

Our Mission:

Scenic Hudson is dedicated to protecting and restoring the Hudson River, its riverfront and the majestic vistas and working landscapes beyond as an irreplaceable national treasure for America and a vital resource for residents and visitors.



**SCENIC
HUDSON**

land ■ parks ■ advocacy

Revitalizing Hudson Riverfronts:

Resilient waterfronts in an era of Sea Level Rise

Hastings-on-Hudson



Jeffrey Anzevino, AICP

Hastings-on-Hudson

January 11, 2017



Photo: Jeff Anzevino

Revitalizing Hudson Riverfronts:

Resilient waterfronts in an era of Sea Level Rise

Hastings-on-Hudson

- Smart Growth
- Prioritize Water-dependent and -enhanced uses
- Capitalize on Connections!
- Resilient to Sea Level Rise and Flooding
- Public involvement

Jeffrey Anzevino, AICP
Hastings-on-Hudson
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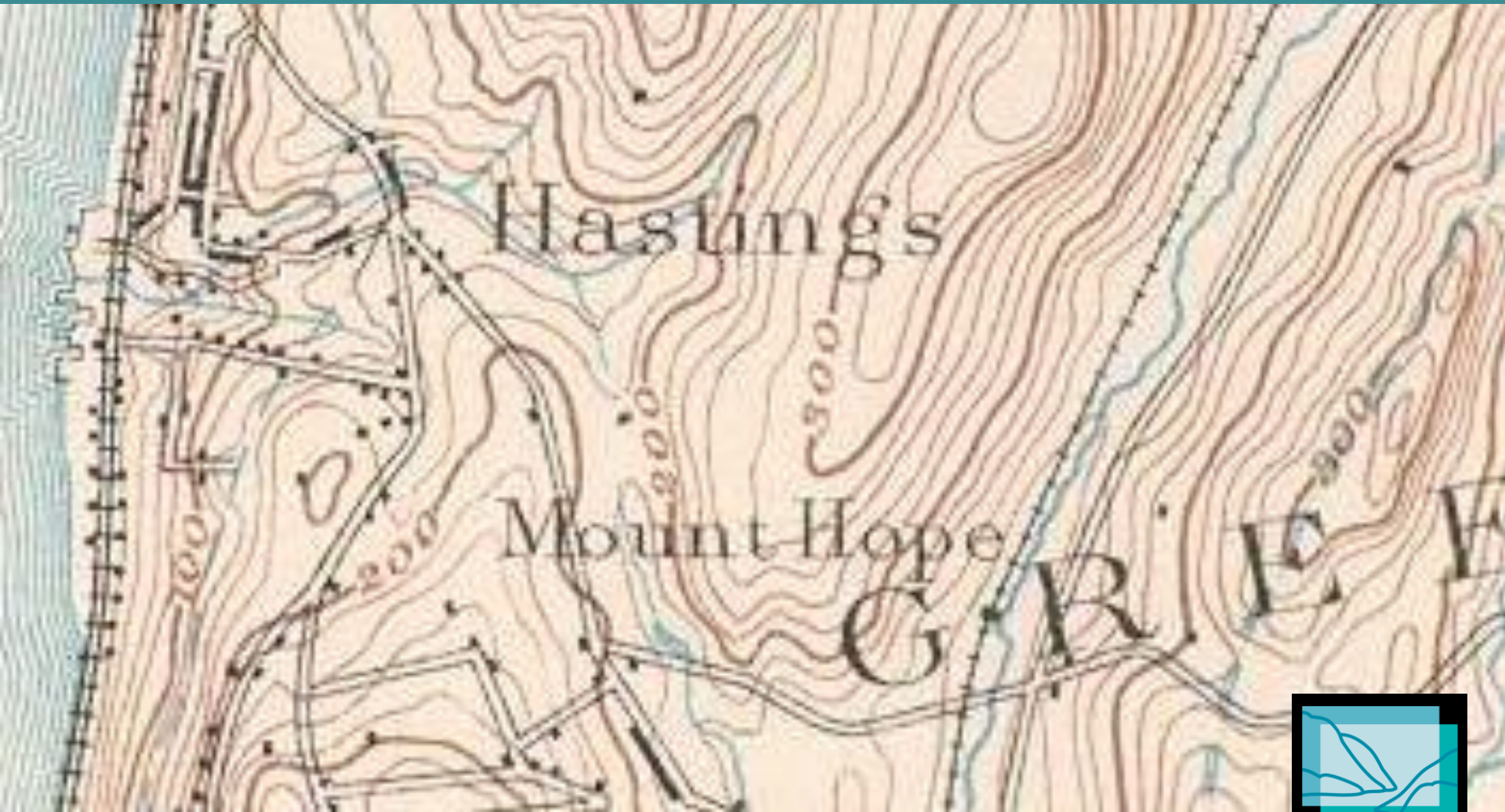
Photo: Jeff Anzevino



View of Hastings-on-Hudson, oil on canvas, John Ludlow Martin, 1856

Hastings-on-Hudson at the turn of the 20th Century

Harlem, NY Quadrangle, 1894, USGS 15' Series





Jeff Anzevino/Scenic Hudson

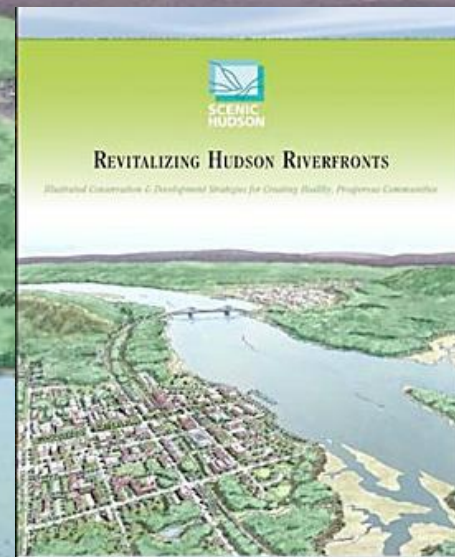
Illustrated Conservation and Development Strategies for Creating Healthy, Prosperous Communities

www.revitalizinghudsonriverfronts.org

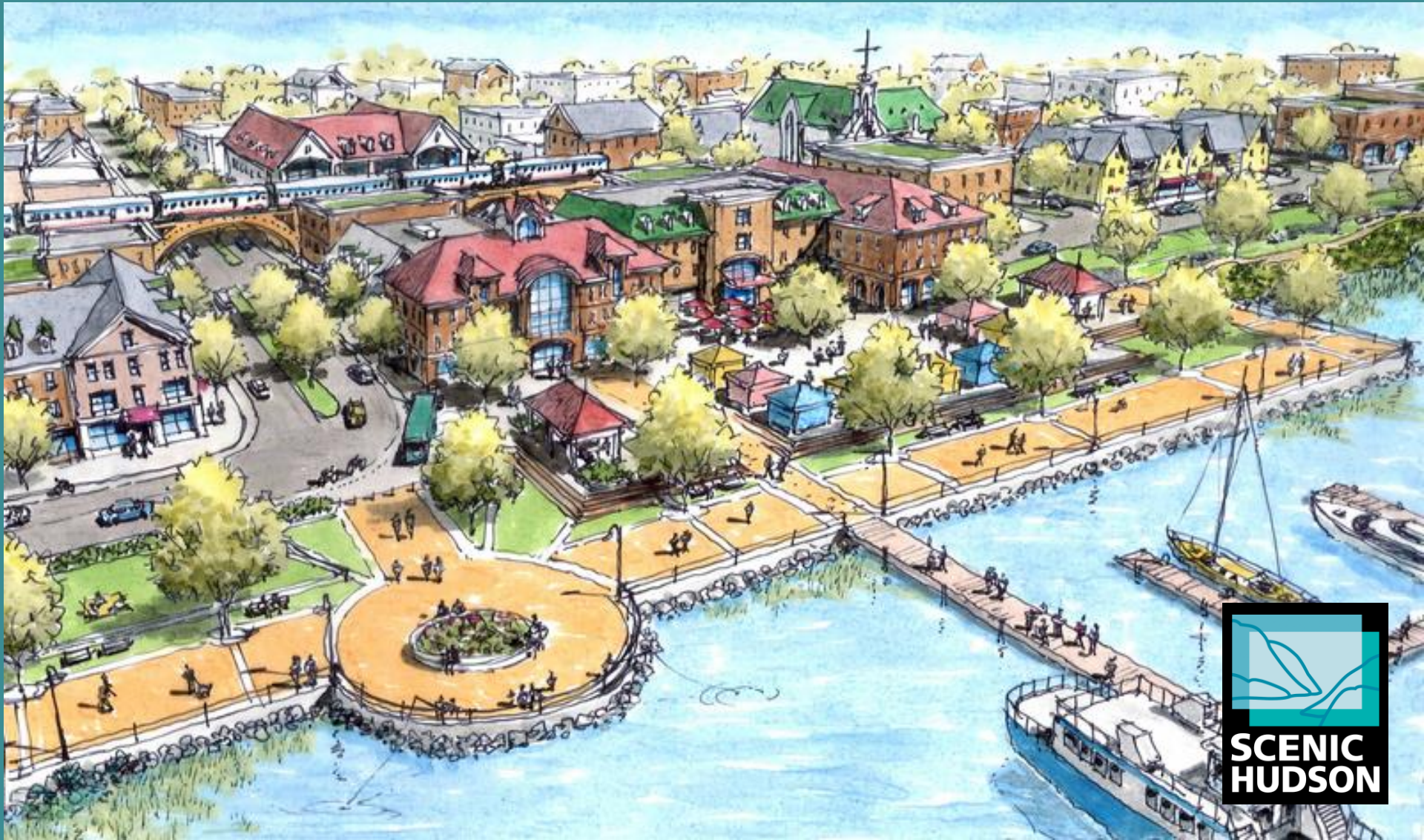
- I. Promote Riverfront Development in Areas with Existing Infrastructure**
- II. Encourage Water-Dependent and Water-Enhanced Uses on the Waterfront**
- III. Connect People to the River**
- IV. Protect Natural Resources**
- V. Protect Scenic Resources**
- VI. Promote Good Urban Planning & Sustainable Design**

Climate Change: Adaptation & Mitigation





1) Promote Riverfront Development in Areas with Existing Infrastructure



Promote Riverfront Development in Areas with Existing Infrastructure

- 1) Takes advantage of existing infrastructure
- 2) Close to existing services.
- 3) Provides opportunities to reuse historic building stock
- 4) Encourages walking, bicycling, & a healthful lifestyle
- 5) Protects open space and farmland
- 6) Helps mitigate against a warming planet

Compact and Walkable



Infill Development



Adaptive Reuse of Historic Buildings



2) Encourage Water-dependent and Water-enhanced Uses



Water dependent = Marinas



Water enhanced = restaurants, hotels



Non-water dependent



3) Connecting People to the River—and Beyond



Connecting People to the River—and Beyond

WHAT TO CONNECT

- Business Districts
- Neighborhoods
- Historic Sites
- Parks
- Educational Institutions
- Other communities
- Cross-river connections

Connecting People to the River—and Beyond



Connecting People to the River—and Beyond



What kinds of connections?

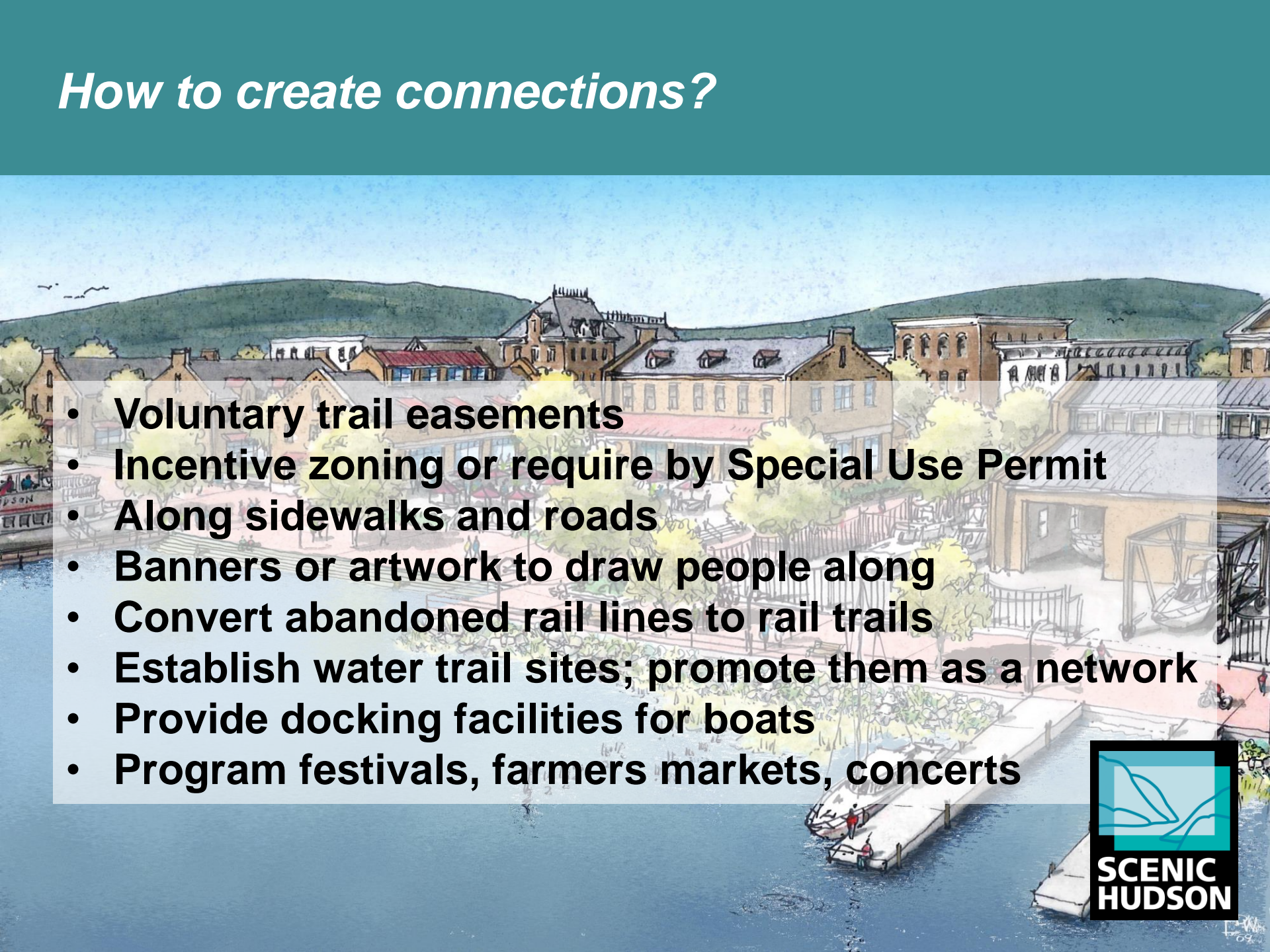
WAYS TO CONNECT: physically & visually

- Walkways both to and along the river
- Trolleys
- Boat docks, launches, and tours
- View corridors





How to create connections?

- 
- **Voluntary trail easements**
 - **Incentive zoning or require by Special Use Permit**
 - **Along sidewalks and roads**
 - **Banners or artwork to draw people along**
 - **Convert abandoned rail lines to rail trails**
 - **Establish water trail sites; promote them as a network**
 - **Provide docking facilities for boats**
 - **Program festivals, farmers markets, concerts**

Establish a Continuous riverfront greenway

100/100 Rule

Maintain 100-foot minimum setback or avoid development in 100-year floodplain, whichever is greater

Benefits:

- Provides place for rising water to go
- Open space
 - Public access
 - Recreation
 - Habitat protection

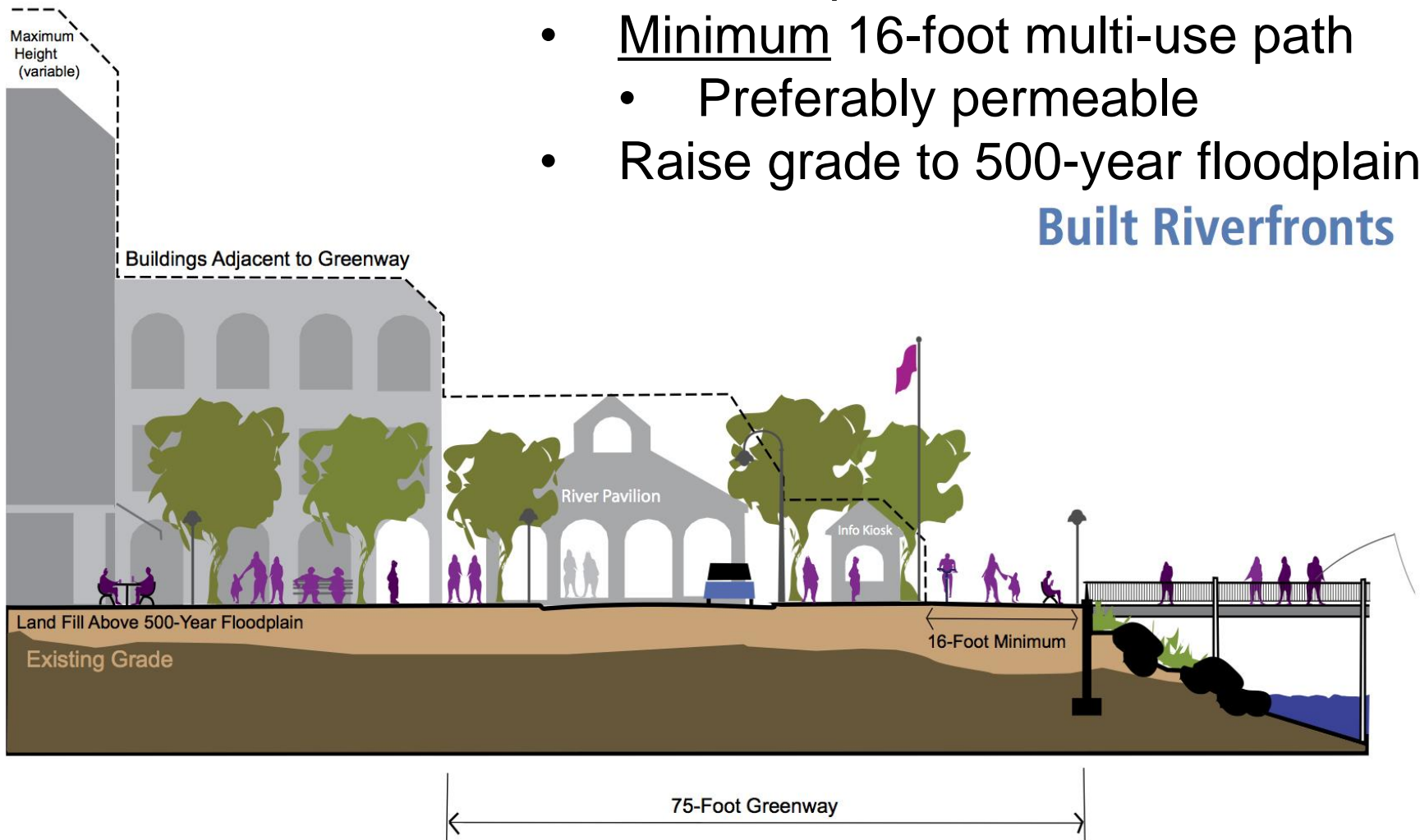


Greenway: Built Riverfront

Maintain 75-foot minimum setback

- Public Access
- Water dependent & enhanced uses
- Minimum 16-foot multi-use path
 - Preferably permeable
- Raise grade to 500-year floodplain

Built Riverfronts



4) Protect Natural Resources



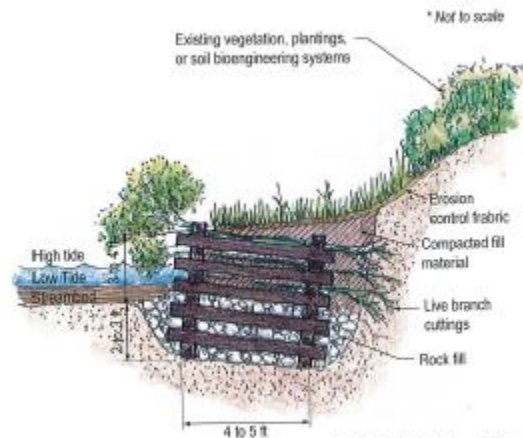
How?



How?



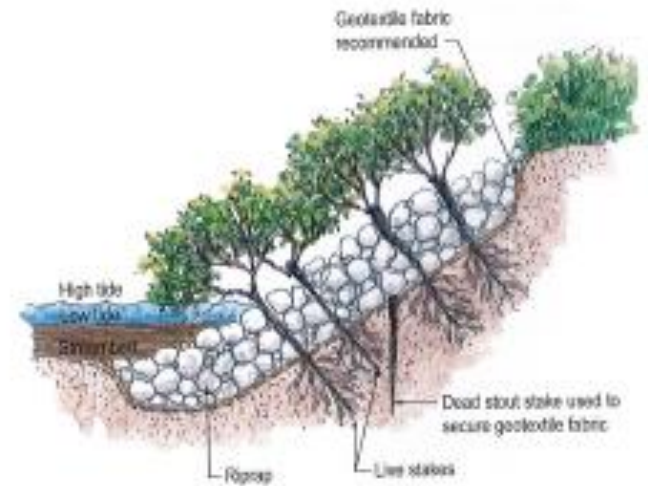
Live crib wall: A box-like arrangement of interlocking logs, timbers, precast concrete, or plastic structural members. The crib is filled with layers of backfill and live cuttings that root inside the crib and beyond into the slope.



NOTE: Rooted/leaked condition of living plant material does not represent time of installation.

Joint planting: Riprap with live stakes tamped into the joints between the rocks.

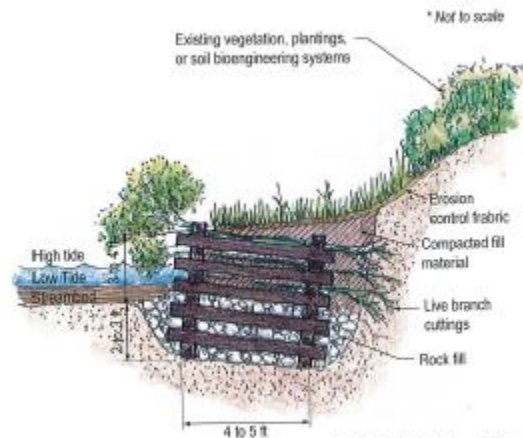
*Not to scale



How?



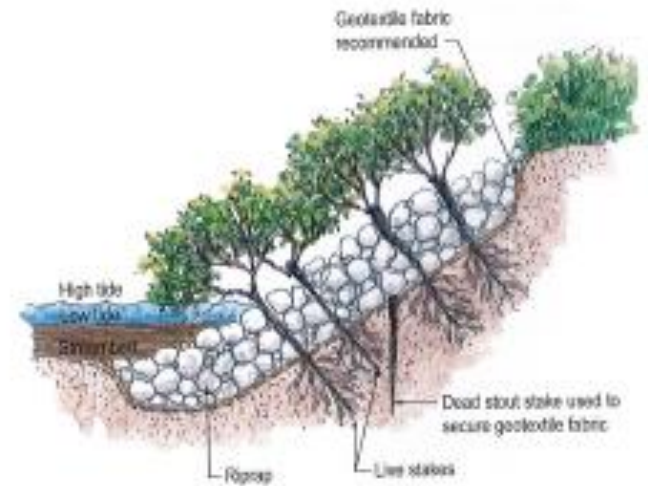
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Joint planting: Riprap with live stakes tamped into the joints between the rocks.

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5) Protect Scenic Resources



Protect Scenic Resources



Protect Scenic Resources



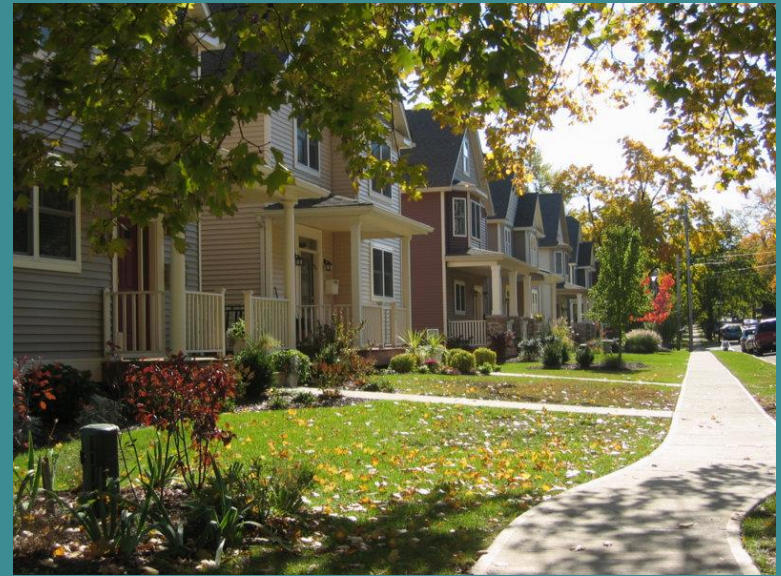
6) Promote Good Urban Planning & Sustainable Design



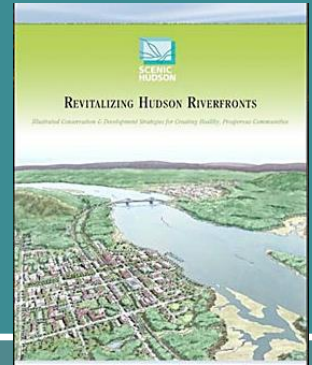
Promote Good Urban Planning & Sustainable Design



Promote Good Urban Planning & Sustainable Design



Revitalizing Hudson Riverfronts



Where conditions allow:

- a) Promote riverfront greenway corridor*
- b) Preserve and restore floodplains*
- c) Locate critical infrastructure above the 500-year floodplain*
- d) Update policies for resilience*
- e) Promote green development*



THE HUDSON RIVER ESTUARY AND SEA LEVEL RISE

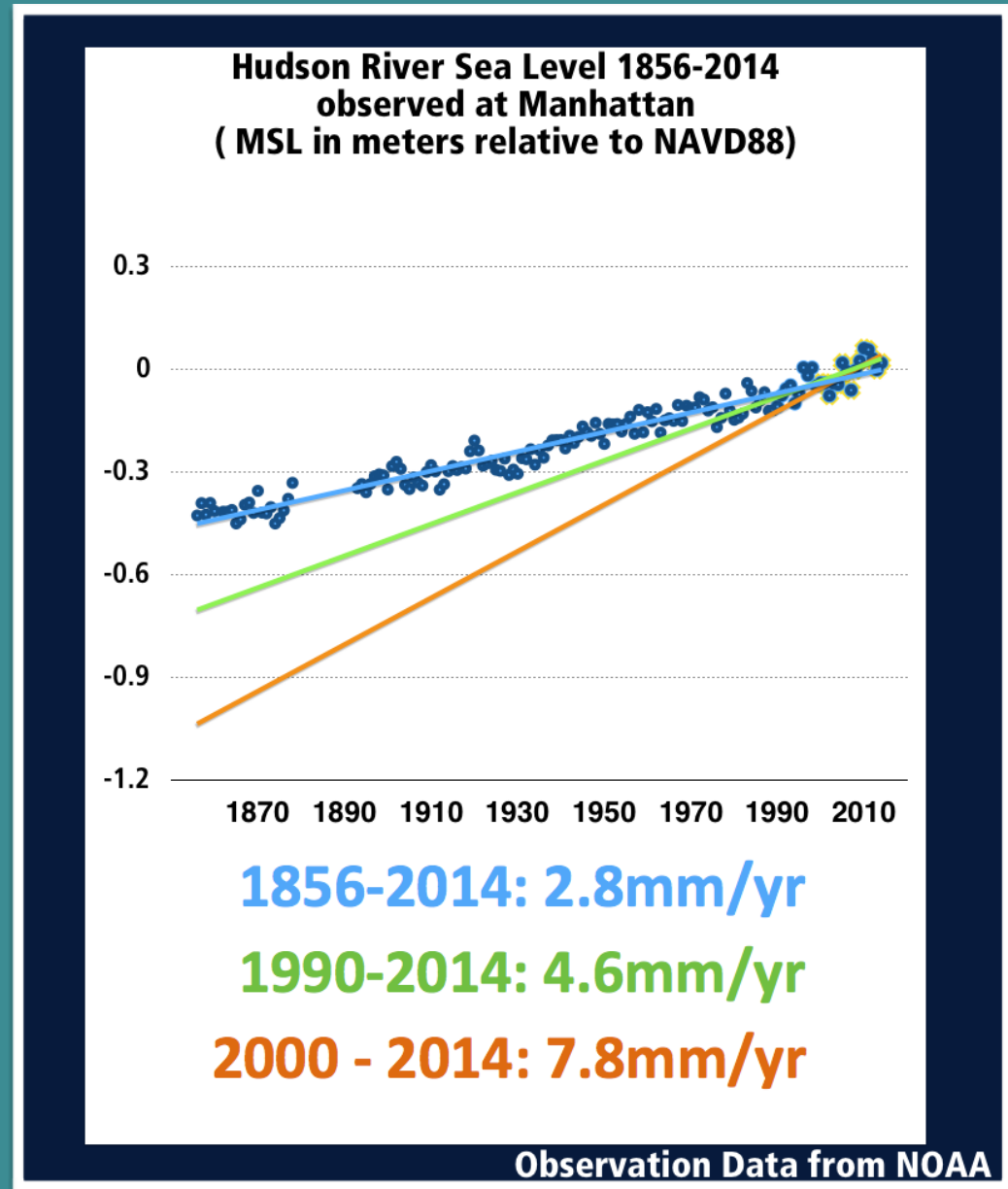
- Approximately 150 miles long
- Strong tidal influence
- 78 municipalities



THE HUDSON RIVER ESTUARY & SEA LEVEL RISE:

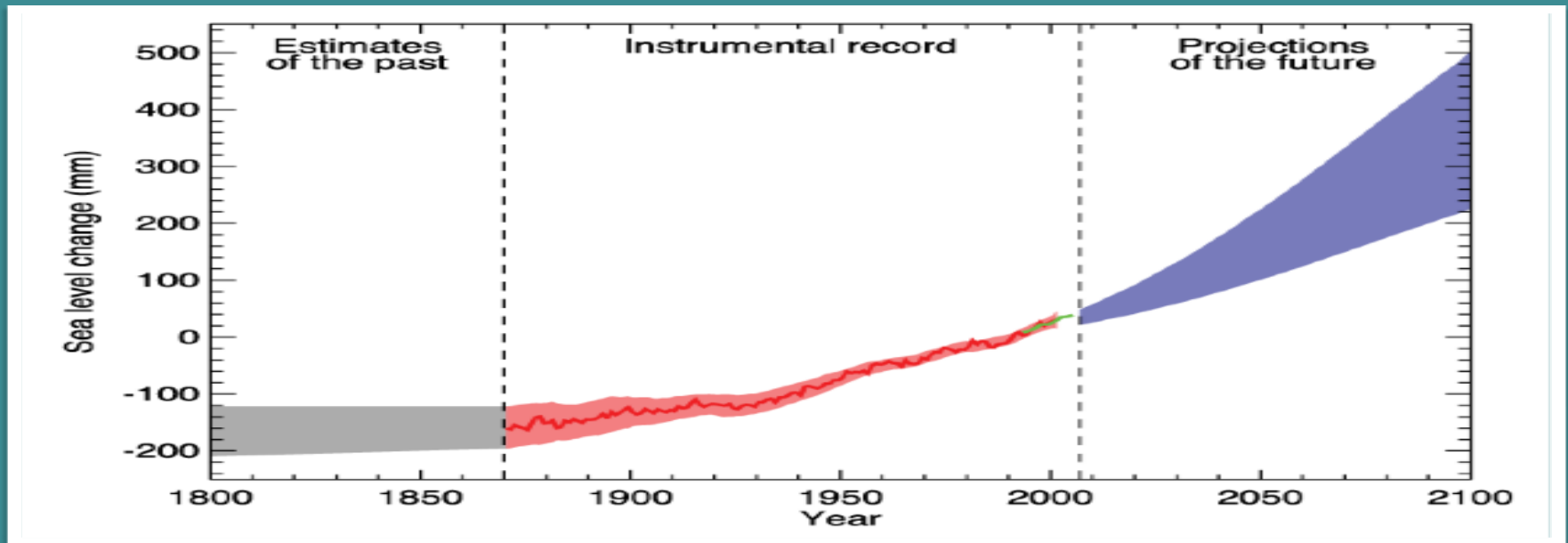
Past, present and future

- The Hudson River is over 12" higher than a century ago
- 21st Century SLR rate is higher and projected to continue accelerating



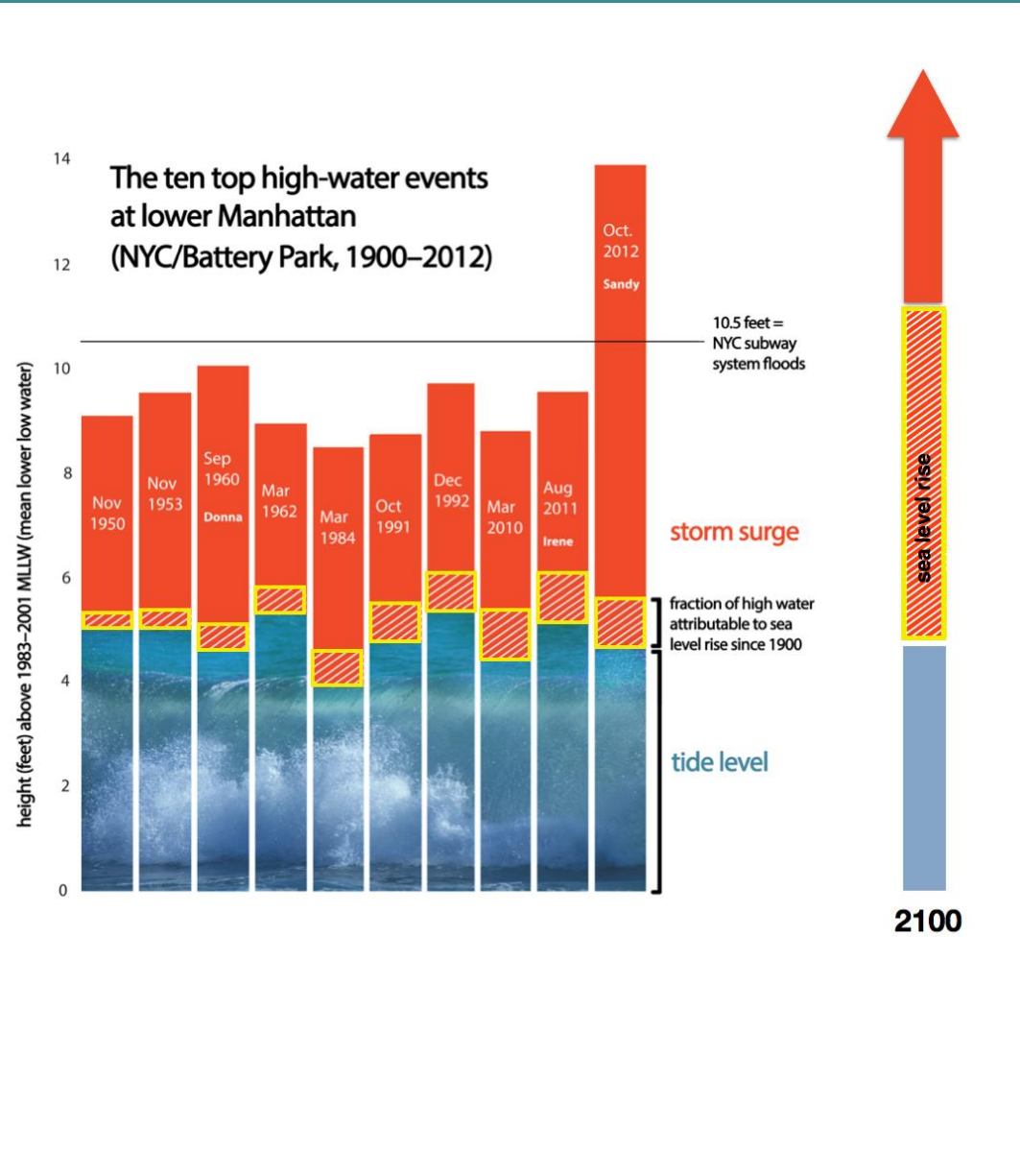
THE HUDSON RIVER ESTUARY & SEA LEVEL RISE:

Past, present and future

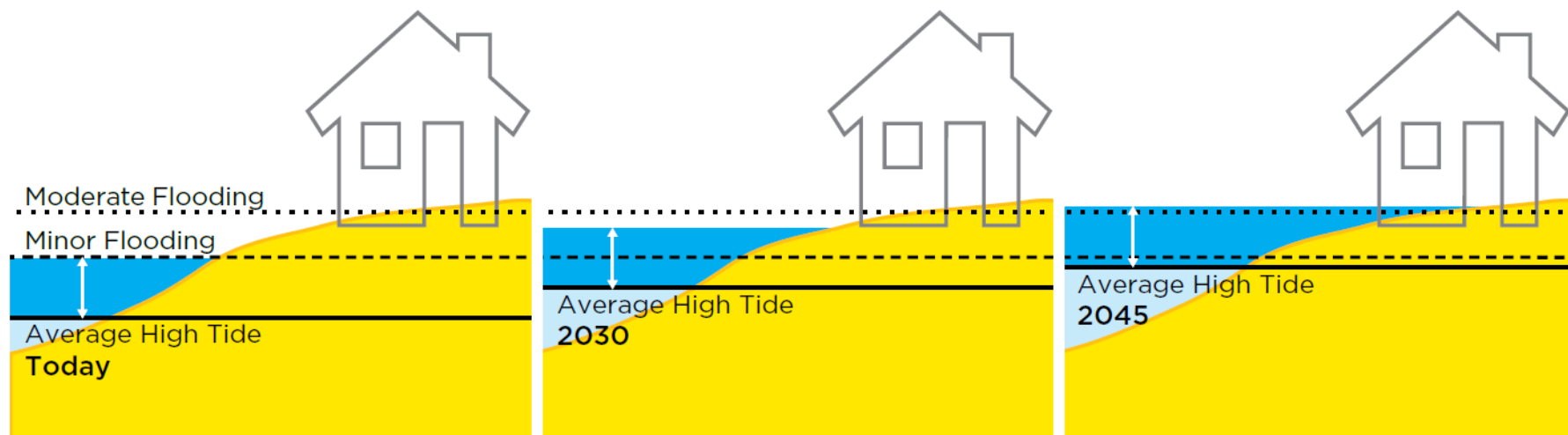


THE HUDSON RIVER ESTUARY & SEA LEVEL RISE:

Past, present and future



FLOODING & SEA LEVEL RISE:



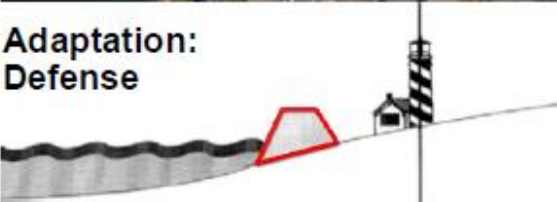
A tide that causes a minor flood today is a nuisance (white arrow). In the future, higher sea levels will allow high tides to push water deeper into coastal communities, affecting more homes, businesses, and infrastructure. Extensive moderate flooding—now usually associated with storms and high winds—is expected to become more common, simply from high tides.

Responses to SEA LEVEL RISE:

Coastal defense: Solutions that protect existing critical infrastructure - including sea walls, rip rap, levies and hardened shorelines



Adaptation:
Defense



Strategic accommodation: Solutions that permit flooding - including raised infrastructure, adaptive design strategies and compatible land uses



Adaptation:
Accommodate



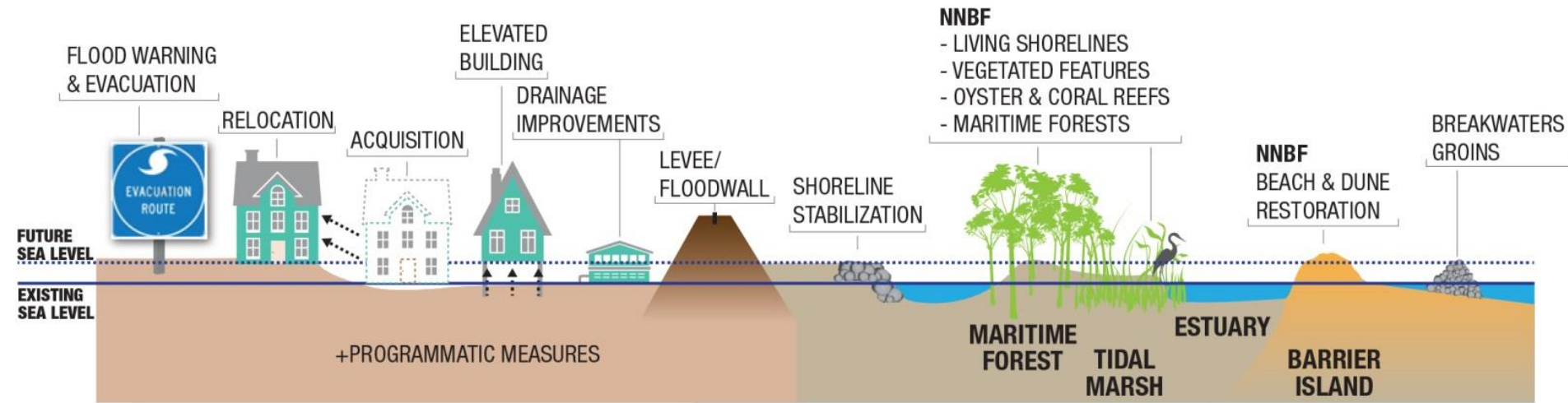
Managed relocation: Solutions that allow for inundation and flooding while promoting the migration of tidal wetlands and other important natural resources



Adaptation:
Relocate



Responses to SEA LEVEL RISE:



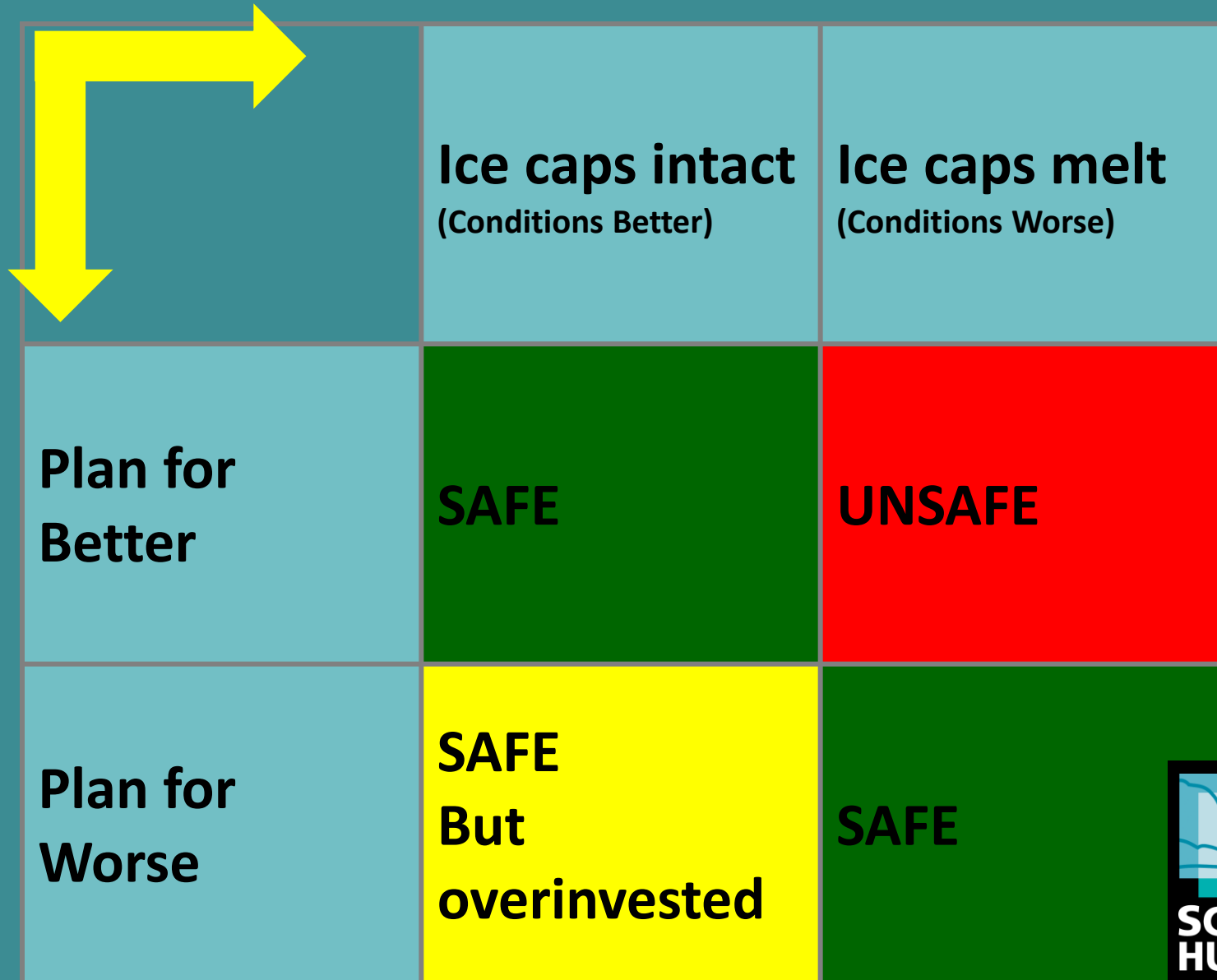
Lower Hudson River sea level rise projections

Rapid polar ice cap melt?

	Low	Low-Medium	Medium	High-Medium	High
2020s	2"	4"	6"	8"	10"
2050s	8"	11"	16"	21"	30"
2080s	13"	18"	29"	39"	58"
2100	15"	22"	36"	50"	75"



Risk Tolerance: selecting an approach to planning



	Ice caps intact (Conditions Better)	Ice caps melt (Conditions Worse)
Plan for Better	SAFE	UNSAFE
Plan for Worse	SAFE But overinvested	SAFE

Hudson River Sustainable Shorelines



The Hudson River Sustainable Shorelines Project aims to develop science-based recommendations for shore zone management to enhance natural benefits while meeting protection needs.

<https://www.hrnerr.org/hudson-river-sustainable-shorelines/>



Benefits of sustainable shorelines

Provide erosion control and protect upland land use by absorbing energy from waves and currents

Provide alternative options to bulkheads and rip rap revetments

Protect water by capturing polluted runoff

Provide pathways for wetland migration in gradual-slope areas

Increase coastal greenery, which adds to beauty, takes in carbon dioxide, and provides habitat

Increase biodiversity of habitats with rocks, plants and natural debris

Minimize cost over life span of shoreline stabilization, as opposed to hardened protection

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



case study: Esopus Meadows



before



after

A degrading bulkhead was replaced with softer stabilizing alternatives that still provide shoreline protection. A stone toe was placed at the high tide line and soft gabions positioned above it help hold the soil in place.

RESILIENT WATERFRONT DESIGN



Scenic Hudson's Long Dock Park

RESILIENT WATERFRONT DESIGN



Climate Adaptive Design, Hudson, NY

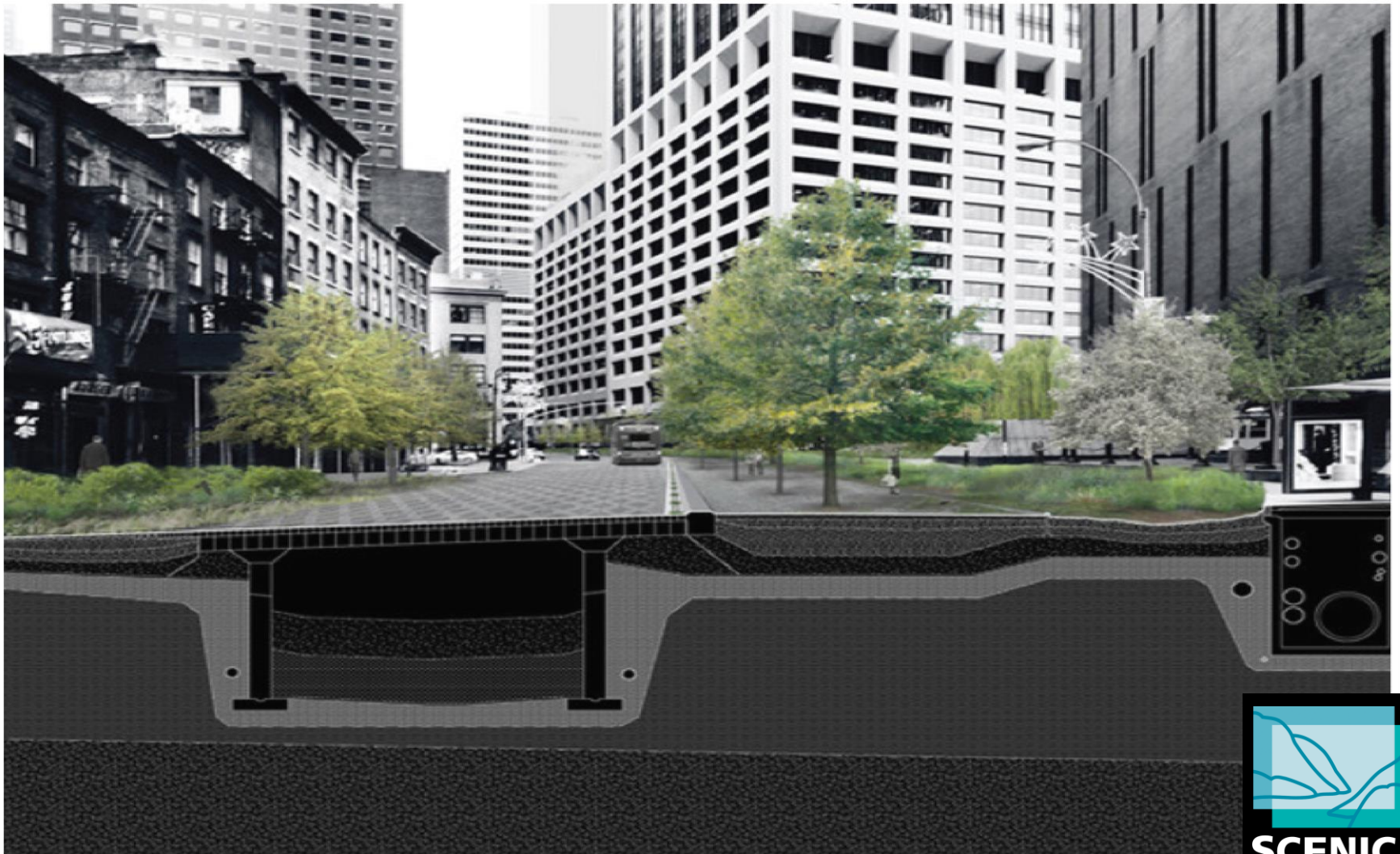


RESILIENT WATERFRONT DESIGN



Pivers Island living shoreline, Beaufort NC

RESILIENT WATERFRONT DESIGN



Green streets

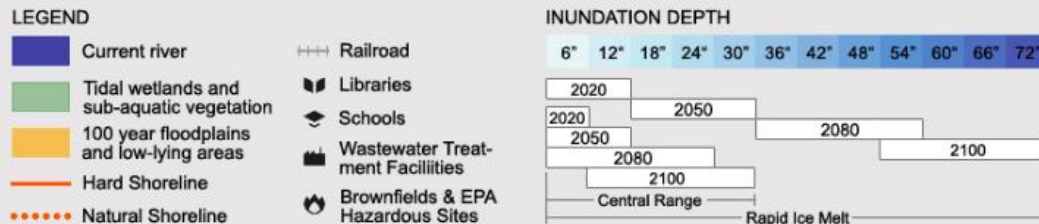
12" Sea Level Rise



Jeff Anzevino/Scenic Hudson



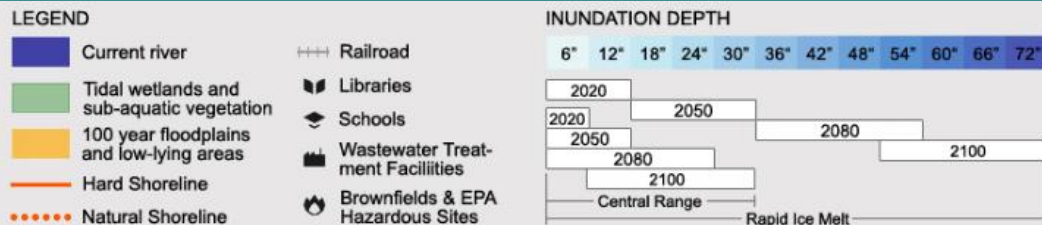
SEA LEVEL RISE MAPPER: <http://scenichudson.org/slr/mapper>



24" Sea Level Rise



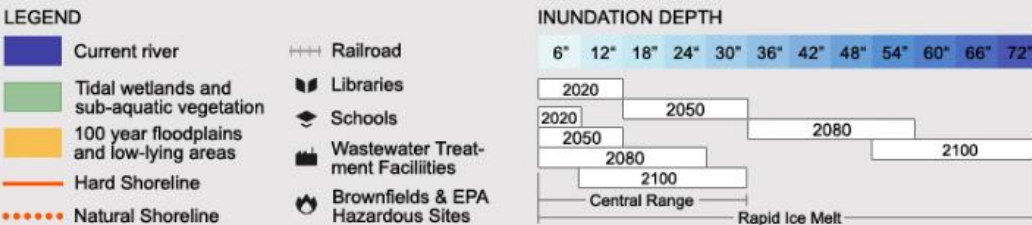
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36" Sea Level Rise



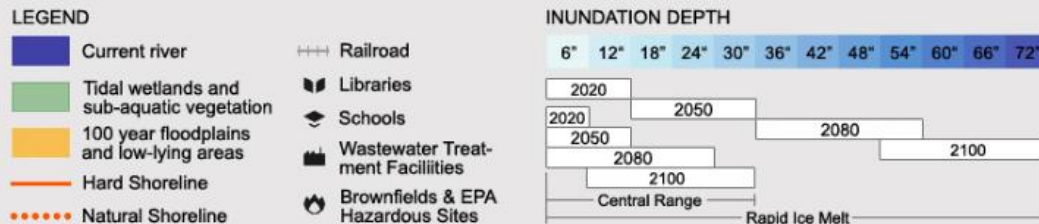
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48" Sea Level Rise



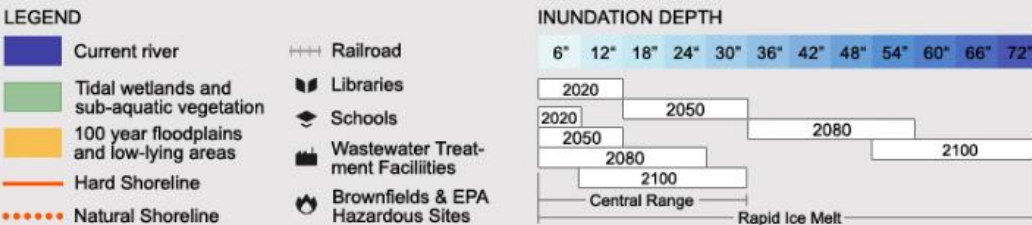
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60" Sea Level Rise



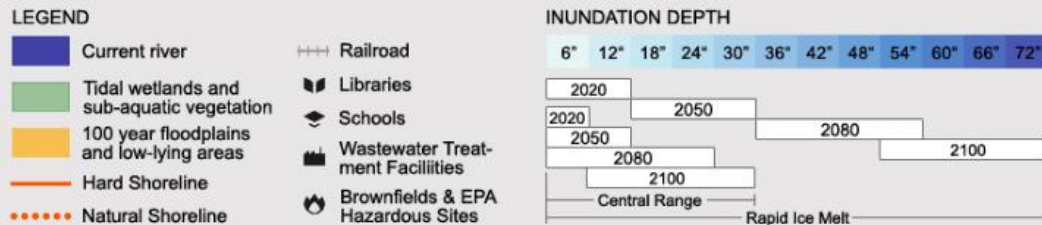
SEA LEVEL RISE MAPPER: <http://scenichudson.org/slr/mapper>



72" Sea Level Rise



SEA LEVEL RISE MAPPER: <http://scenichudson.org/slr/mapper>



Public involvement

- Early and often in the planning process
- Often required
- Projects often improved
- Benefits of public “buy-in”
- Don’t overlook disenfranchised people



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CONCLUSION

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