

Responding to the Surge: Lessons from the Hudson River

Prepared by:

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NYSDEC Hudson River National Estuarine Research Reserve

Presented by:

Eric Roberts, Associate
Consensus Building Institute, Inc.

Responding to the Surge: Coastal Buffers

LOCAL SOLUTIONS: Northeast Climate Change Preparedness

May 20, 2014 8:30 to 10:00 am



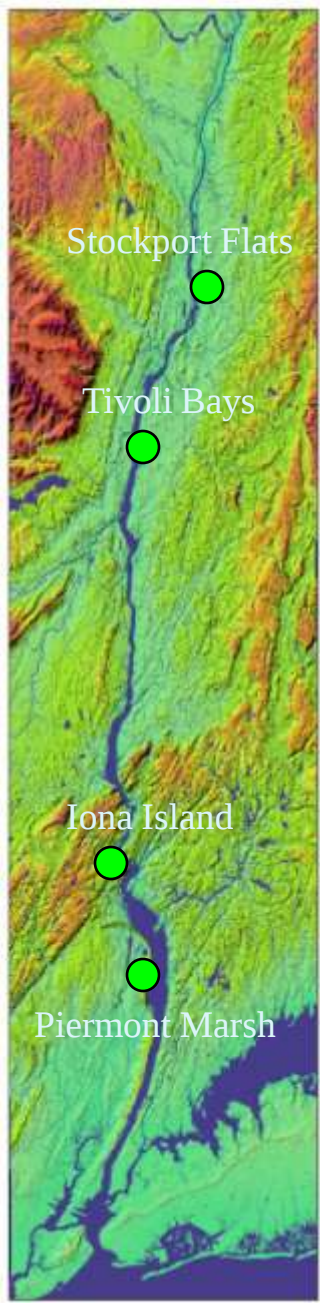
Hudson River National Estuarine Research Reserve

- Mission: improve the health and vitality of the Hudson River Estuary through habitat protection, integrated education, training, stewardship, restoration, and monitoring and research.
- Estuary Training Program seeks to enhance the scientific knowledge and skills of professionals involved in making decisions that affect the habitats, shore lands, and other natural resources of the Hudson River Estuary.

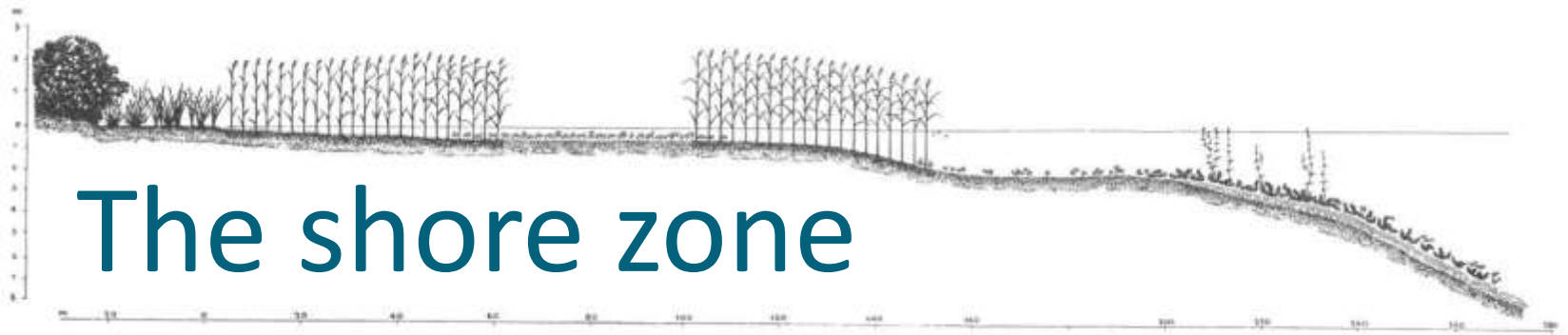


Hudson River Estuary

- Hudson River – Tidal from NYC to Troy ~150 miles
- Approximately half has been “engineered”
- Very little “green” shoreline
- Storms – Irene/Lee/Sandy
- Waterfront revitalization, public access
- Railroads 28 %



The shore zone



- Provide habitat & corridors for fish & other life
- Dissipate energy that can damage our shore zone
- Support high biodiversity; produce plants & animals



Strayer & Findlay, 2010. Ecology of freshwater shore zones.



— HUDSON RIVER — **SUSTAINABLE** **SHORELINES**

- Cary Institute of Ecosystem Studies
- Stevens Institute of Technology
- Consensus Building Institute
- NYSDEC Hudson River NERR and Estuary Program

<http://www.hrnerr.org/udson-river-sustainable-shorelines/>



Coordinating Team Members

NYSDEC Hudson River National Estuarine Research Reserve

Emilie Hauser, Betsy Blair

NYS DEC Hudson River Estuary Program

Daniel Miller, Kristin Marcell

Cary Institute of Ecosystem Studies

Stuart Findlay, David Strayer

Consensus Building Institute

Ona Ferguson, Eric Roberts

Stevens Institute of Technology

Jon Miller, Nickitas Georgas, Andrew Rella

“Sustainable Shorelines”



Shoreline management practices that seek to protect the shore zone's wildlife habitat, ecological benefits, outdoor recreation, community quality of life, and water-dependent businesses for future generations.

Should be: adaptable & ecologically enhanced
Includes: “soft” and “hard”

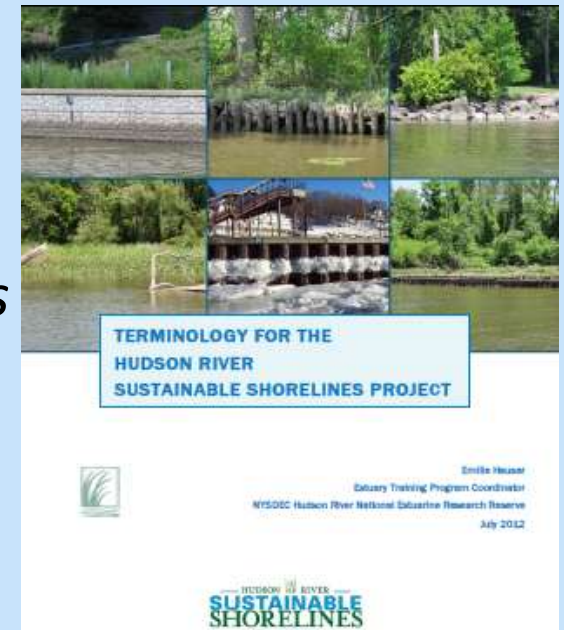
Shorelines approaches depend on project goals and location

- Uses
- Energy
 - Waves, currents, wakes, ice
- Geomorphology
- Ecology (fish, shellfish, terrestrial & aquatic plants,)
- Salinity



Ecologically Enhanced Shorelines

Subset of shore protection methods that incorporate measures to attract and support both terrestrial and aquatic biota and desirable ecological functions. These can be either modifications to existing structures through the addition of plantings and other ecological measures or the design of new structures incorporating ecologically-friendly materials, geometry, or placement.





Revetments

Approach



Construction Cost



Maintenance Cost



Adaptability



Revetment

Joint Plantings



Live Stakes / Joint Planting

Approach



Construction Cost



Maintenance Cost



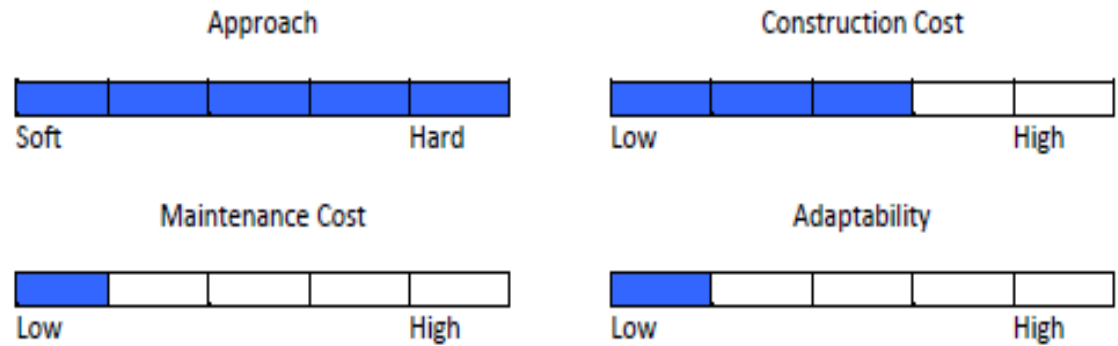
Adaptability



Bulkhead

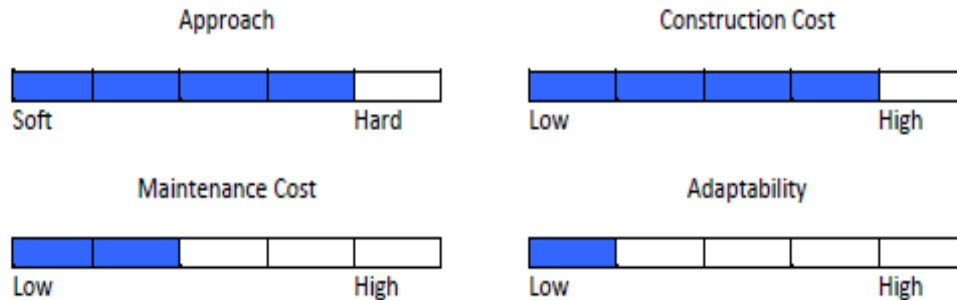


Bulkheads



Ecologically Enhanced Bulkhead

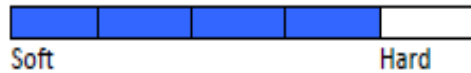
Green (Bio) Walls



Timber Cribbing / Crib Wall

Timber Cribbing

Approach



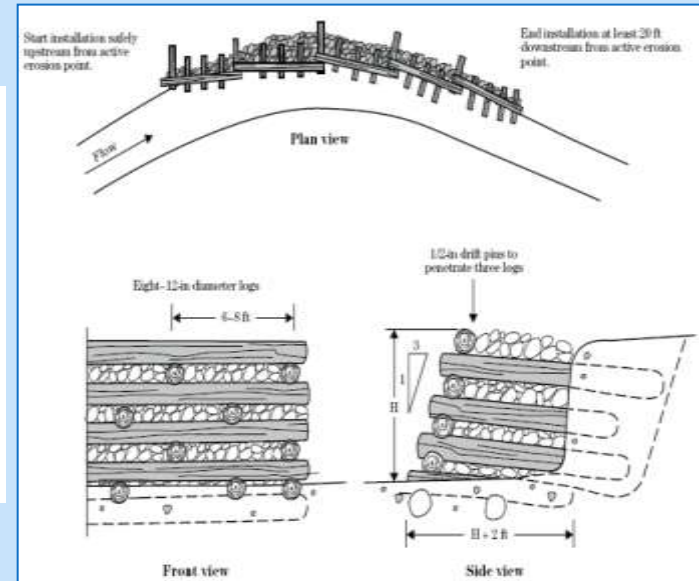
Construction Cost



Maintenance Cost



Adaptability



Live Crib Wall



Live Crib Wall

Approach



Construction Cost



Maintenance Cost



Adaptability



Comparative Cost Analysis includes:

- **Initial Costs (IC)**
 - Material and labor costs to construct the stabilization measure
- **Maintenance and Repair Costs (M&R)**
 - Costs associated with routine maintenance and repairs (i.e. not associated with any given storm)
- **Damage Costs (DC)**
 - Costs associated with restoring a structure to its original function after a specific storm causes damage
- **Replacement Costs (RC)**
 - Costs of replacing a structure once it reaches the end of its serviceable life. (Typically associated with material decay/degradation)

Rella, A. and Miller, J., 2012b . A Comparative Cost Analysis of Ten Shore Protection Approaches at Three Sites Under Two Sea Level Rise Scenarios.

Comparative Cost Analysis

Rapid Sea Level Rise Scenario

Poughkeepsie

Wooden Bulkhead	\$	688,203
Steel Bulkhead	\$	2,372,407
Revetment	\$	1,081,098
Rip rap	\$	1,133,764
Crib Wall	\$	765,821
Live Crib Wall	\$	1,074,401
Joint Planting	\$	1,826,545
Vegetated Geogrid	\$	648,316
Bio Wall	\$	2,185,780
Sill		N/A

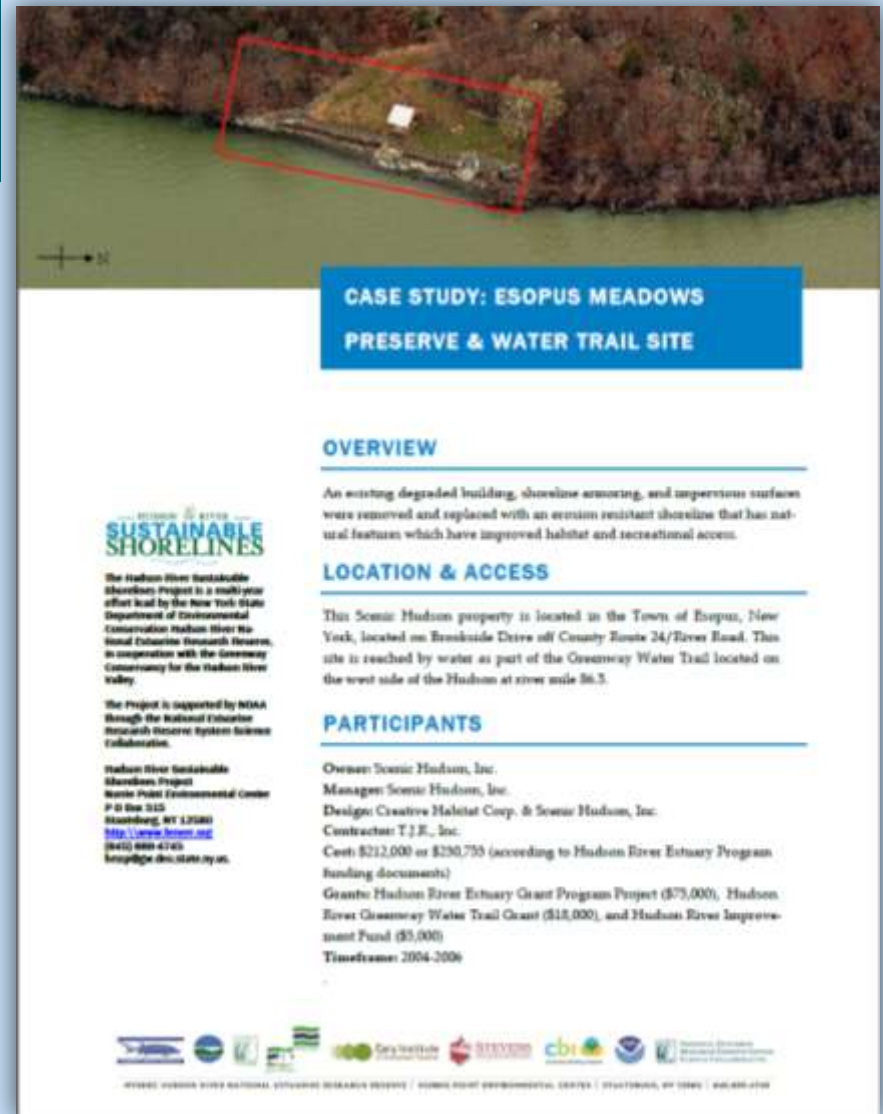
\$688,203

\$765,821

\$648,316

Demonstration Site Case Studies

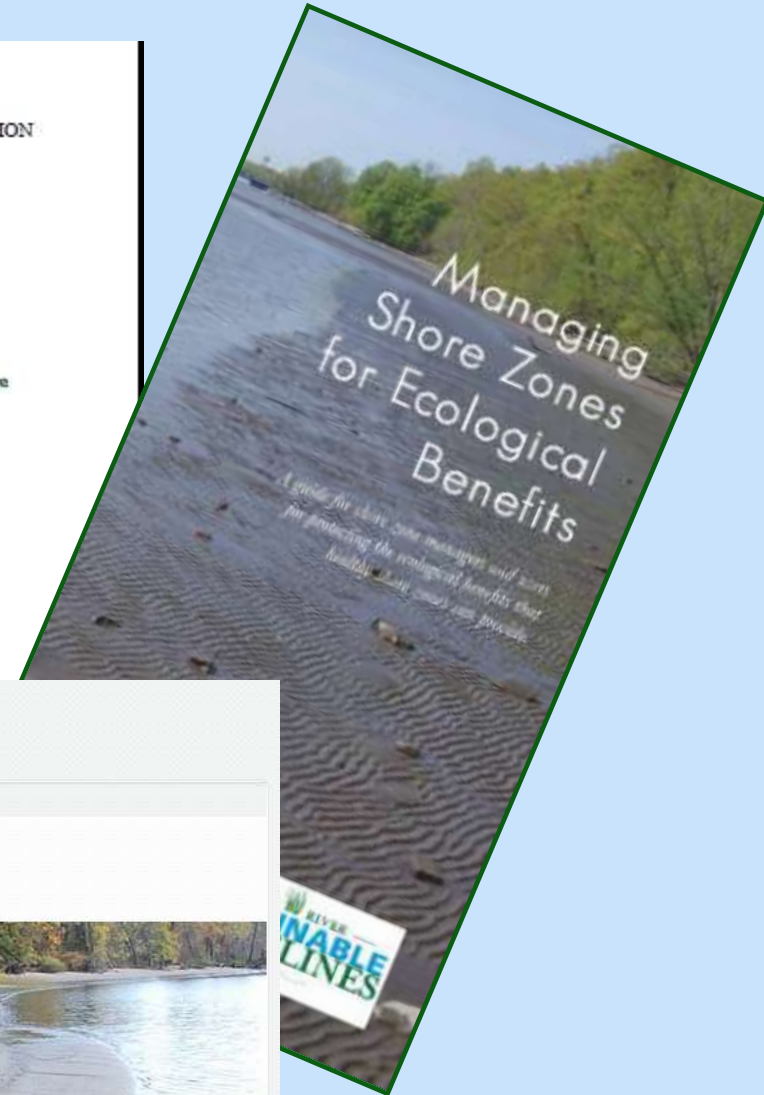
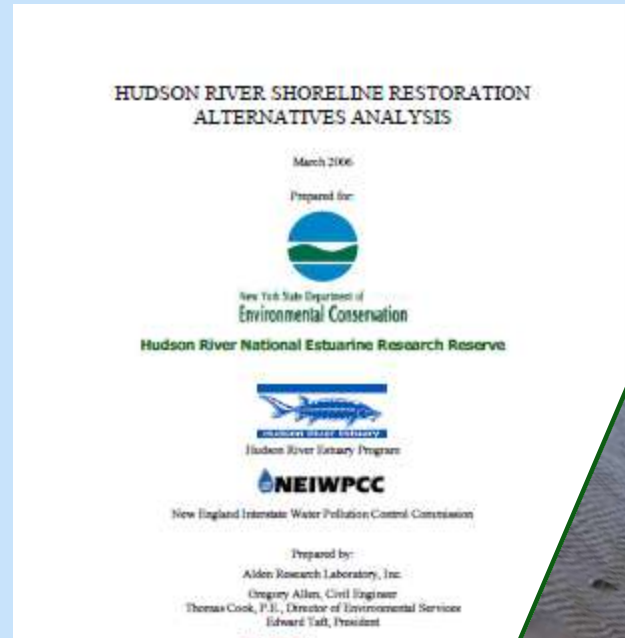
- Overview
- Location
- Participants
- Background and Story
- Assessment, Planning & Design
- Plan Implementation & Design
- Lessons Learned



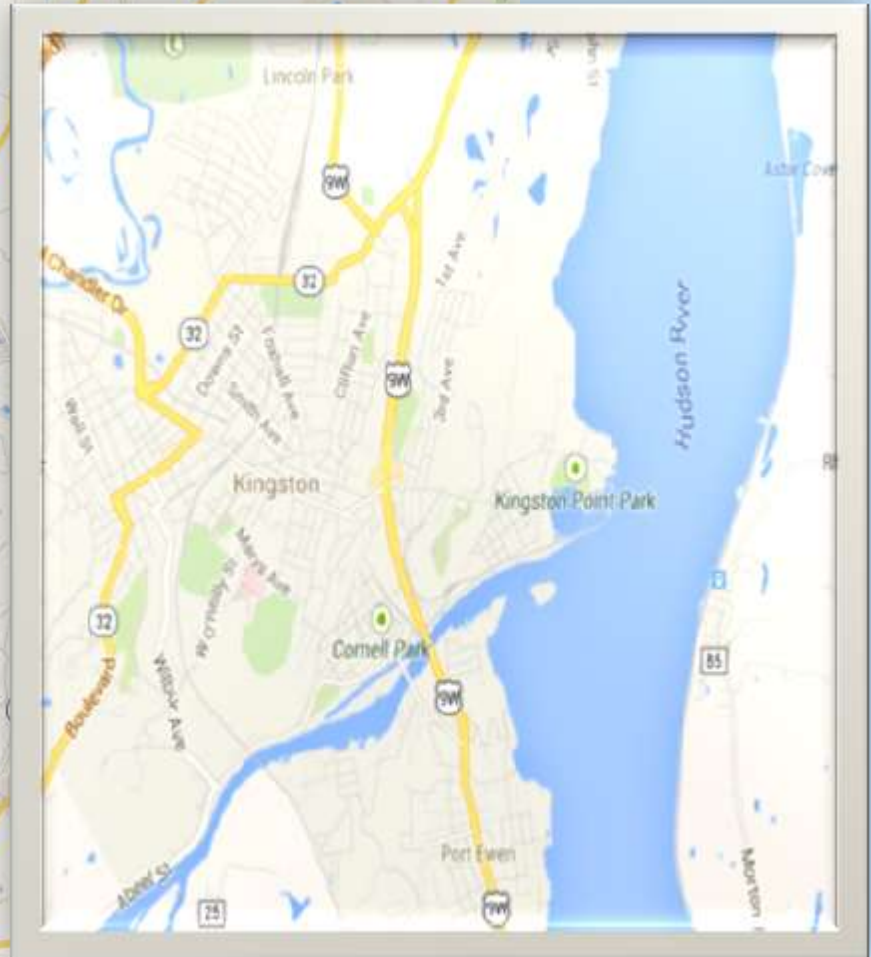
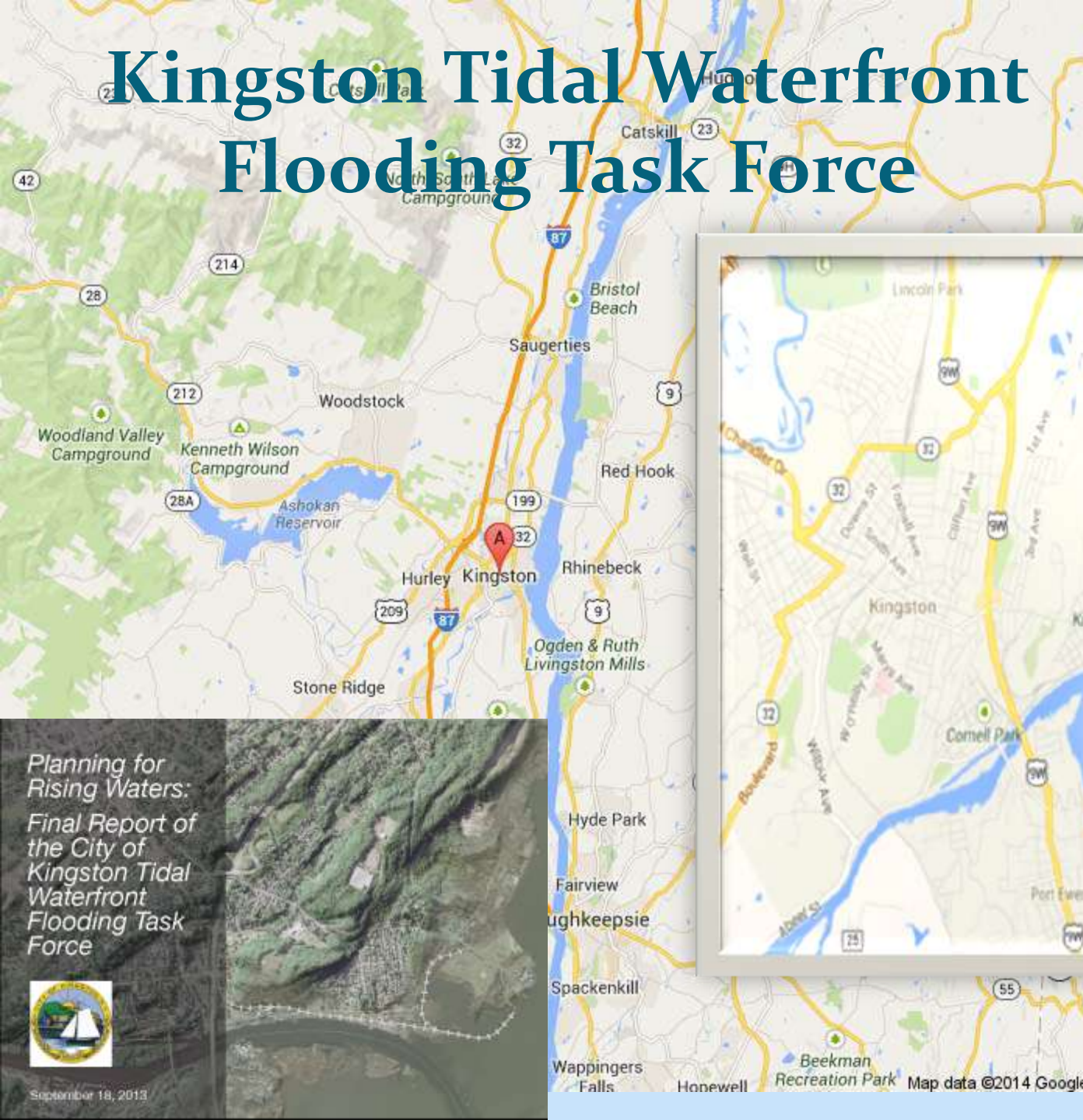
Sharing what we've learned

- User-friendly “key findings” documents
- Technical assistance
- Decision tools
- Training

www.hrnerr.org/hudson-river-sustainable-shorelines/



Kingston Tidal Waterfront Flooding Task Force



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



September 18, 2013

Kingstoncac.org

Today's Flood Is Tomorrow's High Tide

Wastewater
treatment
plant



2005



2011

Flooding Impacts on the Kingston
Waterfront



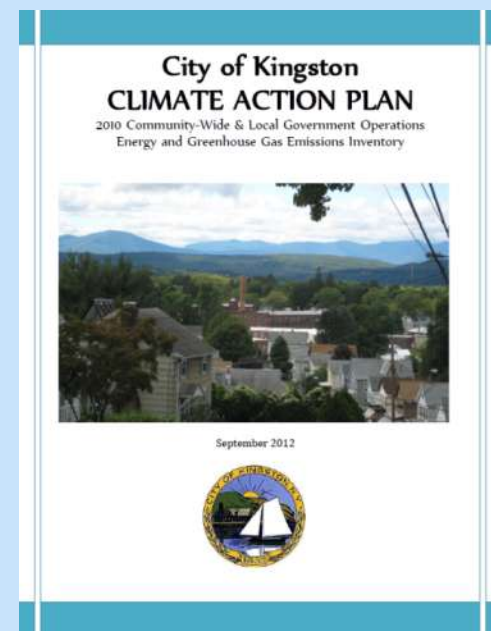
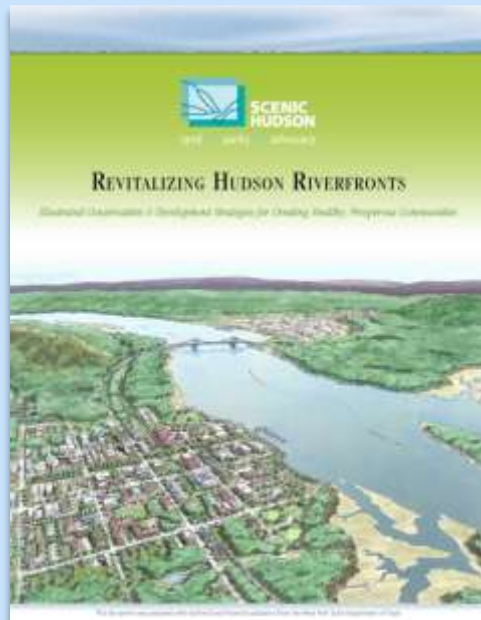
2012



Kingston Climate Initiatives



- Climate Action Plan, Oct 2012
- Climate Smart Kingston, Oct 2012 – present
- and others



The timing was right...

- Kingston community felt the impacts of flooding and had started thinking about impacts of climate change.
- Regional efforts raised community awareness about the potential impacts of sea level rise.
- State efforts produced many relevant climate change and sea level rise documents.
- The State wanted to pilot a project, and Scenic Hudson and CBI acquired funding to work with the community.

Kingston Tidal Waterfront Flooding Task Force

Planning Team Members

- City of Kingston
- Scenic Hudson
- NYS Department of Environmental Conservation
- NYS Department Of State
- Consensus Building Institute

Task Force Members

- Marinas
- City employees
- Museums
- Churches
- Businesses
- Developers
- Residents



Planning Team

Scenic Hudson: Sacha Spector

Consensus Building Institute: Ona Ferguson

City of Kingston: Julie Noble (Conservation Advisory Council)
Gregg Swanzey (Economic Development)
Suzanne Cahill (Planning)

NYS Department of State: Barry Pendergrass

NYS Department of Environmental Conservation:

Mark Lowery (Office of Climate Change)

Kristin Marcell (Hudson River Estuary Program/ Cornell)

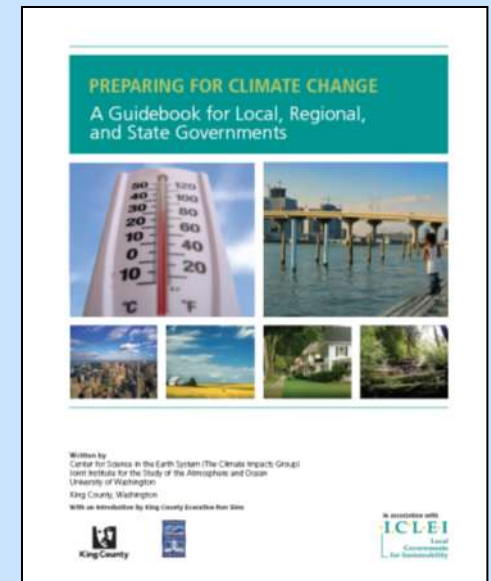
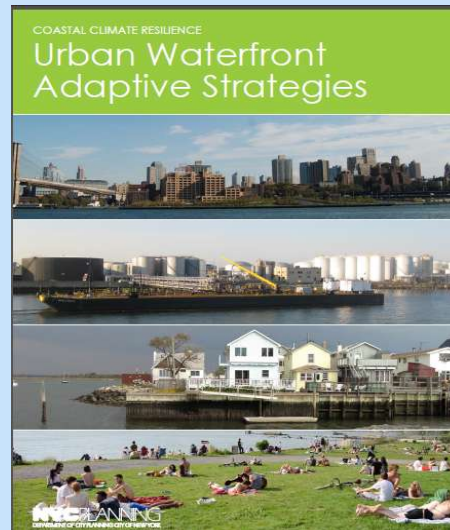
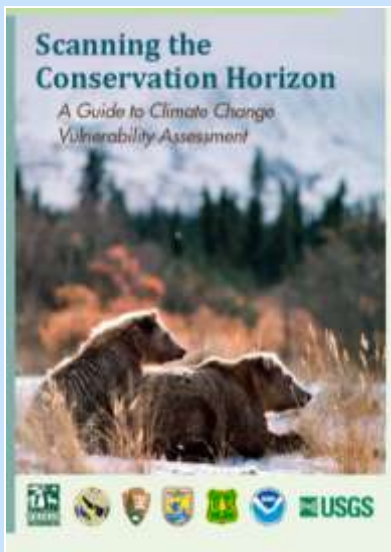
Libby Murphy (Hudson River Estuary Program/ Cornell)

Emilie Hauser (Hudson River National Estuarine Research Reserve)

Christina Tobitsch (Hudson River National Estuarine Research Reserve)

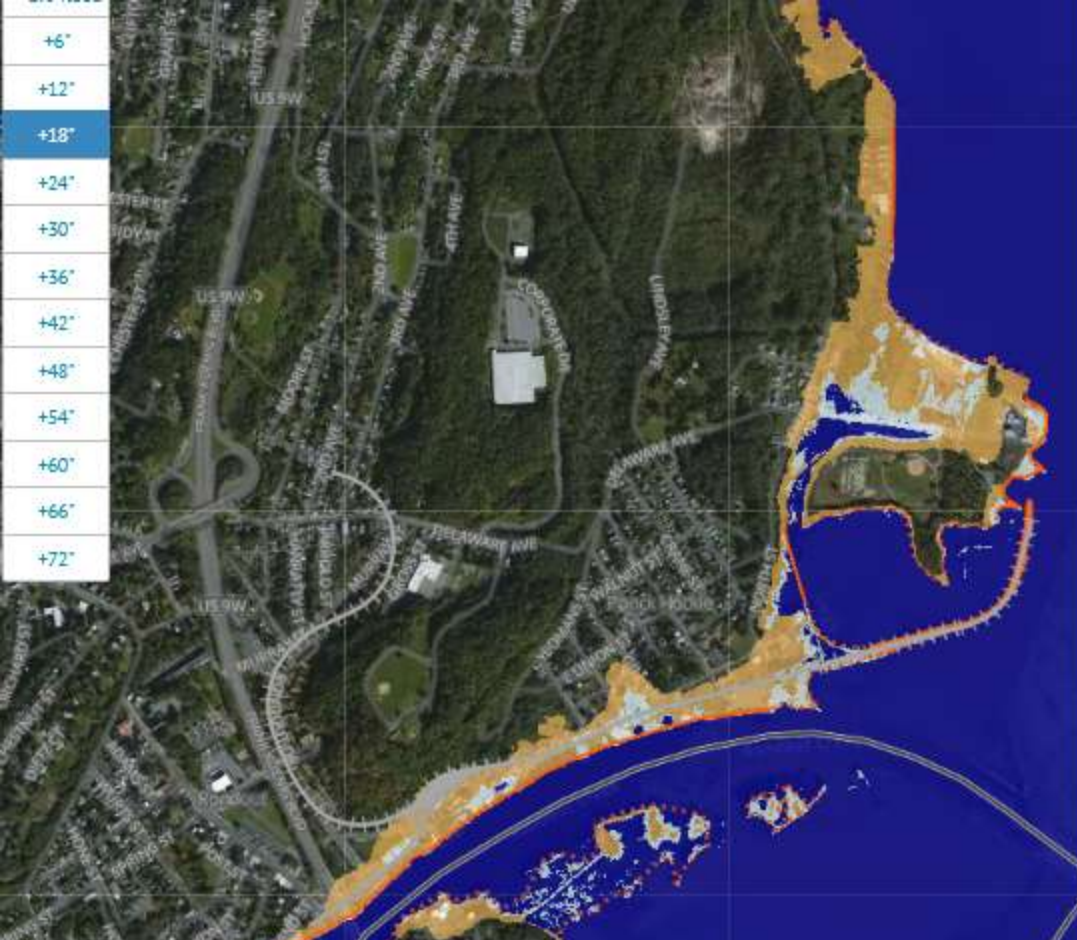
Catalysis Adaptation Partners: JT Lockman



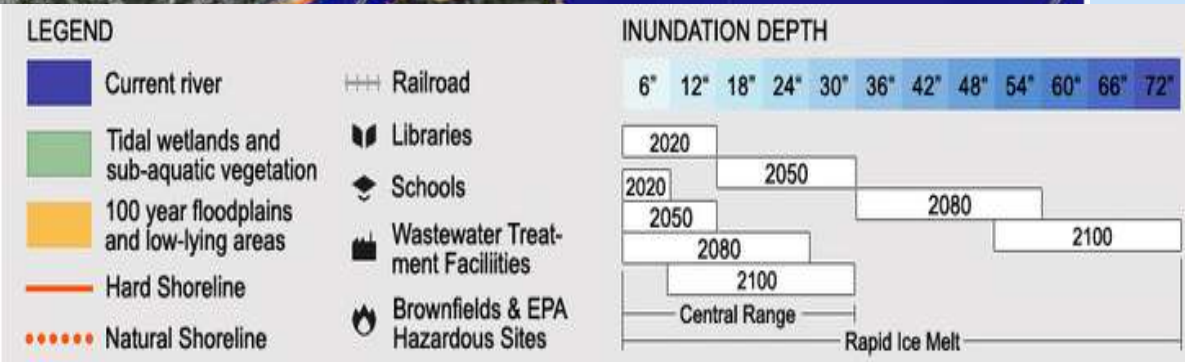


The Task Force chose projections for Kingston to plan for:

Year Sea Level Rise Scenario	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>

CANVIS

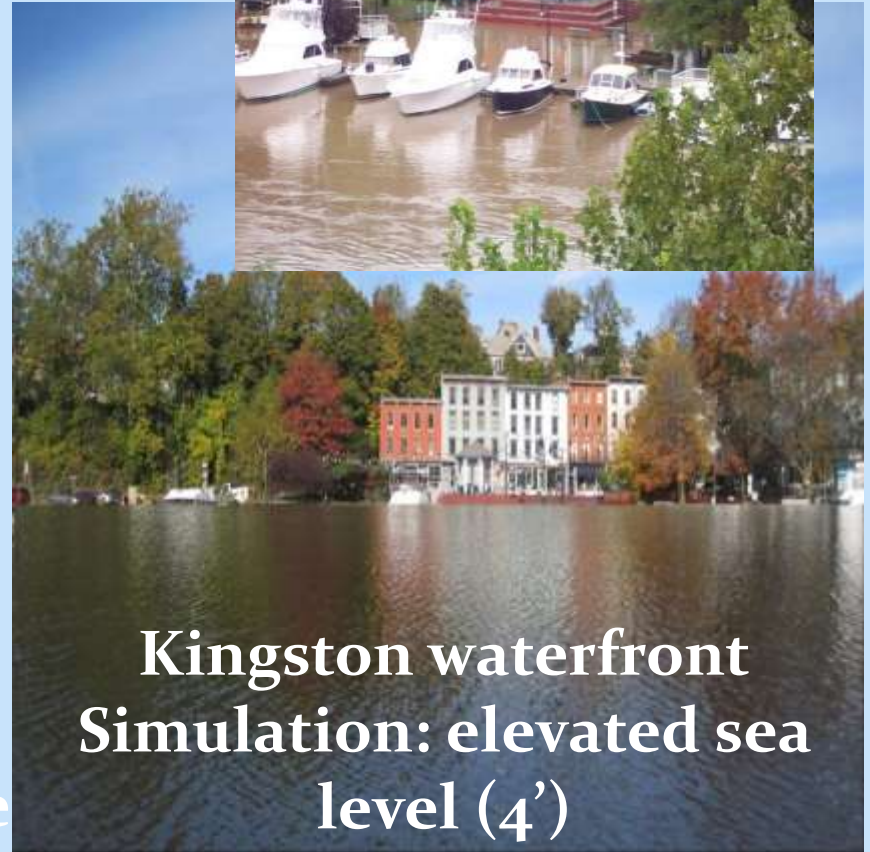
West Strand in Kingston



Kingston waterfront low tide



Irene 2011



Kingston waterfront
Simulation: elevated sea
level (4')

<http://www.csc.noaa.gov/digitalcoast/tools/canvis>

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

**COAST- Coastal
Adaptation to Sea Level
Rise Tool**



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





Guidebooks and Resources

New York State
Climate Smart Communities



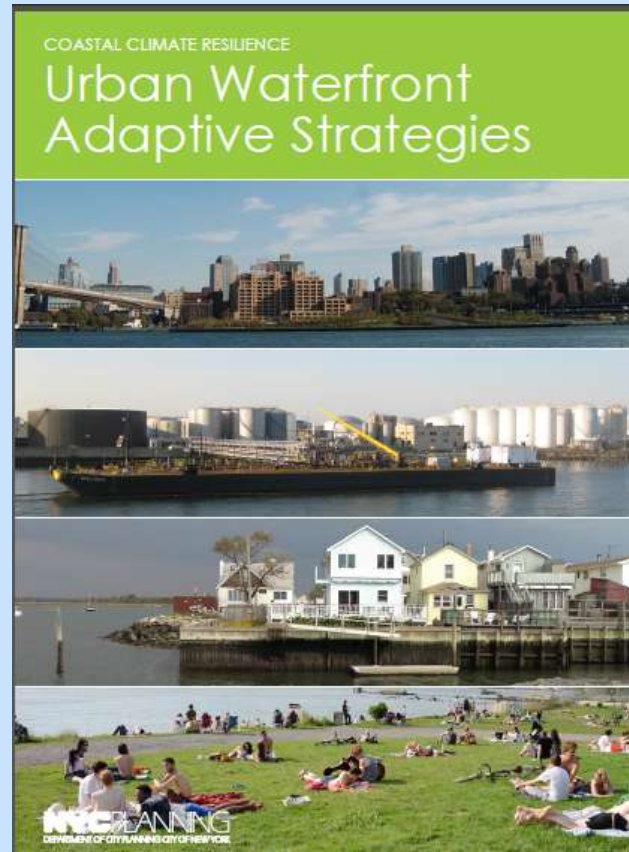
Climate Smart Resiliency Planning

A Planning Evaluation Tool
for
New York State Communities



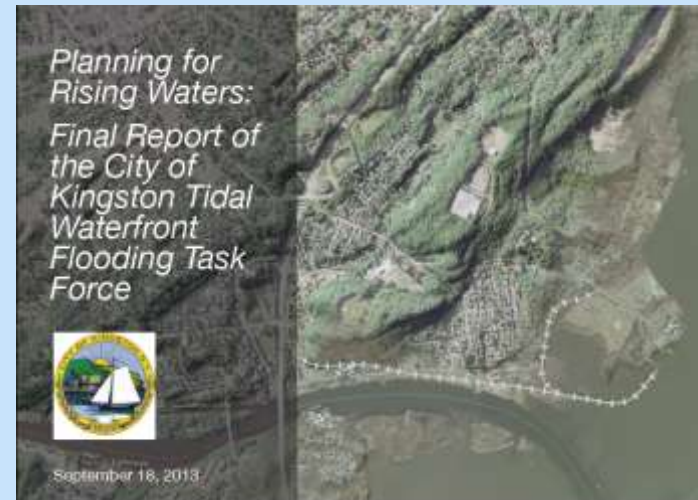
Climate Smart Communities is a program of the New York State departments of Environmental Conservation, Health, State and Transportation; State Public Service Commission; and State Energy Research and Development Authority.

December 2013



Final recommendations of Task Force 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

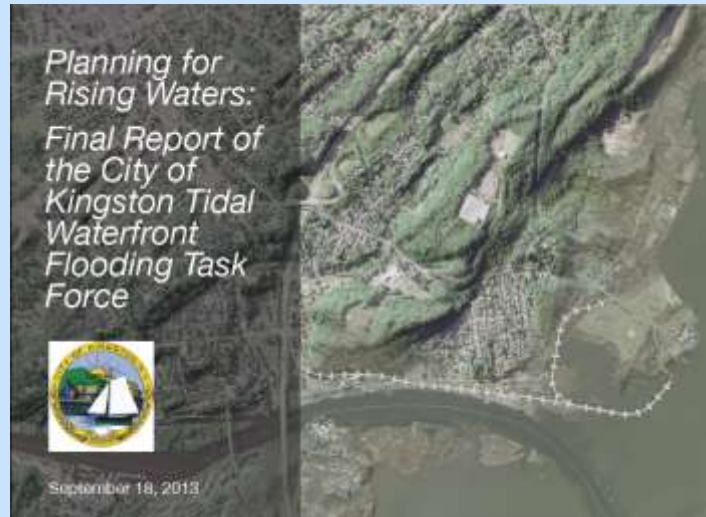


Next steps



- FEMA “Sandy” monies
 - \$5 million Waterfront Resiliency Project
 - \$500,000: Emergency generators at Wastewater Treatment Plant
- 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)

All Kingston documents available at www.kingstoncac.org



Thank You!

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Presented by:

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For more Information:

- www.hrnerr.org
- www.nerrs.noaa.gov/Reserve.aspx?ResID=HUD

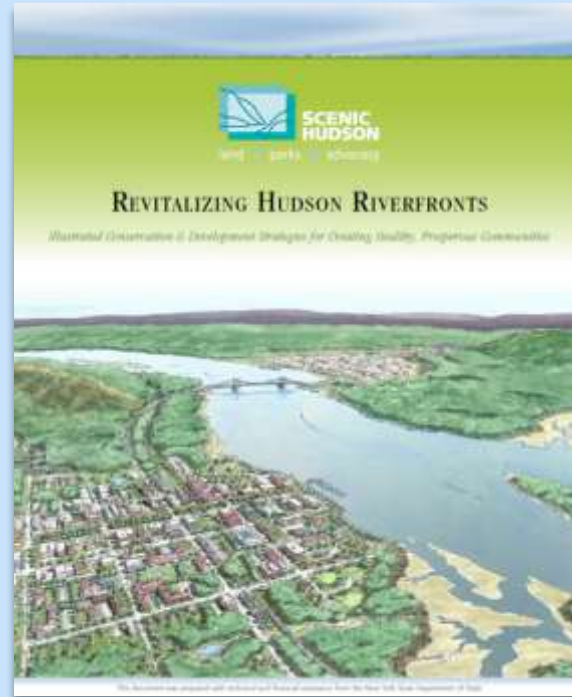
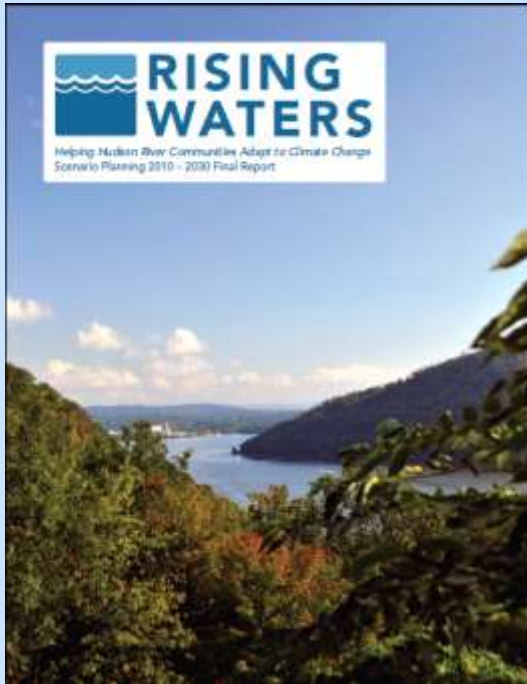


NATIONAL ESTUARINE
RESEARCH RESERVE SYSTEM
SCIENCE COLLABORATIVE

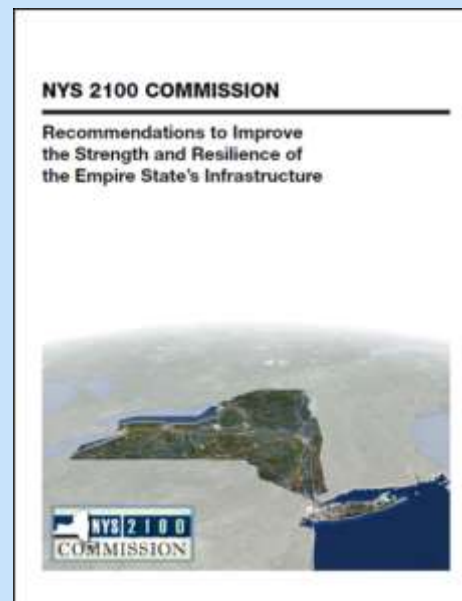
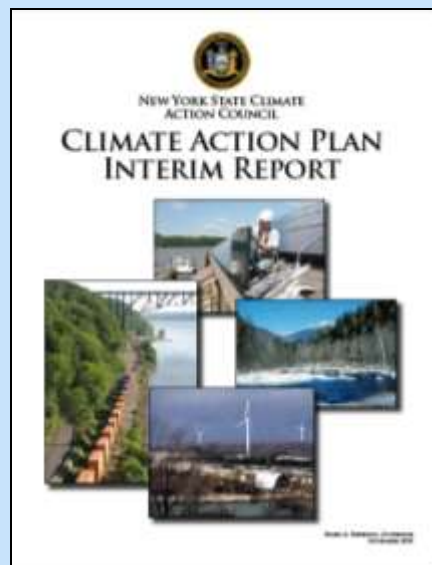
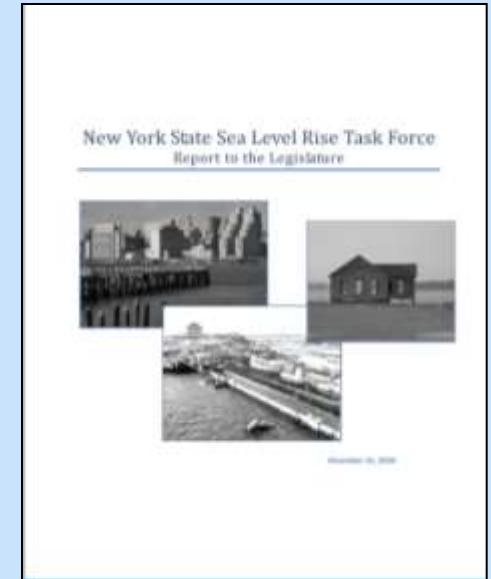
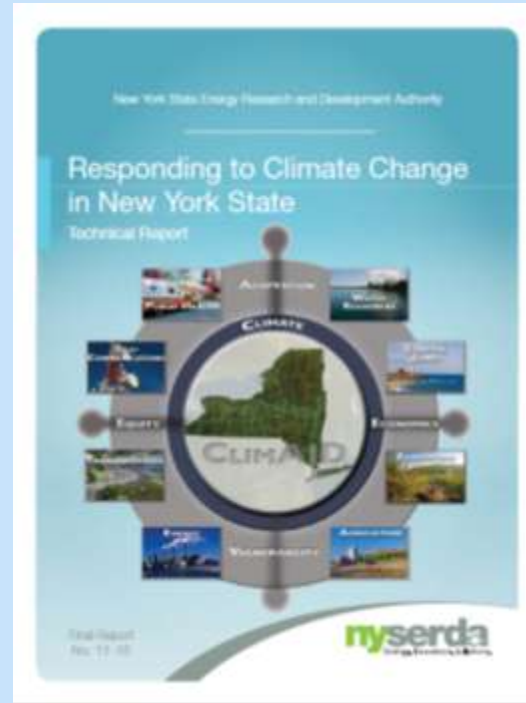
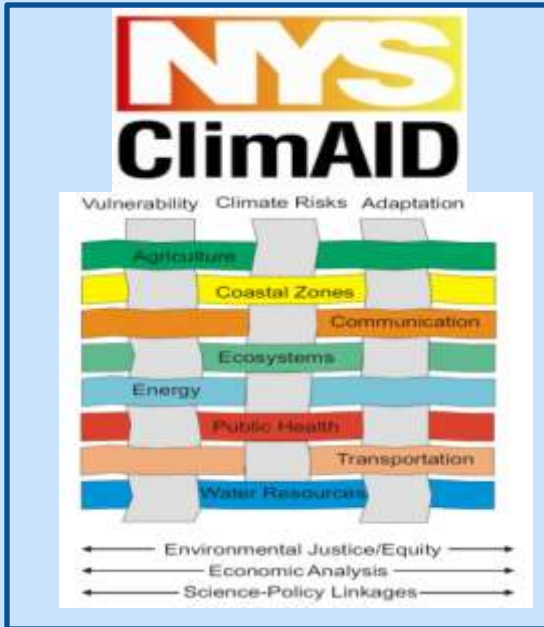


Additional Resources

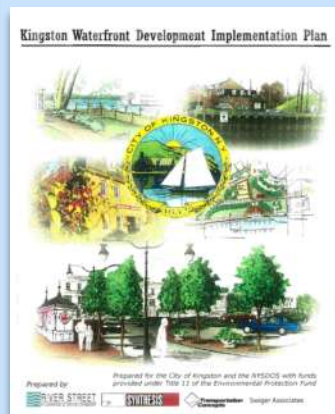
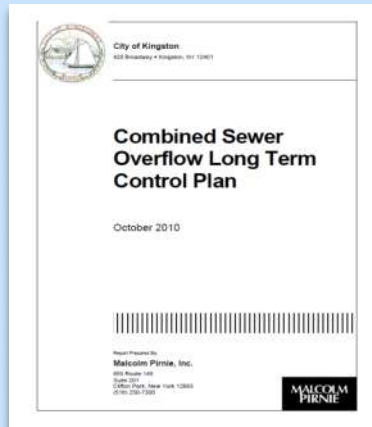
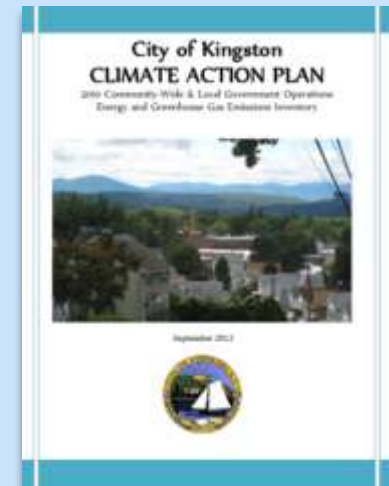
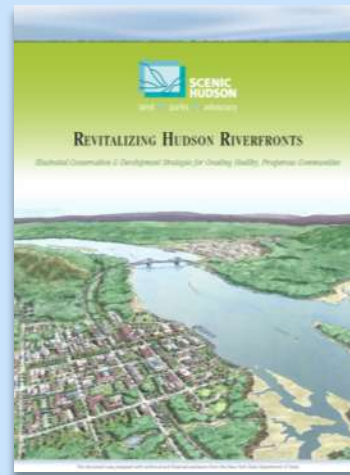
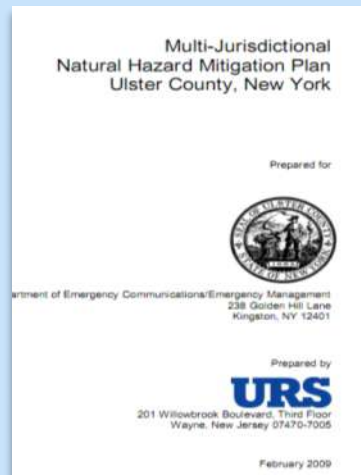
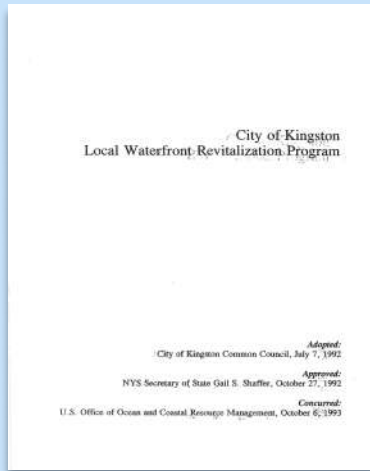
Raising Capacity: Hudson River SLR and Waterfront Resources



New York Climate Change Studies



Informative Plans and Studies



Stormwater Management Plan

Tidal Rondout Watershed
Management Plan

Brownfield Opportunity Area and GEIS