GREEN INFRASTRUCTURE AND RESILIENCY

how communities adapt to climate change and other natural disasters

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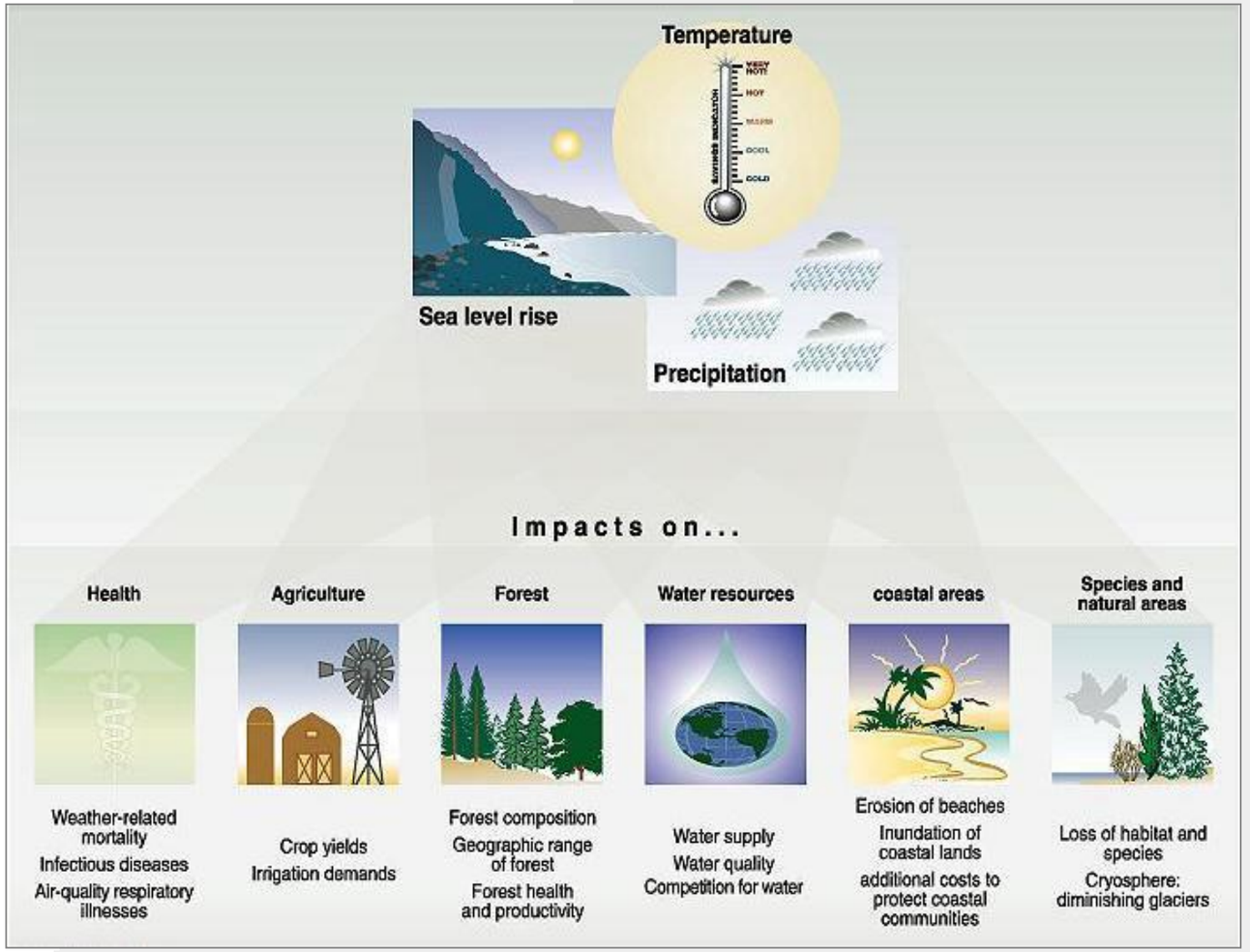
POTENTIAL IMPACTS OF CLIMATE CHANGE



Source: Anthony J. Broccoli, Director, Climate and Environmental Change Initiative, Rutgers

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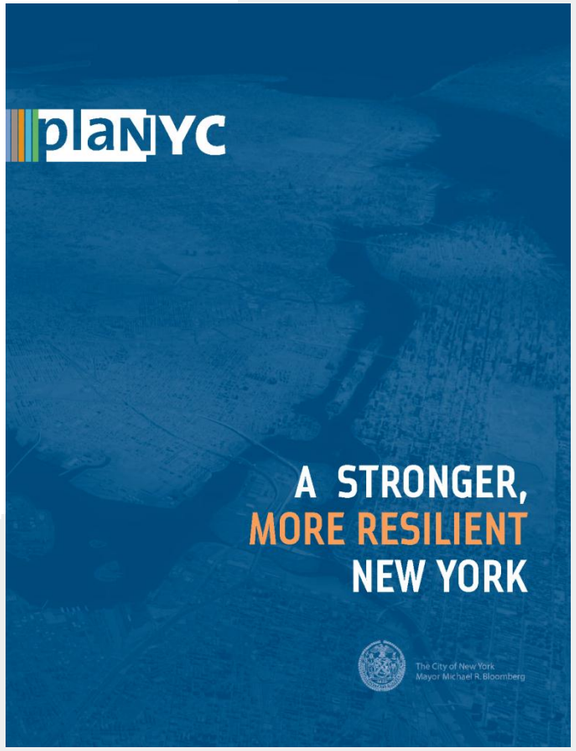
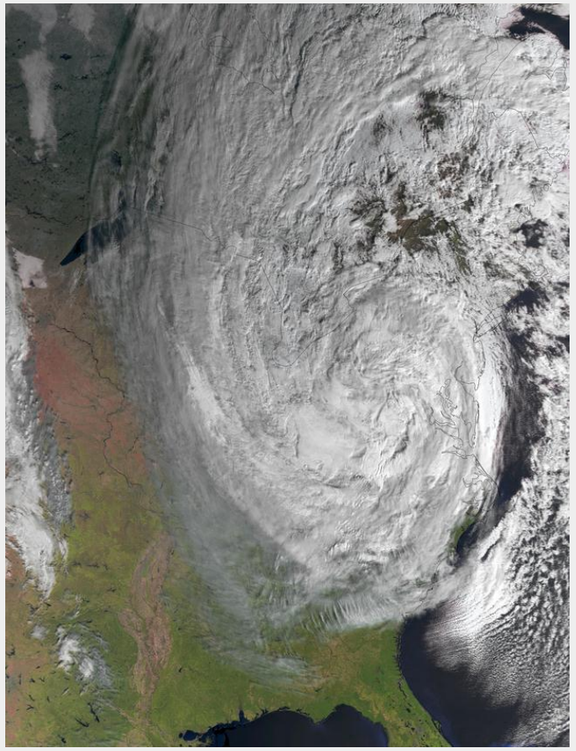
able to bounce back after change or adversity. capable of preparing for, responding to, and recovering from difficult conditions.





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GRAY INFRASTRUCTURE

traditional practices for stormwater management and wastewater treatment, such as pipes and sewers

GREEN INFRASTRUCTURE

sustainable pollution reducing practices that also provide other ecosystem services

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PHILADELPHIA'S GREEN CITY, CLEAN WATERS PROGRAM

25-year, $1.67-billion program for Combined Sewer Overflow Controls

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Cobbs Creak Restoration Overview

- Stream restoration
- Floodplain wetlands
- Riparian buffer enhancements
- Trails/Trailheads Gateways
- Street-side GSI/Retention Berms

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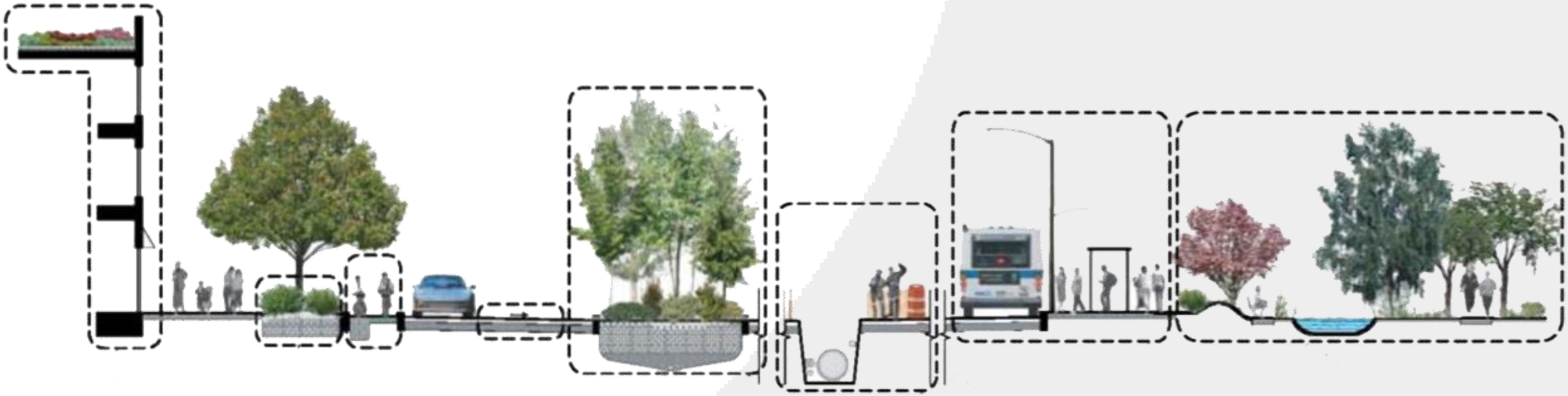
Gray/Green Infrastructure Integration



Strategies

Living Streamside

Single Unit Home

Guide to Designing your Property and Protecting our Watershed

PWD Philadelphia Water Department

BACKYARD BUFFER PROGRAM

This guide is intended to help you learn how to protect our streams and rivers with a well thought-out design and a list of projects that you may implement on your property.

North

1. **Eliminate dumping** of lawn clippings, leaves and other debris into stream. This will prevent excessive nutrients from impairing water quality (see Tip Sheet #5 *Composting* for more information).
2. **Improve immediate stream buffer** by removing invasive plants and replacing them with native species (see Tip Sheet #3 *Native Plants for Pennsylvania* & Tip Sheet #4 *Tree & Shrub Planting Basics* which include information on invasive species identification).
3. **No-mow zone** is a stream buffer where mowing does not occur and Pennsylvania native plants are grown. This improves quality of stormwater reaching the stream, traps sediment, creates habitat, reduces the area of lawn that needs to be mowed and could reduce property loss (see Tip Sheet #1 *No-mow Zone* for more information).
4. **Maintain stream access** by keeping a pathway open (approximately 5 feet wide) through the no-mow zone. Plant low-growing species to maintain view while establishing deep rooting plants (lawn/turf grasses provide very shallow roots) along the streambank.
5. **Green lawn basics** such as reducing/eliminating fertilizer, herbicide and pesticide use will improve stream water quality (see Tip Sheet #2 *Green Lawn Basics* for more information).
6. **Direct rainfall runoff (stormwater) from roof downspout to a rain garden** by digging a swale/shallow depression or by piping the water from downspout to rain garden to capture stormwater.
7. **Build a rain garden** to capture and infiltrate stormwater into the ground (recharging groundwater and stream baseflow). Deep rooted plants filter water and loosen soil (see *Pennsylvania Rain Garden Guide* for more information).
8. **Install a rain barrel** to capture rooftop stormwater runoff and use this water as a resource for irrigation. Try to use all the water in the barrel between storms so the barrel can capture water from the next rain fall event (see Tip Sheet #6 *Rain Barrels* for more information).
9. **Compost bins** are a way to recycle organic yard and household material for garden use. Containerizing compost helps prevent rain from washing the material (excessive nutrients) into the nearby stream.
10. **South side deciduous tree plantings** allow winter sun penetration to home and block summer sun thereby reducing home energy costs (see Tip Sheet #3 *Native Plants for Pennsylvania* for more information)
11. **Buffer plantings** add privacy, create wildlife habitat, and reduce high-maintenance lawn practices (see Tip Sheet #3 *Native Plants for Pennsylvania* for more information).
12. **Planter islands** add privacy and habitat while reducing high-maintenance lawn practices (see Tip Sheet #3 *Native Plants for Pennsylvania* for more information).
13. **North side evergreen tree plantings** block cold winter wind thereby reducing home energy costs (see Tip Sheet #3 *Native Plants for Pennsylvania* for more information).
14. **Porous/permeable driveways & patios** allow stormwater to soak into the ground (infiltrate) (see Tip Sheet #7 *Permeable/Porous Pavers* for more information).

PWD Philadelphia Water Department

For more information, contact:
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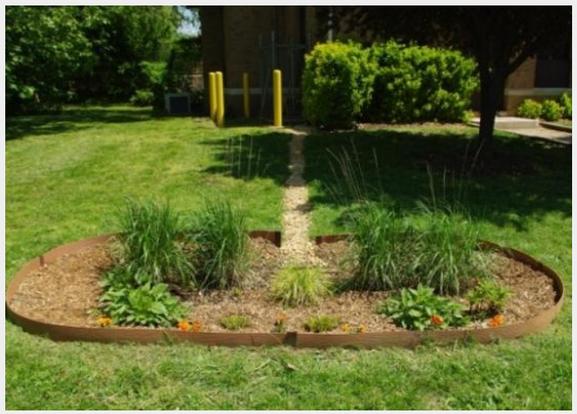
Philadelphia Water Department (Office of Watersheds)
(215) 685-4965
jeanne.waldowski@phila.gov
http://www.phillywatersheds.org/public



Protect Resources

Maintain/restore pre-development hydrologic conditions

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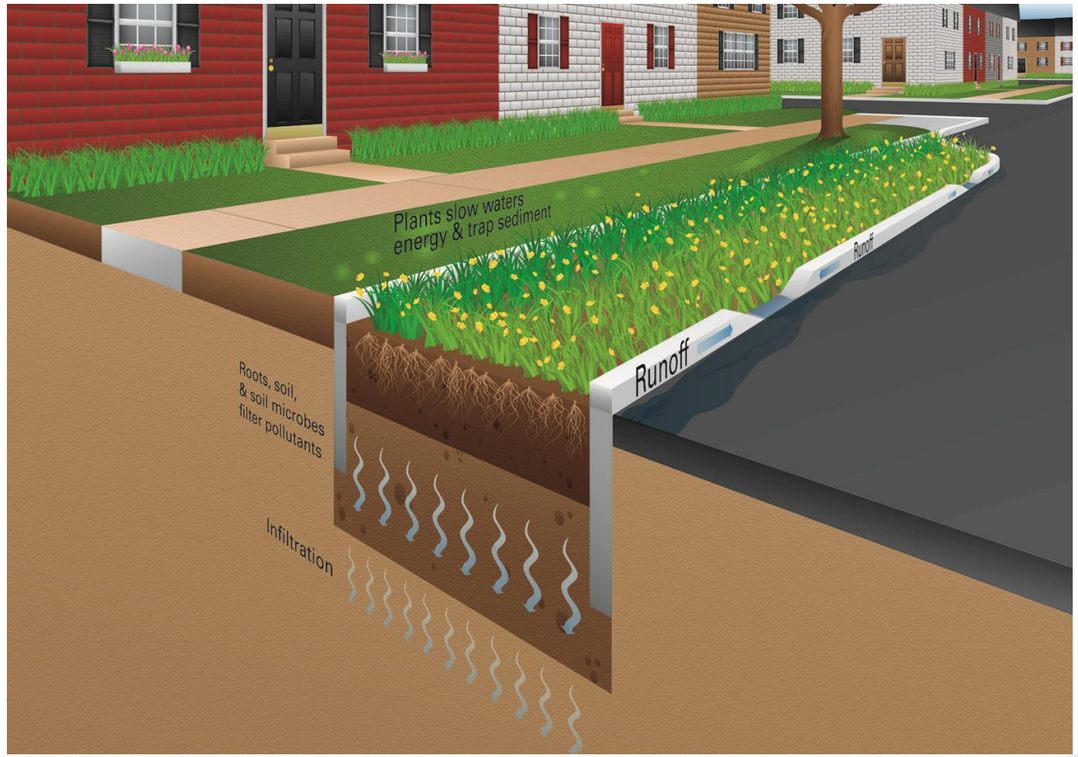
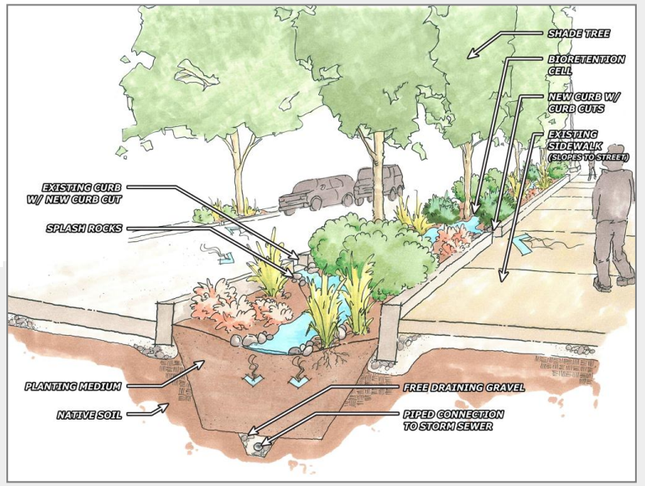
Stormwater Bumpouts / Bioretention Swales





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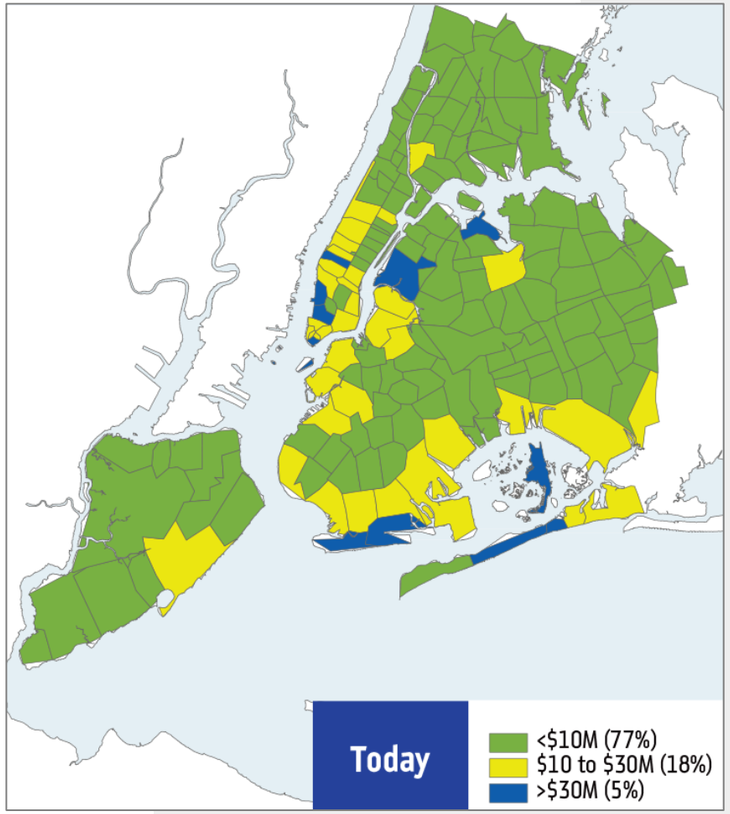
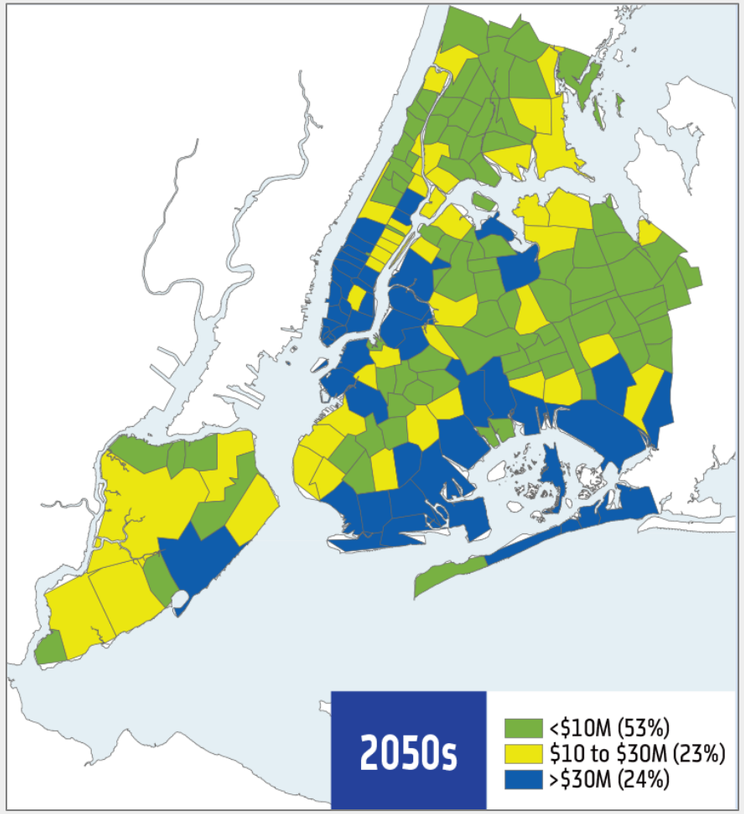
NEW YORK STORM DAMAGE REDUCTION

Economic Impacts





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NEW YORK STORM DAMAGE REDUCTION

Mid-Island Bluebelt Drainage Plans

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COASTAL/ TIDAL GREEN INFRASTRUCTURE

ENERGY GRADIENT

STRUCTURAL
offshore breakwater (openings provide wildlife access)

HYBRID
segmented sills, jetties, or groins with natural beach shoreline and/or marsh plantings

NONSTRUCTURAL:
biologs and vegetation

Source: Chesapeake Bay Foundation

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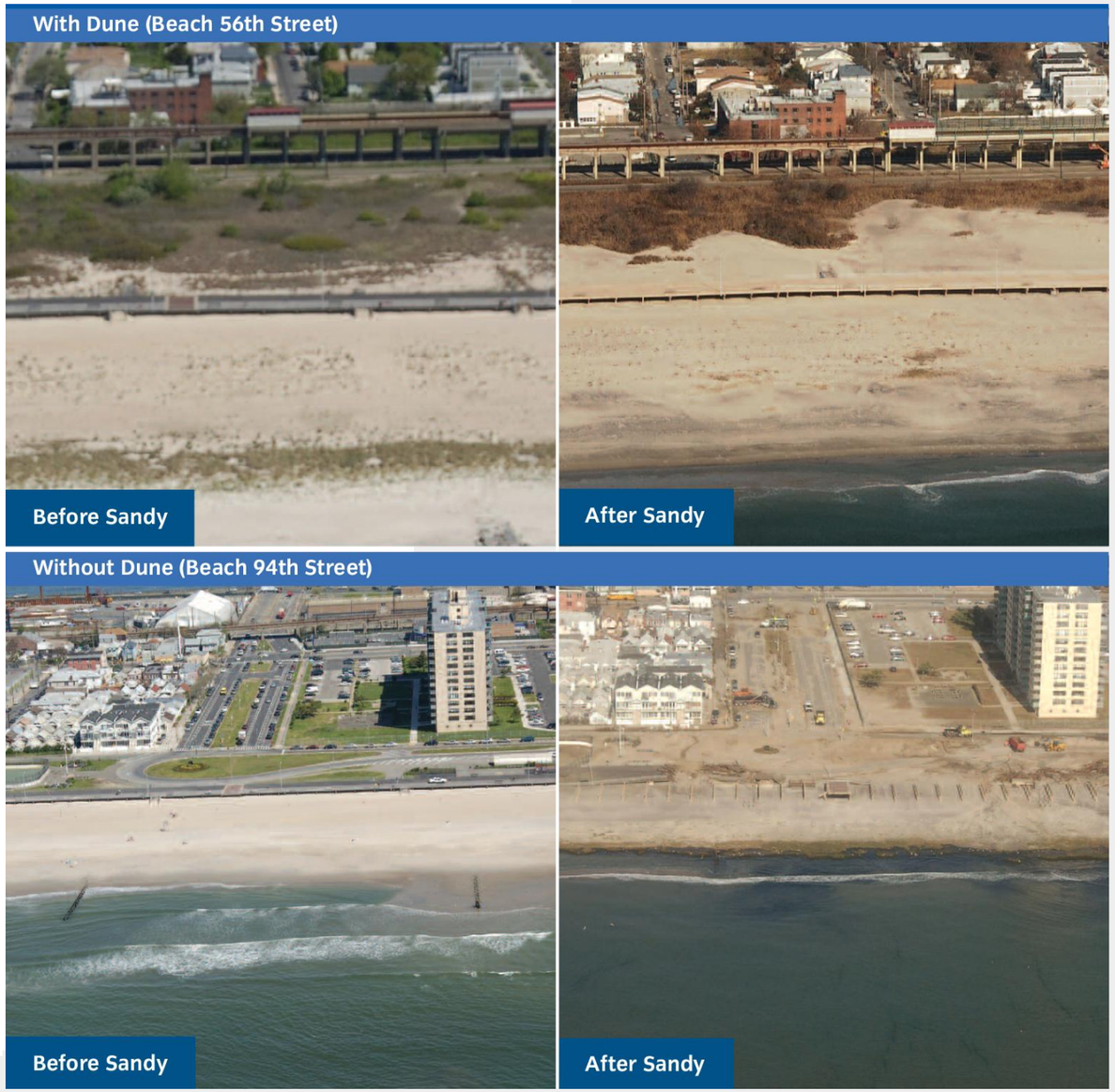
Living Shorelines

Site Conditions	Low Energy (Nonstructural)	Medium Energy (Hybrid)		High Energy (Structural)
Shoreline Location	creek or cove	minor river	major tributary	mainstem bay
Water Depth (ft/near shore)	-.10	-1.0 to -2.0	20.0 to -4.0	-4.0 to -15.0
Fetch (mi/distance to nearest opposite shore)	0.5	1.0 to 1.5	2.0 or more	2.0 or more
Erosion Rate (ft/yr)	2 or less	2 to 4	4 to 8	8 to 20
Cost per foot	$50-100	$150-300	$350-500	$500-1,200

Source: Chesapeake Bay Foundation

NEW YORK STORM DAMAGE REDUCTION

Dune Protection on the Rockaway Peninsula



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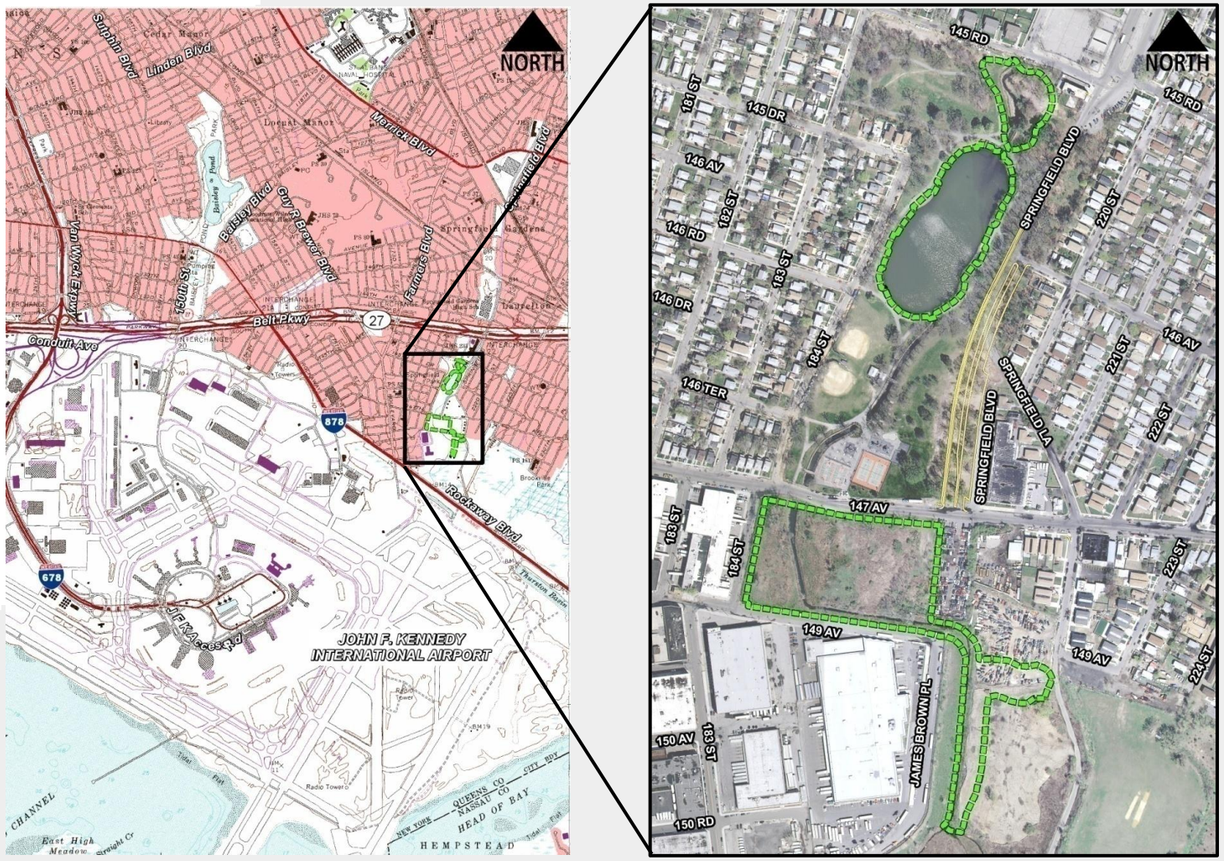
RECONSTRUCTION OF SPRINGFIELD GARDENS

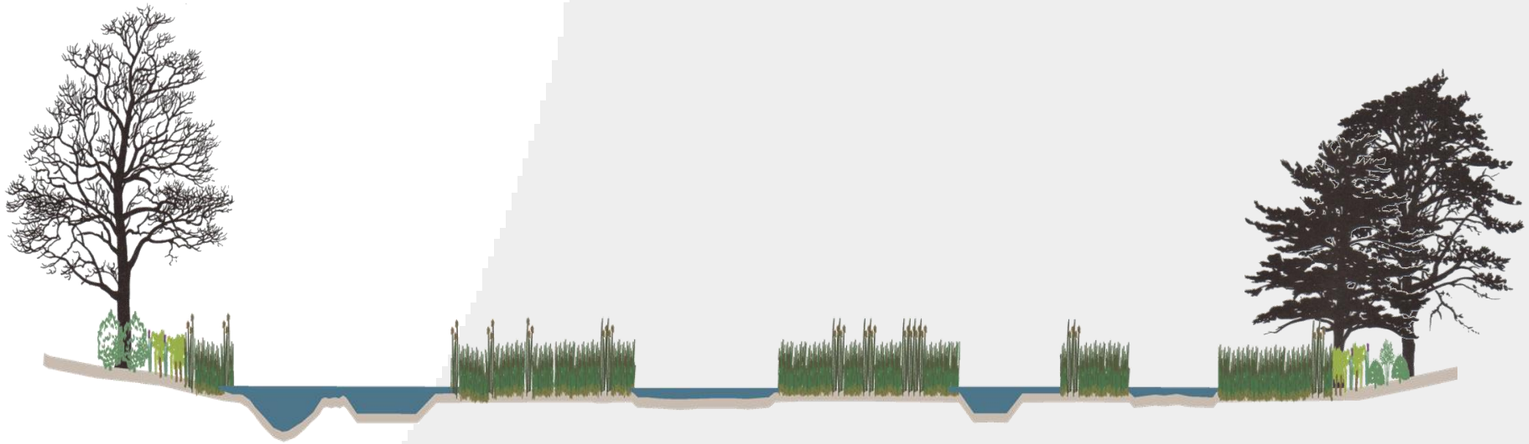
Springfield Lake Restoration, Queens, New York



BMP SL-1 Improvements

Springfield Lake Improvements

BMP SL-2 Improvements



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