Structural Measures at a Glance

GENERAL COASTAL RISK REDUCTION PERFORMANCE FACTORS:
STORM SURGE AND WAVE HEIGHT/PERIOD, WATER LEVEL

Levees

Benefits/Processes

Surge and Wave attenuation and/or dissipation

Reduce Flooding

Risk Reduction for vulnerable areas

Performance Factors

Levee height, crest width, and slope

Wave height and period

Water level

Storm Surge Barriers

Benefits/Processes

Surge and Wave attenuation

Reduced Salinity Intrusion

Performance Factors

Barrier height

Wave height

Wave period

Water level

Seawalls and Revetments

Benefits/Processes

Reduce flooding

Reduce wave overtopping

Shoreline stabilization behind structure

Performance Factors

Wave height

Wave period

Water level

Scour protection

Groins

Benefits/Processes

Shoreline stabilization

Performance Factors

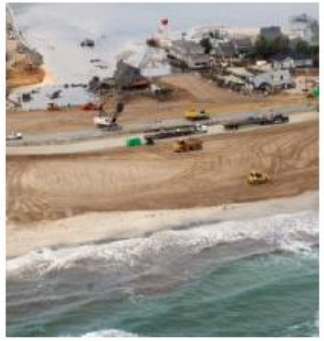
Groin length, height, orientation, permeability and spacing

Depth at seaward end

Wave height

Water level

Longshore transportation rates and distribution



Detached Breakwaters

Benefits/Processes

Shoreline stabilization behind structure

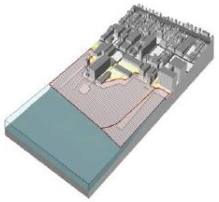
Wave attenuation

Performance Factors

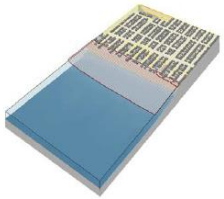
Breakwater height and width.

Breakwater permeability, proximity to shoreline, orientation and spacing

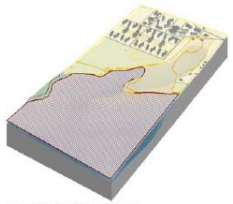
Combined Approaches (Notional Graphic)



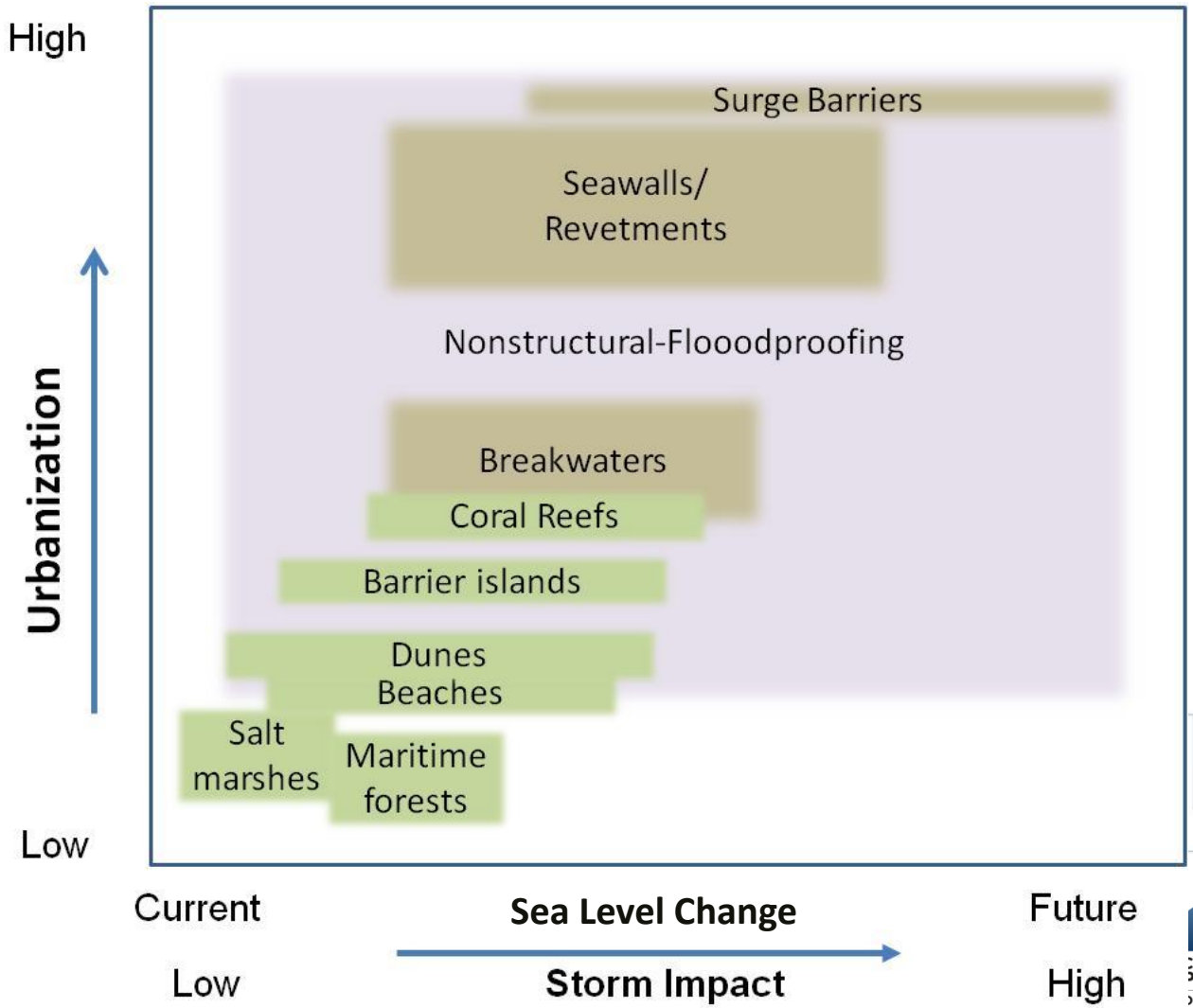
HARDENED SHELTERED BAY SLOPES
INDUSTRIAL



OCEANFRONT BEACHES
LOW DENSITY RESIDENTIAL

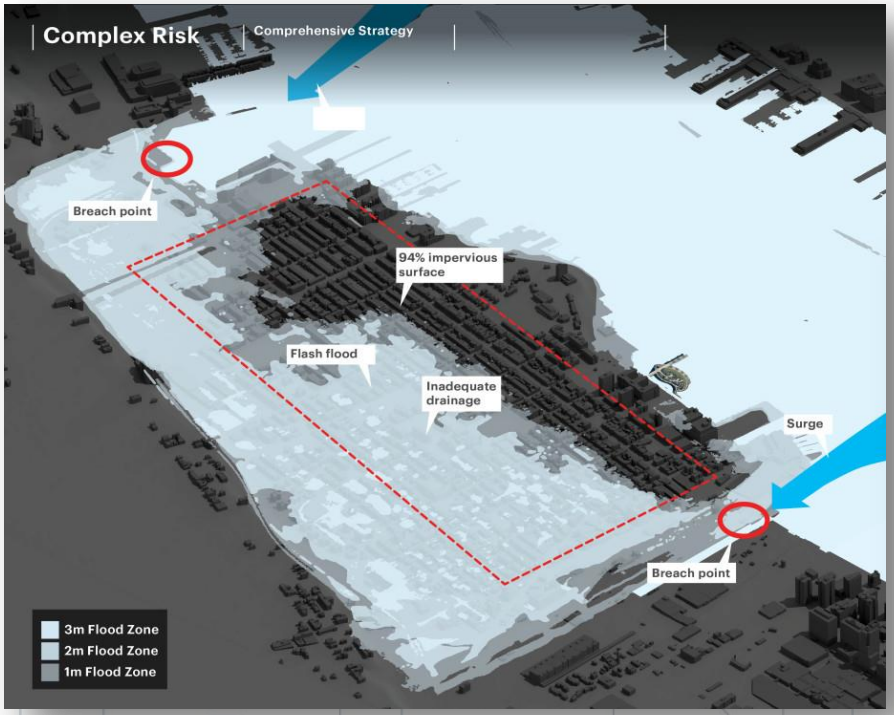


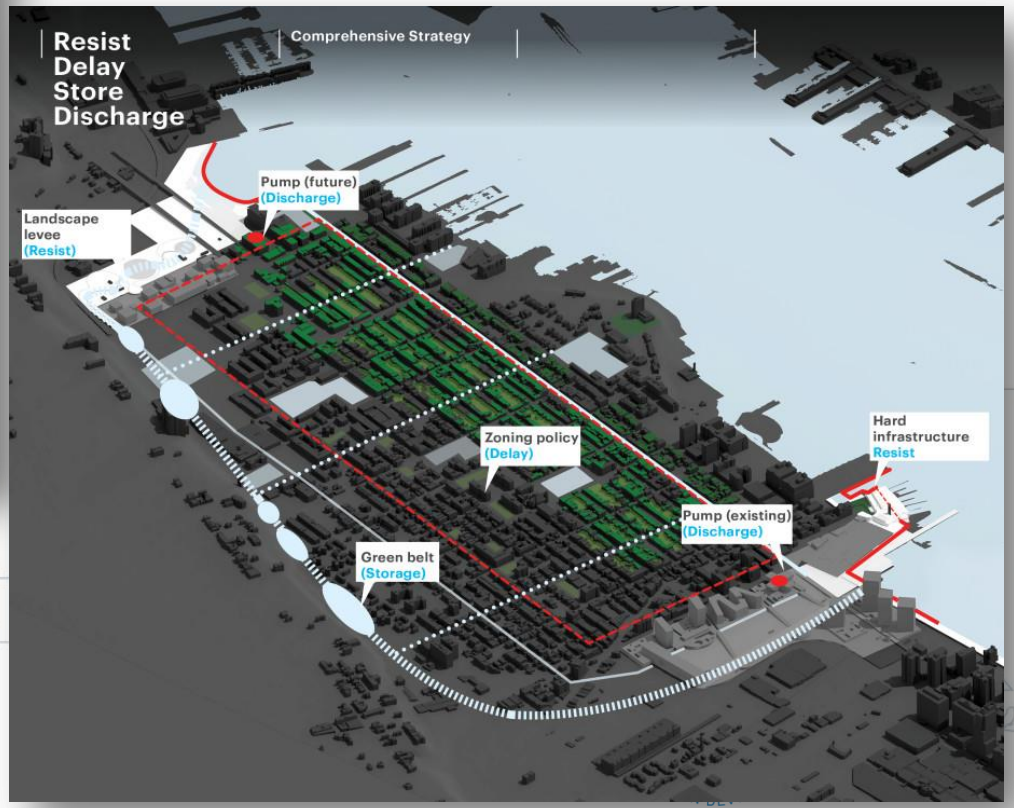
COASTAL MARSHES
MEDIUM DENSITY RESIDENTIAL



www.nyc.gov

Sandy's Rebuild By Design Effort: Hoboken





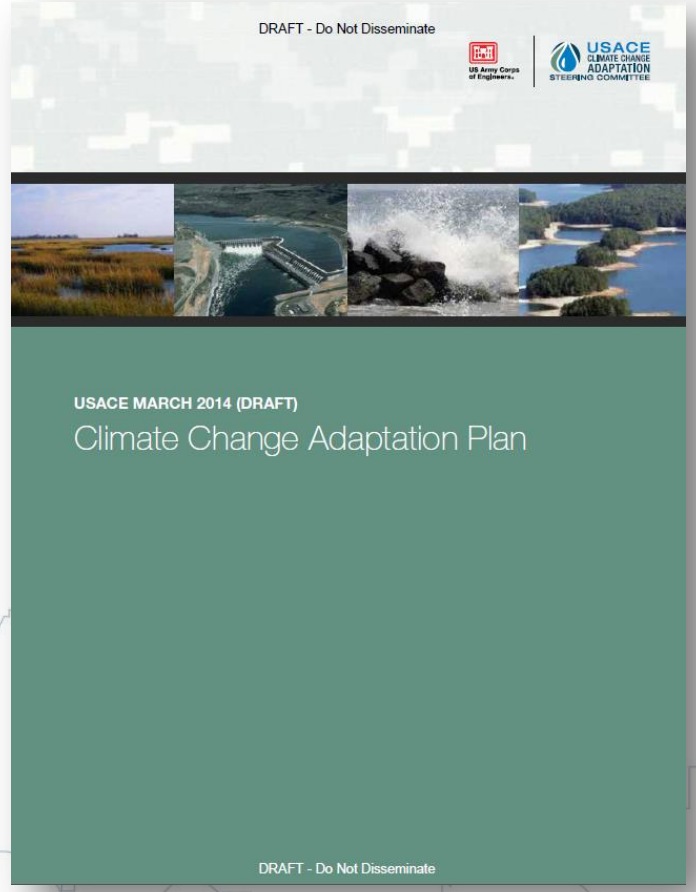
www.rebuildbydesign.org

Courtesy of the Office of Metropolitan Architecture

For More Information

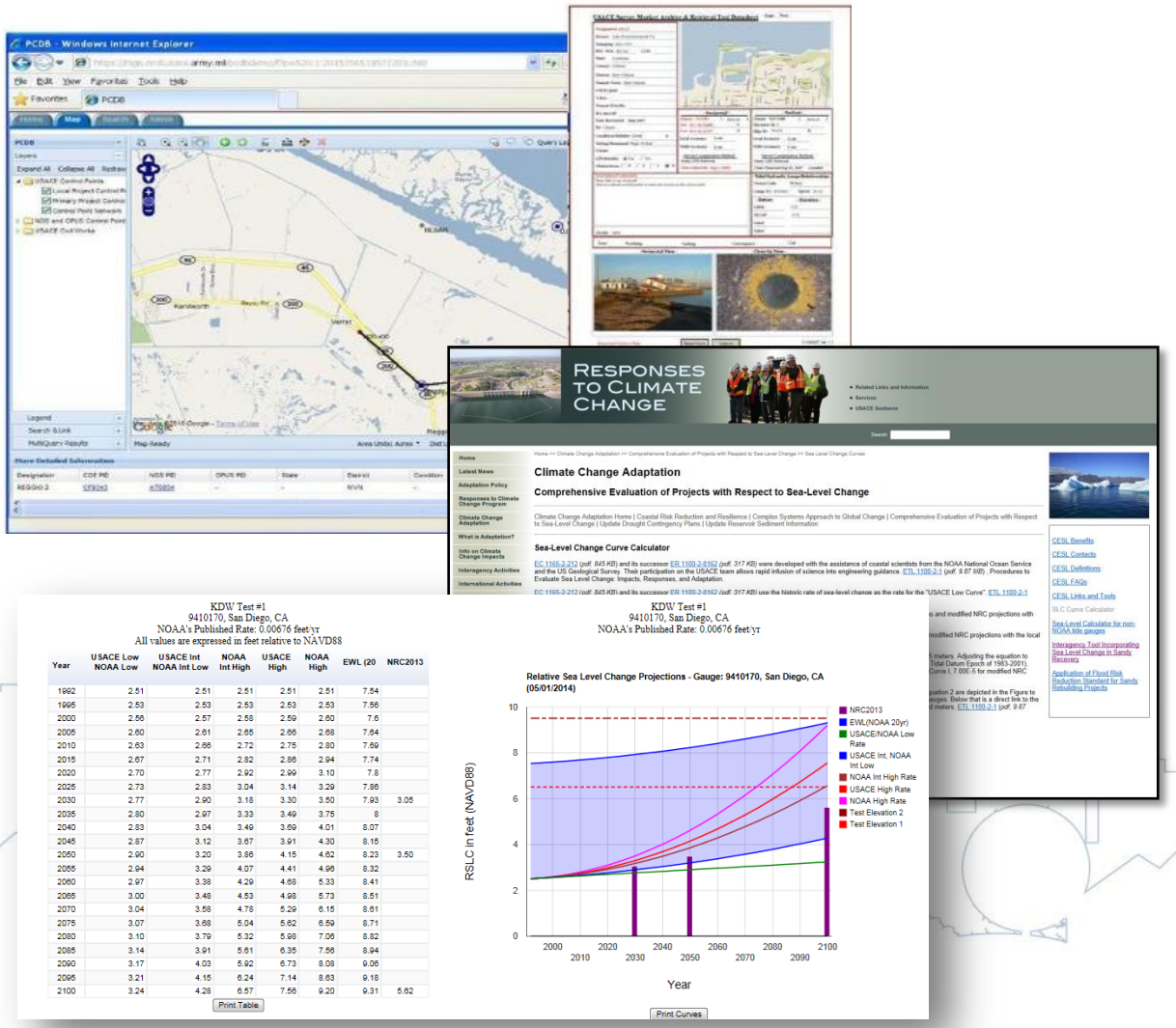
USACE is working with other agencies and experts to develop actionable science on which to base policies and guidance

- Focusing on specific areas
- Conducting vulnerability assessments
- Building adaptive capacity
- Beginning with datums, changing sea levels, then hydrology, developing approaches and technical guidance
- Developing tools to streamline implementation



www.corpsclimate.us

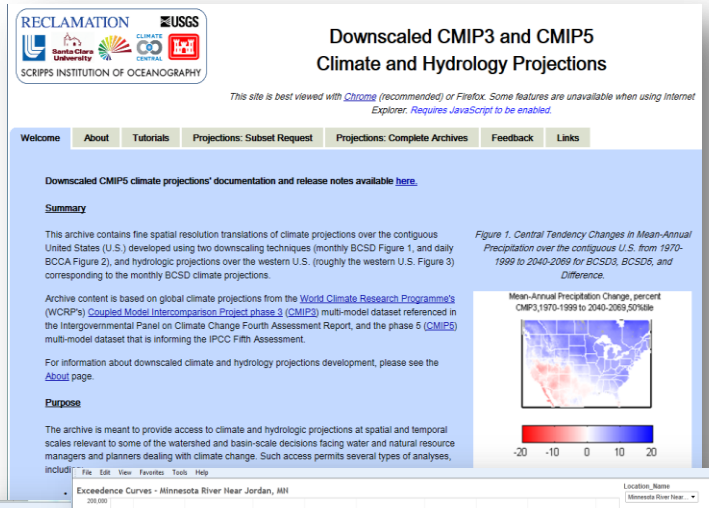
Adaptation for New Infrastructure – USACE Tools 1/2

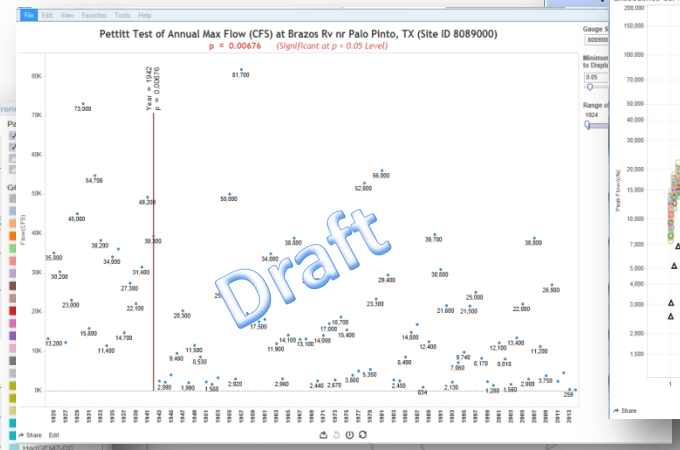


- USACE Survey Monument Archival and Retrieval Tool (U-SMART) Database
- Datum Compliance Tracking Tool
- Sea Level Rise Calculator
- Sandy FRRS calculator supporting Interagency Sandy Sea Level Rise Tool

Adaptation for New Infrastructure – USACE Tools 2/2

- Interagency archive of downscaled climate information and hydrology
- Visualization tools based on archive in preparation:
  - Hydrologic trends supporting ECB 2014-10
  - Detection of nonstationarity supporting draft ETL in preparation
  - Assessment of projected changes in frequency using HEC SSP





Adaptation for Existing Infrastructure – Phased Coastal Vulnerability Assessments

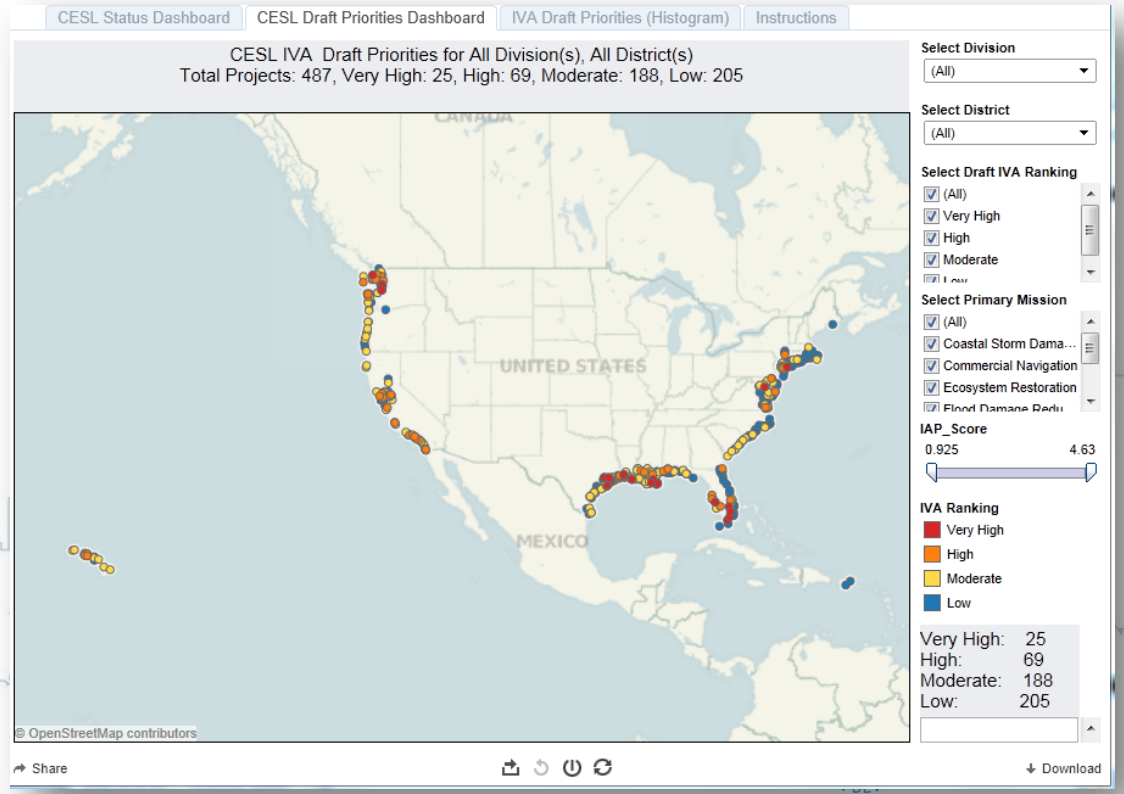
USACE completed Initial Vulnerability Assessment (IVA) of Coastal Projects

- 1431 projects assessed
- ~1/3 (487) potentially vulnerable to the impacts of climate change
- ~ 7% (94) assessed as having high or very high vulnerability

Next steps:

- Conduct next phase assessment for high and very high projects
- Complete pilot detailed assessment of Stamford Barrier – FY15
- Begin pilots for other projects

Working to modify for Army



Summary

- Effective climate preparedness and resilience incorporates a systems approach to long-term planning that recognizes differences in adaptive capacity and performance ranges of risk reduction measures
- Innovative and integrated approaches using the full portfolio of measures hold promise for long-term risk reduction
- Tough choices will have to be made to improve our national climate preparedness and resilience – we can make them by working together

Green Infrastructure

Harnessing Ecosystem Services for Water Management

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COMMUNITY PLANNING DEVELOPMENT

Natural Green Infrastructure

Natural features that perform valuable ecosystem and hydrologic functions

- **Prairies, grasslands**
- **Woodlands**
- **Wetlands**
- **Green open space**

Natural Green Infrastructure

Protect and Restore

- Partnerships, Acquisitions
- Conservation Easements
- Zoning, Comprehensive Plans
- Restoration, Stewardship

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Stormwater Green Infrastructure

Constructed features that mimic natural systems

- Rain Gardens
- Bioswales
- Permeable Pavement
- Green Roofs

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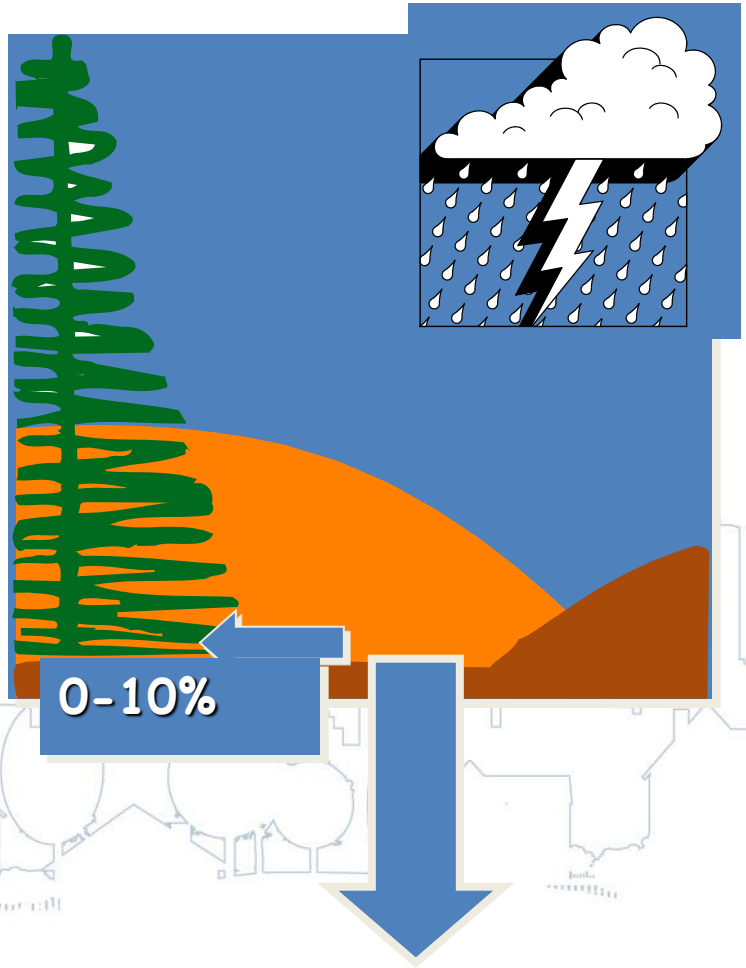
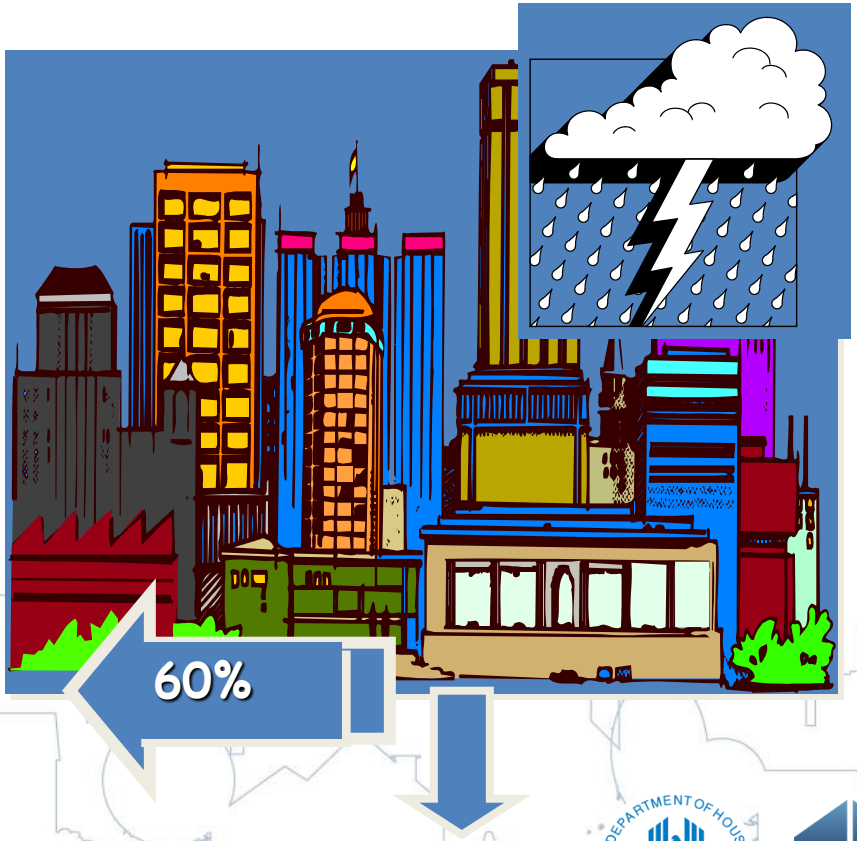
Why Do We Need Stormwater Green Infrastructure Features?

Development Increases Run-off





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Increased Run-off due to Impervious Surfaces


~ 75% Impervious Surfaces
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Effects of Impervious Surfaces and Large Runoff Volumes

Combined Sewer Areas: CSOs

Separate Sewer Areas:

Stream channel damage

- **Stream widening and erosion**
- **Decreased channel stability**
- **Loss of riparian tree canopy**

Degraded habitat for fish and macroinvertebrates

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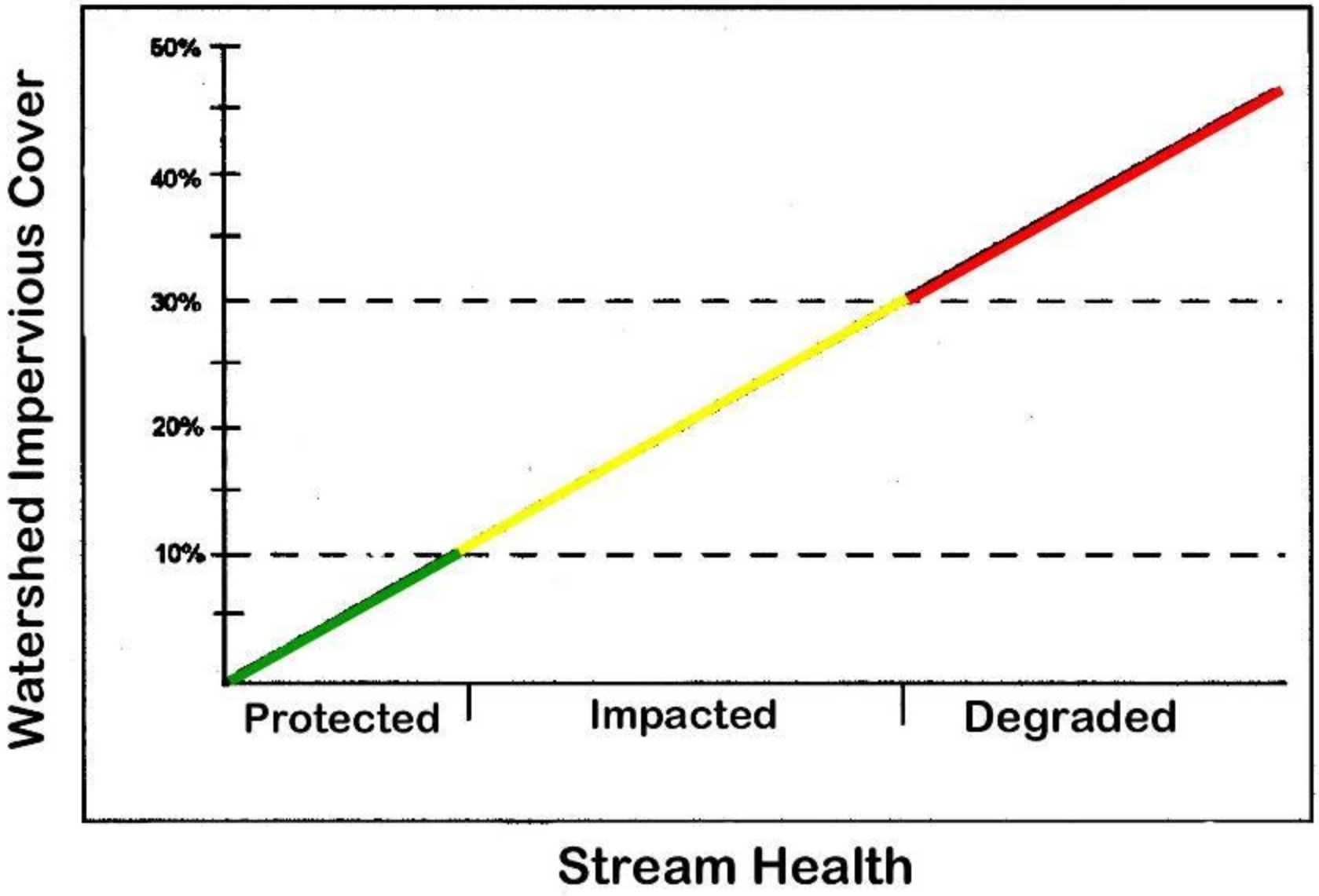
Pollutants in Stormwater Discharges

- Nutrients
- Pathogens
- Sediment
- Toxic Contaminants
- Oil and Grease
- Thermal Stress

Increased quantity

Decreased quality

Relationship of Impervious Cover to Stream Health



Center for Watershed Protection

Excessive Runoff from Impervious Surfaces also Contributes to Localized Flooding and Basement Back-ups

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How to make this…

function like this?

What Measures Can Be Implemented to More Sustainably Manage Stormwater Discharges?

Stormwater Green Infrastructure

- Increase Infiltration
- Increase Evapotranspiration
- Harvest and Re-use Stormwater

These Practices Reduce the Volume of Runoff

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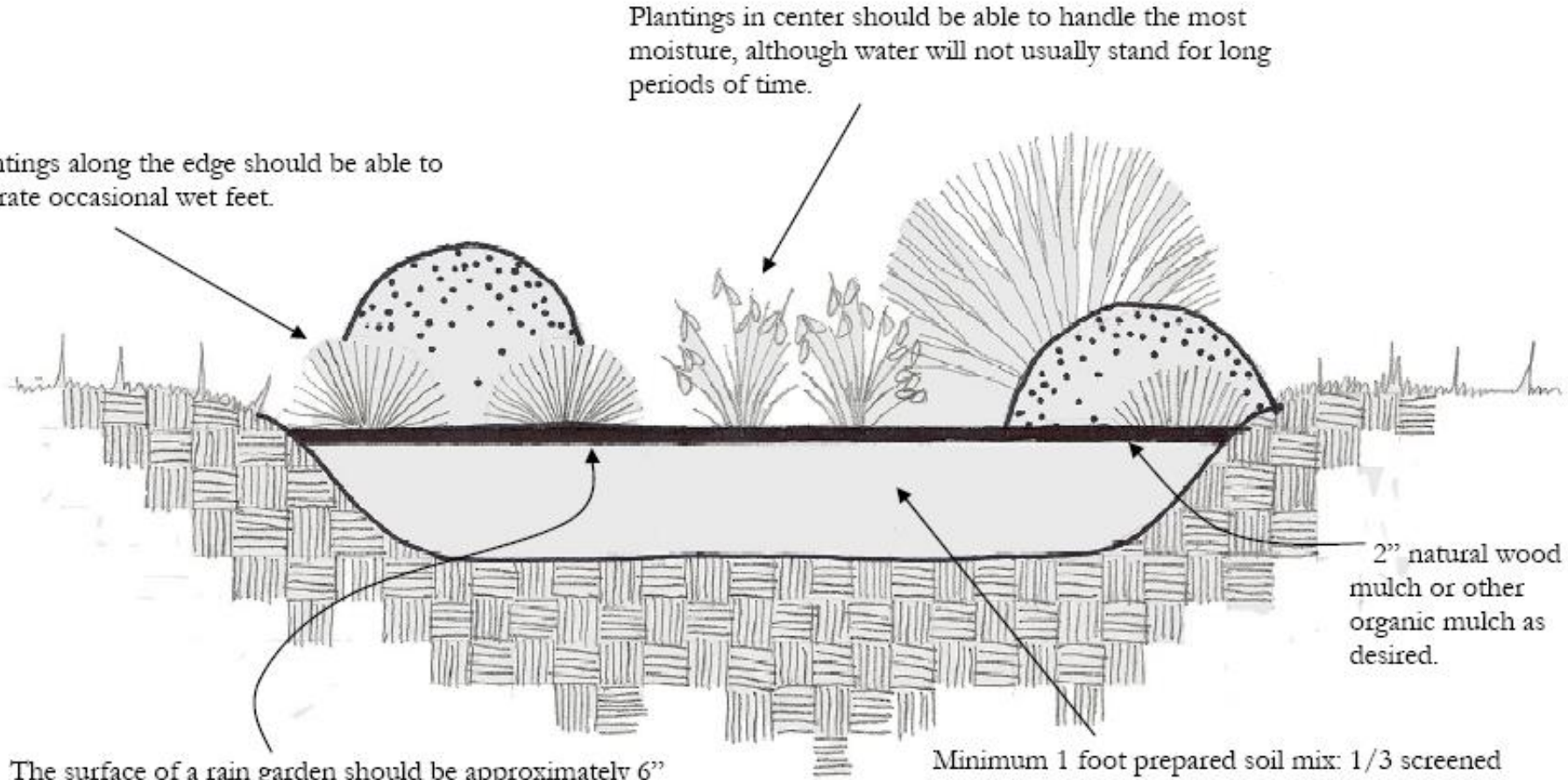
Infiltration Practices
Rain Gardens

Maplewood, MN

Rain Garden Design

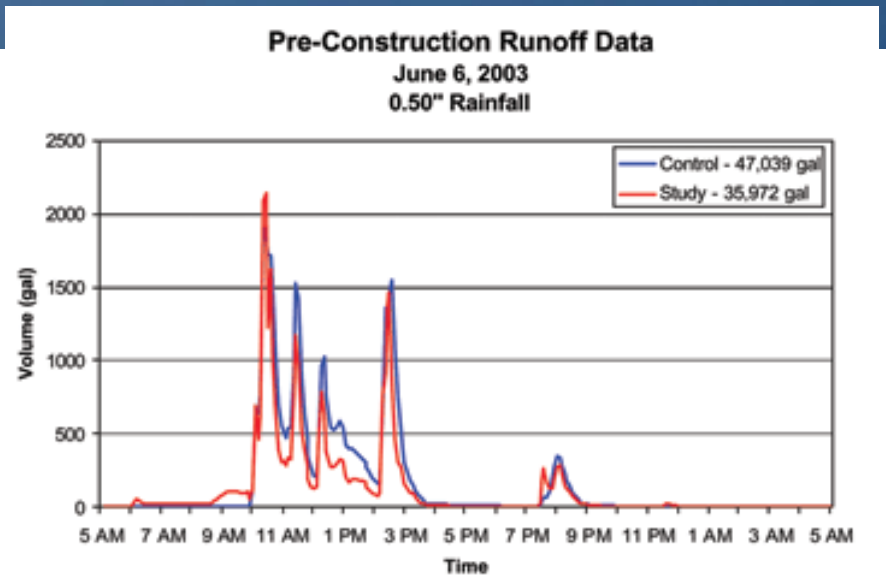


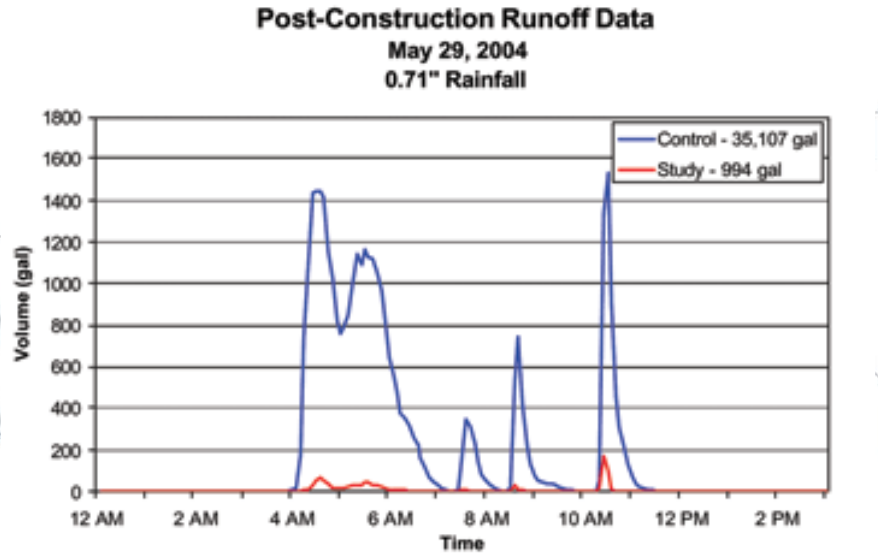
Try to use native plants, as they will tend to do the best job for you.

Burnsville, MN

Rain Gardens Throughout a Neighborhood

Do Rain Gardens Really Work?





Blue: Runoff from control neighborhood

Red: Runoff from neighborhood retrofitted with rain gardens

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Green Roofs


Chicago City Hall
20,300 sf intensive green roof with 20,000 plants of more than 100 native species
Installed in 2000
Decreases air and roof surface temperatures
Retains 75% of a one-inch rainfall event
Provides habitat

Extensive Green Roof
Light and Relatively Inexpensive

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Storing and Reusing Rainwater
Cisterns

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Parking Lots

drain

Good – Run-off from the parking lot can be absorbed by the plants and soil

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