rourke, Xinyue Hope Shen, Dustin Smith, Tingyue Tan, Jinyi Yang, and Kelly Zhan. Special thanks to Teaching Assistant Chen Chen (MLA '22) and Research Fellow Maren Louttit Johnson (MLA '23).

This LookBook was made possible through a partnership between Cornell University Department of Landscape Architecture, Resilience Communications & Consulting, LLC, and Cornell University Water Resources Institute, with funding from the Environmental Protection Fund through the NYS Department of Environmental Conservation's Hudson River Estuary Program.

Sincerely,

The CaD Team

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The Climate-adaptive Design (CaD) studio

Pre-semester meeting The CaD team meets with key community members

Getting to Know You



Section 1



Who We Are

Inspiring change for waterfront communities

The Climate-adaptive Design (CaD) studio is a course created by Cornell University Associate Professor Josh Cerra that links landscape architecture students with Hudson riverfront communities to explore design ideas for more climate resilient and connected waterfront areas.

The CaD studio is an education and research effort made possible by a 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.



What We Do

The CaD team wants to help your community:

- Start the conversation about what climate change could look like on 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 adaptation projects.

What's Next

After the CaD studio is over...

- □ 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.

The City of Poughkeepsie

Making strides toward greater sustainability and resilience

The CaD studio focused on the City of Poughkeepsie waterfront during the fall semester of 2021. Poughkeepsie is approximately 5 square miles in area, with a population of around 32,000 people. Poughkeepsie is steeped in history and is home to colleges, vibrant art and cultural institutions, businesses, and nonprofit organizations. The population is diverse, with 40% of residents identifying as white, 34% African American, and over 19% Hispanic or Latinx, according to the 2020 U.S. census. Many residents of Poughkeepsie face financial hardship, with a poverty rate of 20%, which is well above the NYS average of 12.7%. Much of the city is identified as a potential environmental justice area by the NYS DEC. Low-income people, people of color, and other historically marginalized groups are often more exposed to climate-related impacts and lack the resources to recover guickly.

The City of Poughkeepsie is working toward greater resilience for all residents. The city earned NYS Climate Smart Communities Bronze-level certification in 2021, has participated in a Community Resilience Building workshop, and is participating in the Hudson Valley Regional Council's Climate Action Planning Institute. They completed an Open Space Plan, a Community Forestry Management Plan with an aim of increasing tree canopy throughout the city, and they are investing in the revitalization of city parks. The city is also updating their comprehensive plan and Local Waterfront Revitalization Plan.









- data.

Climate Risk in Poughkeepise

Flooding due to extreme precipitation, stormwater runoff, storm surge, and sealevel 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

• 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 58" higher than current levels by the the 2080's.



Depths of temporary flooding anticipated in the "100-year" or 1% flood zone on the Poughkeepsie waterfront for the present-day baseline condition.



Inundation depths (blue) and temporary flooding depths (green) for the "100-year" or 1% flood condition on the Poughkeepsie waterfront with 60" of projected sea-level rise during the 2080's.

Data source: Columbia University Hudson River Flood Impact Decision Support System Version 2

Project Study Area

Dutchess County, New York State



Study area is located on the Hudson waterfront in the City of Poughkeepsie



The City of Poughkeepsie is located in Dutchess County, on the east side of the Hudson River. The Fall Kill, major tributary of the Hudson, flows through the city. The study area stretched along the Hudson waterfront from Longview Park in the north to the DeLaval site to the south. The study area included the mouth of the Fall Kill, the Walkway Overthe Hudson, and a number of parks -Longview, Upper Landing, Waryas and Kaal Rock. The redevelopment of the DaLaval site will result in additional public access on the Southern Waterfront. Students envisioned a future Hudson Riverfront - up to the year 2080, with 60" of sea-level rise - and developed phased plans for implementing improvements while adapting to rising sea levels.



Key Themes

- loved.
- music.
- youth.



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

- There is an interest in improving the waterfront, which is well-used and well-
- Improving connectivity between the waterfront and the city.
- Participants expressed a need for more dedicated space for arts, performance &
- More recreational amenities, especially for
- Adequate, well-located parking and improved pedestrian mobility are needed.
- Parks should serve all people with diverse, accessible and equitable opportunities.



Challenges

- Most of the study area is already at risk of flooding. Flooding and erosion are impacting waterfront infrastructure.
- New York State official sea-level rise projections indicate that some areas will be inundated in the future, including Waryas Park
- Kaal Rock is an asset, but poses a barrier to a waterfront trail system and improving pedestrian access, as does the Central Hudson site to the north.
- Safe access for boating, fishing and wading are needed.

Opportunities

- The City is pursuing design of a walkway to facilitate pedestrian access around Kaal Rock.
- The redevelopment of the DeLaval site on the Southern Waterfront will provide new opportunities for public access.
- Current efforts, such as the Local Waterfront Revitalization Plan, will provide a roadmap for improvements.
- Financial resources are available for waterfront improvements.
- There is an opportunity to connect the Hudson waterfront to trails on the Fall Kill and the Empire State Trail.

CaD Principles

The CaD studio focuses on five key principles in its approach to waterfront design. These principles guide student work and inform the concepts they develop.



Maximize the value of a waterfront by encouraging waterdependent & watermarinas, beaches & restaurants.

Poughkeepsie.





Design a Destination enhanced uses, like



Design for Flooding Work with water instead of working against it by pursuing strategies such as adaptation. reinforcement & relocation.



Design with Nature Preserve & enhance natural areas on the waterfront & use nature-based techniques for erosion control & stormwater management



Design with Community Waterfronts that are universally accessible and decidedly memorable can contribute to the wellbeing and prosperity of the entire community.



Design for Change Create places that continually provide value under changing conditions. Phase projects over time in ways that are both practical & visionary

Fourteen students created comprehensive designs for the study area, which can be viewed in detail at https://trophic. design/cad/. In their designs, students explored a number of strategies that employ the CaD principles. The following pages provide brief introductions to design strategies that Poughkeepsie can explore.

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
- 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 Poughkeepsie.



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 28 to learn more.

For more information about a strategy, explore the references in this section, located on page 26.



If you're viewing the LookBook on the computer, click the icon to see more information!



Resilient Waterfront Parks



Waterfront parks are an excellent choice for flood-prone areas - they offer recreational opportunities, shoreline access and wildlife habitat, while reducing vulnerability and risk. Waterfront parks should be designed with input from residents to meet the needs of the community and be universally accessible to people of diverse abilities, needs and resources. The park landscape can accommodate floodwaters and be graded to guickly drain after storm events.

The Poughkeepsie waterfront includes a number of parks that are vulnerable to flooding. If the water rises a few feet or more above current levels areas of the parks, including Waryas Park, may become permanently flooded. Students envisioned a variety of ways to enhance and maintain public use of the waterfront, despite rising seas.

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 recommendations for flood-resilient plants and trees.
- Review policies and procedures of the parks department and revise as needed to require more climateadaptive 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 projects may increase local property values and displace 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



Flood Resilience Handbook for Sites Along the Hudson River Estuary High Performing Landscape Guidelines: 21st Century Parks for NYC Naturally Resilient Communities







Taking advantage of the hillside on the northeast edge of Waryas Park to create an elevated amphitheater for performance and gatherings in an area out of the flood zone.

Freeze, Thaw, Expand Sophie Bellemare (MLA '22)



Using fill to elevate a section of Waryas Park provides a larger flat area on the hillside for year-round uses, while lower elevation areas may flood.

Metamorphic Hudson Monica Rourke (MLA '22)



A terraced hillside and floating stage maintain use of Waryas Park as water levels rise.

Strand Forms

Permeable Connection Kate Flaherty (MLA '22/MRP '22)



Lower and upper pathways provide access during dry and wet conditions. Low-lying areas of the park become wetlands over time.

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. Gently sloped areas stretching down to the water can provide pathways for inland migration of wetlands as sea levels rise.

The river is deep off of the Poughkeepsie shore and much of the waterfront has been hardened with bulkheads and riprap. Students viewed rising water levels as an opportunity to create vegetated, shallow water habitats at Waryas Park and the Southern Waterfront, allowing the water to inundate low-lying areas. These constructed, tidal wetlands provide safe access for exploration and recreation.

Actions To Take

- □ Read the Hudson River Sustainable Shoreline website.
- □ Explore 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 recommendations in the Waterfront Alliance's Waterfront Edge Design Guidelines (WEDG).
- □ Check out NYS Sea Grant's Hudson Dynamic Shorelines StoryMap.
- □ Consult with NYS DEC Permits staff early in the process of considering any alterations to shorelines.
- □ 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 intentional 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, Revegetate & 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 Hudson Dynamic Shorelines StoryMap



A naturalized shoreline at Waryas Park is created in phases as sea-level rises. Gradual sloping into shallow water areas create intentionally floodable habitats and access to the river for exploration and recreation.

o-Restoration at Play vette Pollack (MLA '22)



Metamorphic Hudson Monica Rourke (MLA '22)

An elevated walkway around Kaal Rock leads to a waterfront path along a naturalized shoreline.



Combining 'soft' features. such as trees. shrubs and plantings. along with strategic limited placement of 'hard' features like riprap can help stabilize shorelines while adding ecological benefits.

Connectivity & Accessibility



Connecting the waterfront to the community in ways that provide easy access for pedestrians, bicycles, wheelchairs, motorized vehicles, and public transportation enhances quality of life. Roadway circulation is an important consideration, especially assuring alternative access routes for flood-prone neighborhoods.

Students considered options for creating more direct connections between the Poughkeepsie city grid and the waterfront, with some suggesting major changes to roadways and others exploring shorterterm solutions, such as re-opening the tunnel on the Southern Waterfront. A north-south trail to create connections between waterfront parks was a common theme in many designs.

Actions To Take

- Consider flood-risk, potential inundation, and long-term viability as part of a feasibility study for waterfront trails, roadways, and rail lines
- □ Assure easy access to trails, parking areas, and waterfront amenities for people of diverse physical and mental abilities.
- Incorporate water access for pedestrians and boaters when designing waterfront improvements.
- Include way-finding and informational signage into roadway and trail improvements to help visitors stay oriented, informed and engaged.
- □ 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.



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
- Hudson Estuary Accessibility Project
 - Tompkin's County Way-finding & Interpretive Signage Plan







Creative ideas for increasing enjoyment of the Southern Waterfront included a circular plaza overlooking the river. accessible from multiple pathways.

Lightness, Connection, Folding Memories Findvue Tan (BSLA '22/BA URS '22)

A number of students envisioned an elevated walkway around Kaal Rock to connect Waryas Park with the Southern waterfront.



Flood//Land Dom Malacaman (BSLA '22)



Conceptual design for an adjustable walkway that can be raised as waters rise.

Poughkeepsie Waterfront Sirui Qiu (MLA '22)



Some students considered options for more connections between the waterfront and downtown, including enhanced multimodal street corridors connecting to the river and even bold moves to re-route major roads that divide the city. Many students envisioned a pathway connecting the waterfront from North to South

Sculpting the Landscape



According to NYS DEC, about half of the tidal Hudson's shorelines have been altered. Wetlands have been dredged or filled, and meandering reaches of the river have been channelized. Past shoreline alterations have had a negative impact on ecological function, but with careful planning some of these techniques can be used to restore habitats, maintain access, and increase resilience.

Some students focused on strategies such as "cut & fill" to sculpt sites that have been previously altered. For example in low-lying areas, fill can be removed to facilitate marsh habitat creation. Soil can also be added in other locations to maintain access amidst flooding and/or projected future inundation. Critically, 'balancing cut & fill' is a major focus of these techniques so that floodplains are not constricted.

Action To Take

- Learn more about the history of shoreline alterations and the value of shallow water habitats in the Hudson River Estuary Habitat Restoration Plan.
- Read about NYS permit requirements for coastal erosion management, tidal wetlands and protection of waters.
- Learn about FEMA regulations about adding fill in Special Flood Hazard Areas
- □ Visit Scenic Hudson's Protecting the Pathways StoryMap to learn about the potential for marsh migration along the Poughkeepsie shoreline.
- □ Visit the Hudson River Sustainable Shorelines project case studies to see examples of bulkheaded shorelines that have been restored to tidal marsh.



It's estimated that 71 miles of natural shoreline in the upper estuary was eliminated during construction of the Hudson's federal navigation channel.



DEC HREP || DEC CSC || DOS LWRP || WQIP



Discussing potential shoreline projects with the DEC Permits Office should be a first step for communities. They will provide advice and guidance to help achieve aims while complying with state regulations.

CSC

7.20 Design for Flood Elevation || 7.18 Use Nature-Based Shoreline Protection

Hudson River Habitat Restoration Plan NYS DEC Environmental Permits FEMA glossery - Fill



Protecting the Pathways Hudson River Sustainable Shorelines Monitoring



ice-shear erosion while during daily tides.



A parking garage is built at Waryas Park and capped with a green terrace to maintain recreational space.

Freeze, Thaw, Expand Sophie Bellemare (MLA '22)



Metamorphic Hudson Monica Rourke (MLA '22)

Flood//Land Dom Malacaman (BSLA '22)

A cut & fill strategy creates an earthen berm that prevents providing an elevated walkway. The cut area inland is linked to river water levels to create accessible habitat features

Employing a phased cut & fill strategy, some areas are elevated and water is allowed into other locations to create wetland habitats.



River That Flows Three Wavs Lauren Cruvellier (MLA '22)

> A proposal to cap the railroad crossing over the Fall Kill and create an open lawn area for recreation that expands Upper Landing Park and improves connectivity with the city grid.

Inspiration & Learning

The landscape can be a canvas for art that informs viewers about how sea-level rise may change our waterfronts. Sculpture, murals, high water marks, tide gauges, signage, and landscape installations are excellent tools for communicating how much the shoreline will move inland. Waterways offer many opportunities for nature study, and pursuit of imaginative and innovative expression and exploration.

Students in the Poughkeepsie studio embraced the waterfront as a place to provide an aesthetic experience of water through trails and gathering spaces. They suggested enhanced access through the use of teaching platforms and shallow water learning stations, and considered the role of ice in the history of the Hudson through the design of a seasonal skating rink.

Action To Take

- Learn about the FEMA High Water Mark initiative.
- Visit the indoor/outdoor climate change exhibit at the Hudson River Maritime Museum in Kingston, NY.
- Check out examples of public climate art projects, such as Rising Waters installations. Art at the Blue Line in NYC, and 5 Ecological Piers sculptures in Rhode Island.
- Review climate education resources from NOAA.
- Read Conveying the Human Implications of Climate Change from the George Mason University Center for Climate Change Communication.

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Norking with local artists and art organizations is a great way to create place-based artwork that is specific to your location.

DEC HREP || NYSCA



Collaboration is key! Non-profit arts or educational organizations may have to take the lead on projects to qualify for some grant funding.

CSC 9.1 Climate Change Education & Engagement || 9.3 Climate-related Public Events

NOAA Climate Education Resources



Rising Waters Art at the Blue Line

Conveying the Human Implications of Climate Change



A design inspired by the movement of water mimics its flow in shoreline walkways and gathering spaces. Elevated walkways are built on land and project above fluctuating waters as sea levels rise.





A teaching platform at the mouth of the Fall **Kill provides** access for environmental education and exploration.



Freeze, Thaw, Expand Sophie Bellemare (MLA '22)

A waterfront skating rink offers winter recreation as part of a design that celebrates the historic Hudson River ice industry.



tertwining Poughkeepsie Kelly Zhan (BSLA '22/BS ES '22)



A floodable Waryas Park provides ample amenities and maintains access for educational assets like the Hudson River Sloop Clearwater.

A Living Shoreline For All (invue Hope Shen (MLA '22)



River That Flows Three Ways Lauren Cruvellier (MLA '22)



Section 2

Section 3

pages 24 & 25.

- on page 26.
- page 27.

- assistance.

Next Steps

Learn more about protecting and restoring the Hudson River estuary on

□ Explore the design strategy references

□ Research funding opportunities listed on

□ Share this Look Book with municipal staff, elected officials, planning boards, waterfront stakeholders and other interested people.

□ Identify opportunities to share the CaD designs with residents of Poughkeepsie.

 Consider joining the <u>Hudson River Flood</u> Resilience Network.

□ Stay in touch and contact us with ideas, questions or if you are in need of

Keep in Touch!

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River That Flows Three Ways Lauren Cruvellier (MLA '22)

Protecting The River That Connects Us

The Hudson Estuary

The Hudson flows for 314 miles from the Adirondack Mountains to New York Harbor. For half of its length, the Hudson is an estuary a place where salt and fresh water mix. Tides from the Atlantic Ocean reach over 150 miles upstream of New York City to the City of Troy.

Estuaries are nurseries for ocean fish like striped bass. American shad, and Atlantic sturgeon, which swim into the river to lay their eggs each spring. In this way, the health of the Hudson is directly connected to the condition of the marine ecosystem in the ocean.

In the past, much of the Hudson shoreline was characterized by shallow water habitats that provided ample food and shelter for fish and wildlife, which also supported the well-being of human inhabitants¹.

A History of Shoreline Development

The Hudson's natural shorelines have been dramatically altered by human development over the past 200 years. An inventory of shoreline types by NYSDEC found that nearly half of the shoreline from the Mario M. Cuomo Bridge to the Troy dam has been converted to bulkheads, riprap, dikes, and other hard structures intended to protect property from erosion or to facilitate industry, transportation or cultural use².

Comparisons between modern and historic maps have estimated that 71 miles of shoreline in the upper estuary were eliminated when shallows and backwaters were filled during construction of the federal navigation channel. The loss of natural shorelines and shallow water habitats have negatively impacted ecosystem function and populations of fish and other organisms².

Looking to the Future

How communities respond to sea-level rise will affect the health of the Hudson. Protecting against flooding by building hard structures, like sea walls and levees, can lead to unintended consequences. When barriers are overtopped by floodwaters serious damage can occur. Hard structures may increase erosion and flooding of adjacent areas and do not commonly provide habitat value.

If your community has critical infrastructure that may require the protection of hard structures, a good reference to start with is 10 Questions to Ask When Building Defenses to Protect Hudson River Shorelines.

It's important to meet with the NYSDEC Regional Permits Program early in the planning stage of any waterfront project to understand shoreline protection regulations.



Sources:

1- Miller, Daniel E., 2013. Hudson River Estuary Habitat Restoration Plan. NYSDEC, Hudson River Estuary Program. https://www.dec.ny.gov/docs/remediation_hudson_pdf/hrhrp.pdf 2- Partners Restoring the Hudson. 2018. Hudson River Comprehensive Restoration Plan: Recommendations for the NY-NJ Harbor & Estuary Program Action Agenda and the NYS Hudson River Estuary Action Agenda. NY, NY The Nature Conservancy. http://thehudsonweshare.org/wp-content/uploads/2018/07/Hudson_River_Report_Final_August-2018_s.pdf

Sea-level Rise and Tidal Marshes

The Hudson estuary currently includes over 7,000 acres of tidal wetlands, which protect shorelines, trap greenhouse gases that contribute to climate change, and help keep water clean. Freshwater, tidal wetlands-- like those in the northern reaches of the estuary-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 accumulationor accretion-keeps pace with rising waters, wetlands may persist. If not, marsh plant communities may be able to migrate inland to maintain optimal conditions as sea-level rises. In many areas--like the Poughkeepsie's waterfront--marsh migration is at odds with human uses, requiring thoughtful decisions about where to site and maintain waterfront development.

The Future of Hudson Habitats

This map depicts the potential for marsh migration on the Poughkeepsie waterfront at Waryas Park in 2100 under a high sea-level rise, medium accretion scenario.

The color orange depicts areas where development conflicts with the establishment of new wetlands, even though the topography is ideal for the growth of marsh plants as sea-level rises.

Map source: Scenic Hudson Sea-level Rise & Marsh Migration Mapper

Protecting Marsh Migration Pathways

Scenic Hudson's Protecting the Pathways is a climate change adaptation initiative for tidal wetlands in the Hudson River Estuary. Their Hudson River Sea-level Rise & Marsh Migration Mapper predicts wetland areas that will be gained or lost under different sea-level rise and sediment accretion scenarios. The mapper also indicates where development could prevent marshes from migrating inland to maintain viability.

We recommend that communities consult the Sea-level Rise and Marsh Migration Mapper when contemplating development decisions on their waterfronts. This tool can be used to prioritize areas to protect in an effort to conserve current and future marsh habitats.



Initiatives to protect natural landscapes and to restore critical habitats are ongoing. Land use ordinances, dam removals, re-vegetating stream banks, and wetland restoration efforts are important to the future of the estuary.

The Hudson River Comprehensive Restoration Plan, was produced in 2018 by a consortium

of NGO's, public agencies, municipalities and academic institutions. The plan includes an assessment of current conditions and sets goals for ecosystem restoration and community resilience.

Read the 2020 State of the Hudson for up-todate information on challenges the river faces and accomplishments in addressing them.



This map depicts the potential for marsh migration on the Poughkeepsie Southern Waterfront in 2100 under a high sea-level rise. medium accretion scenario.

The color areen indicates potential for new wetlands. and orange depicts areas where development conflicts with marsh migration as sea-level rises.

Map source: Scenic Hudson Sea-level Rise & Marsh Migration Mapper



Design Strategy References

	Flood Resilience Handbook for Public Access Sites Along the Hudson	https://tinyurl.com/hrefldhndbk
Resilient Waterfront Parks	High Performing Landscape Guidelines: 21st Century Parks for NYC	https://www.nycgovparks.org/greening/ sustainable-parks/landscape-guidelines
	Naturally Resilient Communities	nrcsolutions.org/
	Hudson River Sustainable Shorelines	https://hrnerr.org/sustainable-shorelines/
Sustainable Shorelines	NYS DOS Geographic Information Gateway Living Shorelines	<u>http://opdgig.dos.ny.gov/index.html#/</u> <u>storyTemplate/11/1/1</u>
oustainable onorennes	Hudson Valley Natural Resource Mapper	www.dec.ny.gov/lands/112137.html
	NYS Sea Grant Hudson Dynamic Shoreline StoryMap	https://bit.ly/HudsonCollection
	Waterfront Edge Design Guidelines (WEDG)	http://wedg.waterfrontalliance.org/ resources/#manual-and-guidelines
	NYS DOT Complete Streets	https://www.dot.ny.gov/programs/ completestreets
Connectivity & Accessibility	Culvert Prioritization Project	https://tinyurl.com/y4kywkok
	Hudson Estuary Accessibility Project	<u>https://www.dec.ny.gov>docs>remediation_</u> <u>hudson_pdf>hrebusinessacess.pdf</u>
	Tompkins County Wayfinding & Interpretive Signage Plan	https://tinyurl.com/TCwayfinding
	Hudson River Estuary Habitat Restoration Plan	https://www.dec.ny.gov > docs > remediation_ hudson_pdf > hrhrp.pdf
Sculpting the Landscape	NYS DEC Environmental Permits	https://www.dec.ny.gov/permits/6081.html
	Hudson River Sustainable Shorelines Monitoring Case Studies	https://tinyurl.com/HRSSlessons
	Protecting the Pathways	https://arcg.is/1jbXG4
	FEMA Glossery - Fill	https://www.fema.gov/glossary/fill
	FEMA High Water Mark Initiative	https://www.fema.gov/flood-maps/products- tools/high-water-mark-initiative
	NOAA Climate Education Resources	https://www.climate.gov/teaching
Inspiration & Learning	Rising Waters	https://www.risingwaters.org/
	Art at the Blue Line	https://waterfrontalliance.org/city-of-water-day/ art-at-the-blueline/
	Conveying the Human Implications of Climate Change	https://tinyurl.com/conveycc

risks.

Agency

Department of Environmental Conservation

Environmental Facilities Corp (EFC)

Federal Emerg Management / (FEMA)

Department of

Other

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

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ral agencio nunicipalit for activitio oding, sea-	es offer financial ties and non-profit es building resilience to level rise and other climate		à	cipal P	aming lent Str	Jetures Jetures	Manager	inent put	and an and a section solution and a section solution of the section of the sectio
	Assistance Program	Grant amounts, required match	Mur	, Res	, the	, colle	Nat	, tho	/
	Hudson River Estuary Program (HREP)	\$10,500-\$50,000, 15% match	•	•			•	•	
f	Climate Smart Communities (CSC)	\$10,000-\$2M, 50% match	•	•				•	
ii (DEC)	Water Quality Improvements Program (WQIP)	25-60% match		•				•	
	Trees for Tribs	N/A						•	
J	Wastewater Infrastructure Engineering Planning	≤\$100,000, 20% match	•	•					
poration	Clean Water Revolving Loan Fund	N/A	•	•				•	
	Green Innovation Grant Program (GIGP)	10-60% match						•	
20201	Hazard Mitigation Assistance (HMA)	Over \$3M, 25% match	•	•					
Agency	Public Assistance	N/A			•				
	Community Rating System (CRS)	N/A			•	•			
f State	Local Waterfront Revitalization Program (LWRP)	15-25% match	•	•		•			
	New York State Energy Research and Development Authority (NYSERDA)	≤\$250,000, no match	•	•		•			
	NYS Office of Parks, Recreation and Historic Preservation (OPRHP)	≤\$500,000, 25-50% match					•	•	
	US Housing and Urban Development (HUD)	\$50,000 - \$900,000, 0-5%	•	•			•		
	Empire State Development	80% match for soft costs		•			•		
	Hudson River Greenway	\$5,000 - \$10,000+					•	•	
	NYS Council on the Arts (NYSCA)	N/A				•			

Rel	evant Climate Smart Community Actions		
Get po	pints and funding projects related to CaD concepts through the state's Climate Smart Communities	Pledg	je Element
certifi	cation program. See related actions below and learn more at: <u>https://climatesmart.ny.gov/</u>	7.1	Conduct
Pledg	e Element 6: Reduce greenhouse gas emissions through use of climate-smart land-use tools	7.2	Develop
6.1	Develop and adopt a comprehensive plan with sustainability elements	7.3	Review e
6.2	Incorporate smart growth principles into land-use policies and regulations	7.4	Develop
6.3	Adopt a renewable energy ordinance	7.5	Incorpor
6.4	Establish green building codes	7.6	Update t
6.5	Create resource-efficient site design guidelines	7.7	Develop
6.6	Incentivize renewable energy and energy efficiency projects	7.8	Requires
6.7	Adopt land-use policies that support or incentivize farmers' markets, community gardens and urban and rural agriculture	7.9	Open ne
6.8	Adopt green parking lot standards	7.10	Create o
6.9	Adopt a complete streets policy	7.11	Adopt a
6.10	Implement strategies that support bicycling and walking	7.12	Conserv
6.11	Install electric-vehicle infrastructure	7.13	Conserv
6.12	Implement strategies that increase public transit ridership and alternative transport modes	7.14	Facilitate
6.13	Implement a Safe Routes to School program	7.15	Promote
6.14	Implement traffic calming measures	7.16	Use gree
6.15	Adopt and enforce an anti-idling ordinance	7.17	Conserve
6.16	Implement transportation technology solutions	7.18	Use natu
6.17	Develop a natural resource inventory	7.19	Extend a
6.18	Develop a local forestry or tree planting project or program	7.20	Require
6.19	Preserve natural areas through zoning or other regulations	7.21	Right-siz
		722	Develop

7.23 Implement a water conservation and reuse program

7.24 Encourage xeriscaping

t 7: Plan for adaptation to unavoidable climate change

t a vulnerability assessment

a climate resilience vision and associated goals

existing community plans, policies and projects to identify climate adaptation strategies and policies or projects that may decrease vulnerability

climate adaptation strategies

rate climate resiliency vision, goals, and strategies into local plans and projects

he multi-hazard mitigation plan to address changing conditions and identify specific actions to reduce vulnerability to natural hazards

and implement a heat emergency plan

shade structures and features in public spaces

w or expand existing cooling centers

r update a watershed assessment to identify flooding and water quality priorities

floodplain management and protection ordinance to reduce vulnerability to flooding and erosion

e, revegetate and reconnect floodplains and buffers in riparian areas

ve natural areas for species migration and ecosystem resilience

e a strategic relocation of uses that are not water dependent from flood prone areas

community flood prevention strategies through the National Flood Insurance Program Community Rating System

en infrastructure to manage stormwater in developed areas

ve wetlands and forests to manage stormwater, recharge groundwater and mitigate flooding

ural, nature-based or ecologically enhanced shoreline protection

areas in which the two foot freeboard requirement applies

consideration of sea-level rise in planning coastal development

ze bridges and culverts and remove unnecessary and hazardous dams

7.22 Develop or enhance early warning systems and community evacuation plans

7.25 Implement a source water protection program

More Information on Climate Change in the Hudson River Valley

Websites	URL
Resources for resilience	tinyurl.com/resilienceres
Hudson River Sustainable Shorelines	https://hrnerr.org/sustainable-shorelines/
NY Climate Smart Communities	climatesmart.ny.gov/
Hudson River Estuary Program grants	www.dec.ny.gov/lands/5091.html
Adaptation Clearinghouse	adaptationclearinghouse.org/
NY Community Risk and Resiliency Act (CRRA)	www.dec.ny.gov/energy/102559.html
Estuary Program's Climate Resilience webpage	www.dec.ny.gov/lands/39786.html
CaD studio Designs from host communites	https://trophic.design/cad/
Interactive Maps	
Hudson River Flood Impact Decision Support System	www.ciesin.columbia.edu/hudson-river-flood-map/
Protecting the Pathways, Scenic Hudson	https://arcg.is/1jbXG4
Sea-level Rise Mapper, Scenic Hudson	scenichudson.org/slr/mapper
NYS Department of State Geographic Information Gateway	http://opdgig.dos.ny.gov/index.html#/map/resilience
Publications	
Financing waterfront resilience fact sheet	tinyurl.com/finres
Revitalizing Hudson Riverfronts, Scenic Hudson	https://www.scenichudson.org/news-events/reports-publications/
2020 State of the Hudson Report	https://www.hudsonriver.org/state-of-the-estuary#report
Flood Adaptation Strategies for Hudson Riverfront Communities	www.slideshare.net/hrepclimate/flood-adaptation-strategies
NYSERDA's Responding to Climate Change in New York ClimAID	www.nyserda.ny.gov/climaid
Hudson River Estuary Habitat Restoration Plan	https://www.dec.ny.gov > docs > remediation_hudson_pdf > hrhrp.pdf
Hudson River Comprehensive Restoration Plan	http://thehudsonweshare.org/about-the-plan/
Videos	

Sustainable Shorelines tinyurl.com/CSCvideoSS Planning for Sea-level Rise tinyurl.com/CSCvideoSLR Climate-adaptive Design tinyurl.com/CSCvideoCAD Dams & Culverts: Reconnecting Our Waterways https://youtu.be/eZmvoVE4dAg

Student Designs

(MLA '22)

(MLA '22)

River that Flows Three Ways - Lauren Cruvelier (MLA '22)

Permeable Connection - Kate Flaherty (MLA '22/MRP '22)

Performance Laboratories of Poughkeepsie - Allan Greller (MLA '22)

'22)

Ecological Restoration at Play - Yvette Pollack (MLA '22)

Strand Forms - Dustin Smith (MLA '22)

'22)

(MLA '22)

Shen (MLA '22)

Lightness, Connection, Folding Memories -Tinguye Tan (BSLA '22/BA URS '22)

Intertwining Poughkeepsie - Kelly Zhan (BSLA '22/BS ES '22)

Freeze, Thaw, Expand - Sophie Bellemare

Uncertain Futures - Lydia Macklin Camel

Poughkeepsie Waterfront as a Place of Encounter - Andrew Curtis (MLA '22)

Flood//Land - Dominic Malacaman (BSLA

Poughkeepsie Waterfront - Sirui Qiu (MLA

Metamorphic Hudson - Monica Rourke

A Living Shoreline for All - Xinyue Hope

STRATEGIES PROTOTYPES



Lightness, Connection, Folding Memories Tingyue Tan (BSLA '22/BA URS '22)