Planning for Rising Waters:

Final Report of the City of Kingston Tidal Waterfront Flooding Task Force

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Shayne R. Gallo
Mayor

July 31,2013

Dear friends and neighbors,

In October 2012 the Kingston Tidal Waterfront Flooding Task Force was formed including waterfront property and business owners, representatives of waterfront cultural institutions, and others with interest or expertise that are important to any dialogue about the future of the City's Rondout/Hudson waterfront. I charged this group with the task of assessing local risks and generating strategies that will help create a more vibrant, secure and prosperous waterfront in the coming decades and to address the challenges our city faces from waterfront flooding and sea-level rise.

This community-driven process was convened by the City's Conservation Advisory Council and the Economic Development Office, and led by a consulting team from Scenic Hudson, NYS Department of Environmental Conservation, and Catalysis Adaptation Partners, with expert facilitation from the Consensus Building Institute.

The City was selected to participate in this pilot effort because of the actions we are taking to respond to climate change by adopting the "Climate Smart and Green Jobs Community" pledge and becoming a New York State "Climate Smart Community". The Climate Action Plan was adopted by the Common Council in September 2012.

The Kingston Tidal Waterfront Flooding Task Force met seven times over eight months, to address community needs and goals, identify our waterfronts greatest vulnerabilities and opportunities, and assist in developing final recommendations. Recommendations in this report draw on contributions from Task Force meetings and discussions, the Georgetown Climate Center's Adaptation Clearinghouse, Kingston's use (and piloting) of the New York *Climate Smart Planning* self-assessment process and a review of the recommendations of the New York State Sea Level Rise Task Force.

The findings and recommendations of the Task Force will be instrumental in the implementation of the Climate Action Plan's recommendations as well as contributing directly to the City of Kingston's new Comprehensive Master Plan now in planning stages. It is my hope that is part of our effort to improve the quality of life in the City of Kingston and continue to grow as a sustainable community, that you join me in the active participation in the endeavors set forth in this plan. We have a tremendous opportunity to be a "model" of sustainability, not only for the Hudson Valley but for the entire State of New York.

Sincerely



Shayne R. Gallo

Mayor, City of Kingston

Foreword

This document describes the recommendations of the Kingston Waterfront Flooding Task Force, developed over the course of the Task Force's work from December 2012 through August 2013. The recommendations draw on contributions from Task Force meetings and discussions, the Georgetown Climate Center's Adaptation Clearinghouse, Kingston's use of the New York Climate Smart Planning self-assessment process and a review of the recommendations of the New York State Sea Level Rise Task Force. The Task Force used the following key themes to guide their process and ultimately these recommendations:

- Recognize waterfront history and preserve a sense of community and a "sense of place,"
- Promote a waterfront economy and economic revitalization,
- Prioritize health and safety,
- Use natural systems to reduce flood risk,
- Secure infrastructure,
- Promote the implementation of Kingston's Climate Action Plan, including reduction of greenhouse gas emissions through green architecture and infrastructure.

Acknowledgements

This report was prepared by members of the City of Kingston, NY, Waterfront Flooding Task Force, appointed by Mayor Shayne Gallo. Kingston staff convened and participated on the Planning Team:

Suzanne Cahill, City of Kingston Department of Planning

Julie Noble, City of Kingston, Parks and Recreation & Conservation Advisory Council

Gregg Swanzey, City of Kingston Department of Economic Development

A Planning Team consisting of the following provided technical assistance and project management:

Ona Ferguson, The Consensus Building Institute

Jonathan T. Lockman, Catalysis Adaptation Partners, LLC

Barry Pendergrass, NYS Department of State

Sacha Spector, Scenic Hudson, Inc.

Emilie Hauser, NYS Department of Environmental Conservation NYSDEC Hudson River National Estuarine Research Reserve (HRNERR) and New England Interstate Water Pollution Control Commission

Mark Lowery, NYSDEC Office of Climate Change

Kristin Marcell, NYSDEC Hudson River Estuary Program and Cornell University Water Resources Institute

Elizabeth Murphy, NYSDEC Hudson River Estuary Program and Cornell University Water Resources Institute

Christina Tobitsch, Student Conservation Association at NYSDEC Hudson River National Estuarine Research Reserve

The following experts provided Information, tools and resources during the process:

Jessica Grannis, Georgetown Climate Center

Robert Lane, Regional Plan Association

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The following local organizations donated space for public and task force meetings:

City of Kingston

Steel House Restaurant

Riverview Baptist Church

New Central Baptist Church

Art Society of Kingston

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Sean Eldridge

Lincoln Institute of Land Policy

NYSDEC Hudson River Estuary Program

NYSDEC HRNERR Estuary Training Program

Whitney Foundation

Report Contents

CONTENTS

A. Executive Summary 7

B. Overview of Kingston Flooding Task Force Process, Methodology, and Activities 11

C. Flooding Risks Today and In The Future 17

D. Resilience Vision for Kingston 26

E. Recommendations 31

F. Appendices 49

1. Participants 50
2. Recommendations by categories 52
3. Glossary 59
4. Resources 61
5. Supplemental Materials 65

A. Executive Summary

Introduction

The Kingston, NY waterfront along the Rondout Creek and Hudson River is home to the commercial, industrial, and recreational shipping and boating communities, energy and wastewater infrastructure, businesses, churches, City parks and one of the few public beaches on the Hudson. A natural draw for festivals and celebrations, it also serves as the jumping off point for cruises of the Hudson River.

Flooding in the Kingston waterfront is nothing new. Over the last 100 years, the waterfront has experienced flooding from at least 12 hurricanes and tropical storms. Today, some areas of the waterfront, such as low areas along East Strand, occasionally flood when high tides coincide with a few inches of rain.

In the fall of 2012, Mayor Shayne Gallo appointed the Kingston Waterfront Flooding Task Force. Mayor Gallo charged the Task Force with evaluating the present and future vulnerability to flooding, storm surge, and sea-level rise along the Rondout-Hudson waterfront. He asked the Task Force to recommend strategies for a resilient waterfront. The Task Force included waterfront and business property owners, representatives of cultural institutions, neighborhood residents, elected officials, and City and County staff. The Kingston Conservation Advisory Council (CAC), Office for Economic Development, and Planning Department convened the Task Force. A planning team consisting of staff from the City of Kingston, the New York State Department of Environmental Conservation Hudson River Estuary Program and Office of Climate Change, the New York State Department of State, and Scenic Hudson guided the efforts of the Task Force. The Consensus Building Institute and Catalysis Adaptation Partners provided facilitation and modeling services for the effort.

Task Force Process

The Task Force met seven times between December 2012 and July 2013. Participants at the large public kick-off meeting described their visions of a flood-resilient Kingston waterfront. The Task Force selected the following key themes from that vision to guide the process and ultimately the selection of final recommendations:

- Recognize waterfront history and preserve a sense of community and a “sense of place.”
- Promote a waterfront economy and economic revitalization.
- Prioritize health and safety.
- Use natural systems to reduce flood risk.
- Secure infrastructure.
- Promote the implementation of Kingston’s Climate Action Plan, including reduction of greenhouse gas emissions through green architecture.

Task Force Sea-Level Rise Projections and Planning Horizons

The Task Force identified and mapped waterfront assets and assessed vulnerability of the assets under a variety of sea-level rise and storm scenarios. Next, the Task Force, with assistance from the Planning Team, learned about, and evaluated flood adaptation

strategies for the waterfront and for shoreline neighborhoods. In addition, three site-specific strategies for the Strand and Ponckhockie neighborhoods were evaluated with a cost-benefit analysis under future sea-level rise and flood scenarios.

	2060s	2100
Sea-Level Rise	20”	33”
Sea-Level Rise with Rapid Ice Melt	36”	68”

Sea-level rise projections and planning timeframes selected by the Task Force. These projections are consistent with the most recent projections released by New York State in the Governor's 2100 Commission report (http://goo.gl/K9ohoi).

Vulnerability of the Kingston Waterfront

Flooding already costs the city millions of dollars. Sandy cost the city $2.3 million (estimate from Arcadis via Swanzey).The Task Force’s vulnerability assessment demonstrated that Kingston could see tens of millions of dollars in future property damage if flooding is not mitigated along the Rondout-Hudson waterfront. The wastewater treatment plant is the most valuable building complex at risk, and its outflow pipes could cease to function if sea level rises enough to block them. In the high sea-level rise scenario over 50 properties, including the wastewater treatment plant, could be inundated in the next 50 years if no action is taken.

Task Force Recommendations

The Task Force developed 24 general recommendations for the City, listed below, and many site- specific recommendations for shoreline neighborhoods which can be found in the full report. The final recommendations of the Task Force were endorsed by 17 members of the Task Force. Some of the recommendations can be implemented immediately; others call for further study to investigate complex policy issues. Both the Planning Team and the Task Force hope that their work will inspire Kingston to consider flood resiliency in all of its decision making and to continue the dialogue on this important issue.

1. **Adopt the sea-level rise and flood projections recommended by New York State and the Kingston Waterfront Flooding Task Force for planning purposes.**
2. **Incorporate these 24 findings and recommendations from the Kingston Waterfront Flooding Task Force into other City and regional plans.**
3. **Develop a Kingston Waterfront Long-term Resiliency Plan.**
4. **Reduce Kingston’s greenhouse gas emissions and contribution to sea level rise and other climate impacts through the implementation of Kingston’s Climate Action Plan, green infrastructure and green architecture.**
5. **Ensure that all relevant City staff and elected and appointed officials are fully trained in and expected to incorporate impacts of flooding and sea-level rise into their daily work.**

6. Ensure that zoning designations in the Kingston 2025 Comprehensive Plan consider increasing risk and vulnerability from flooding and sea-level rise.

7. Require that proposals for new development of any kind in the Flood Hazard Overlay District take flood risk into account.

8. Reduce stormwater, upland flooding and combined sewer overflows through green infrastructure and best stormwater management practices.

9. Research, evaluate and implement changes to City building and zoning codes that will increase resiliency and are cost-effective and socially equitable.

10. Study the feasibility of using policy, zoning and building codes to achieve creative, water-dependent and water-enhanced uses that are resilient, including elevated, amphibious, or floating structures, wharves, berms and elevated rights of way.

11. Evaluate the use of natural buffers and green shoreline infrastructure to reduce flood risk and erosion and conserve natural resource functions.

12. Ensure that local street networks, utilities and other infrastructure function and remain connected as the City implements adaptation strategies to sea-level rise.

13. Research and evaluate land-use tools and financing mechanisms or incentives to facilitate flood adaptation in the waterfront.

14. Ensure opportunities exist for open space and recreation over the long term.

15. Consider future flood hazards in economic development planning.

16. Develop a plan to mitigate both near- and long- term risk to the wastewater treatment facility.

17. Host an informational public meeting with FEMA.

18. Conduct public outreach to property owners, tenants and prospective buyers in the Flood Hazard Overlay District.

19. Encourage and assist community-based organizations in their efforts to communicate the risks of flooding and potential adaptation solutions to vulnerable or non-English speaking populations.

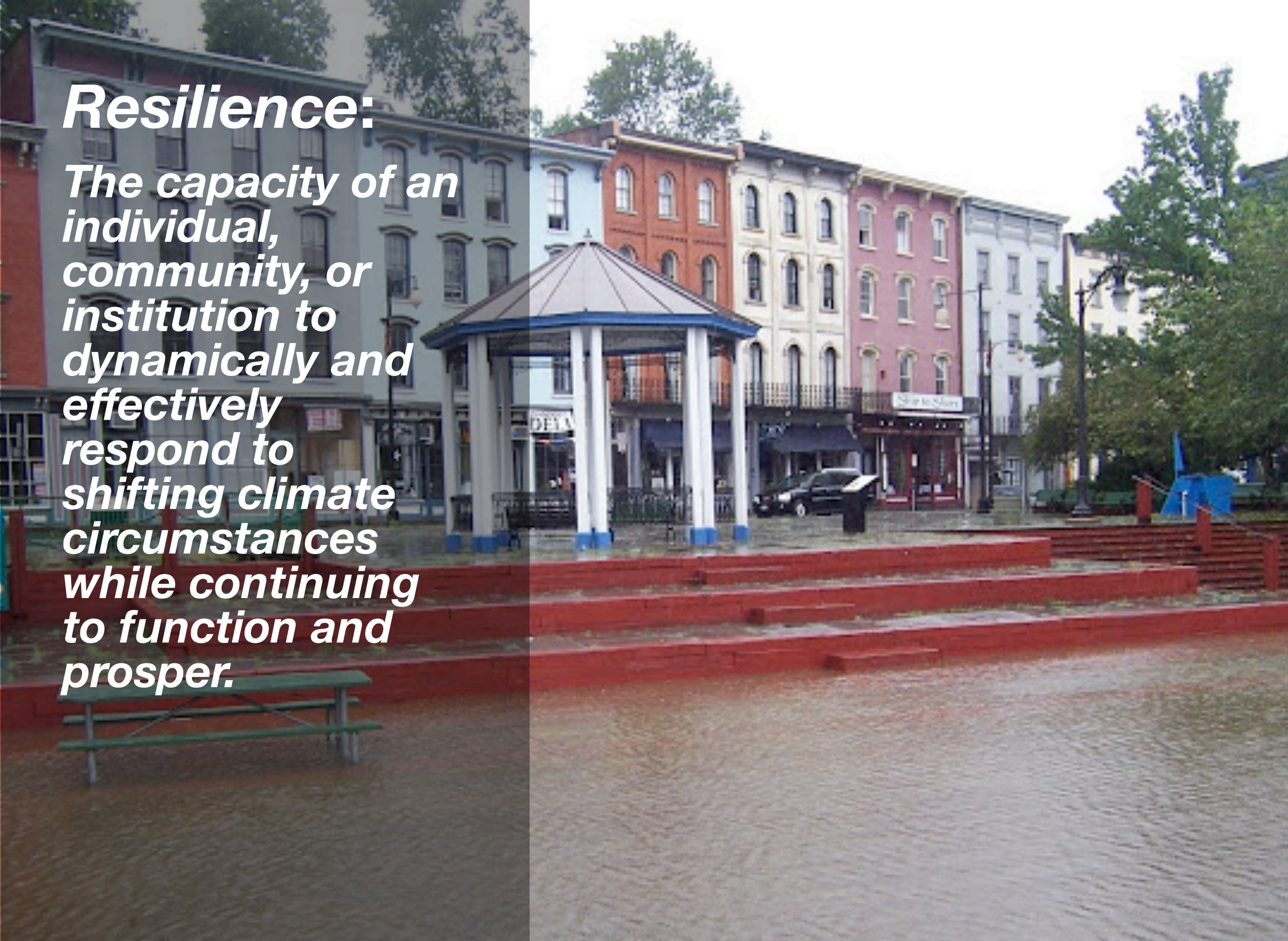
20. Collaborate with other waterfront communities and county and state government to plan for coastal hazards like sea-level rise and storm surge.

21. Revise emergency management planning documents.

22. Employ new tools to improve real time emergency management planning.

23. Ensure safe access and evacuation along the waterfront during regular flood events.

24. Develop a process to map and track repetitive storm damage.



Resilience:

The capacity of an individual, community, or institution to dynamically and effectively respond to shifting climate circumstances while continuing to function and prosper.

B. Task Force Overview

- Process
- Objectives
- Activities



Process

During the summer of 2012, staff from Hudson River organizations interested in helping Hudson waterfront communities address flooding risk related to sea-level rise began talking with leaders in the City of Kingston. These partner groups, including Scenic Hudson, the New York State Department of Environmental Conservation (NYSDEC)'s Hudson River Estuary Program and Hudson River National Estuarine Research Reserve, the New York State Department of State, the Consensus Building Institute and the Lincoln Institute of Land Policy, and Catalysis Adaptation Partners began to work with City staff in the Planning and Economic Development departments and members of the Kingston Conservation Advisory Council. Together, with a shared interest in helping the City move forward to address the pressing issue of flooding on the Hudson and Rondout, they formed a Planning Team and designed a process to help local residents, community and business leaders tackle this challenge. The partners brought the following expertise to the Task Force:

- Kingston CAC – local climate and environmental initiatives
- Kingston Economic Development Department – local economic development plans and initiatives
- Kingston Planning Department – local zoning, building codes and planning processes
- NYS DEC Hudson River Estuary Program and Hudson River Research Reserve – training program coordination, natural resources and adaptation policy
- NYS DEC Office of Climate Change – sea-level rise science, natural resources and adaptation policy
- Scenic Hudson – mapping, planning, sea-level rise science, natural resources and adaptation policy
- NYS DOS – risk assessment and coastal processes
- The Consensus Building Institute and the Lincoln Institute of Land Policy – meeting facilitation and consensus building
- Catalysis Adaptation Partners – vulnerability assessment and cost benefit analysis

In December of 2012, Mayor Gallo selected and appointed the Kingston Waterfront Flooding Task Force to conduct a study of Kingston's waterfront flooding to make recommendations to the City. Task Force members were selected to represent a wide range of perspectives on and local knowledge of the waterfront area, including residents, business owners, developers, and City and county staff. (See Appendix 1 for a list of appointed members, a list of the Planning Team, and a list of others who attended three or more of the Task Force's meetings.)

The Task Force met seven times between December 2012 and July 2013. They met at numerous locations along the waterfront, generously hosted by the following businesses, organizations and by the City: City Hall, Riverview Baptist Church, New Central Baptist Church, The Steel House and The Art Society of Kingston. Task Force participation ranged from 11 – 26 members per meeting, and overall meeting participation ranged from 27 – 76 people. For more details on individual meetings, please see the meeting summaries, available at http://www.kingstoncac.org/index.php/initiatives/tidal-waterfront-flooding-task-force.

Development of the Recommendations and Final Report

After careful consideration of (1) the vulnerability of assets along the Rondout Hudson waterfront under the selected sea-level rise and flood scenarios and (2) potential adaptation approaches, Task Force members offered ideas for strategies to improve flood resilience at the site, neighborhood and city scale. These ideas were discussed at in-person meetings and members had several opportunities to review them in detail online and provide feedback via email and survey. The Task Force members were encouraged to evaluate strategies considering the key themes identified in the visioning session at the kick-off meeting, local knowledge, feasibility, current and planned initiatives, and the cost-benefit analysis done by Catalysis. The Planning Team used feedback from the Task Force to refine the Task Force's 24 final recommendations to the City, as presented in this report. Because there was varied attendance at meetings, including some appointed members of the Task Force who attended very few meetings, members had the option to "opt in" to endorsing the recommendations. Members approved the final recommendations in this report in July 2013 and submitted to Mayor Shayne Gallo and the Common Council for consideration thereafter.

Objectives

Task Force Objectives

At the outset of the Task Force a series of objectives were defined by Mayor Gallo, the partner groups and the members of the Task Force. These ultimately included:

- Bring the community together to describe a shared vision for the future of their waterfront;
- Create a foundation of analysis, data and communal knowledge about sea-level rise and flooding adaptation approaches, and use this information to determine which approaches make sense for Kingston, and why;
- Produce a set of specific, phased recommendations for policy improvements, capital investments, open space/access opportunities and future studies that will move Kingston toward its vision for greater resilience;
- Position Kingston to begin implementing the Task Force's recommendations and to better compete for future state and federal support for waterfront improvements;
- Build the community's capacity and experience in planning for waterfront resilience.

Activities

Sequence

With technical support from the Planning Team, the Task Force used multiple tools and exercises to think about Kingston's waterfront flood risk and options for how best to prepare the waterfront and community for the future. Over the course of the eight-month process, the group followed this step-wise sequence to arrive at its recommendations:

Identify and assess risks to community assets

Determine vulnerability of assets

Prioritize vulnerabilities and opportunities

Develop adaptation vision and select strategies

Identify implementation tools to achieve vision and strategies

Develop adaptation roadmap

Activities

1. **Mapped waterfront assets and evaluated their current flood risk**. In the kick-off meeting, Task Force members and the public completed an interactive mapping exercise to identify locations of past flooding and important waterfront assets. Scenic Hudson compiled this local knowledge with FEMA's 100-year floodplain and future sea-level rise projections to create story-telling maps showing future flooding projections and waterfront assets.

2. **Created a vision for a flood-resilient Kingston waterfront**. Participants at the kick-off meeting described what a future flood-resilient waterfront would look like for Kingston. Their comments were grouped into six key themes, which are listed earlier in this report.

3. **Chose sea-level rise and flood scenarios for planning purposes**. Mark Lowery (NYS DEC) and Sacha Spector (Scenic Hudson) presented the Task Force with a background on the latest sea-level rise and flooding projections from New York State. The Task Force chose to study one and ten percent storms ("100-" and "10-year" flood events) in years 2060 and 2100, with a total of 66 inches of sea-level rise by 2100 (a moderate-high projection).

4. **Assessed the vulnerability of waterfront assets and parcels under selected sea-level rise and flood scenarios**. The Task Force completed two vulnerability assessments of the Kingston waterfront: the Department of State's Coastal Reconstruction and

Resilience Planning (CRRP) tool and the Coastal Adaptation to Sea-Level Rise Tool (COAST). The CRRP tool was piloted by this Task Force. It looks at the hazard, exposure, and vulnerability of each of the 121 identified waterfront assets to create a relative scoring of risk. This CRRP tool has since been finalized and is available for use by other communities. Catalysis Partners ran COAST using parcel value and the damage depth function, developed by the Army Corps of Engineers, to estimate damage costs in various places under various scenarios over time.

5. **Considered site-specific options for adaptation for 11 neighborhoods/areas along the waterfront**. Mary Kimball (NYC Planning), Mark Lowery (NYS DEC), and Kristin Marcell (NYS DEC) presented the Task Force with an overview of some of the potential responses to flooding, from updating City zoning to retrofitting buildings to accommodate periodic flooding. The Task Force used their local knowledge and what they had learned through the process to define 11 neighborhoods along the waterfront. They then explored options for adaptation strategies for each neighborhood based on physical attributes and land use. There was a range of opinions about these approaches, and those that reached agreement by most of the participants were included in the recommendations section as site specific recommendations.

6. **Analyzed the costs and benefits of three adaptation strategies for the Strand and Ponckhockie**. The Task Force identified three adaptation scenarios for the Strand and Ponckhockie neighborhoods to run through COAST to better understand the relative costs and benefits of each strategy. JT Lockman (Catalysis) ran the model and presented results… [Want a little more about what they chose and the results here.] The cost benefit analysis was undertaken by Catalysis Adaptation Partners and funded by the NYSDEC Hudson River Estuary Program, through NEIWPCC.

7. **Developed final recommendations for the Mayor and Common Council.** Using prior local knowledge with increased understanding of Kingston's flooding risk, vulnerable assets, key values, city planning, adaptation strategies, and costs and benefits, the Task Force developed a suite of final recommendations to the City, as presented in this report.

C. Flooding Risks Today and in the Future

Risks and Vulnerabilities on the Kingston Waterfront

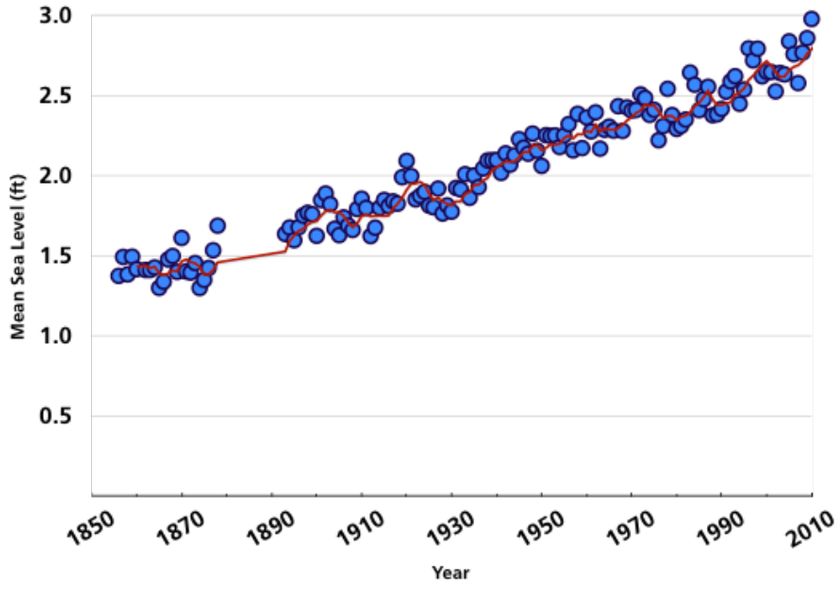
The same confluence of waterways that attracted commerce and amenities to the waterfront presents the risks of serious waterfront flooding. Historically, the waterfront has been subject to flooding from both the Rondout Creek, due to heavy rainfall events, and the Hudson River, due to high tides and storm surges (associated with hurricanes, tropical storms, and nor'easters) that travel up the river.

Over the last 100 years the waterfront has experienced flooding from at least 12 hurricanes and tropical storms and many more nor'easters. In recent years, the entire waterfront area was seriously impacted by flooding from both the Hudson and Rondout during Tropical Storms Irene and Lee in 2011 and by a record-breaking storm surge during Hurricane Sandy in 2012. Some areas of the waterfront, like the Ponckhockie neighborhood, are flooded regularly when high tides coincide with a few inches of rain.

Public health and safety, damage to assets, business downtime, and accessibility are some of the top concerns motivating Kingston to take action against future flooding events, whose frequency and intensity are likely to increase due to more frequent intense downpours, storm surge events, and rising sea level that exacerbates the impact of both upland and tidal flooding.

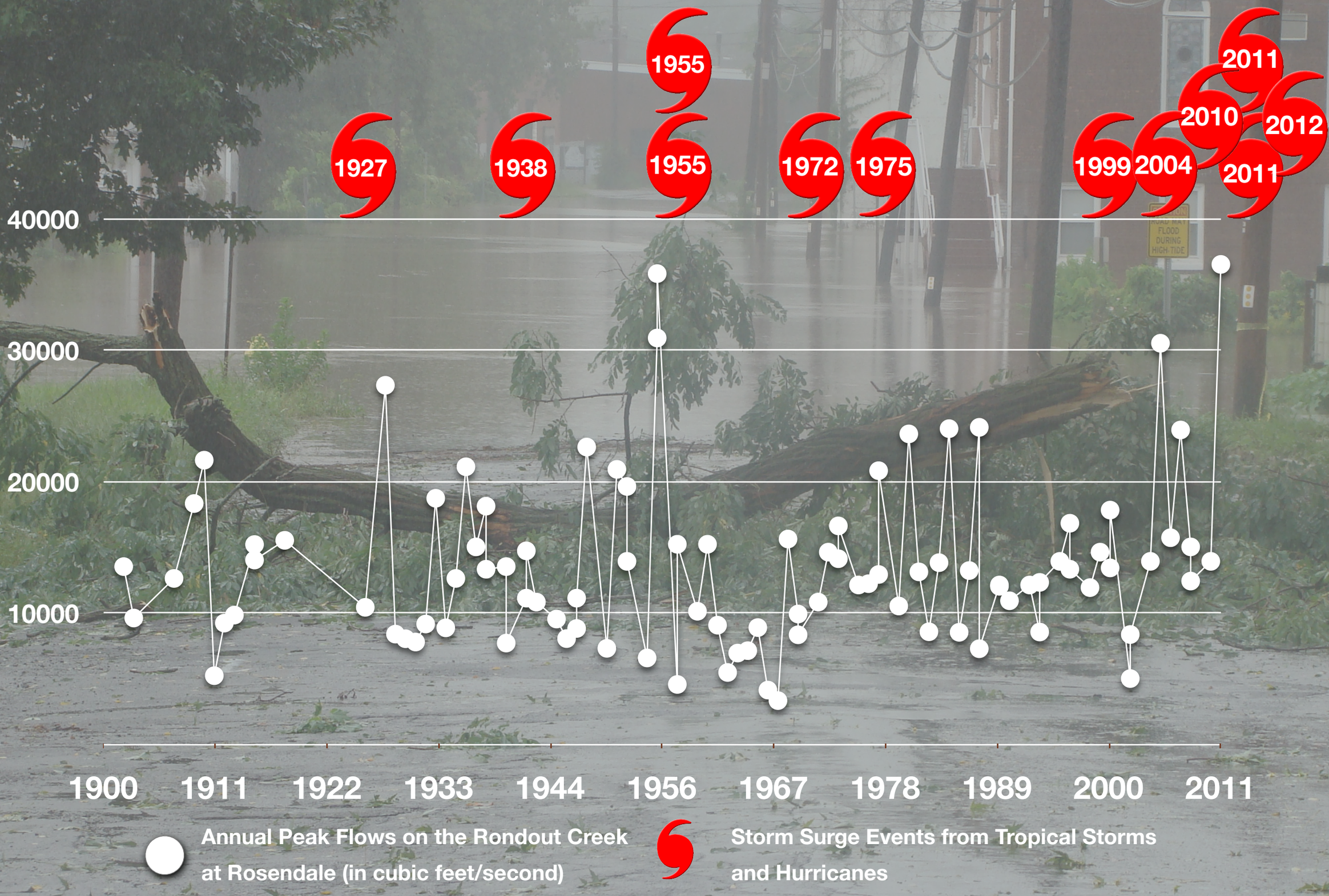
Sea-Level Rise

Around the world ocean sea levels are rising at an accelerating pace (*1*). Along the Hudson River, from the Battery in Manhattan to the Federal Dam at Troy, sea level has risen approximately one foot over the past century and there is evidence that regional sea-level rise in the western Atlantic will be greater than the global average (*2*). While the exact pace of future sea-level rise is not yet certain, there is every reason to believe that sea level will continue to accelerate throughout this century and beyond. Much depends on how much more greenhouse gas pollution humanity adds to the atmosphere and how quickly the global climate system warms in response. It also depends on how quickly the Greenland and Antarctic ice sheets melt and add their water to the oceans.



Mean sea level measured by tidal gauge at The Battery, Manhattan from 1856-2012. Blue dots denote annual mean sea level, the red line is a 5-year running average. Source: NOAA

Historical Flooding on the Kingston Waterfront



Projections for future sea-level rise on the Hudson River and elsewhere in New York State have been provided in recent reports from NYS CLIMAID (*3*), the New York State Sea-Level Rise Task Force (*4*) and the NYS2100 Commission (*5*). These projections are based on a combination of empirical data about the historical relationships between climate and sea level, predictions of future climate conditions generated by a suite of global circulation/climate models, and estimates of ice sheet melt behavior from current observation and models. For the Mid-Hudson to Capital District along the Hudson River, they are as follows:

	2020s	2050s	2080s	2100
Sea-Level Rise	1"-4"	5"-9"	8"-18"	11-26"
Sea-Level Rise with Rapid Ice Melt	4"-9"	17"-26"	37"-50"	52"-68"

Sea-level rise projections for Hudson River from Mid-Hudson to Capital Region, from NYS 2100 Commission report.

Local Sea-Level Rise and Flooding Projections

The Task Force considered sea-level rise projections and planning timeframes that it felt were most appropriate for developing Kingston's adaptation goals. Broad discussion focused on balancing the scientific consensus and uncertainties surrounding sea-level rise as well as the need to plan proactively for "worst case scenarios" and assess long-range flooding challenges.

The task force ultimately selected 2060 and 2100 as the time horizons for analyzing waterfront risks, and low and high sea-level rise values of 20" and 36" in 2060 and 33" and 68" in 2100. Because there was not enough information at this time to project future rainfall amounts and upland flooding dynamics into this analysis, base flood depths along the waterfront were assumed to remain constant – 1% (or 100 year) floods are 8.2 feet (98.4") and 10% (or 10 year) floods are 6 feet (72"). For mapping future extent of floodplains above the high tide line, the base flood elevation was simply added to projected future Mean Higher High Water (MHHW) following sea-level rise.

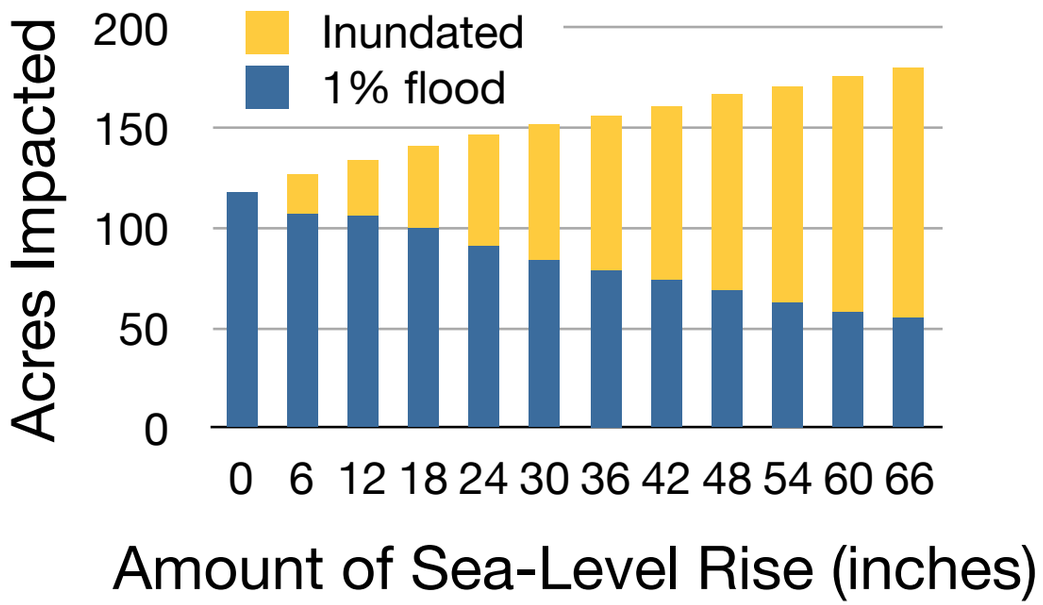
	2060s	2100
Sea-Level Rise	20"	33"
Sea-Level Rise with Rapid Ice Melt	36"	68"

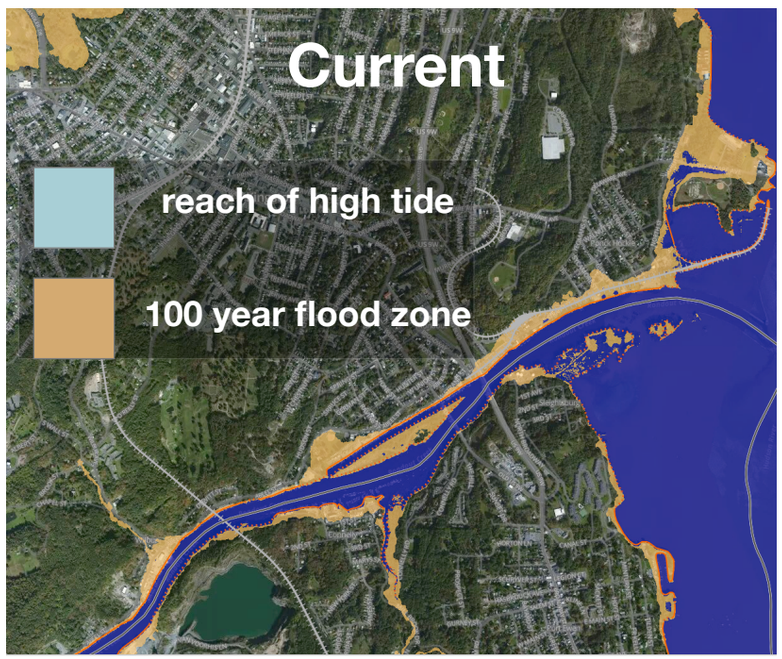
Sea-level rise projections and planning timeframes selected by the Task Force.

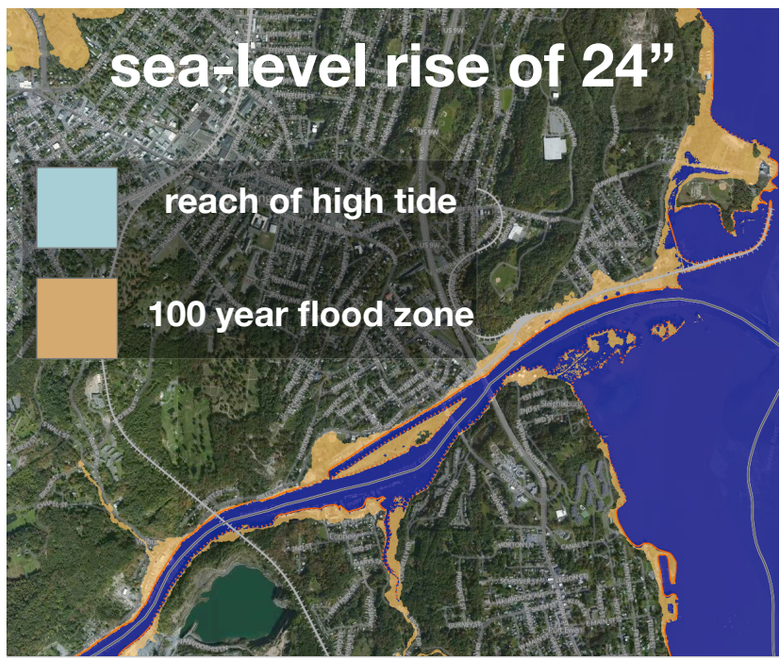
Mapping Sea-Level Rise and Flooding

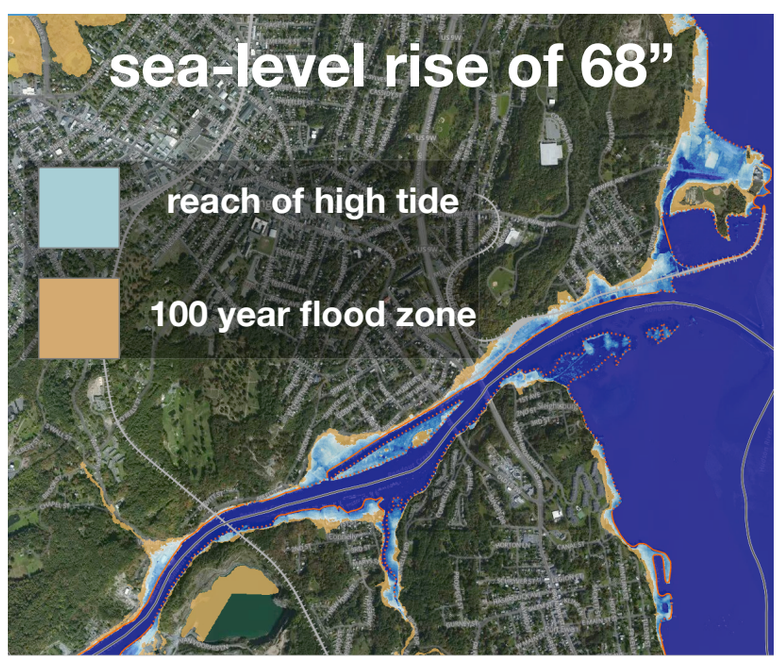
Using information from Scenic Hudson's Sea-Level Rise Mapper (*6*) and additional modeling by Scenic Hudson, the Task Force examined the current extent of flood prone areas, and areas that will be exposed to daily tides (inundated) or increasingly flood prone under various sea-level rise scenarios.

By the end of the century, the area along Kingston's waterfront subject to tides or flooding could expand by over 50% - from 118 acres to 180 acres. In the expanding risk zone lie additional community assets, households and citizens.







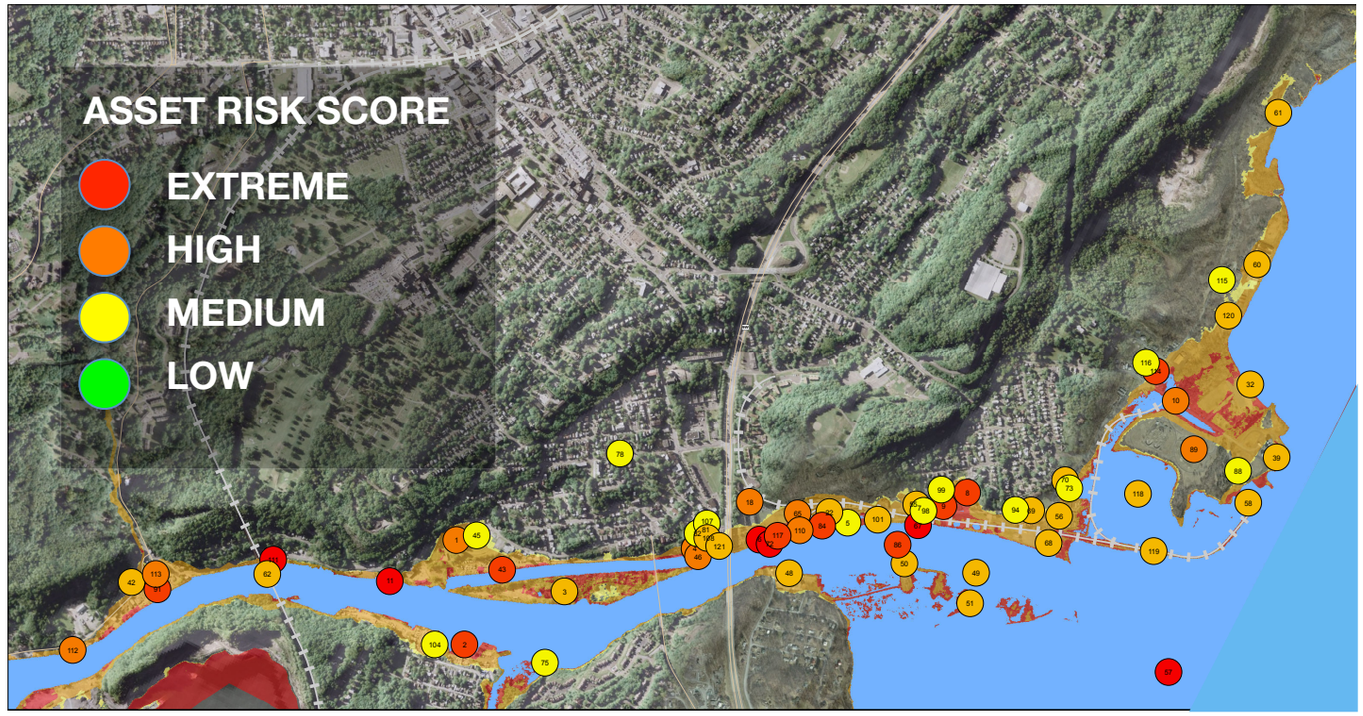


Assessing Risk and Vulnerability

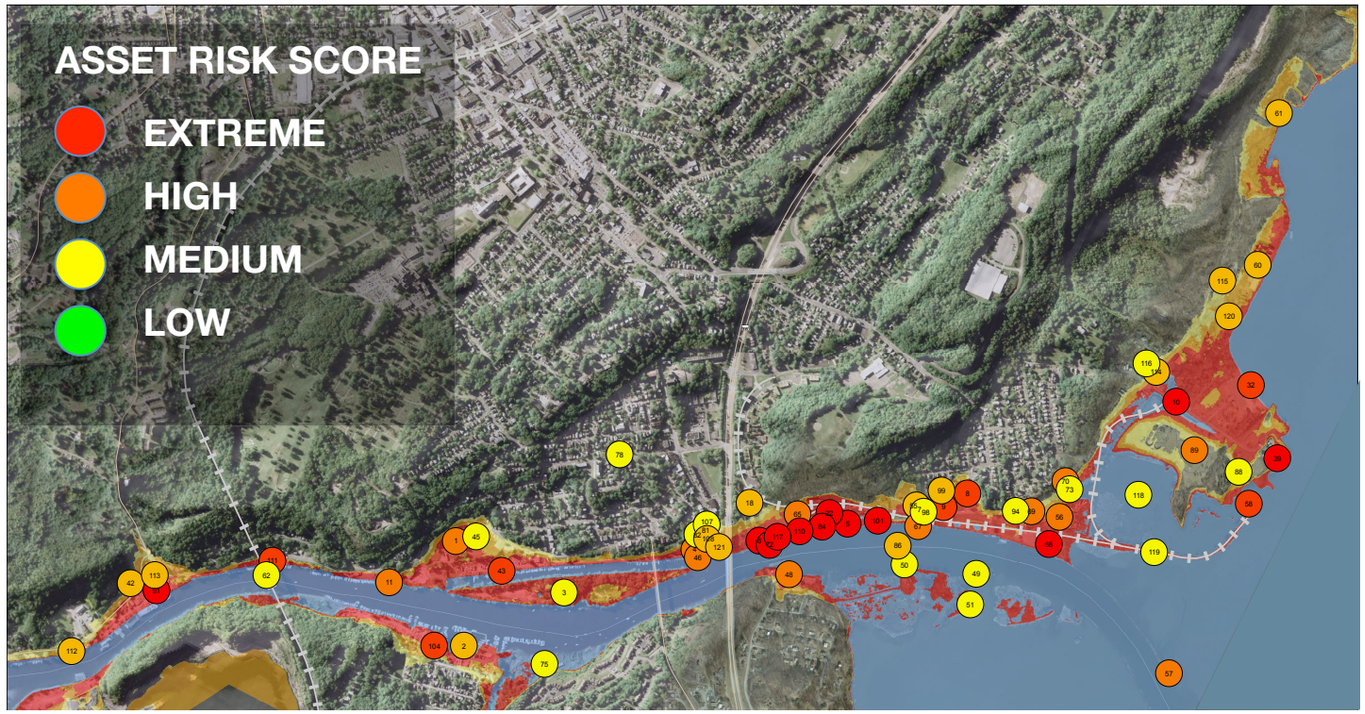
The task force used two tools to map and evaluate the vulnerability of parcels and/or assets under the selected sea-level rise and flood scenarios through 2100. A Risk Assessment Tool was piloted by Kingston for the NYS Department of State as part of the New York Rising – Community Reconstruction Program (NYR-CR Program). The second tool, the Coastal Adaptation to Sea Level Rise Tool (COAST), was developed by Catalysis Adaptation Partners. The results of both tools allowed the task force to prioritize vulnerable assets and consider specific adaptation options for particular reaches of the waterfront.

The results of the NYR-CR Program Risk Assessment Tool indicate that flood risk will increase for more than two-thirds of the assets along the waterfront in the study area as a result of three feet of sea-level rise and finds Delaware Avenue, near North Street, the old gas plant along the Rondout near North Street (a brownfield site) and the wastewater treatment plant as three of the most vulnerable infrastructure assets.

The results of the COAST analysis indicate that a dozen parcels are predicted to be inundated by sea level rise by 2030, in either the low or high sea-level rise scenarios. In the High Sea-Level Rise scenario, the COAST model predicts an additional 39 properties will be inundated by sea-level rise by 2070, including the wastewater treatment plant, if no action is taken. The results of both analyses



Current Assets and Risk



Current Assets and Future Risk - with 3 feet of sea-level rise

indicate that Kingston's wastewater treatment plant will be routinely or permanently inundated at 36" of sea-level rise and strategies will need to be developed to adapt this critical infrastructure. See Supplemental Materials for the full results of the NYR-CR Program Risk Assessment Tool and COAST analyses at http://www.kingstoncac.org/index.php/initiatives/tidal-waterfront-flooding-task-force.

YEAR	Low Sea Level Rise Scenario		High Sea Level Rise Scenario	
	Number of Parcels	Value of Buildings ($ million)	Number of Parcels	Value of Buildings ($ million)
2020	3	1.3	12	2.1
2030	9	0.8		
2070			39	53.3

Parcels inundated by sea-level rise if no action is taken along Kingston Waterfront, and their assessed values.

The task force learned about a variety of strategies for waterfront adaptation under four broad adaptation approaches: do nothing, fortify, accommodate or strategically relocate uses. Adaptation options that "fortify" use hard or soft structures to prevent flood waters from reaching community assets. Adaptation options that "accommodate" modify community assets to reduce the impact of flood waters. Adaptation options that "strategically relocate" move buildings, infrastructure or uses back from the most vulnerable areas to greatly minimize the risk of flooding. There are trade-offs in cost, maintenance, reduction of risk, feasibility and other concerns for all adaptation strategies. For more information on benefits and drawbacks of adaptation strategies refer to the NYC Department of City Planning Urban Waterfront Adaptive Strategies report at *http://www.nyc.gov/html/dcp/pdf/sustainable_communities/urban_waterfront_print.pdf.*

Evaluating Alternatives

The task force divided the waterfront into eleven neighborhoods and considered which of the four approaches and strategies were most appropriate for each reach based on physical properties and land use. There was a range of opinions about these approaches, and those that reached agreement by most of the participants were included in the recommendations section as site specific recommendations.

The task force selected the Strand and Ponckhockie neighborhoods for a more detailed evaluation of adaptation strategies using a benefit/cost analysis in the COAST tool. The task force selected four adaptation approaches for evaluation:

Scenario A: Do Nothing

Scenario B: Elevate Strand Street to 11 feet (NAVD 88)

Scenario C: Elevate bulkhead with levee and path to 11 feet (NAVD 88)

Scenario D: Purchase rolling easements of at-risk properties with transfer of title to City in 2060 or when Mean Higher High Water reaches 6 feet (NAVD 88)

The consulting firm Parsons Brinkerhoff provided construction and maintenance cost estimates for Scenarios B and C. The results of the cumulative damage estimates from the COAST model for these four scenarios are summarized in the following table. For more information on the scenarios and the results see the full COAST report at http://www.kingstoncac.org/index.php/initiatives/tidal-waterfront-flooding-task-force .

The elevation of the bulkhead along the East Strand/Ponckhockie neighborhood appears to have the best benefit/cost ratio of the four scenarios explored in this timeframe, and with these assumptions.

It is important to note that both of the fortification approaches, elevation of the Strand and the bulkhead, have high levels of residual risk. They encourage additional development in high risk areas and if they fail due to overtopping or a breach the results can be catastrophic, if no redundant safety measures are in place. Initial investments in fortification measures can also limit future opportunities to accommodate or strategically relocate uses.

BENEFIT COST ANALYSIS OF ADAPTATION STRATEGIES – KINGSTON						
	Scenario B: WITH ELEVATION OF EAST STRAND STREET TO 11 FEET (NAVD 88)		Scenario C: WITH ELEVATION OF BULKHEAD/WITH PATH TO 11 FEET (NAVD 88)		Scenario D: PURCHASES OF ROLLING EASEMENTS, WITH TRANSFER OF TITLE TO CITY AT 2060 OR WHEN MHHW REACHES 6.0 FEET (NAVD 88)	
	Low SLR	High SLR	Low SLR	High SLR	Low SLR	High SLR
Cumulative Damage to East Strand Study Area With No Action[1]	46,400,000	44,100,000	46,400,000	44,100,000	46,400,000	44,100,000
Cumulative Damage with Adaptation Strategy in Place[1]	4,900,000	4,700,000	241,000	466,900	36,900,000	39,576,000
Avoided Damage (Row 1 – Row 2) or BENEFIT	41,500,000	39,400,000	46,159,000	43,633,100	9,500,000	4,524,000
Estimated COST of Adaptation Strategy	9,800,000		6,200,000		[2]2,540,000	
BENEFIT/COST Ratio (The higher the number above 1, the more favorable the ratio.)	4.2	4.0	7.4	7.0	3.7	1.8

[1]Discount Rate of 3.3% applied.
[2]Does not include purchase of easements at five city-owned properties, and sewage treatment plant remains unprotected.

Sources and Notes

(1) Vermeer, M., and S. Rahmstorf. 2009. Global sea level linked to global temperature. Proceedings of the National Academy of Sciences 106:21527 -21532.

(2) Church, J. A., N. J. White, R. Coleman, K. Lambeck, and J. X. Mitrovica. 2004. Estimates of the Regional Distribution of Sea Level Rise over the 1950-2000 Period. Journal of Climate 17:2609-2625.

(3) NYSERDA ClimAID Team. 2010. Integrated Assessment for Effective Climate-change Adaptation Strategies in New York State. http://www.nyserda.ny.gov/climaid

(4) New York State Sea Level Rise Task Force. 2010. Report to the Legislature. http://www.dec.ny.gov/docs/administration_pdf/slrtffinalrep.pdf

(5) The NYS 2100 Commission. 2012. Building Resilience in New York. http://www.rockefellerfoundation.org/media/download/7c012997-176f-4e80-bf9c-b473ae9bbbf3

(6) Scenic Hudson Sea-Level Rise Mapper - Please see the Disclaimer and Terms of Use for the Scenic Hudson Sea-Level Rise Mapper at http://www.scenichudson.org/slr/mapper/disclaimer-and-terms

(7) The NYR-CR Program Risk Assessment tool will generate a Risk Score representing the relative risk of the assets in the community to one another. Risk Scores rely on past experience as predictor of future risk and include some subjective analysis. They should not be compared from one community to the next. Risk assessment maps are intended for planning purposes only. These maps can be used in conjunction with other planning tools, maps, and resources to advance reconstruction plans. They should not be confused with, and may not be substituted for, any existing regulatory maps or associated boundaries.

(8) COAST tool and approach are designed to help communities evaluate the merits of various options, and to show which ideas might merit further study. More rigorous feasibility studies and evaluations of potential costs may be needed before any designs are prepared or actions are taken.

D. A Flood-Resilient Kingston: Vision for the Future

Over 80 participants at the kick-off meeting were invited to envision what a flood-resilient waterfront would look like for Kingston. Asked to complete the sentence, “A future flood-resilient waterfront in Kingston would...”, their responses painted a picture of a community that, among other things, would do the following:

“A future flood-resilient waterfront in Kingston would:

- *allow for Kingston to use the waterfront for economic revitalization.”*
- *protect public health, avoid sewage spills and sewage treatment plant downtime.”*
- *create a peaceful, safe, sound environment for the Rondout community as well as the waterfront businesses.”*
- *[be] willing to make the harder more expensive decision if it’s better in the long run.”*
- *[be] a wash and wear waterfront.”*
- *be an inspiration to people everywhere.”*



Once compiled, the public responses were grouped into six key themes that the Task Force used to guide their process and ultimate recommendations to the City:

1. Recognize waterfront history and preserve a sense of community and a “sense of place”,

2. Promote a waterfront economy and economic revitalization,

3. Prioritize health and safety,

4. Use natural systems to reduce flood risk,

5. Secure infrastructure, and

6. Promote the implementation of Kingston’s Climate Action Plan, including reduction of greenhouse gas emissions through green architecture.

Solutions through public policy

The greatest number of ideas looked to use policy as a tool for intelligent planning, land use and building codes to restrict unsustainable development.

Comments included:

"[Have] no building within the flood zones"
"[Have] high density development in areas that do not flood"
"Reflect resiliency, best practices in updated zoning code"
"Be prepared to take advantage of funding or other opportunities: be ready with a plan"
"Remove, through buy-outs, people and buildings from repetitively flooded areas"
"Ensure flood-adaptive buildings are considered in planning approvals"
"Vote to increase taxes temporarily to pay for project to address problem"

Prioritize health and safety

Discussions on public health and safety were frequently linked with concerns of flooding leading to spills at the sewage treatment plant, Central Hudson gas tanks, and other sites with toxic substances.

Comments included:

"[Be] planned to meet human safety concerns"
"Protect public health, avoid sewage spills and sewage treatment plant downtime"
"[Be] seen as the best "hurricane hole" port in the storm during hurricane season"
"Secure and clean up toxics at Central Hudson Gas and Electric and Millen's sites"

Promote a waterfront economy and economic revitalization

Group discussions underlined the importance of Kingston's waterfront as an economic driver. Many attendees noted the opportunity for flood resiliency to increase the area's economic benefit. Marinas, restaurants, museums and historical buildings are important in attracting boaters and other tourists to the area.

Comments included:

"Allow for Kingston to use water front for economic revitalization"
"Invest to protect maritime assets w/o which economic vitality disappears"
"[Mean that] boaters entering the Rondout experience a pleasant entry"
"[Be] self-sustaining, repairable, and profitable"
"Be similar to Kingston Point Park during the recreational era (Note from transcriber: KPP used to be a dayliner landing with a Ferris wheel and other tourist activities) but with modern enhancements. It would draw tourist and residents to its clean water for recreation, historical and cultural assets"

Build and retrofit to accommodate flooding

More attendees discussed building and retrofitting waterfront assets to accommodate flooding rather than armoring or relocating them. Several pointed out the Steelhouse and Clearwater buildings as models that highlight the importance of designing assets to recover quickly after a flood ("Resiliency is reflected in how quickly we recover"). Other comments included:

Comments included:

"Flooding should be a temporary inconvenience – not a catastrophe"
"Design infrastructure to adapt to changing climate; get new technology that will rebound to water; mold; drying faster materials"
"Elevate critical systems"
"Design [buildings] to absorb force"
"Assets that can tolerate inundation temporarily should be recognized"
"[Be] a wash and wear waterfront"

Fortify some areas and secure infrastructure

Several groups discussed the possibility of fortifying key infrastructure or areas using gating, bulkheads, dykes or break away walls. The negative viewshed implications of creating a wall was mentioned under this topic.

Comments included:

Secure the existing Rondout business, churches and residents with a dyke upon which the trolley would run"
"Gate buildings that can't be re-engineered to withstand surges"

Maximize use of natural systems to reduce flood risk

Attendees recognized the use of natural systems to create a healthy shoreline. Ideas included preserving and creating floodable land uses, including parks, walkways, green spaces, wetlands and other biomass.

Comments included:

"An environmentally safe waterfront area would create a peaceful, safe, sound environment for the Rondout community as well as the waterfront businesses"
"NOT be diked; include more parkland and "floodable" land uses and preserve walkways"
"[Have] healthy habitats"
"Consider doing plantings to put some biomass in the floodplain to absorb force"
"Use biomass in areas where needed"
"Secure Slightsburg Spit (the wetland) to the extent possible"
"[Have] an enhanced riparian forested buffer with less hard walkways to allow for access to the creek's green areas"
"[Have] green space along the river"
"Leave Island Dock undeveloped"

Address upstream sources of flood risk

Several attendees discussed the need to "attack the problem at the source" by preventing the upper Rondout from becoming clogged or relying on new energy sources that do not lead to toxic spills.

Relocate some uses away from high risk areas

Attendees volunteered several vulnerable assets they would like to see relocated. There was disagreement regarding relocating versus armoring the sewage treatment plant.

Comments included:

"[Remove] areas that can't handle temporary inundation"
"Move City Beach to Shoreline on North Street by AVR development"
"Move historic framed buildings to a safe place"
"Move the wastewater treatment plant!"

Make decisions based on the best available information and collaboration

Groups were quite interested in using knowledge and collaboration to make well informed decisions. Attendees suggested we look at what other places have done and to watch what happens in New York City. They also noted that it is "important to make goals attainable."

Comments included:

We usually take the cheapest option today but then spend more money in the long run"
"Let's make sure that we are willing to make the harder more expensive decision if it's better in the long run"

Preserve a sense of community and a "sense of place"

Kingston waterfront inspires a "sense of place", a connection between people and the water, that people do not want to sacrifice in order to become more flood-resilient. This includes preserving parks and historic buildings, or perhaps future sites for recreation and access.

Comments included:

"Be an inspiration to people everywhere"
"[Have] public and private sites that maintain and honor the individual and community "sense of place" that a waterfront embodies"
"[Where] waterfront access would be public all along the shoreline"
"Have [a] solution without changing the character of the waterfront"
"[Have] waterfront parks like Kingston Point"
"Take the stress out of the waterfront"

E. Recommendations

Based on eight months of study and discussion of future risks of flooding and sea-level rise along the Kingston waterfront, the Task Force grouped its recommendations for the City of Kingston in the following categories:

1. City operations, funding and decision-making
2. Resilient structures
3. Promotion of a waterfront economy and economic revitalization
4. Collaboration and public outreach
5. Emergency management
6. Site-based recommendations

Some recommended actions would be implemented in the near term (0-5 years) and some in the longer term (5 years+).
The recommendations were endorsed by the following Task Force members, including all Task Force members present at the final Task Force meeting: David Allen, Susan Spencer Crowe, Steve Finkle, Scott Herrington, Tom Hoffay, Ann Loeding, Patrick McDonough, Kevin McEvoy, Jon McGrew, Julie Noble, Steve Noble, Steve Schabot, Jennifer Schwartz Berky, Allan Shope, Arthur Snyder and Gregg Swanzey.

Based on its findings, the Task Force presents the City with the following recommendations to achieve these themes listed above, the stated goals of the Task Force, and a more flood-resilient waterfront.

City Operations, Funding and Decision Making

RECOMMENDATION

City operations, funding and decision making should strive to reduce vulnerability to flooding and increase resilience.

City agencies responsible for the management and regulation of resources, infrastructure and vulnerable populations should consider the impacts of flooding, sea-level rise and climate change in all relevant decision making, including long-term planning, programming, permitting, regulation, emergency response, and funding and capital-expenditure decisions.

Near-term Actions

1. Adopt the sea-level rise and flood projections recommended by New York State and used by the Kingston Task Force for planning purposes.

Adopt these projections to inform all City near-term planning and decision making, recognizing both the inherent uncertainty in long-term climate projections and the need to adapt to conditions that may occur if meaningful steps are not taken to reduce greenhouse gas emissions. Ensure there is a mechanism in place to regularly re-evaluate and update these sea-level rise and flood projections, using new information released by the state, and to incorporate updated projections into planning and decision making.

2. Incorporate the findings and recommendations from the Kingston Waterfront Flooding Task Force into other City and regional plans.

Relevant plans include the current comprehensive plan and zoning update (Kingston 2025), Tidal Rondout Creek Watershed Management Plan, East Strand Street Flooding and Stormwater Management Analysis, Generic Environmental Impact Statement for Brownfields along the Rondout, open space plan and future plans such as climate adaptation plan, revisions to the Local Waterfront Revitalization Program, transportation plans, the Ulster County Multi-Hazard Mitigation Plan, and the inter-municipal comprehensive harbor management plan. Consider updating and adopting the 2010 City of Kingston Stormwater Management Plan.

Long-term Actions

3. Develop a Kingston Waterfront Long-term Resiliency Plan.

In order to refine Kingston's approach to increasing the resiliency of its waterfront, this plan should build on the efforts of the Kingston Tidal Waterfront Flooding Task Force and:

- Implement the recommendations of the Kingston Tidal Waterfront Flooding Task Force consistent with the six key themes;
- Prioritize adaptation actions City-wide according to the vulnerability of assets, their value to the community, considerations of environmental quality and human welfare, and capital-investment capacity.
- Work with property owners to explore the appropriateness of and select site-specific strategies for implementation of adaptation approaches such as fortification, accommodation or relocation of assets from flood-prone areas;
- Consider identifying areas where development should be restricted in the future to minimize vulnerability;
- Outline a research agenda to explore new approaches to waterfront architecture and infrastructure;
- Assess the risk of suspension or release of contaminants from waterfront properties and facilities during flood events and with inundation from sea-level rise;
- Ensure that the approval of structural protection measures (like seawalls and bulkheads) will not result in the elimination of all intertidal areas and the public's right to access those areas as water levels rise.

4. Reduce Kingston's greenhouse gas emissions and contribution to sea level rise and other climate change impacts through the implementation of Kingston's Climate Action Plan, green infrastructure and green architecture.

5. Ensure that all relevant City staff and elected and appointed officials are fully trained in and expected to incorporate impacts of flooding and sea-level rise into their daily work.

This could include planning, engineering, emergency management and public works personnel as well as common council and other leaders. Kingston could consider implementing the following recommendations:

- Issuing an executive policy that requires City staff to consider flooding and sea-level rise impacts into their daily work and decision making.
- Informing and training staff and officials of Kingston, neighboring municipalities and county officials on the risk assessments and findings from the Kingston Waterfront Flooding Task Force.

- Adapting and modifying infrastructure over time to address increasing vulnerability to flooding and sea-level rise.
- Considering sea-level rise and flood impacts over the lifespan of any proposed project that will require capital expenditure plans or departmental requests for funds. Develop a City-wide capital improvement plan that incorporates the needs of all departments to allow for prioritization of investment in flood resilience across departments.
- Enforcing existing regulations relevant to status quo flooding and sea-level rise impacts, such as those that fall to the local floodplain administrator (Kingston § 405-26. Flood Hazard Overlay District) and zoning board of appeals.
- Requiring that City agencies report regularly on emerging vulnerabilities and progress toward achieving resiliency to sea-level rise and flooding in their agencies' annual reports.
- Evaluating the costs and benefits of reducing the impact of rising flood insurance premiums on residents and businesses by participating in the National Flood Insurance Program's Community Rating System.

Resilient Structures

RECOMMENDATION

The City should encourage safe and resilient structures in the waterfront area through zoning, permitting and building codes in existing and new development.

Near-term Actions

6. Ensure that zoning designations in the Kingston 2025 Comprehensive Plan consider increasing risk and vulnerability from flooding and sea-level rise.

7. Require that proposals for new development of any kind in the Flood Hazard Overlay District take flood risk into account.

Ensure that current building codes are being enforced along the waterfront and that all proposals for new development demonstrate adequate safety and viability over the long run, including, but not limited to shoreline protection, building standards, locations of structures and uses of structures.

8. Reduce stormwater, upland flooding and combined sewer overflows through green infrastructure and best stormwater management practices.

The waterfront experiences significant flood impacts from the landward side. Evaluate the use of backflow preventers in some areas as a near-term solution to waterfront flooding issues. Where feasible and cost effective, promote the use of best stormwater management practices and green infrastructure to absorb stormwater.

Long-term Actions

9. Research, evaluate and implement changes to City building and zoning codes that will increase resiliency and are cost-effective and socially equitable.

At present, the FEMA Special Flood Hazard Area (i.e., the regulated 100-year floodplain) does not account for changes in flood risk due to sea-level rise and stronger storms. Kingston has adopted the state's two-foot freeboard requirement for construction of new structures, substantial improvement (>50%) or reconstruction of substantially damaged structures. Kingston could consider going beyond state floodplain regulations to reduce long-term vulnerability and reduce the cost of flood insurance for new construction. Options include extending the boundaries of the current Flood Hazard Overlay District (Kingston §405-26) or increasing the freeboard requirement in this district. The costs and benefits of these and other options should be evaluated to inform potential implementation.

10. Study the feasibility of using policy, zoning and building codes to achieve creative, water-dependent and water-enhanced uses that are resilient, including elevated, amphibious, or floating structures, wharves, berms and elevated rights of way.

11. Evaluate the use of natural buffers and green shoreline infrastructure to reduce flood risk and erosion and conserve natural resource functions.

In codes and zoning policies, encourage the use of buffer areas and other land-use based coastal protection strategies to reduce flooding risk to human communities and reduce risk to natural resources. Consistent with this Task Force's site-specific recommendations, support projects or actions that use green shoreline infrastructure to protect shoreline assets and conserve natural protective features and/or secure opportunities for habitat migration in response to sea-level rise where appropriate (e.g., Kingston Point).

12. Ensure that local street networks, utilities and other infrastructure function and remain connected as the City implements adaptation strategies to sea-level rise.

Pay special attention to waterfront road access, entrances and exits; and the implications for public safety, emergency response, public infrastructure and evacuation. Ensure that zoning revisions and other policies incorporate these vulnerabilities and adaptive responses.

13. Research and evaluate land-use tools and financing mechanisms or incentives to facilitate flood adaptation in the waterfront.

Conduct further studies to evaluate land-use tools and financing mechanisms to promote resilient development along the waterfront. Financing could include the use of tax incentives, waiver of permit fees, or a grant or revolving loan fund to encourage property owners to flood-proof or elevate structures. Land-use tools could include rolling easements, incentives for donation of conservation easements or the use of publicly owned properties acquired through tax delinquency as relocation sites for exchange with willing flood vulnerable owners. Mechanisms should be evaluated for social equity and effects on affordable housing.

Promoting a Waterfront Economy and Economic Revitalization

RECOMMENDATION

Kingston should promote its waterfront as a world-class destination, home to vibrant businesses, cultural assets and water-based recreation. Kingston should promote its waterfront economy and economic revitalization. The local economy depends on safe, clean water and public access to the shoreline from land and river.

Long-term Actions

14. Ensure opportunities exist for open space and recreation over the long term.

Waterfront access and water recreation draw visitors to the Rondout; these recreational opportunities are critical to local businesses. Current waterfront open space and parks should be studied, and an adaptation and transition plan for existing sites and potential locations for future sites put in place.

15. Consider future flood hazards in economic development planning.

The City should ensure that any new waterfront economic development planning and implementation consider current coastal hazards and future impacts of sea-level rise and flooding. Plans for remediation of contaminated sites and redevelopment of brownfields must be effective and safe as sea levels rise and flood risk increases.

16. Develop a plan to mitigate both near- and long- term risk to the wastewater treatment facility.

This plan should include short -term solutions to mitigate flood risk at the current facility and associated pump stations and the evaluation of long- term strategies such as protection in place or relocation of the plant. The plan should also consider the life cycle of plant components, the value of the property for other uses, and innovative approaches (e.g., distributed systems and shared municipal services) that may effectively meet the wastewater treatment needs for the City and surrounding communities over the long term.

Community Collaboration and Public Outreach

RECOMMENDATION

The City should engage with and protect the community through collaboration and public outreach in order to raise public awareness of the risks of flooding, coastal hazards and sea-level rise, and give community members the tools and information they need to reduce their vulnerability.

Near-term Actions

17. Host an informational public meeting with FEMA.

Work with FEMA to inform community members about the Community Rating System, flood insurance changes, flood hazard overlay districts and resilient rebuilding approaches. Provide public informational events as necessary.

18. Conduct public outreach to property owners, tenants and prospective buyers in the Flood Hazard Overlay District.

Enforce existing regulations that require that all developers be notified if their properties are in the current Area of Special Flood Hazard §405-26 C (7). Be sure all property owners, tenants, and prospective buyers are aware of the current and projected future floodplain. Mail all property owners and tenants in the District information on flood safety and emergency warning systems in Kingston, appropriate responses to flood warnings, the public health effects of flooding, and potential flood-mitigation strategies for their properties. Consider using interpretive signs to educate the public about flood risk and measures Kingston is taking to increase resiliency. Repeat as necessary.

19. Encourage and assist community-based organizations in their efforts to communicate the risks of flooding and potential adaptation solutions to vulnerable or non-English speaking populations.

Work with community-based organizations to facilitate translation of complex information to community members in vulnerable or non-English speaking neighborhoods, gather information on local impacts of flooding and encourage dialogue on potential adaptation solutions.

20. Collaborate with other waterfront communities and county and state government to plan for coastal hazards like sea-level rise and storm surge.

Present findings from the Kingston Waterfront Flooding Task Force to adjacent waterfront communities. Collaborate on a plan with Esopus and Ulster that outlines joint goals for waterfront resiliency along the Rondout. Work together to advocate for the federal government to continue to fund the maintenance and operation of the USGS stream gauges in the Rondout and elsewhere for real-time flood emergency management.

Emergency Management

RECOMMENDATION

Kingston should ensure the efficiency and effectiveness of emergency management strategies to promote the safety of residents and limit damage to infrastructure and properties.

Near-term Actions

21. Revise emergency management planning documents.

Incorporate flooding and sea-level rise risks into Kingston's updated comprehensive emergency management plan. Specifically, include sea-level rise as a hazard in Kingston, a plan for emergency debris removal following large flood events, and strategies to manage marinas and other water dependent uses in flood emergencies. Work with Ulster County Emergency Management on the five-year update of its multi-hazard mitigation plan so that sea-level rise and storm surge are considered in the plan.

22. Employ new tools to improve real time emergency management planning.

Use tools like the USGS Rondout stream gauge and the Stevens Institute New York Harbor Observing and Predicting System (NYHOPS) model to improve real time planning in flood situations. The Rondout stream gauge provides real time information on water level and flow and notifications as water levels reach certain heights. The NYHOPS model of the Hudson estuary can be used to access more localized water level forecasts for estuary shoreline communities as a storm approaches. Streamline emergency management decision making during flooding by creating an organizational framework to conduct rapid preliminary damage assessments. Collaborate with other members of the Hudson Valley emergency management community to advocate for new tools and modeling that will improve decision making.

23. Ensure safe access and evacuation along the waterfront during regular flood events.

Evaluate evacuation plans in light of sea-level rise to ensure evacuation routes are safe and accessible. Ensure that the law enforcement and emergency services launch facility on the Rondout remains accessible and operational during high-water events.

Long-term Actions

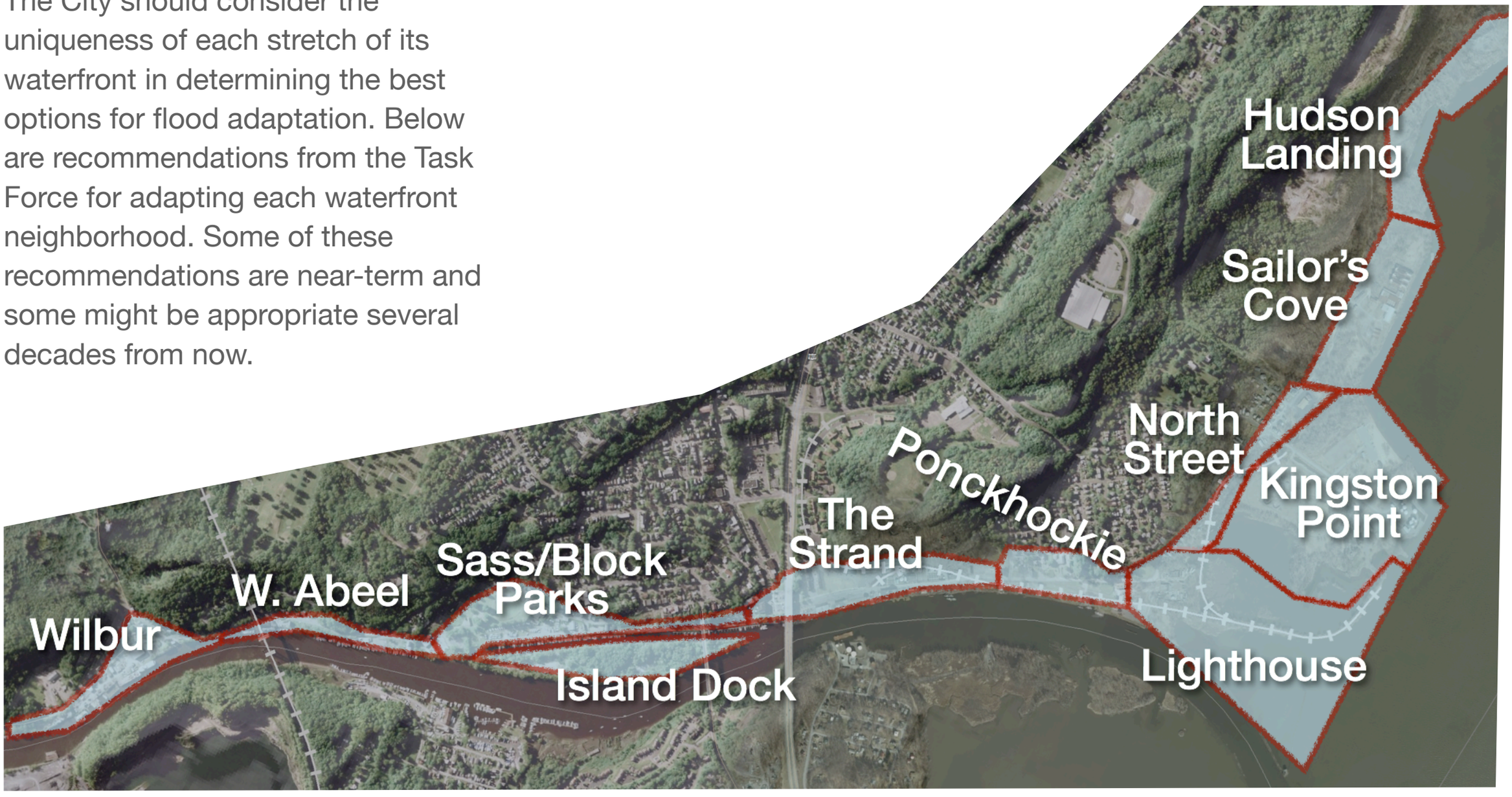
24. Develop a process to map and track repetitive storm damage.

The process should include a method to gather, record and archive information on properties affected by storms and damages sustained over time to be used for future planning decisions, and should cover coastal, riverine and stormwater impacts.

Site-Specific Recommendations

RECOMMENDATION

The City should consider the uniqueness of each stretch of its waterfront in determining the best options for flood adaptation. Below are recommendations from the Task Force for adapting each waterfront neighborhood. Some of these recommendations are near-term and some might be appropriate several decades from now.



Wilbur

- Route 213 may need to be elevated or re-engineered and may need additional planning to ensure access and egress for residents during high-water events.
- Several existing residential and commercial structures need to be made flood-resilient or flood-proof.

West Abeel

- Consider elevating or re-engineering the roadway, or other measures to ensure access and egress for residents during high-water events.
- Consider working with property owners to explore options and feasibilities for constructing resilient waterfront wharf or pier structures to enable continued waterfront use, not berms or shoreline hardening.

Sass/Block Parks

- Develop a plan for the adaptation of waterfront parks to maintain uses as water levels rise.
- Ensure that the harbor and its use are continued as one of the most storm-secure deep-water harbors on the Hudson River.
- Evaluate whether the channel adjacent to Block Park must be dredged to allow continued use for marinas. Consider enabling water flow through channel.
- Consider alternatives to the use of berms or hardened shorelines where appropriate. Evaluate potential for raised walkways along shoreline.
- Consider elevating or re-engineering Abeel Street, or taking other measures to ensure access and egress for residents during high-water events.
- Develop strategies to assist property owners in making existing residential and commercial structures flood-resilient or flood-proof in the near term.

Island Dock

- Evaluate whether it is desirable to use this area as a protective waterfront buffer. Conduct a cost-benefit analysis to determine whether remediation and fortification of the island is a feasible alternative over the long term.

The Strand

- Maintain the Strand as a “water-oriented zone” that preserves the historic connection of Kingston to the waterfront, including water-dependent uses, maintaining historic and cultural resources and public access to the Rondout.

- Consider fitting the municipal stormwater system with backflow restrictors in this area in the near term so that water from the Rondout cannot flood the Strand roadway during high-tide events.
- Develop strategies to assist property owners to make existing residential and commercial structures flood-resilient or flood-proof in the near term.
- Investigate the potential for relocating the East Strand northward to higher ground and/or constructing wharf or pier structures to enable continued waterfront uses and development.
- The City should develop a phased plan for making structures and infrastructure safer now, and mapping a path to a resilient Strand waterfront over coming decades. The City should not make investments or facilitate development that is not responsive to a long-term plan for the Strand.

Ponckhockie

- Develop strategies to assist property owners in making existing residential and commercial structures flood-resilient or flood-proof in the near term.
- Consider fitting the municipal stormwater system with backflow restrictors in this area in the near term so that water from the Rondout does not flood the Strand roadway during high-tide events.
- Investigate the potential for relocating the East Strand roadway northward to higher ground and/or constructing wharf or pier structures to enable continued waterfront uses and development.
- Ensure that long term plans for Ponckhockie are consistent with any long -term plans for the Strand.

Lighthouse

- Consider elevating East Strand and North Street to maintain connections to Kingston Point and beyond.
- Evaluate potential for a developing a public greenway here.
- Work with the Trolley Museum to develop a long-term strategy for elevating or relocating the railway.
- Consider flood and inundation risk to brownfields and any remediation efforts in this area.

North Street

- Consider elevating East Strand and North Street to maintain connections to Kingston Point and beyond.
- Evaluate the potential for developing a public greenway here.
- Work with the Trolley Museum to develop a long-term strategy for elevating or relocating the railway.

- Examine the feasibility of voluntary relocation or buyouts for residents here, both to reduce future flood impacts and to facilitate the creation of a public greenway or relocation of the trolley railway.

Kingston Point

- Develop a phased plan for long-term transformation of the Kingston Point Park area as water levels rise that ensures continued recreational use and boat access, includes a long-term plan for existing energy infrastructure, and includes provisions for wetland expansion over time.
- Consider elevating East Strand and North Street to maintain connections to Kingston Point and beyond and potentially integrate that project into a shoreline elevation effort to protect the North Street neighborhood.

Sailor's Cove and Hudson Landing

- Ensure that development designs and building standards are consistent with future sea-level rise and flooding scenarios.
- Encourage development patterns away from the river's edge in order to maintain a public greenway or promenade.

F. Appendices

I. Participants

II. Recommendations by Category

III. Glossary

IV. Resources

V. Supplemental Materials

Appendix 1: Participants

This appendix indicates people appointed to the Kingston Waterfront Flooding Task Force, Planning Team members, and others who attended three meetings or more. There were seven (7) total Task Force meetings. Alternates for Task Force members are listed beside the appointed member's name.

Appointed Task Force members

Deborah Brown, *City of Kingston - Common Council Ward 9*

Suzanne Cahill, *City of Kingston – Planning Department*

Bob Cacchio, *City of Kingston - Sewage Treatment Plant*

Susan Spencer Crowe, *Resident* ✪‡

Dennis Doyle (or alternate Amanda Lavalle), *Ulster County* ‡

Doris Edwards, *Riverview Baptist Church* ‡

Tim Feeney, *Feeney's Shipyard*

Steve Finkle, *AVR* ✪‡

Abel Garraghan, *Heritage Energy* ‡

Huntley Gill, *Guardia Architects* ✪ ‡

Frank Guido, *Mariners Harbor*

Kyla Haber, *City of Kingston - Planning Department*

Sandy Henne, *Hudson River Cruises* ‡

Scott Herrington, *Kingston City Marina* ✪

Tom Hoffay, *City of Kingston - Common Council Ward 2* ✪ ‡

Samir Hrichi (or alternate Sarah Hrichi), *Ship to Shore Restaurant*

Joseph Hurwitz, *Sailors Cove*

Gayle Johnson, *New Central Baptist Church* ‡

Ann Loeding, *Friends of Kingston Waterfront* ✪‡

Patrick McDonough, *Hudson River Maritime Museum* ✪

Kevin McEvoy, *Kingston Land Trust* ✪ ‡

Jon McGrew, *Trolley Museum* ✪‡

James Noble, *City of Kingston - Common Council At Large*

Julie Noble, *City of Kingston, Parks and Recreation & Conservation Advisory Council* ✪‡

Steve Noble, *City of Kingston - Environmental Education* ✪

Mike Oats (or alternate Deanna Robertson), *Hudson River Ventures* ‡

Lisa Pugliese, *Steel House*

John Reinhardt (retired during project period, replaced by current Chief Mark Brown or alternate David Allen), *City of*

Kingston - Fire and Building Department ✪ ‡

Steve Schabot, *City of Kingston - Parks and Recreation Board* ✪‡

Mike Schupp, *City of Kingston - Public Works*

Jennifer Schwartz Berky, *resident and urban planner* ✪‡

Allan Shope, *Clearwater* ✪‡

Arthur Snyder, *Ulster County Emergency Management* ✪‡

Gregg Swanzey, *City of Kingston - Economic Development* ✪‡

Ralph Swenson, *City of Kingston - City Engineer*

Allen Winchell, *City of Kingston - Sewage Treatment Plant*

✪ *Endorsed list of recommendations in this Report*

‡ *Attended 3 or more Task Force meetings*

Planning Team Members

Suzanne Cahill, *City of Kingston – Planning Department*

Ona Ferguson, *Consensus Building Institute*

Emilie Hauser, *NYSDEC Hudson River National Estuarine Research Reserve*

JT Lockman, *Catalysis Adaptation Partners, LLC*

Mark Lowery, *NYSDEC Office of Climate Change*

Kristin Marcell, *NYSDEC Hudson River Estuary Program / Cornell*

Libby Murphy, *NYSDEC Hudson River Estuary Program / Cornell*

Julie Noble, *City of Kingston* – Parks and Recreation & Conservation Advisory Council

Barry Pendergrass, *NYS Department of State*

Sacha Spector, *Scenic Hudson*

Gregg Swanzey, *City of Kingston - Economic Development*

Christina Tobitsch, *NYSDEC Hudson River National Estuarine Research Reserve and SCA*

Others who attended at least 3 meetings

Jeff Anzevino, *Scenic Hudson*

Betsy Blair, *NYSDEC HRNERR*

Diane Dintruff, *Esopus Environmental Board*

Fran Dunwell, *NYSDEC Hudson River Estuary Program*

Jim Murac, *Milone and MacBroom*

David Railsback, *ARCADIS*

Steve Rosenberg, *Scenic Hudson*

Joan Williams Washington, *Kingston Resident*

Appendix 2 - Recommendations Categories

Recommendation	Near-term *(In the next 5 years)*	Long-term *(Beyond 5 years)*	Planning *(Land use, capital & economic dev.)*	Zoning	Public Outreach	Safety & Emergency Preparedness	Technical Training	Further Study
1	X	X	X				X	
2	X	X	X				X	
3		X	X					
4	X	X	X					
5	X	X					X	
6	X			X				
7	X			X			X	
8	X	X	X	X				
9	X	X		X			X	X
10		X	X	X				X
11	X	X	X	X				X
12		X	X					
13		X	X					X
14		X	X					X
15	X	X	X					
16		X	X					X
17	X				X	X		
18	X				X	X		
19	X	X	X		X	X		
20	X	X	X		X		X	
21	X					X		
22	X					X	X	
23	X				X	X		
24	X	X				X		
TOTAL	18	17	13	6	5	7	7	6

Near-Term Recommendations (Next 1-5 years)	
1	Adopt the sea-level rise and flood projections recommended by New York State and the Kingston Task Force for planning purposes.
2	Incorporate the findings and recommendations from the Kingston Waterfront Flooding Task Force into other city and regional plans.
4	Reduce Kingston's greenhouse gas emissions and contribution to sea level rise and other climate impacts through the implementation of Kingston's Climate Action Plan, green infrastructure and green architecture.
5	Ensure that all relevant City staff and elected and appointed officials are fully trained in and expected to incorporate impacts of flooding and sea-level rise into their daily work.
6	Ensure that zoning designations in the Kingston 2025 Comprehensive Plan consider increasing risk and vulnerability from flooding and sea-level rise.
7	Require that proposals for new development of any kind in the Flood Hazard Overlay District take flood risk into account.
8	Reduce stormwater, upland flooding and combined sewer overflows through green infrastructure and best stormwater management practices.
9	Research, evaluate and implement changes to City building and zoning codes that will increase resiliency and are cost-effective and socially equitable.
10	Evaluate the use of natural buffers and green shoreline infrastructure to reduce flood risk and erosion and conserve natural resource functions.
15	Consider future flood hazards in economic development planning.
17	Host an informational public meeting with FEMA.
18	Conduct public outreach to property owners, tenants and prospective buyers in the Flood Hazard Overlay District.
19	Encourage and assist community-based organizations in their efforts to communicate the risks of flooding and potential adaptation solutions to vulnerable or non-English speaking populations.
20	Collaborate with other waterfront communities and county and state government to plan for coastal hazards like sea-level rise and storm surge.
21	Revise emergency management planning documents.
22	Employ new tools to improve real time emergency management planning.
23	Ensure safe access and evacuation along the waterfront during regular flood events.
24	Develop a process to map and track repetitive storm damage.

Long-Term Recommendations (Beyond 5 years)	
1	Adopt the sea-level rise and flood projections recommended by New York State and the Kingston Task Force for planning purposes.
2	Incorporate the findings and recommendations from the Kingston Waterfront Flooding Task Force into other City and regional plans.
3	Develop a Kingston Waterfront Long-term Resiliency Plan.
4	Reduce Kingston's greenhouse gas emissions and contribution to sea level rise and other climate impacts through the implementation of Kingston's Climate Action Plan, green infrastructure and green architecture.
5	Ensure that all relevant City staff and elected and appointed officials are fully trained in and expected to incorporate impacts of flooding and sea-level rise into their daily work.
8	Reduce stormwater, upland flooding and combined sewer overflows through green infrastructure and best stormwater management practices.
9	Research, evaluate and implement changes to City building and zoning codes that will increase resiliency and are cost-effective and socially equitable.
10	Study the feasibility of using policy, zoning and building codes to achieve creative, water-dependent and water-enhanced uses that are resilient, including elevated, amphibious, or floating structures, wharves, berms and elevated rights of way.
11	Evaluate the use of natural buffers and green shoreline infrastructure to reduce flood risk and erosion and conserve natural resource functions.
12	Ensure that local street networks, utilities and other infrastructure function and remain connected as the City implements adaptation strategies to sea-level rise.
13	Research and evaluate land-use tools and financing mechanisms or incentives to facilitate flood adaptation in the waterfront.
14	Ensure opportunities exist for open space and recreation over the long term.
15	Consider future flood hazards in economic development planning.
16	Develop a plan to mitigate both near- and long- term risk to the wastewater treatment facility
19	Encourage and assist community-based organizations in their efforts to communicate the risks of flooding and potential adaptation solutions to vulnerable or non-English speaking populations.
20	Collaborate with other waterfront communities and county and state government to plan for coastal hazards like sea-level rise and storm surge.
24	Develop a process to map and track repetitive storm damage.

Planning (Land Use, Capital & Economic Development)	
1	Adopt the sea-level rise and flood projections recommended by New York State and the Kingston Task Force for planning purposes.
2	Incorporate the findings and recommendations from the Kingston Waterfront Flooding Task Force into other City and regional plans.
3	Develop a Kingston Waterfront Long-term Resiliency Plan.
4	Reduce Kingston's greenhouse gas emissions and contribution to sea level rise and other climate impacts through the implementation of Kingston's Climate Action Plan, green infrastructure and green architecture.
8	Reduce stormwater, upland flooding and combined sewer overflows through green infrastructure and best stormwater management practices.
10	Study the feasibility of using policy, zoning and building codes to achieve creative, water-dependent and water-enhanced uses that are resilient, including elevated, amphibious, or floating structures, wharves, berms and elevated rights of way.
11	Evaluate the use of natural buffers and green shoreline infrastructure to reduce flood risk and erosion and conserve natural resource functions.
12	Ensure that local street networks, utilities and other infrastructure function and remain connected as the City implements adaptation strategies to sea- level rise.
13	Research and evaluate land- use tools and financing mechanisms or incentives to facilitate flood adaptation in the waterfront.
14	Ensure opportunities exist for open space and recreation over the long term.
15	Consider future flood hazards in economic development planning.
16	Develop a feasibility study for relocating the wastewater treatment facility.
19	Encourage and assist community-based organizations in their efforts to communicate the risks of flooding and potential adaptation solutions to vulnerable or non-English speaking populations.
20	Collaborate with other waterfront communities and county and state government to plan for coastal hazards like sea-level rise and storm surge.

Zoning	
6	Ensure that zoning designations in the Kingston 2025 Comprehensive Plan consider increasing risk and vulnerability from flooding and sea-level rise.
7	Require that proposals for new development of any kind in the Flood Hazard Overlay District take flood risk into account.
8	Reduce stormwater, upland flooding and combined sewer overflows through green infrastructure and best stormwater management practices.
9	Research, evaluate and implement changes to City building and zoning codes that will increase resiliency and are cost-effective and socially equitable.
10	Study the feasibility of using policy, zoning and building codes to achieve creative, water-dependent and water-enhanced uses that are resilient, including elevated, amphibious, or floating structures, wharves, berms and elevated rights of way.
11	Evaluate the use of natural buffers and green shoreline infrastructure to reduce flood risk and erosion and conserve natural resource functions.
Public Outreach	
17	Host an informational public meeting with FEMA.
18	Conduct public outreach to property owners, tenants and prospective buyers in the Flood Hazard Overlay District.
19	Encourage and assist community-based organizations in their efforts to communicate the risks of flooding and potential adaptation solutions to vulnerable or non-English speaking populations.
20	Collaborate with other waterfront communities and county and state government to plan for coastal hazards like sea-level rise and storm surge.
23	Ensure safe access and evacuation along the waterfront during regular flood events.
Safety and Emergency Preparedness	
17	Host an informational public meeting with FEMA.
18	Conduct public outreach to property owners, tenants and prospective buyers in the Flood Hazard Overlay District.
19	Encourage and assist community-based organizations in their efforts to communicate the risks of flooding and potential adaptation solutions to vulnerable or non-English speaking populations.
21	Revise emergency management planning documents.
22	Employ new tools to improve real time emergency management planning.

Safety and Emergency Preparedness	
17	Host an informational public meeting with FEMA.
18	Conduct public outreach to property owners, tenants and prospective buyers in the Flood Hazard Overlay District.
19	Encourage and assist community-based organizations in their efforts to communicate the risks of flooding and potential adaptation solutions to vulnerable or non-English speaking populations.
21	Revise emergency management planning documents.
22	Employ new tools to improve real time emergency management planning.
23	Ensure safe access and evacuation along the waterfront during regular flood events.
24	Develop a process to map and track repetitive storm damage.

Technical Training	
1	Adopt the sea-level rise and flood projections recommended by New York State and the Kingston Task Force for planning purposes.
2	Incorporate the findings and recommendations from the Kingston Waterfront Flooding Task Force into other City and regional plans.
5	Ensure that all relevant City staff and elected and appointed officials are fully trained in and expected to incorporate impacts of flooding and sea-level rise into their daily work.
7	Require that proposals for new development of any kind in the Flood Hazard Overlay District take flood risk into account.
9	Research, evaluate and implement changes to City building and zoning codes that will increase resiliency and are cost-effective and socially equitable.
20	Collaborate with other waterfront communities and county and state government to plan for coastal hazards like sea-level rise and storm surge.
22	Employ new tools to improve real time emergency management planning.

Further Study	
9	Research, evaluate and implement changes to City building and zoning codes that will increase resiliency and are cost-effective and socially equitable.
10	Study the feasibility of using policy, zoning and building codes to achieve creative, water-dependent and water-enhanced uses that are resilient, including elevated, amphibious, or floating structures, wharves, berms and elevated rights of way.
11	Evaluate the use of natural buffers and green shoreline infrastructure to reduce flood risk and erosion and conserve natural resource functions.
13	Research and evaluate land-use tools and financing mechanisms or incentives to facilitate flood adaptation in the waterfront.
14	Ensure opportunities exist for open space and recreation over the long term.
16	Develop a plan to mitigate both near- and long- term risk to the wastewater treatment facility

Appendix 3 - Glossary

Accommodation, the use of strategies that allow the continued use of vulnerable lands, but that do not attempt to prevent flooding or inundation with shoreline flooding protection.

Adaptation, adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Base flood, the flood that has a one percent chance of being equaled or exceed in any given year, also known as the "one-percent" or "100-year flood.

Base flood elevation, the computed elevation to which floodwater is anticipated to rise during the base flood, shown on flood insurance rate maps.

CEMP, comprehensive emergency management plan.

Climate Smart Planning, a planning evaluation tool for New York State communities.

Community Rating System, a voluntary incentive program of the National Flood Insurance Program (NFIP) that encourages communities to adopt floodplain management activities that exceed the NFIP requirements.

Conservation Easement, a power invested in a qualified private land conservation organization (often called a "land trust") or government (municipal, county, state or federal) to constrain, as to a specified land area, the exercise of rights otherwise held by a landowner so as to achieve certain conservation purposes.

DEM, digital elevation model, a digital or 3-dimensional representation of a terrain's surface.

FEMA, Federal Emergency Management Agency.

Fortification, traditional coastal hardening techniques such as seawalls, and beach nourishment that attempt to maintain a static shoreline position.

FIRM, flood insurance rate maps, official map of a community on which FEMA has delineated both the special hazard areas and the risk premium zones applicable to the community.

FIS, flood insurance study (survey), A flood insurance survey is a compilation and presentation of flood risk data within a community. When a flood study is completed, the information and maps are assembled into an flood insurance study report, which contains detailed flood elevation data in flood profiles and data tables.

Freeboard, a factor of safety usually expressed in feet above a flood level for purposes of floodplain management.

GIS, geographic information system, a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data.

Hazard, a dangerous phenomenon or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

LiDAR, light detecting and ranging radar, a remote sensing technology used to make high-resolution maps.

MHHW, mean higher high water, the average of the higher high water height of each tidal day.

NFIP, National Flood Insurance Program.

NYHOPS, New York Harbor Observing and Prediction System, a model operated by the Stevens Institute to provide ocean and weather information for the Port of New York and New Jersey.

NYSDEC, New York State Department of Environmental Conservation.

NYSDOS, New York State Department of State.

Relocation, moving development out of harm's way in a planned and controlled manner using techniques such as abandonment, relocation, avoidance.

Resilience (*also* Resiliency), the capacity of an individual, community, or institution to dynamically and effectively respond to shifting climate impact circumstances while continuing to function and prosper.

Risk assessment, a process to analyze both the probability of an event and the consequences.

Rolling Easement, a special type of easement placed along the shoreline to prevent property owners from holding back the sea but allowing any other type of use and activity on the land. As the sea advances, the easement automatically moves or "rolls" landward, and tidal lands become public.

SLR, sea-level rise, an increase in the mean level of the ocean.

Special Flood Hazard Area, the land area covered by the floodwaters of the base flood, as designated on NFIP maps.

USGS, United State Geoglogical Survey.

Vulnerability, the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes, or susceptible attribute or resource.

Appendix 4 - Resources

RESOURCES LIST

The following resources were either used or referred to during the Kingston Waterfront Flooding Task Force's work.

City of Kingston Studies and Plans

City of Kingston Climate Action Plan and 2010 Community-Wide & Local Government Operations Energy and Greenhouse Gas Emissions Inventory, published by the City of Kingston, NY (2012). http://kingstoncac.org/index.php/climate-action-plan

City of Kingston Local Waterfront Revitalization Program (LWRP), prepared by the City of Kingston Common Council (1992). http://docs.dos.ny.gov/communitieswaterfronts/LWRP/Kingston_C/Original/City%20of%20Kingston%201992.pdf

Oil Storage Facilities Study, Kingston, NY, prepared by Daniel Shuster, Olko Engineering, and Raymond, Parish, Pine & Weiner, Inc. (1981). (An analysis of the feasibility of relocating and/or consolidating existing oil storage and distribution facilities in order to recapture valuable waterfront property.) http://www.gpo.gov/fdsys/pkg/CZIC-tp692-5-s58-1982/pdf/CZIC-tp692-5-s58-1982.pdf

Waterfront Brownfield Opportunity Area Step 2 Nomination (August 19, 2010). http://www.kingston-ny.gov/filestorage/76/78/82/6765/boa_step_2_final_narrative.pdf

Municipal Climate Change Action and Adaptation Plans

Preparing for Climate Change in Groton, Connecticut: A Model for Communities in the Northeast (2011) http://www.icleiusa.org/library/documents/ICLEI_Final_Report_Groton_Coastal_Climate_Change_ProjectJP.pdf

State of New York Action Plan for Community Development Block Grant Program Disaster Recovery, prepared by New York State Homes and Community Renewal, Office of Community Renewal (April 2013). http://www.ny.gov/assets/documents/CDBGActionPlan.pdf

Resilient and Adaptive Waterfront Strategies

Coastal Climate Resilience, Urban Waterfront Adaptive Strategies, prepared by New York City Department of City Planning (June 2013). http://www.nyc.gov/html/dcp/pdf/sustainable_communities/urban_waterfront_print.pdf

Coastal No Adverse Impact Handbook, Chapter 5: Mitigation. (May 2007). http://www.floods.org/NoAdverseImpact/CNAI_Handbook/CNAI_Handbook_Chapter5.pdf

Georgetown Climate Center Adaptation Tool Kit: Sea-Level Rise and Coastal Land Use, How Governments Can Use Land-Use Practices to Adapt to Sea-Level Rise, by Jessica Grannis (October 2011). http://www.georgetownclimate.org/resources/adaptation-tool-kit-sea-level-rise-and-coastal-land-use

Incorporating Sea Level Change Scenarios at the Local Level published by NOAA (2012). http://www.csc.noaa.gov/digitalcoast/_/pdf/slcscenarios.pdf

Planning and Building Livable, Safe, & Sustainable Communities: The Patchwork Quilt Approach by Edward A. Thomas and others, published by The Natural Hazard Mitigation Association (Updated June 8, 2011). http://stormsmart.org/uploads/patchwork-quilt/patchwork_quilt.pdf

Revitalizing Hudson Riverfronts: Illustrated Conservation & Development Strategies for Creating Healthy, Prosperous Communities. Eisenman, R. J. Anzevino, S. Rosenberg, and S.Spector (eds.), published by Scenic Hudson, Inc. (2010). http://www.scenichudson.org/ourwork/riverfrontcommunities/publications

Flooding and Stormwater Management, Flood Maps, and Flood Insurance

City of Kingston Zoning Code, Flood Hazard Overlay District § 405-26. http://ecode360.com/6727255#6727947

East Strand Flooding and Stormwater Management Analysis Draft, prepared by Milone and MacBroom, Inc., for the City of Kingston (April 5, 2013).http://www.kingston-ny.gov/filestorage/76/6654/6656/East_Strand_Street_Flooding_and_Stormwater_Management_Analysis_DRAFT_M%26M.pdf

FEMA Brochure on Flood Insurance Changes: Build Back Stronger-What you need to know. http://www.fema.gov/library/viewRecord.do?id=6712

FEMA Map Services Center. https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1&userType=G

Rebuilding After Sandy, but With Costly New Rules by Tara Siegel Bernard, published by the New York Times (May 10, 2013). http://www.nytimes.com/2013/05/11/your-money/after-hurricane-sandy-rebuilding-under-higher-flood-insurance.html?smid=pl-share

Scenic Hudson Sea Level Rise Mapper. http://www.scenichudson.org/slr/mapper

New York Climate Change Reports and Resources

New York State 2100 Commission (2013) Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure. http://www.rockefellerfoundation.org/blog/nys-2100-commission-report-building

ClimAID-Response to Climate Change in New York State (2011). http://www.nyserda.ny.gov/climaid

New York State Sea Level Rise Task Force Report (2010). http://www.dec.ny.gov/docs/administration_pdf/slrtffinalrep.pdf

New York State Climate Action Plan Interim Report(2011). http://www.dec.ny.gov/energy/80930.html

NYSDEC Climate Change, New Yorkers are Working on Many Fronts. http://www.dec.ny.gov/energy/44992.html

NYSDEC Hudson River Estuary Program & Climate Change. http://www.dec.ny.gov/lands/39786.html

Hudson River Sustainable Shorelines Project. http://www.hrnerr.org/hudson-river-sustainable-shorelines

Webinars

Using Floodplain Regulations to Help Communities Prepare for Climate Change. December 6, 2012. Georgetown Climate Center. http://www.georgetownclimate.org/floodplain-regulations

Bridging the Gap between Hazard Mitigation and Climate Adaptation December 18, 2012. Center for Clean Air Policy and the Natural Hazard Mitigation Association. http://ccap.org/event/bridging-the-gap-between-hazard-mitigation-and-climate-adaptation-webinar/

http://ccap.org/event/bridging-the-gap-between-hazard-mitigation-and-climate-adaptation-webinar/National Flood Insurance Program's Community Rating System: Overview, Determining CRS Eligibility and What CRS Could Mean for NYS Coastal Communities. June 6, 2013. New York State Climate Smart Communities program. http://www.dec.ny.gov/energy/84359.html

COAST: COastal Adaptation to Sea level rise Tool

Summary of COAST. http://catalysisadaptationpartners.com/uploads/3/1/4/8/3148042/coast_summary_111012.pdf

About the organization. http://catalysisadaptationpartners.com/index.html

Examples of previous COAST applications.

Merrill, S., P. Kirshen, D. Yakovleff, S. Lloyd, C. Keeley, and B. Hill. 2012. COAST in Action: 2012 Projects from New Hampshire and Maine. New England Environmental Finance Center. Series Report #12-05. Portland, Maine. http://catalysisadaptationpartners.com/uploads/3/1/4/8/3148042/cre_coast_final_report.pdf

Merrill, S., D. Yakovleff, S., Holman, D. Cooper, J., and P. Kirshen (2010) Valuing Mitigation Strategies: A GIS-based approach for climate adaptation analysis, Arc Users. http://www.esri.com/news/arcuser/1010/files/coast.pdf

Appendix 5 - Supplemental Materials

A great deal of analysis, mapping and additional materials were developed during the course of the Task Forces' deliberations. The materials below and others are available for download at the Kingston CAC website: http://www.kingstoncac.org/index.php/initiatives/tidal-waterfront-flooding-task-force

1. Sea-Level Rise and Flood Zone Project Maps
2. List of Important Assets
3. Department of State Coastal Risk Assessment: Results and Maps
4. Waterfront Visioning: Results and Visualizations
5. Climate Smart Planning: results and recommendations
6. COAST Analysis: Results and Maps
7. Presentations and materials from Task Force meetings