

Green Infrastructure & Urban Resilience

Together North Jersey (TNJ)
Resilient Task Force

Webinar 2 of the TNJ Resiliency Webinar Series
June 6, 2018

WEBINAR INSTRUCTIONS

- Please mute your phone
- This webinar is being recorded and will be available at togethernorthjersey.com
- Direct questions to the bottom right chat section to be answered in last 10 minutes of webinar
- If we run out of time, please email either:
 - Stacy Krause, perrines@ejb.rutgers.edu
 - Eliot Benman, ebenman@ejb.rutgers.edu

TNJ RESILIENCY WEBINAR SERIES

The Resilience Webinar Series is a product of the TNJ Resilient Task Force.

Thank you to the following Resilient Task Force members for their guidance and assistance:

Rob Freudenberg, Co-Chair – Regional Plan Association

Tim Van Epp, Co-Chair – Sustainability Planning Consultant

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Linda Weber – Sustainable Jersey

Melissa Harclerode – CDM Smith

TNJ RESILIENCY WEBINAR SERIES

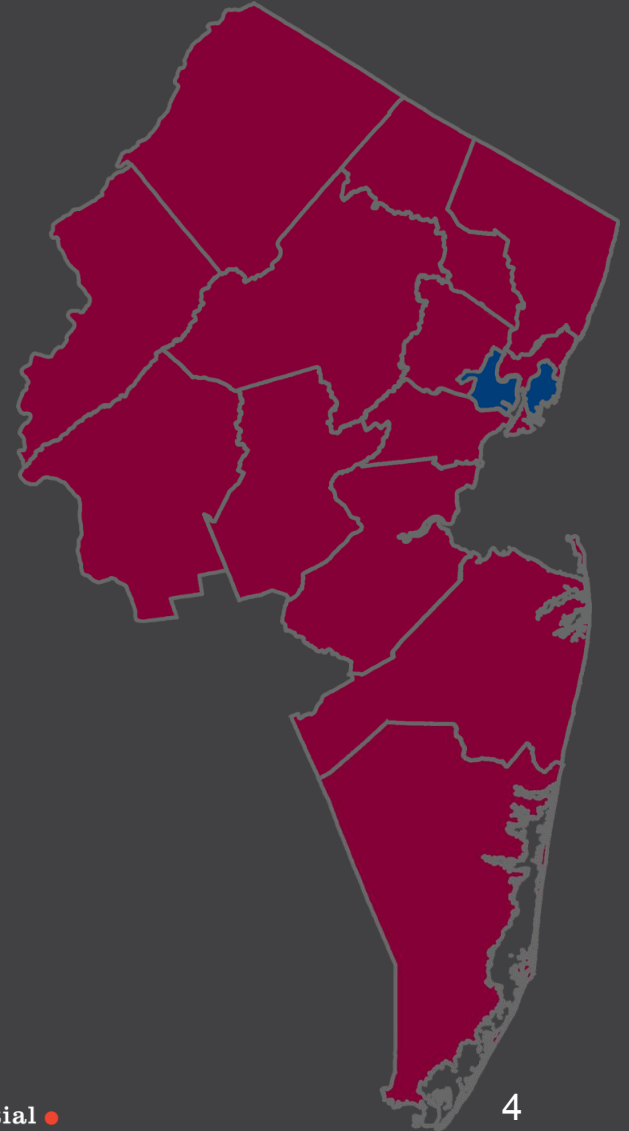
This webinar series is co-sponsored by the North Jersey Transportation Planning Authority (NJTPA).

NJTPA Region

Bergen
Essex
Hudson
Hunterdon
Jersey City

Middlesex
Monmouth
Morris
Newark
Ocean

Passaic
Somerset
Sussex
Union
Warren



TOGETHER NORTH JERSEY RESILIENT VISION.

A resilient North Jersey is ready for adverse events—extreme weather, climate change, economic downturns or other major setbacks—and can quickly bounce back from them. It protects wetlands and other crucial ecosystems, and has strong, well-maintained infrastructure (transportation, utilities, water, sewer, etc.). A resilient North Jersey takes steps to be prepared and reduce negative impacts on our communities.

SPEAKER

Stacy Krause, PP/AICP, CFM

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Environmental Analysis and Communications Group

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Rutgers, The State University of New Jersey

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AGENDA: GREEN INFRASTRUCTURE & URBAN RESILIENCE

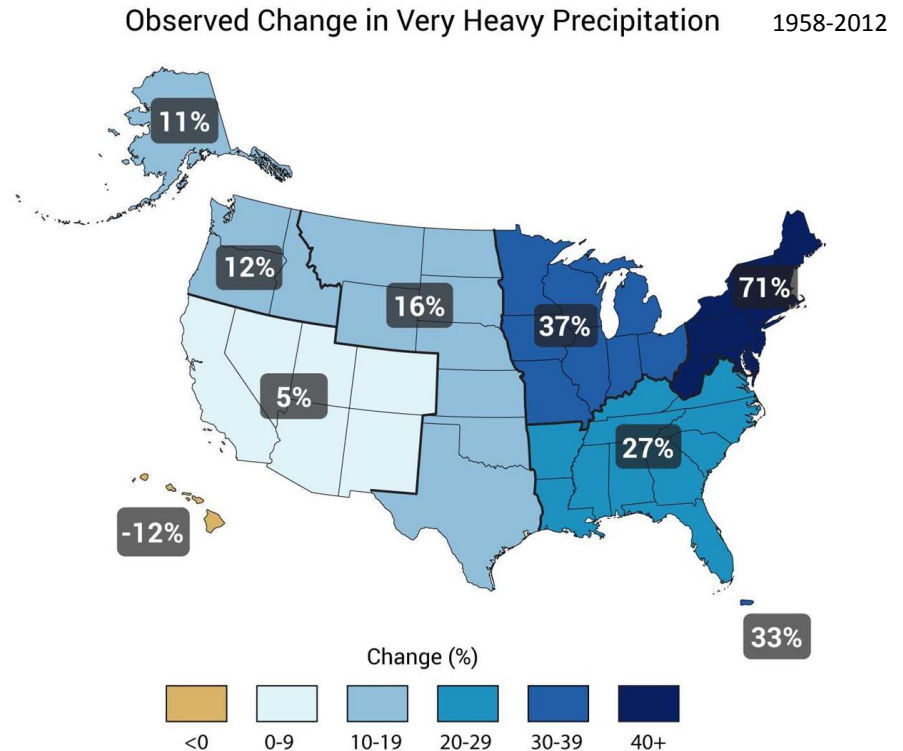
- Climate change and precipitation
- Stormwater impacts on urban landscape
- Green infrastructure project examples
- Municipal green infrastructure use
- Funding opportunities
- Community Rating System
- Resources



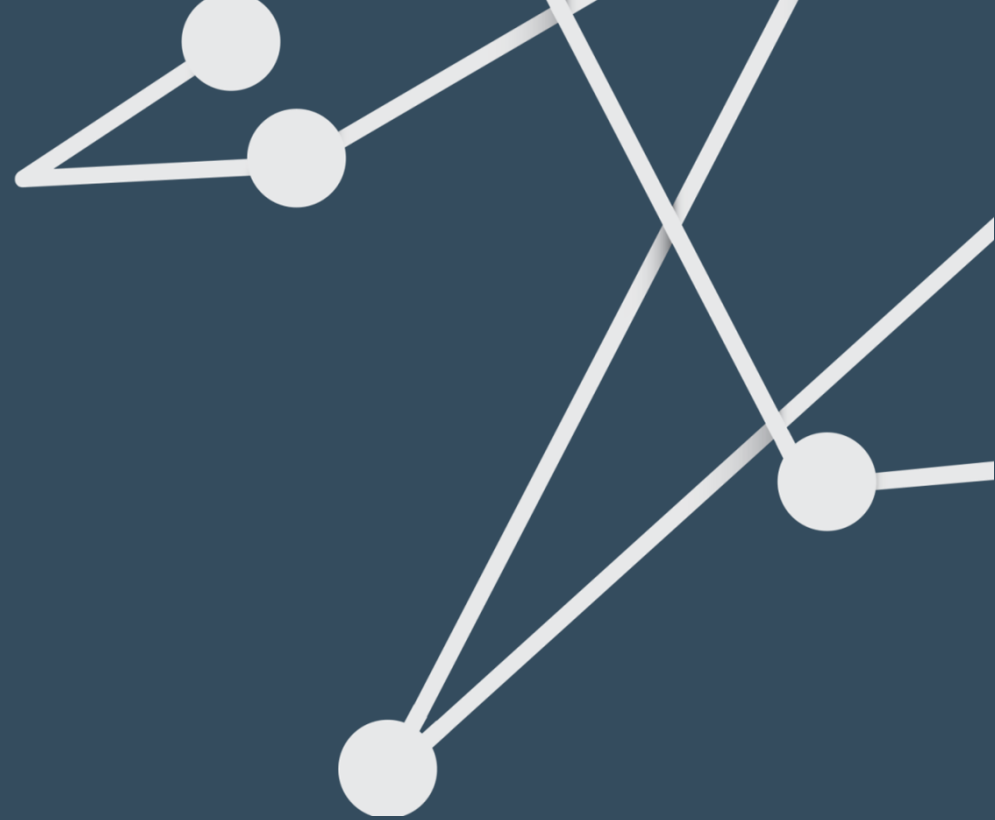
Images: US EPA

CLIMATE CHANGE & PRECIPITATION

- Average US precipitation has increased since 1900
- Heavy precipitation events have increased exponentially in the Northeast and are expected to continue
- Challenges in infrastructure, agriculture, fisheries, and ecosystems



Graphic: National Climate Assessment, 2014



GREEN INFRASTRUCTURE & URBAN RESILIENCE

STORMWATER IMPACTS ON THE URBAN LANDSCAPE

STORMWATER RUNOFF

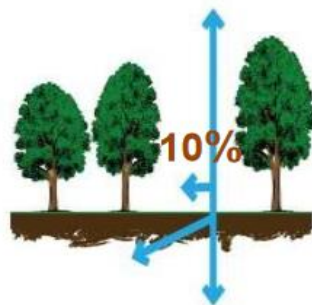
- Generated from rain and snowmelt events
- Flows over land or impervious surfaces and does not soak into the ground
- Impervious surfaces include paved streets, parking lots, and building rooftops

Source: US EPA

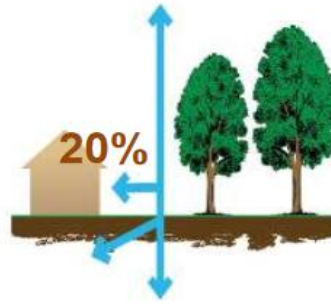


Image: US EPA

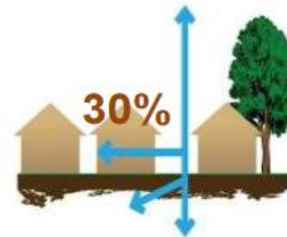
The Impact of Development on Stormwater Runoff



*More
development*



→ *More impervious* →



*More stormwater
runoff*



STORMWATER RUNOFF IMPACTS IN URBAN AREAS

Flooding
Pollution

Property damage
Public health impacts
Economic impacts



- Private homes flood
- Road, bridge, rail damage and closures
- Costly infrastructure upgrades needed
- Water quality degradation
- Aquatic life impacted
- Bathing beach and park closures

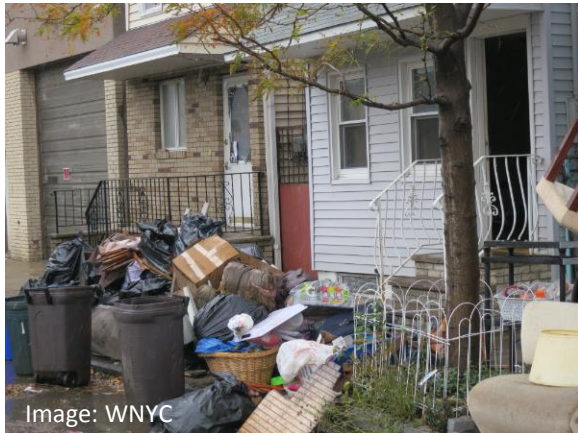


Image: WNYC



Image: geoengineering.org



Image: ECOconnect

MAY 2017 FLASH FLOODS



Images: NBC NY

WHAT CAN WE DO?

GREEN INFRASTRUCTURE is a collection of natural lands, working landscapes, open spaces, and appropriate construction interventions that conserves ecosystem functions and provides benefits to human populations.

- Construct and integrate Green Infrastructure (GI) into local development
- GI projects:
 - Capture
 - Filter
 - Absorb
 - Reuse water



Graphic: New Terrain

GREEN VS GRAY

- Trees, plants, shrubs, flowers and grass vs. pipes, walls and ditches
- Often spearheaded by planning/public works departments and/or environmental commissions
- Public input can be incorporated during planning and design.
- Maintenance generally by public works department

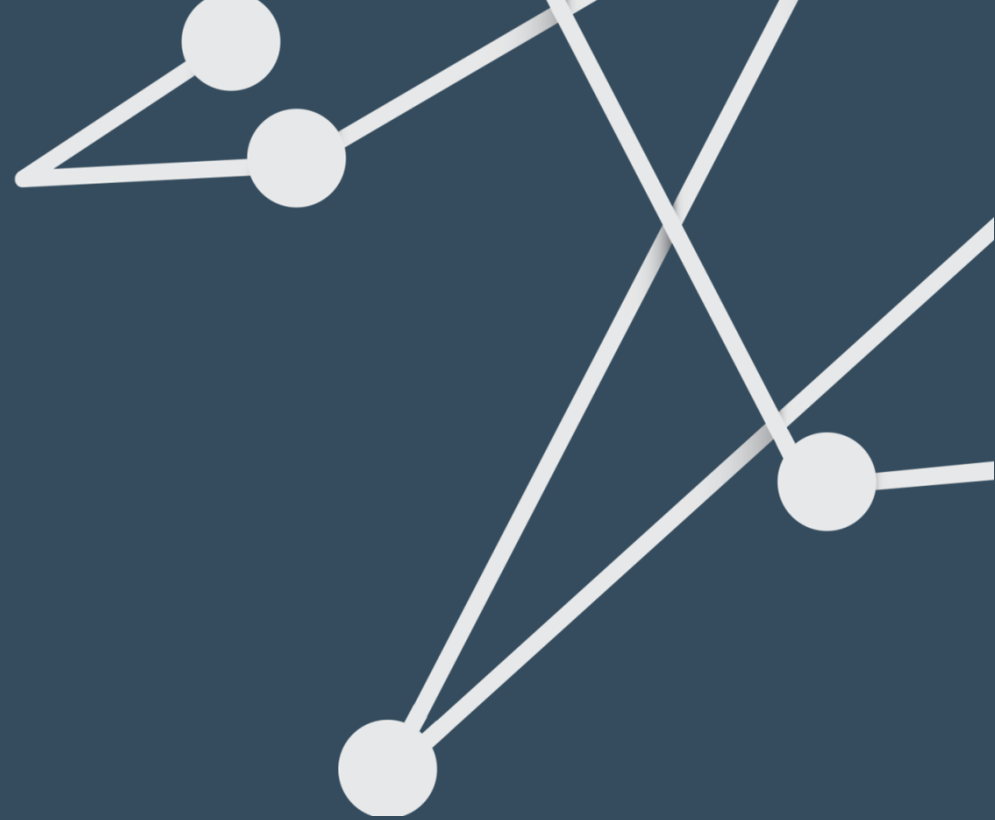
Green Infrastructure



Gray Infrastructure



Image: National
Socio-Economic
Environmental
Synthesis Center



GREEN INFRASTRUCTURE & URBAN RESILIENCE

GREEN INFRASTRUCTURE PROJECT EXAMPLES

GREEN STREETS

- Rain gardens/vegetated areas that collect and absorb runoff, ideal for space-limited sites in dense urban areas
- Benefits:
 - Stormwater management
 - Aesthetic appeal
 - Economic development value
 - Traffic calming / pedestrian safety
- Hoboken GI Strategic Plan
 - Strategies to aid antiquated sewer system, like rain garden bump outs and infiltration planters
- Green Streets chapter in the Passaic County Master Plan Transportation Element Update supports green streets projects



GREEN ALLEYS

- Permeable pavement, bioswales, planter boxes, and trees store rainwater and allow for slow infiltration into ground.
- Benefits:
 - Stormwater management
 - Aesthetically pleasing
 - Inviting public space
 - Public health and safety
- Chicago Department of Transportation Green Alleys Program
 - Over 100 green alleys installed since 2010 using pervious pavement and recycled materials



Graphic: Chicago Green Alley Handbook

GREEN ROOFS & WALLS

- Benefits:
 - Stormwater infiltration and urban gardening
 - Reduces urban heat island effect and regulates building/site temperatures
- Brooklyn Grange Rooftop Farm (Flagship Farm, Queens, NY)
 - Former contaminated site now a rooftop farm for community CSA program
 - 43,000 sq. ft. roof of 6 story building



POCKET PARKS

- Small-scale parks ideal for urban areas where space is limited
- Benefits:
 - Permeable surfaces for stormwater infiltration
 - Public health
 - Easy to manage
 - Adds open space
- Kanouse Park, Boonton, NJ
 - A pocket park located along Route 287



COMMUNITY GARDENS & URBAN AGRICULTURE

- Collective gardening on individual or shared plots on either public or private land
- Benefits:
 - Increase in permeable cover for stormwater infiltration
 - Access to healthy food, especially in food deserts
 - Food and nutrition education
 - Sense of community ownership
 - Increases pollinator habitat
- Greater Newark Conservancy's Plot It Fresh Program
 - Community garden program offering garden plots to residents for a small fee, creating green space and providing healthy food

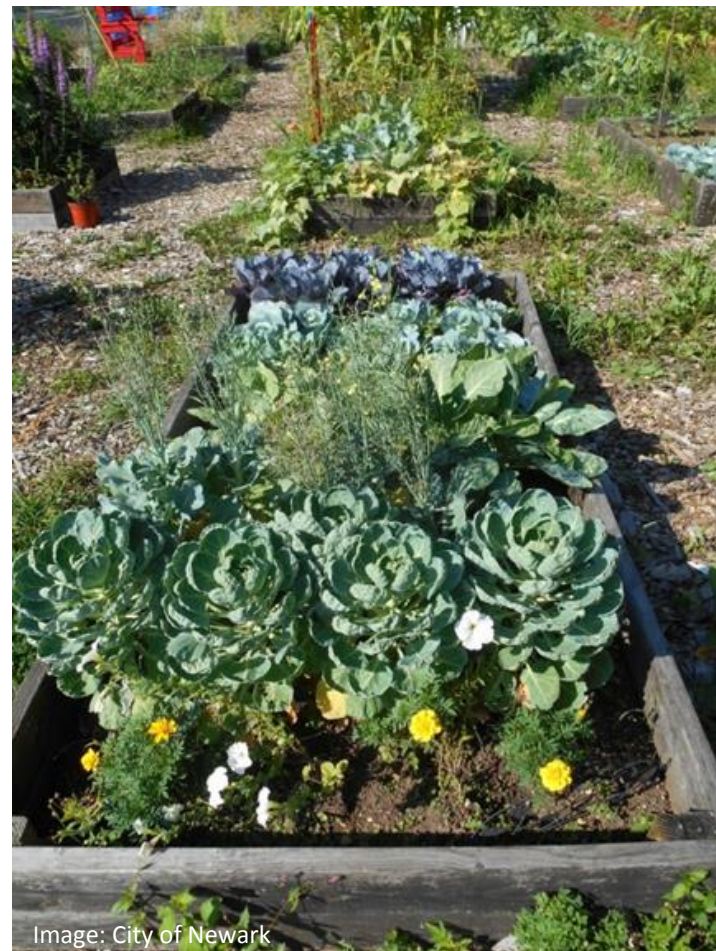
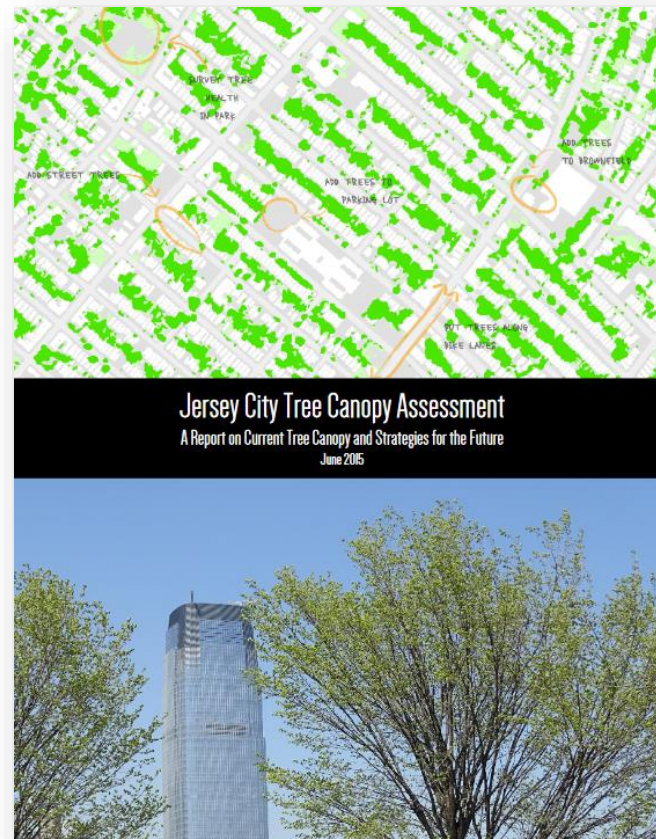


Image: City of Newark

ENHANCED TREE COVER

- Cities can set tree canopy goals for their streets
- Benefits:
 - Stormwater management
 - Carbon sequestration
 - Reduce the urban heat island effect
- Jersey City Tree Canopy Assessment (2015)
 - Quantifies existing tree canopy
 - Lists benefits of city trees and management challenges
 - Offers strategic recommendations:
 - Expand tree canopy
 - Promote long term viability
 - Create funding plan



PARKING LOT DESIGN

- Inclusion of Green Infrastructure in parking design standards
- Benefits:
 - Permeable surface for stormwater management
 - Enhanced pedestrian atmosphere
 - Cooling of area/reductions of urban heat island
- Low impact development ordinance in Cranbury, NJ
 - Requires pedestrian walkways with pervious paving & landscaped dividers with flush curbing in parking lots with 40+ spaces



Parking lot in Cranbury, Image: Google



Image: MN Stormwater Manual

PRESERVING COMMUNITY CHARACTER

- Benefits:
 - Manages stormwater in delicate areas, while maintaining the existing community character
- Block-Scale Green Infrastructure Design in Beaufort, SC
 - Maintains traditional character of historic neighborhood
 - Uses vegetation techniques, permeable pavement, and stormwater wetlands

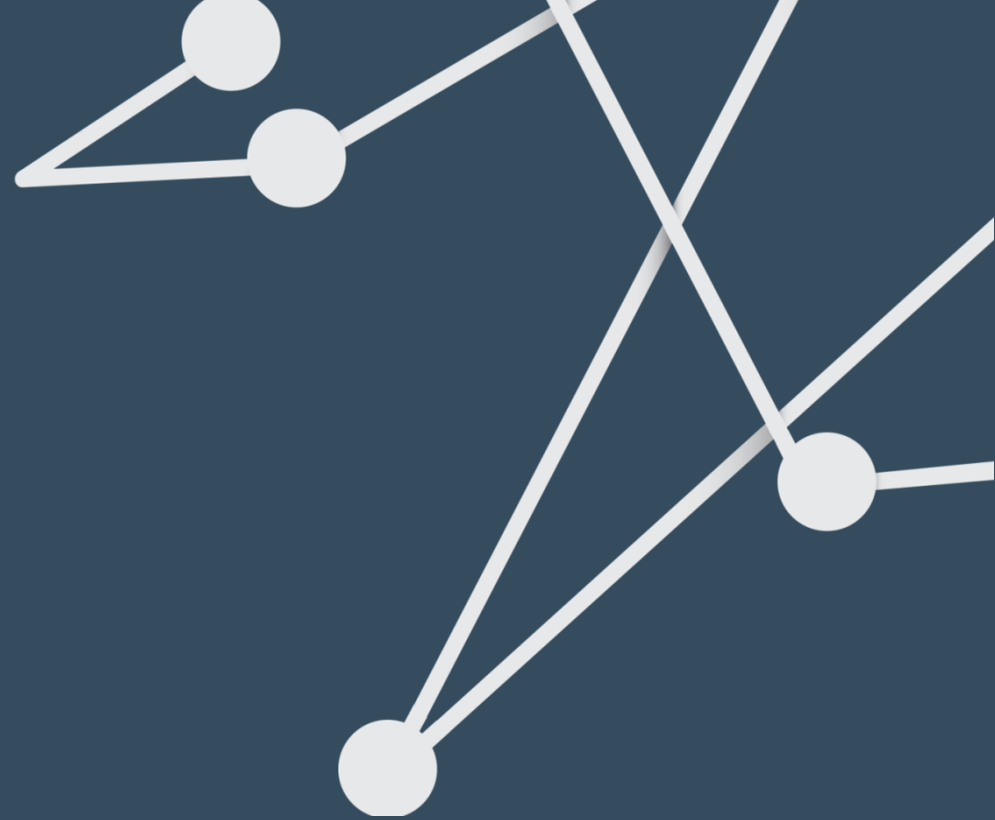


GI IN REDEVELOPMENT

- Volume of opportunities because most urban areas will experience redevelopment at some point
- Benefits:
 - Stormwater management
 - Carbon sequestration
 - Reduces urban heat island effect
 - Aesthetic appeal
- Waterfront South Rain Garden Park in Camden
 - Brownfield (former gas station) transformed into a rain garden



Images: CCMUA



GREEN INFRASTRUCTURE & URBAN RESILIENCE

MUNICIPAL GREEN INFRASTRUCTURE USE

GREEN INFRASTRUCTURE CHALLENGES

- Co-benefits of projects beyond stormwater management may not be fully articulated
- Performance standards not always clear
- Conflicts with existing codes and regulations
- Initial project and future maintenance costs



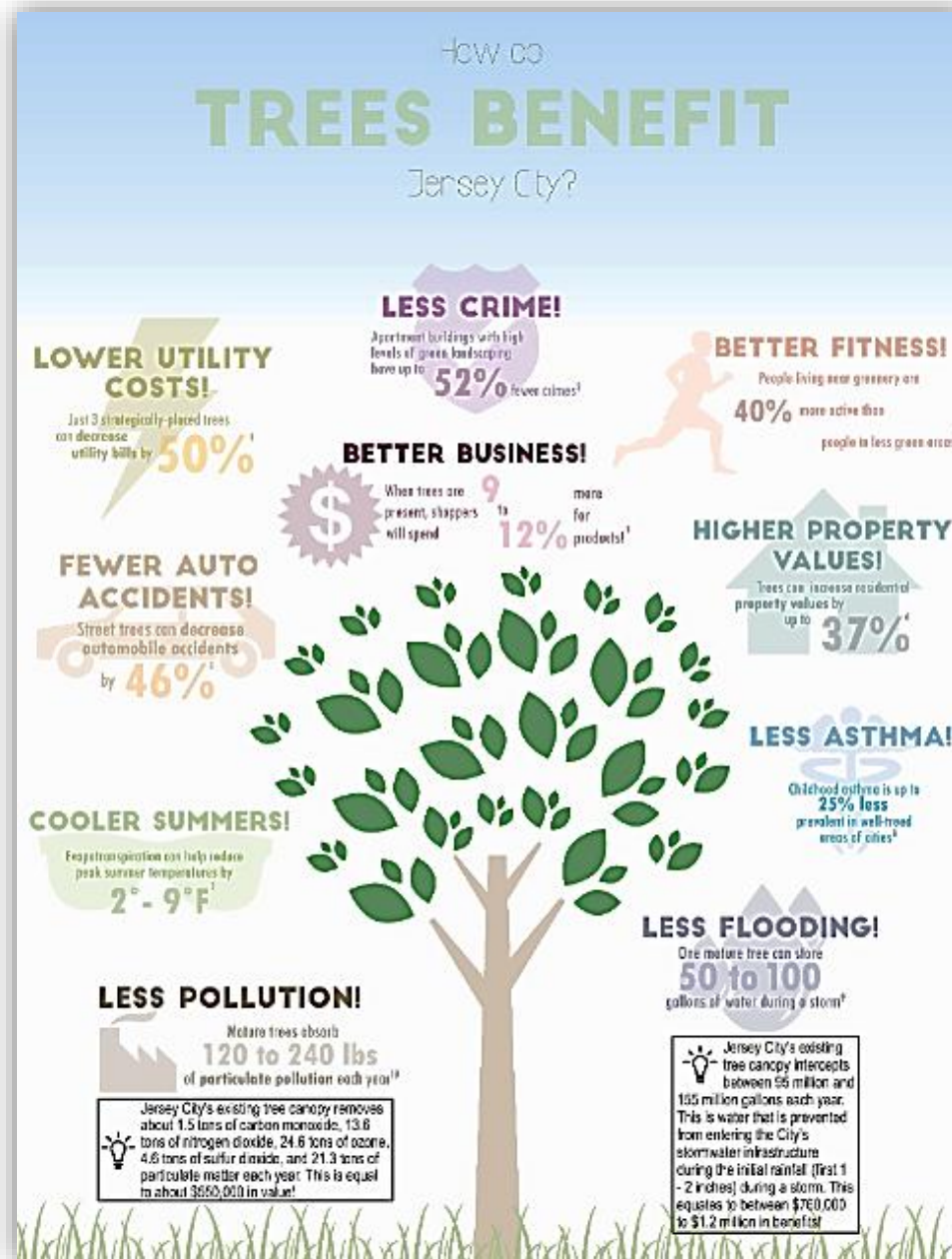
GREEN INFRASTRUCTURE CO-BENEFITS

PRACTICE \ BENEFITS	Climate Mitigation				Cultural Benefits				Conservation and Shoreline Processes				
	Reduces Energy Use	Improves Air Quality	Reduces Atmospheric CO2	Reduces Urban Heat Island	Improves Aesthetics	Increases Recreational Opportunities	Reduces Noise Pollution	Improves Community Cohesion	Improves Habitat	Reduces Wave Energy	Reduces Coastal Flooding	Maintains Sediment Transport	Reduces Saltwater Infiltration
Maintaining and Acquiring Natural and Open Lands	●	●	●		●	●	●	●	●				
Forestry Practices	●	●	●	●	●	●	●	●	●				
Green Streets		●	●	●	●	●	●	●	●				
Bioretention		●	●	●	●	●	●	●	●				
Green or Blue Roofs	●	●	●	●	●	●	●	●	●				
Permeable Pavements	●	●	●	●			●						
Dune or Beach Creation and Protection					●	●		●	●	●	●	●	●
Salt Marsh and Tidal Wetlands			●		●	●		●	●	●	●	●	●
Oyster and Coral Reef Protection/Restoration					●	●			●	●	●	●	
Hybrid Practices			●		●	●		●	●	●	●	●	●

● YES
● MAYBE

Table modified from "The Value of Green Infrastructure: A Guide to Recognizing its Economic, Environmental, and Social Benefits," Center for Neighborhood Technology and American Rivers, 2010.

GREEN INFRASTRUCTURE CO-BENEFITS



Graphic:
Jersey City
Tree Canopy
Assessment

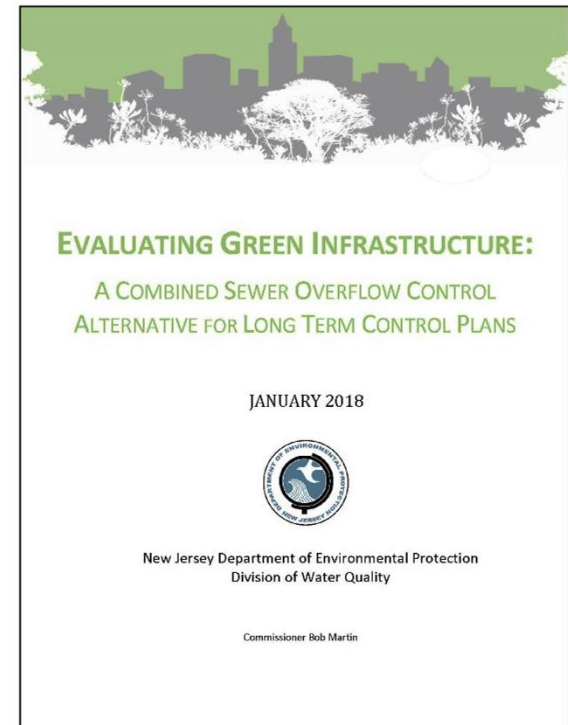
POSSIBLE NEGATIVE IMPACTS

- Things to consider:
 - Developing green space can lead to property value increases and/or displacement of individuals
 - Vegetation can both mitigate and facilitate crime



GREEN INFRASTRUCTURE PERFORMANCE STANDARDS

- There is general familiarity and comfort with gray stormwater infrastructure performance
- Less so with GI, but there are resources available:
 - Database of reports on GI techniques – US EPA
 - Evaluating GI: A CSO Control Alternative for Long Term Control Plans – NJDEP, 2018
 - GI Performance Metrics Report – NYCDEP, 2016
 - GI Effectiveness Database - NOAA



GREEN INFRASTRUCTURE PERFORMANCE STANDARDS

- NJ GI Guidance Manual (RU Agriculture Experiment Station)
 - Details runoff captured with various GI practices

Green Infrastructure Practice	Design Storm	Maximum Volume Captured per Storm per 1,000 sq. ft. of Drainage Area (gallons)*	Total Annual Runoff Volume Captured per 1,000 sq.ft. of Drainage Area (gallons)*
Bioretention Systems/ Rain Gardens	WQS	643	24,684
Bioretention Systems/ Rain Gardens	2-YR	1,915	26,055

* This drainage area includes the surface area of the bioretention system



COSTS

- Center for Neighborhood Technology's (CNT) Green Values Calculator TM
- Compares performance, costs, and benefits of green vs. gray infrastructure
- Takes users through a step-by-step process:
 - Determining the average precipitation at a site
 - Choosing a stormwater runoff volume reduction goal
 - Defining impervious areas of the site under a conventional development scheme
 - Choosing from a range of GI practices to find combination that meets the runoff reduction goal in a cost-effective way

CALCULATOR

Green Interventions:

- i** Roof Drains to Raingardens at All Downspouts:
- i** Half of Lawn Replaced by Garden with Native Landscaping:
- i** Porous Pavement used on Driveway, Sidewalk and other non-street pavement:
- i** Green Roofs:
- i** Provide Tree Cover for an Additional 25% of Lot:
- i** Use Drainage Swales instead of Stormwater Pipes:

Site Statistics:

- i** Select a scenario:
New Development, Suburban
- i** Is this an existing site: (If clicked no construction costs included)
- i** Total size of site: acres
- i** Number of lots:
- i** Average Roof Size, including Garage: ft.²

RESULTS

The difference between the conventional system and the green intervention(s) you chose **decreases** the total 100 year life cycle costs and **increases** benefits by **\$1,377,482!** This strategy reduces peak discharge by **28%**.

[Permanent link for this configuration](#)

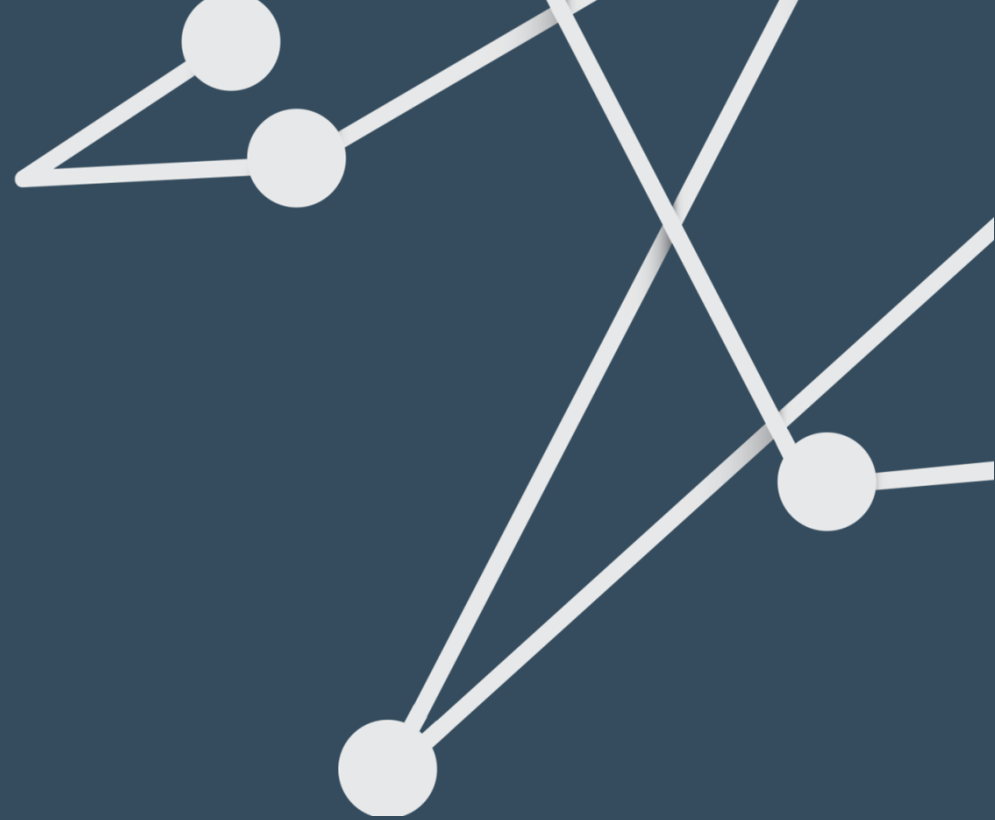
Hydrologic Financial Financial Detail Scenario Detail

Hydrologic Results

Lot Level Improvements:	Conventional	Green	Reduction
Lot Discharge (cf)	1,968	1,320	33.0%
Lot Peak Discharge (cfs)	0.48	0.30	37.4%
Total Site Improvements:	Conventional	Green	Reduction
Total Peak Discharge (cfs)	56.79	41.08	27.7%
Detention Size Improvements:	Conventional	Green	Reduction
Total Detention Required (ft ³)	148,908	90,075	40%
Annual Discharge Improvements:	Conventional:	Green:	Average Annual Ground Water Recharge Increase:
Average Annual Discharge (acre ft)	43.57	31.52	7.54

LOCAL CODES AND REGULATIONS

- Consider changes to incorporate GI:
 - Adopt GI requirements in stormwater management plans that go beyond NJDEP requirements (Sustainable Jersey Model Ordinance coming late 2018)
 - Allow for pervious sidewalk and parking lot materials
 - Utilize minimum street widths that accommodate traffic and emergency response
 - Mandate open space with development
 - Reduce parking requirements
 - Review language on park size/use that may inhibit pocket parks and community gardens
 - Encourage flush curbing at some sites



GREEN INFRASTRUCTURE & URBAN RESILIENCE

IMPLEMENTATION OPPORTUNITIES

FUNDING AND IMPLEMENTATION AVENUES

- General funds
- Fees
- Stormwater utility
- Credits and incentives programs
- Public Financing
- Public-private partnerships



Graphic: Hanslodge Clipart

NEWARK DIG (DOING INFRASTRUCTURE GREEN)

- Public-private partnership
 - Outreach and training for Newark residents on water pollution prevention
 - Planting trees
 - Implemented 17 GI projects in schools, residential areas, parks



- Partners:
 - City of Newark
 - Clean Water Action and Clean Water Fund
 - Greater Newark Conservancy
 - Ironbound Community Corporation
 - It Takes a Village Inc.
 - MnM Consulting
 - Newark Environmental Commission
 - NJDEP
 - NJ Tree Foundation
 - NY/NJ Baykeeper
 - Passaic Valley Sewerage Commission
 - Rutgers Cooperative Extension Water Resources Program
 - Trust for Public Land
 - Unified Vailsburg Services Organization

NEWARK DIG PROJECT: UJIMAA COMMUNITY GARDEN

- Community garden with GI components installed on vacant lot
- GI strategies:
 - Cistern to collect stormwater from adjacent church rooftop
 - Rain garden to collect stormwater from rooftop and nearby parking lot
 - Tree plantings
- Includes recycled materials collected from nearby businesses
- Community helped to design and build



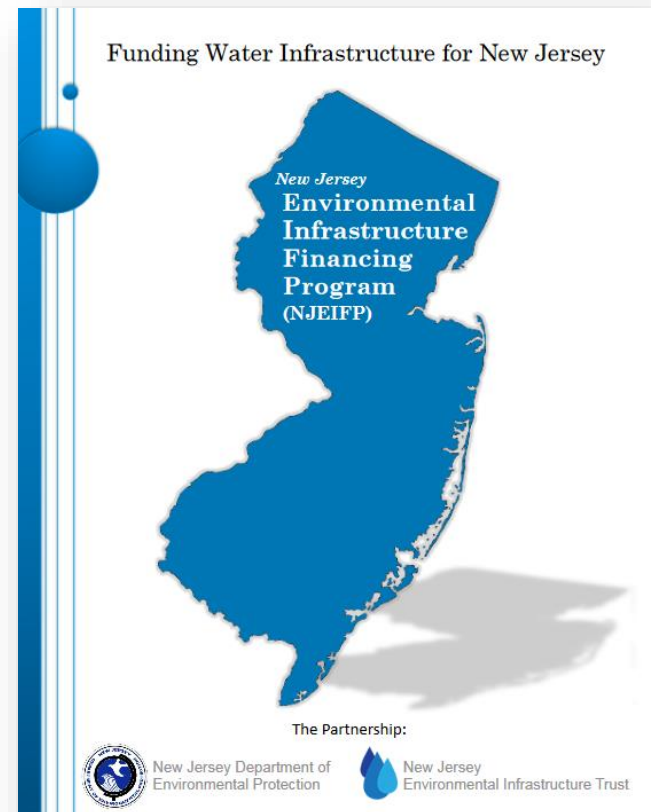
Image: Rutgers Cooperative Extension Water Resources Program

GRANT AND LOAN FUNDING OPPORTUNITIES

- NJDEP funding sources website
<http://www.nj.gov/dep/grantandloanprograms>
- NJ Water Bank (Formerly the NJ Environmental Infrastructure Financing Program) http://www.nj.gov/dep/dwq/mface_njeifp.htm
- Nonpoint Source Pollution (319) Grants
<https://www.epa.gov/nps/319-grant-current-guidance>
- Community Stewardship Incentive Program Grant
<http://www.state.nj.us/dep/parksandforests/forest/community/grants-csip.html>
- Green Acres Grants & Loans <http://www.nj.gov/dep/greenacres/>
- NJ Clean Communities Grant <https://www.njclean.org/>

NJ WATER BANK

- Partnership between NJDEP and the NJ Environmental Infrastructure Trust
- Low cost financing program specifically for GI in places with combined sewer overflows (CSO)
- Rolling application with no submission deadline
- Open to municipalities, counties, utility authorities, public-private partnerships



NJ WATER BANK (continued)

- Eligible projects include:
 - Bioswales, rain gardens, green roofs
 - Porous pavement, permeable pavers
 - Urban parks incorporating GI
 - Green streets and green tree pits.
- Hoboken received \$5.1 million in loans to fund Southwest Park, a one-acre urban park designed to capture 200,000 gallons of stormwater.

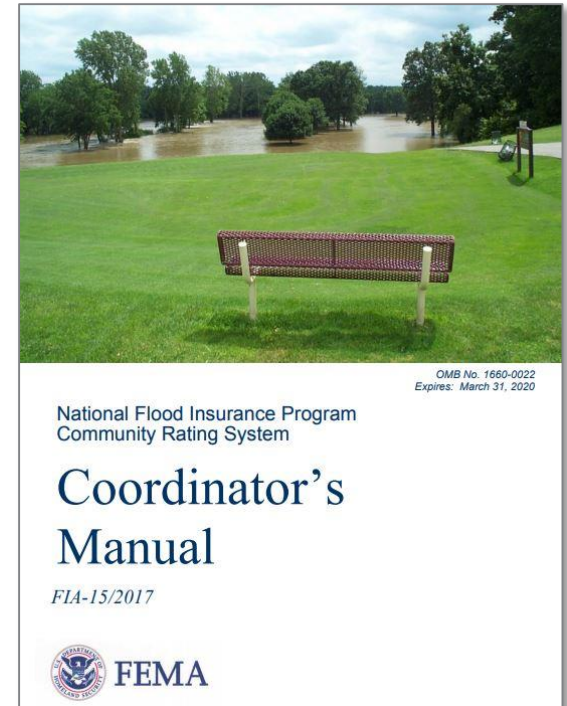


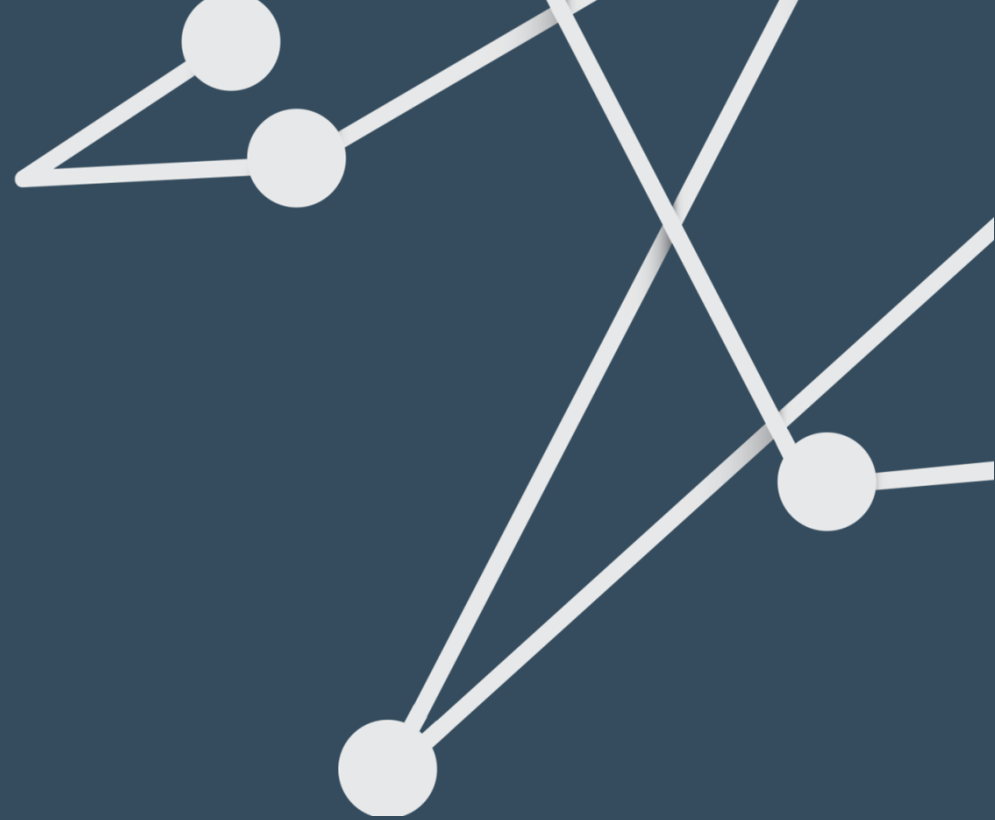
Image: City of Hoboken

COMMUNITY RATING SYSTEM (CRS) APPLICABILITY

CRS is a voluntary incentive program that encourages community floodplain management activities exceeding minimum National Flood Insurance Program (NFIP) requirements:

- Section 422: Open Space Preservation (e.g., a GI plan including open space)
- Section 452: Stormwater Management Regulations (e.g., adopting GI for all development)
- Section 512: Natural Floodplain Function Plan (e.g., a GI plan of open space corridors or connected wetlands)





GREEN INFRASTRUCTURE & URBAN RESILIENCE RESOURCES

RESOURCES

- NASA Precipitation Data:
 - <https://climate.nasa.gov/effects/>
- NOAA Precipitation Events graph:
 - <https://www.ncdc.noaa.gov/extremes/cei/>
- Rutgers Cooperative Extension, Stormwater Runoff:
 - http://water.rutgers.edu/Stormwater_Management/Default.htm
- NJDEP, GI:
 - <http://www.nj.gov/dep/gi/>
- US EPA, Performance of Green Infrastructure:
 - <https://www.epa.gov/green-infrastructure/performance-green-infrastructure>
- NJDEP, Evaluating Green Infrastructure: A Combined Sewer Overflow Control Alternative for Long Term Control Plans:
 - www.nj.gov/dep/dwq/pdf/CSO_Guidance_Evaluating_Green_Infrastructure_A_CSO_Control_Alternative_for_LTCPs.pdf
- NYC DEP GI Standards and Specifications:
 - http://www.nyc.gov/html/dep/html/stormwater/neighborhood_demonstration_area_projects.shtml
- GI Practices and Benefits Matrix:
 - <https://coast.noaa.gov/digitalcoast/training/gi-practices-and-benefits.html>
- Green Infrastructure and Park System Planning (NRPA, 2017):
 - <https://www.nrpa.org/contentassets/Oe196db99af544bbba4f63f480c1316b/gupc-briefing-paper-system-planning.pdf>
- Green Infrastructure Opportunities and Barriers in the Greater Los Angeles Region (USEPA 2012):
 - https://www.epa.gov/sites/production/files/2015-10/documents/council_watershed_health_gi_report.pdf

RESOURCES

- Baltimore Ecosystem Study:
 - https://beslter.org/frame4-page_3d_33.html
- The Green Edge: How Commercial Property Investment in Green Infrastructure Creates Value (NRDC, 2013):
 - <https://www.nrdc.org/sites/default/files/commercial-value-green-infrastructure-report.pdf>
- US EPA, Getting to Green: Paying for Green Infrastructure - Financing Options and Resources for Local Decision-Makers:
 - https://www.epa.gov/sites/production/files/2015-02/documents/gi_financing_options_12-2014_4.pdf
- Jersey City Tree Canopy Assessment:
 - http://www.gjinc.org/PDFs/Jersey_City_Report.pdf
- Green Values GI Calculator:
 - <http://greenvalues.cnt.org/national/calculator.php>
- Newark DIG:
 - <https://www.newarkdig.org/>
- NJ Water Bank:
 - http://www.nj.gov/dep/dwq/mface_njeifp.htm
- CRS for GI:
 - <https://www.epa.gov/nps/using-low-impact-development-and-green-infrastructure-get-benefits-fema-programs>
- Sustainable Jersey GI Actions:
 - <http://www.sustainablejersey.com/actions-certification/actions/#open/action/569>
 - <http://www.sustainablejersey.com/actions-certification/actions/#open/action/568>

10 MINUTE Q&A

Questions taken from chat log at bottom right section of the screen

If we run out of time, please email either:

- Stacy Krause, perrines@ejb.rutgers.edu
- Eliot Benman, ebenman@ejb.rutgers.edu

Thank you!

WEBINAR Q&A, Question #1

Q: Is anyone aware of what typical costs are to allow for the increased roof loads for green roof structures?

A: The American Association of Landscape Architects (ASLA)'s website lists various case studies including costs associated with design at <https://www.asla.org/ContentDetail.aspx?id=43536>

It seems that since this technology is not used in the US as extensively as it is used in other countries, the design standards and associated costs are largely determined by the private sector. There are a large number of private installation companies that will do assessments and estimates based on current roof condition and what would be needed to install a green roof.

WEBINAR Q&A, Question #2

Q: What materials were used in repaving the Chicago alleyways? Is the idea that the material is permeable?

A: The alleyways are paved with permeable asphalt, permeable concrete, and permeable pavers. More information can be found at <http://www.greeningthegrey.org/chicagos-green-alley-program/>

WEBINAR Q&A, Question #3

Q: Generally, who is responsible for the expenses of determining whether the soil on a proposed community garden requires pollution remediation?

A: Generally, a site that has no known history of contamination would be selected. Municipalities, non-profits, community organizations, etc. could use existing, free, and publicly available spatial data to assess lots in a community for contamination. A case study done by Isles Inc. and Rutgers University with the City of Trenton using environmental factors in site selection for community gardens can be found at <http://agriurban.rutgers.edu/WhatisUrbanAg.html>

WEBINAR Q&A, Question #4

Q: Where can one get a copy of the Cranbury low impact parking ordinance?

A: The link to the resolution is currently not working, but the ordinance number is 04-08-09 and could be requested from the township.

WEBINAR Q&A, Question #5

Q: Are public notices usually posted on a community garden site, stating that the soil in the garden has been tested and found suitable for growing produce for human consumption?

A: Similar to question #3, there are no state regulations regarding this matter but best management practices tell us that garden sites are chosen due to their lack of any known soil contaminants. There is more likely a notice to be posted advertising if the food being grown is organic. More information on these best management practices can be found on the website of the Office of Agriculture and Urban Programs at Rutgers University at <http://agriurban.rutgers.edu/WhatisUrbanAg.html>

WEBINAR Q&A, Question #6

Q: Can you share costs and funding source breakouts for sample local or county projects in NJ?

A: Links to each local project example are located on the Resources slide (slides #45-46) with information on costs and funding.

WEBINAR Q&A, Question #7

Q: Is there any research on the post-construction of green curb bumpouts, etc. and the impacts of road salt from winter weather operations?

A: NYC DEP is currently conducting a study on efficiency and effects of salt and other loadings on their 8,000 GI sites in Brooklyn and Queens that is expected to be completed late 2018/early 2019.

WEBINAR Q&A, Question #8

Q: Has electric vehicle car share been considered as a part of the green/complete streets programs?

A: Green streets generally refer to the incorporation of natural landscaping as opposed to gray infrastructure. Electric vehicle infrastructure is sometimes incorporated into sustainable development guidelines, which also encompass green infrastructure. Therefore, both strategies help communities become more sustainable, though there is no direct relationship between them.

TOGETHER
**NORTH
JERSEY.**

Connecting People, Places, and Potential ●