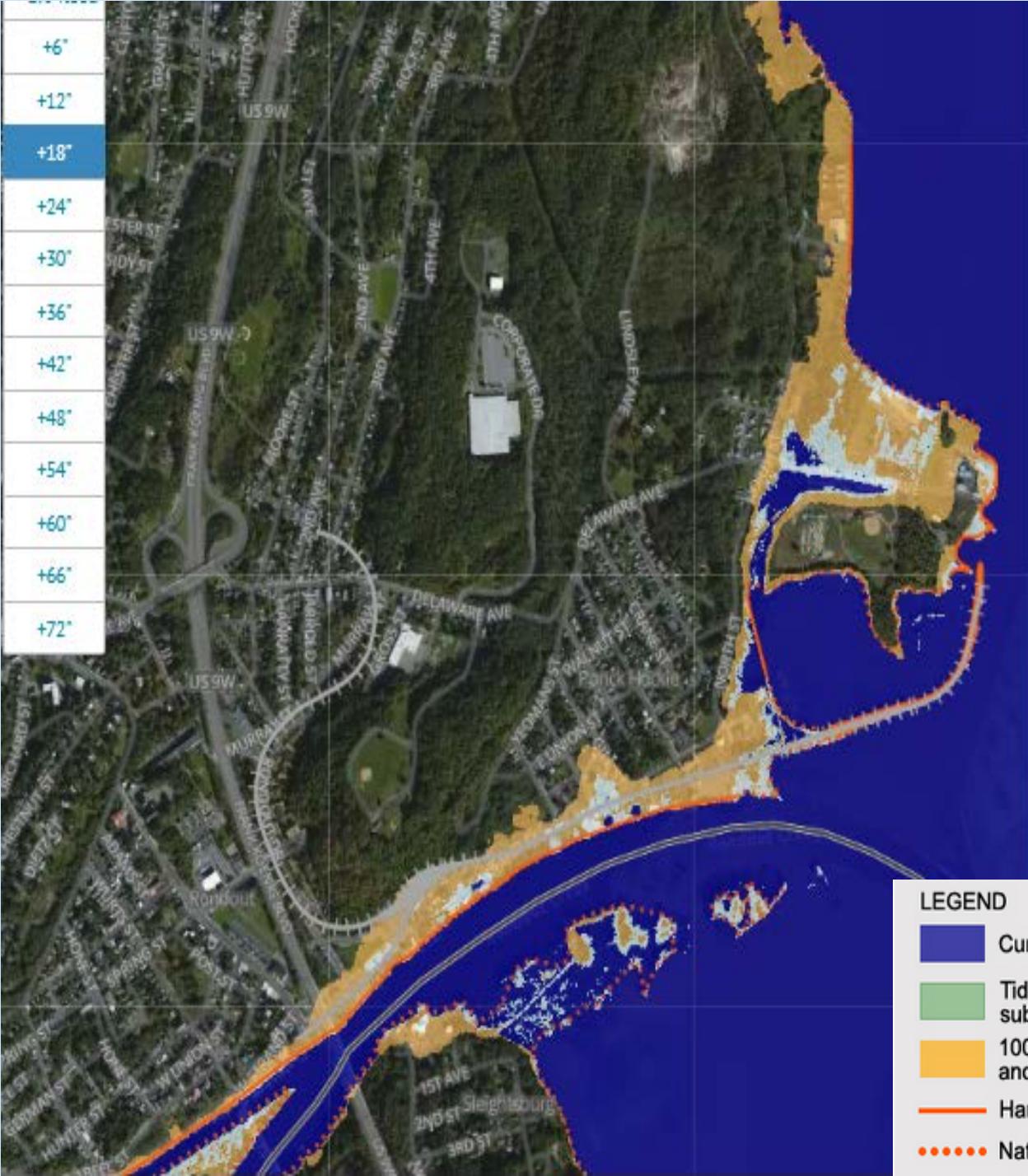


# The Task Force chose projections for Kingston to plan for:

Sea Level Rise Scenario \ Year	2060	2100
Low	20 inches	33 inches
High – rapid ice melt	36 inches	68 inches



# Scenic Hudson's Sea Level Rise Mapper

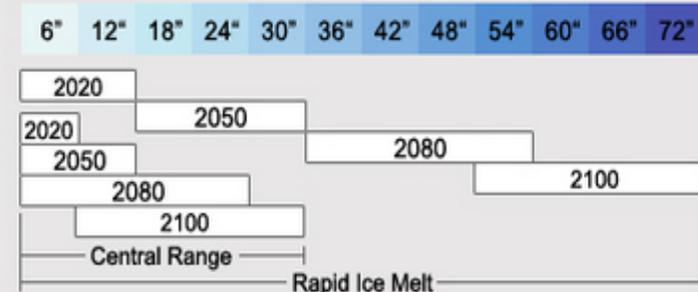
<http://www.scenichudson.org/slr/mapper>

## LEGEND

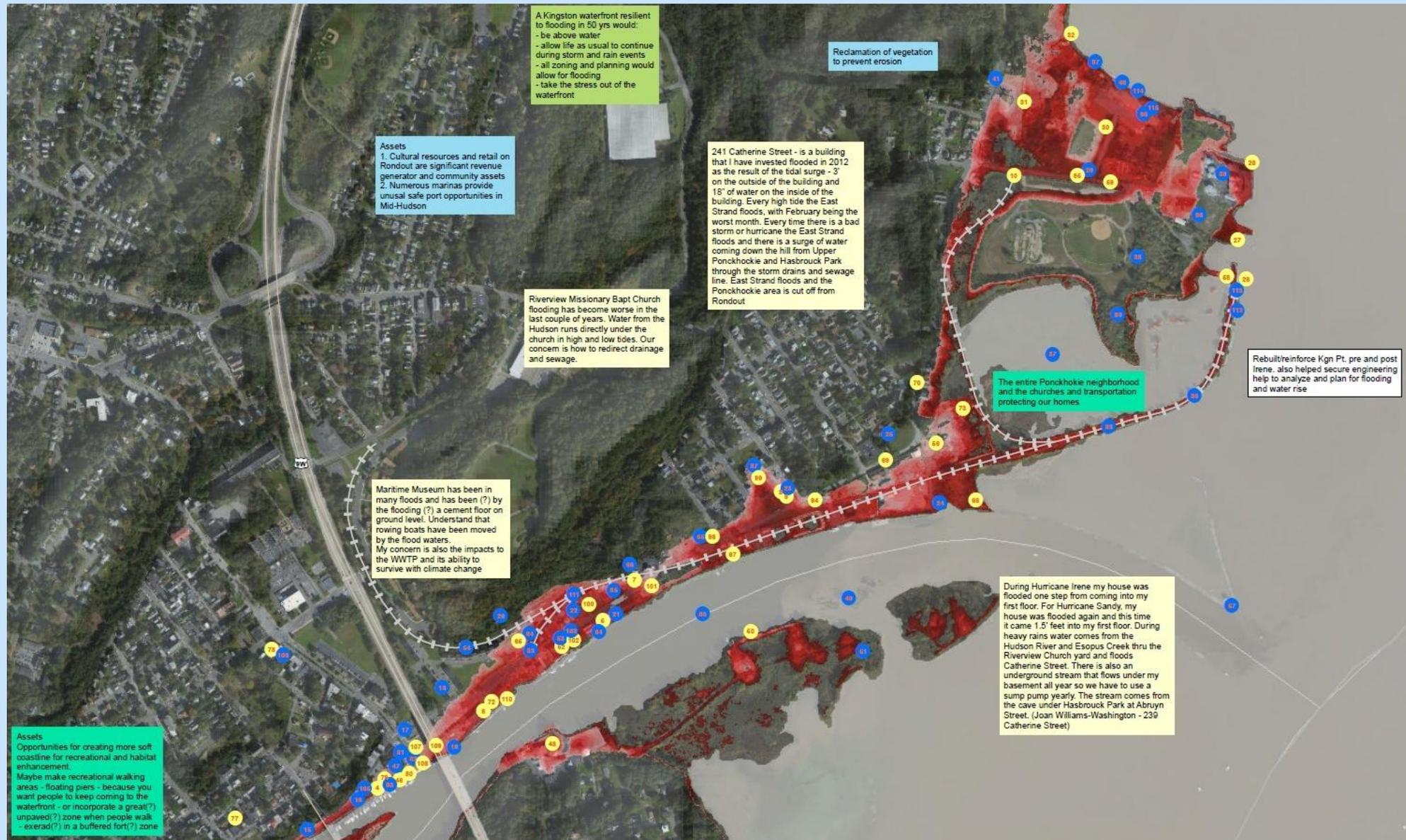
- Current river
- Tidal wetlands and sub-aquatic vegetation
- 100 year floodplains and low-lying areas
- Hard Shoreline
- Natural Shoreline

- Railroad
- Libraries
- Schools
- Wastewater Treatment Facilities
- Brownfields & EPA Hazardous Sites

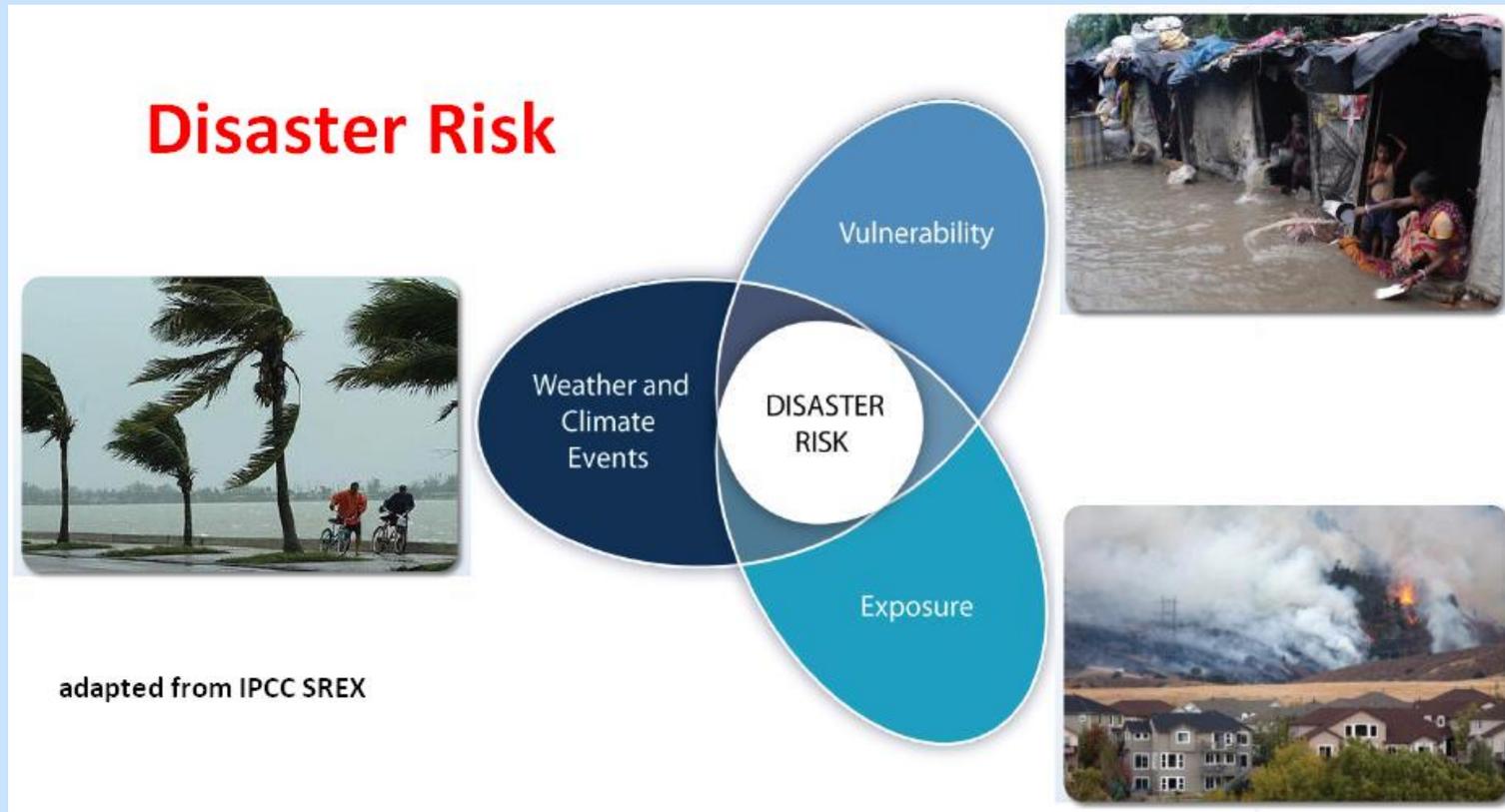
## INUNDATION DEPTH



# Participatory Mapping



# DOS New York Rising – Community Reconstruction Program (NYR-CR Program) Risk Assessment Tool



$$\text{Risk} = \text{Hazard} \times \text{Exposure} \times \text{Vulnerability}$$

<http://stormrecovery.ny.gov/community-reconstruction-program>

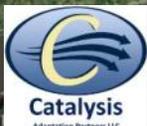
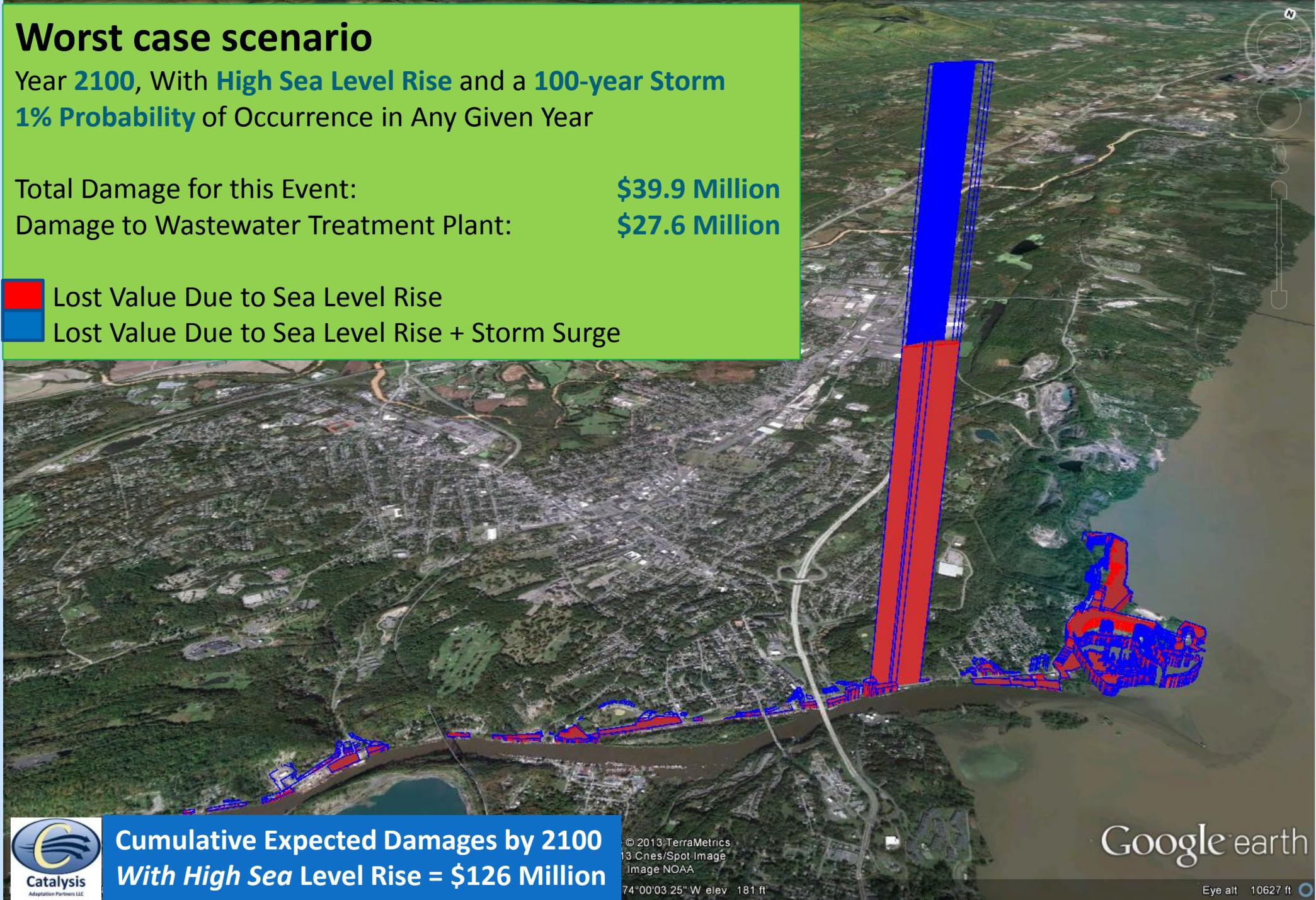
City of Kingston Coastal Flood Risk Assessment - Current Conditions Plus 3 Feet Sea Level Rise 7/15/15												
MAPPING		INVENTORY of ASSETS				RISK ASSESSMENT - Current Conditions						
No.	Risk Area	Risk Area w/ 3ft SLR	Asset Name	Asset Class	Critical Facility	Hazard Score with 3 feet SLR		Exposure Score w/3 ft SLR	Vulnerability Score with 3 ft SLR		Risk Score with 3 ft SLR	
						100-year	10-year		100-year	10-year	100-year	10-year
1	H	Extreme	Block Park	Rec	n	5	5	3.22	4	3	64	48
2	E	Extreme	Rondout Yacht Basin	Com	n	5	5	3.52	3	3	53	53
3	E	Extreme	Island Dock	Rec	n	5	5	3.1	1	1	16	16
4	H	Extreme	Gallo Park	Rec	n	5	5	3.42	4	4	68	68
5	E	Extreme	Historic Kingston Tug Shop	Com	n	5	5	3.64	5	5	91	91
6	H	Extreme	Hud Riv Maritime Museum	Cul	n	5	5	3.86	5	5	97	97
7	E	Extreme	Tomkins Building	Econ	n	5	5	3.7	5	5	93	93

# Worst case scenario

Year **2100**, With **High Sea Level Rise** and a **100-year Storm**  
**1% Probability** of Occurrence in Any Given Year

Total Damage for this Event: **\$39.9 Million**  
Damage to Wastewater Treatment Plant: **\$27.6 Million**

-  Lost Value Due to Sea Level Rise
-  Lost Value Due to Sea Level Rise + Storm Surge



**Cumulative Expected Damages by 2100**  
**With High Sea Level Rise = \$126 Million**

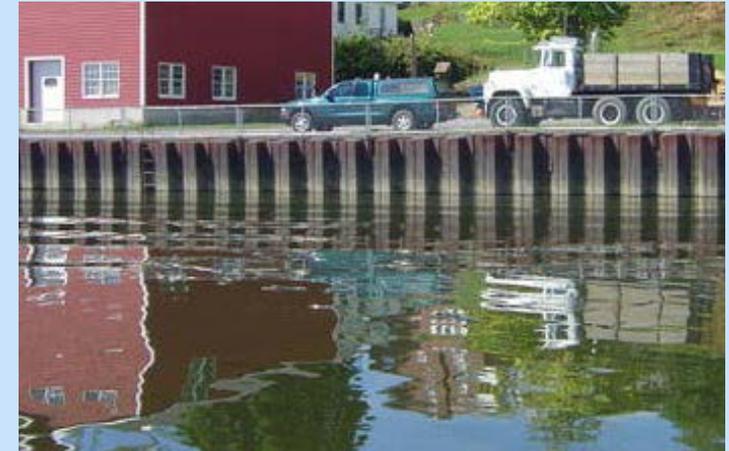
© 2013 TerraMetrics  
13 Ches/Spot Image  
Image NOAA  
74°00'03.25" W elev 181 ft

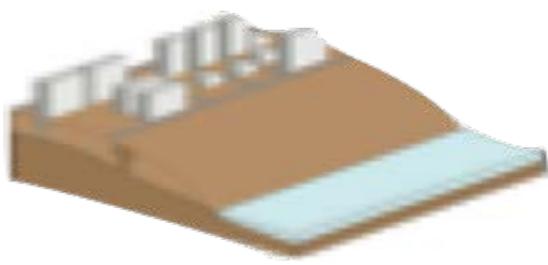
Google earth

Eye alt 10627 ft

# Flooding Adaptation Strategies

- Do Nothing
- Fortify
- Accommodate
- Strategically Relocate





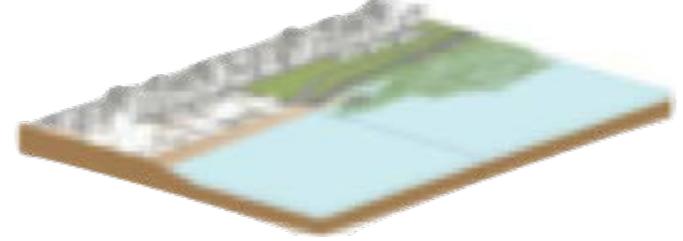
Elevate Land



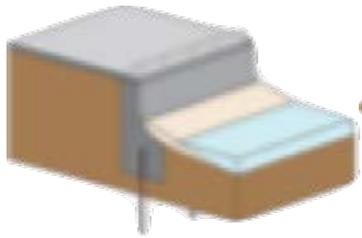
Floodwall



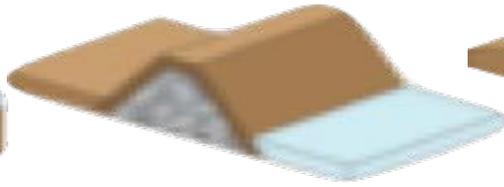
Park Buffer



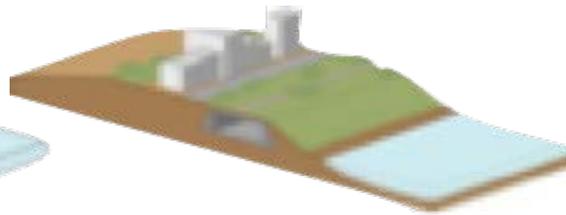
Strategic Retreat



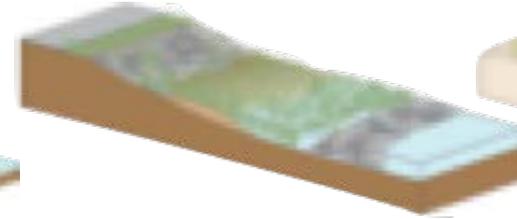
Seawall



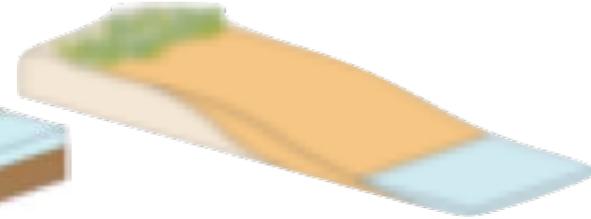
Levee/Dike



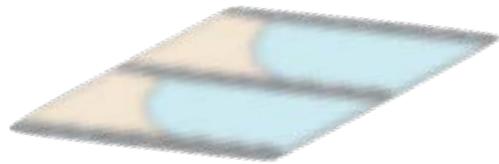
Multi-purpose Levee



Living Shoreline



Beaches & Dunes



Groin Field



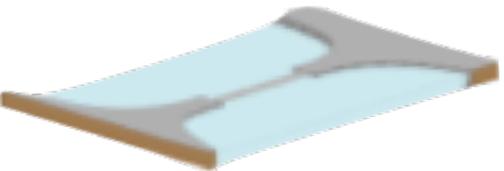
Breakwater



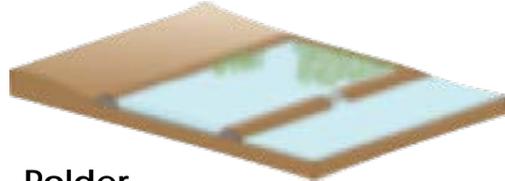
Barrier Island Creation



Wetland Restoration



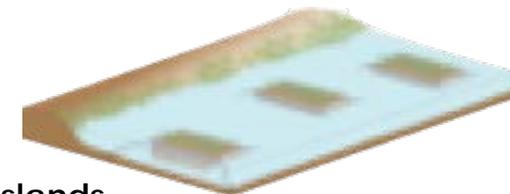
Surge Barrier



Polder



Artificial Reef



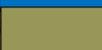
Floating Islands

# Divided shoreline into neighborhoods to assess adaptation strategies

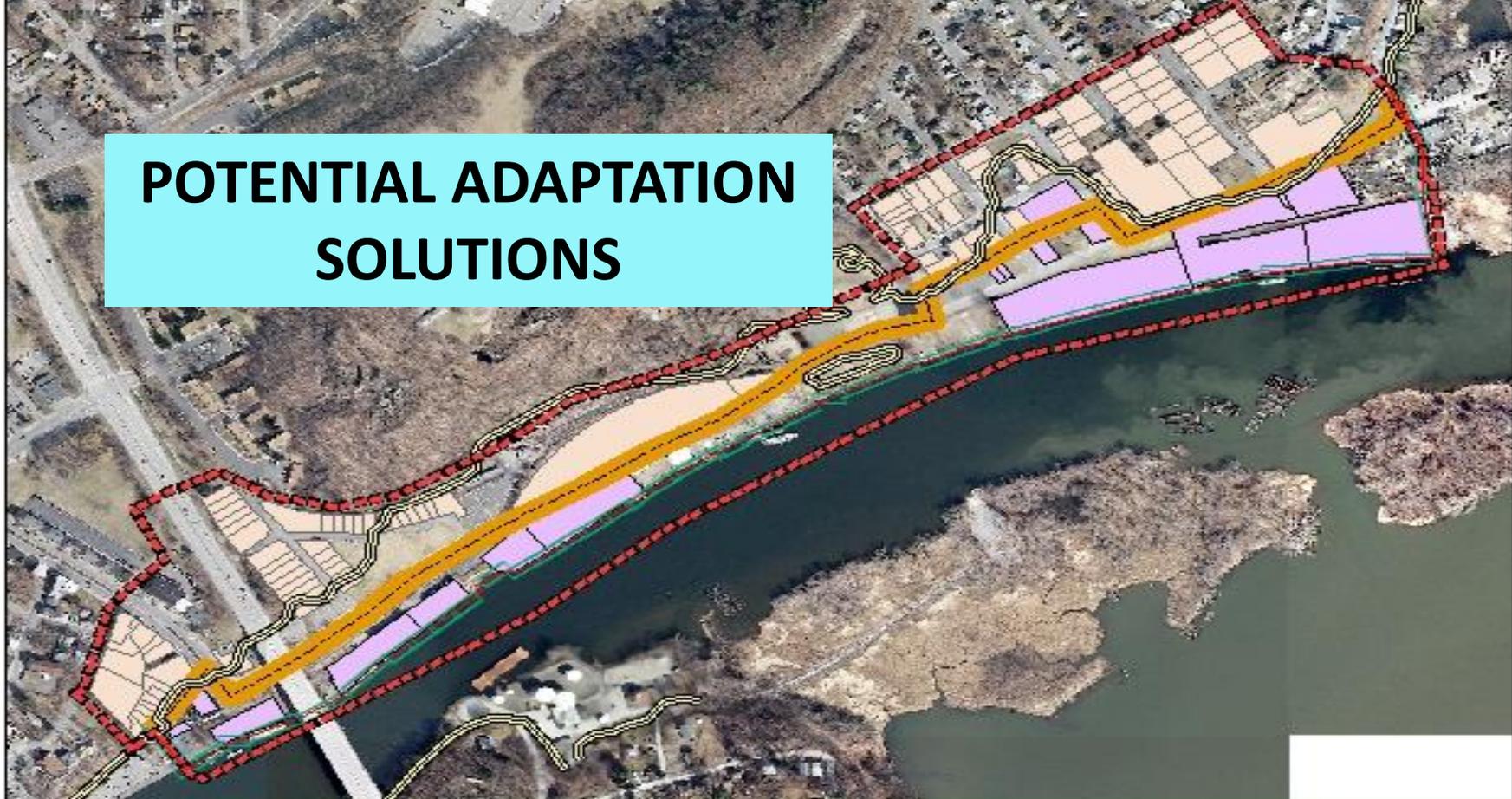


# COAST - COastal Adaptations to Sea level rise Tool



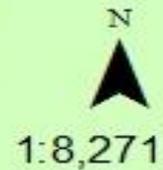
-  Buildings damaged by storm surge from this single event (height of bar indicates relative damage amount)
-  Buildings permanently inundated due to sea level rise by 2060, if no action is taken
-  Extent of flooding from this event

# POTENTIAL ADAPTATION SOLUTIONS



## Legend

-  East Strand Adaptation Study Area
- 11 foot Contour Elevation**
  -  11 ft
  -  East Strand Street Raised to 11 ft Elevation (NAVD88)
  -  Bulkhead/Levee/Path Raised to 11 ft Elevation (NAVD88)
-  East Strand Study Area Parcels With Buildings Protected by Elevated Road
-  Parcels With Buildings Below Elevated Road





## BENEFIT COST ANALYSIS OF ADAPTATION STRATEGIES – KINGSTON

	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, 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 <sup>1</sup>	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 <sup>1</sup>	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		<sup>2</sup> 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

<sup>1</sup>Discount Rate of 3.3% applied.

<sup>2</sup>Does not include purchase of easements at five city-owned properties, and sewage treatment plant remains unprotected.

New York State  
Climate Smart Communities



## Climate Smart Resiliency Planning

A Planning Evaluation Tool  
for  
New York State Communities



Climate Smart Communities is a program of the New York State departments of Environmental Conservation, Health, State and Transportation; State Public Service Commission; and State Energy Research and Development Authority.

December 2013

# DEC Climate Smart Resiliency Planning tool

<http://www.dec.ny.gov/energy/82168.html>

[http://www.dec.ny.gov/docs/administration\\_pdf/csrptool.pdf](http://www.dec.ny.gov/docs/administration_pdf/csrptool.pdf)

# Climate Smart Resiliency Planning Assessment

Three areas of opportunities for Kingston to incorporate flood-preparedness:



Planning



Zoning, building codes and regulation



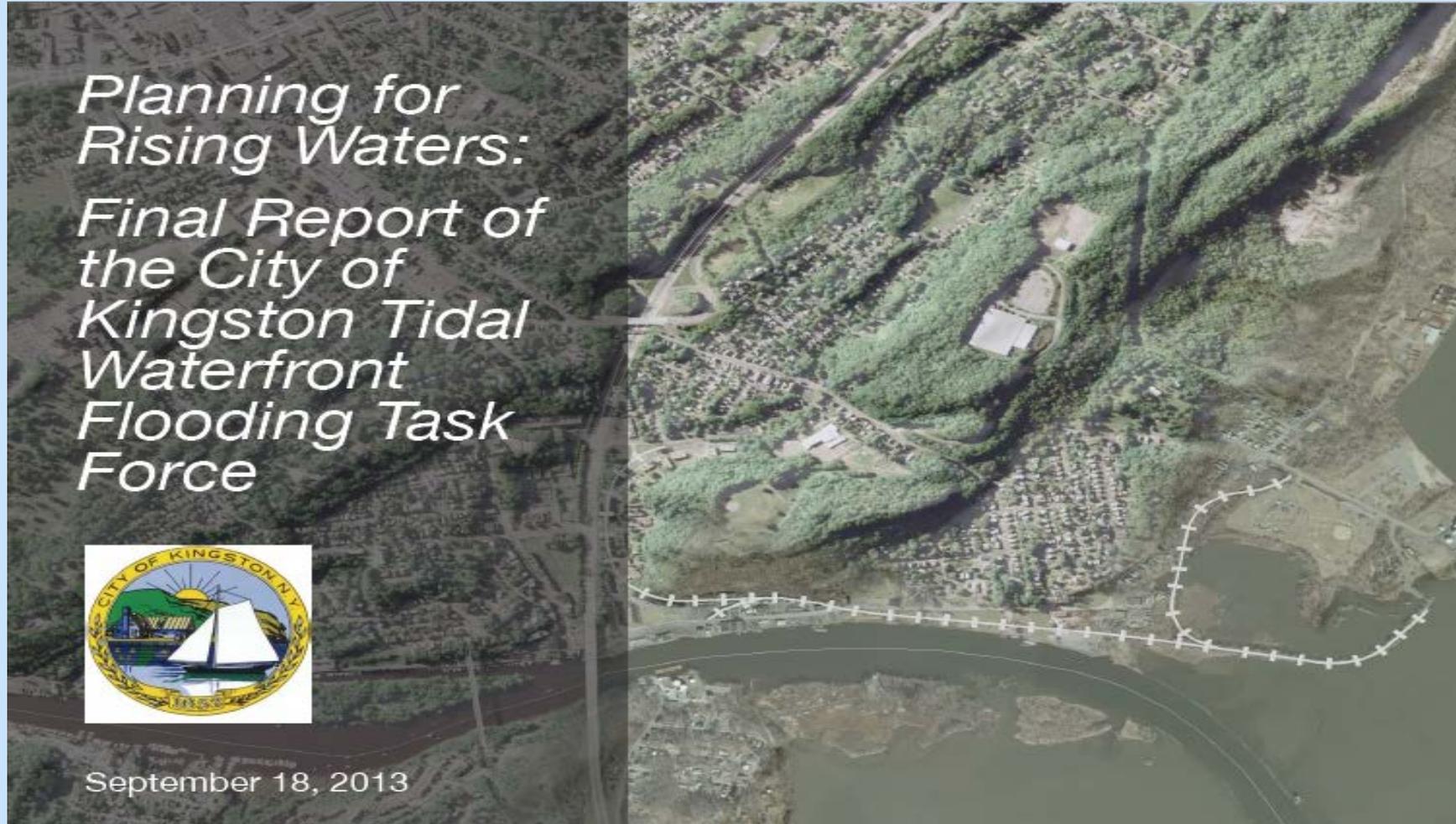
Outreach and collaboration

# Final Report

*Planning for  
Rising Waters:  
Final Report of  
the City of  
Kingston Tidal  
Waterfront  
Flooding Task  
Force*



September 18, 2013



# Final recommendations fall into 6 categories

- City operations, funding and decision-making
- Resilient structures
- Promotion of a waterfront economy and economic revitalization
- Collaboration and public outreach
- Emergency management
- Site-based recommendations



# Recommendations: City Operations, Funding and Decision-Making

NEAR TERM

- 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.

# Recommendations: Resilient structures

NEAR TERM

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.



# Recommendations: Resilient structures

LONG TERM

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.

# Recommendations: Promoting A Waterfront Economy and Economic Revitalization

LONG TERM

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.**



# Recommendations: Community Collaboration and Public Outreach

NEAR TERM

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.

# Recommendations: Emergency Management

NEAR TERM

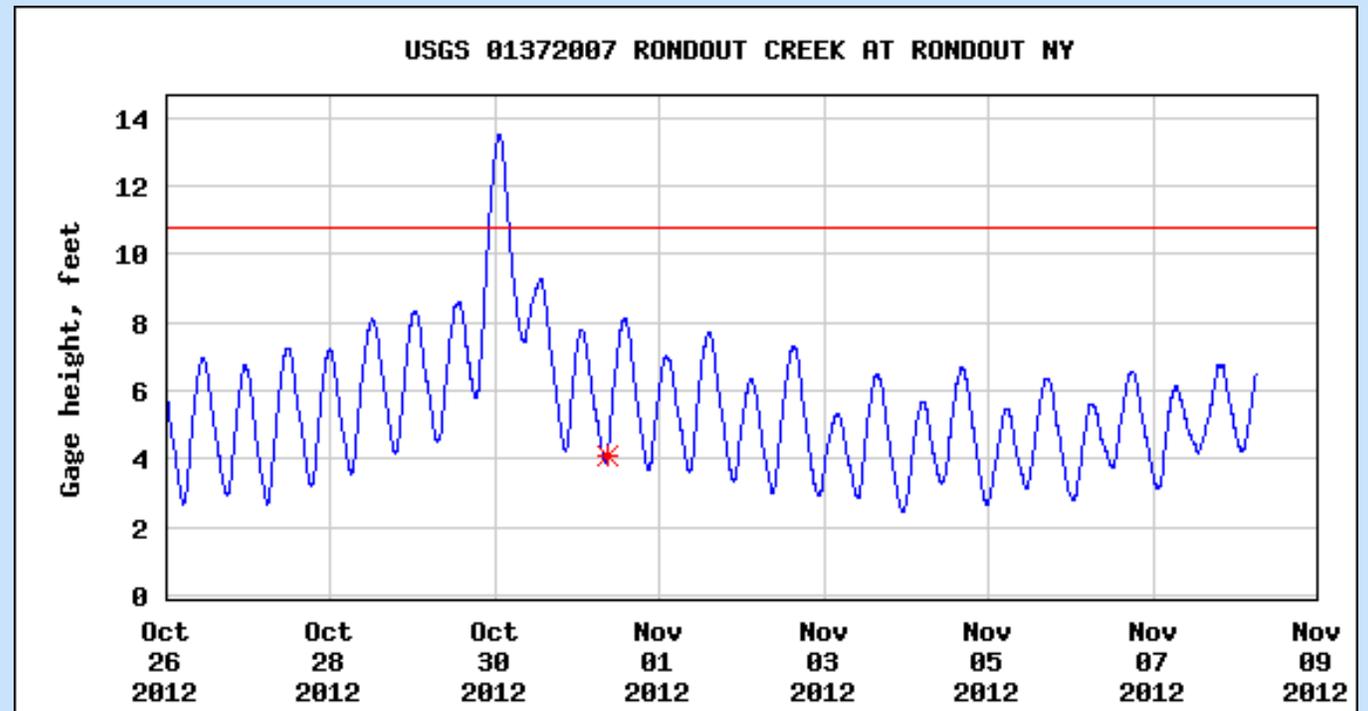
## 21. Revise

**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.**



# Recommendations: Emergency Management

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

LONG TERM





# Outcomes

- Official adoption of the recommendations
- Integrate in comprehensive plan and emergency management plan
- Changes in design of waterfront development proposals
- NFIP and Community Rating System Workshop 12/4/13
- Model for other communities (DEC funded task forces in Catskill, Piermont and Stony Point for 2013-14)



# Next steps

- January 14, 2014 public meeting to share results and next steps  
(6:15 PM in the Council Chambers at Kingston City Hall)
- Stewardship of process forward by various community organizations
- Buy-in from community and municipal staff
- Investigate policy changes to reduce risks
- Follow up with Community Rating System (to reduce insurance rates)

# Funding Mechanisms for Communities

## Consolidated Funding Application Process

- Various state agencies participate
- Funding applications were submitted
- Department of Homeland Security and Emergency Services
- FEMA “Sandy” monies
  - \$5 million Waterfront Resiliency Project
  - \$2.7 million: Certification of levee along Esopus Creek (non-tidal)
  - \$500,000: Emergency generators at Wastewater Treatment Plant

# All Kingston documents available at [www.kingstoncac.org](http://www.kingstoncac.org)

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# Climate Smart Communities Webinar

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# Climate Smart Communities Webinar

**Website Address**



<http://www.dec.ny.gov/energy/50845.html>