MODULE 1: Stormwater

2022

Rainwater Readiness

Massachusetts Rivers Alliance

Water Environment Federation®
the water quality people®

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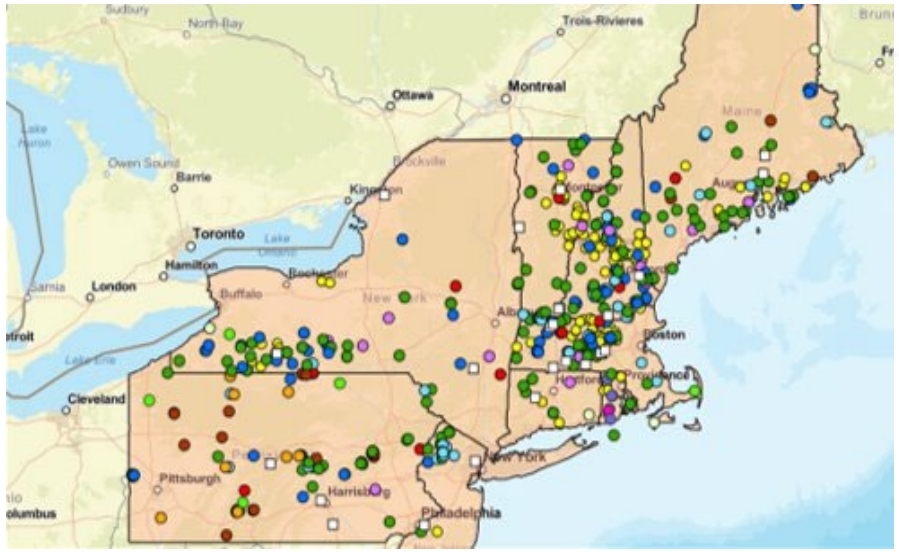
RCAP Solutions

Water Environment Federation
the water quality people

- Our Mission
  - Inspiring the water community in pursuit of human and environmental well-being
- Our Vision
  - Life free of water challenges

Your Presenter and RCAP Community Specialist

Andrew Evans
aevans@rcapsolutions.org



Acknowledgement

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Stormwater Management for Rural Communities

- Introduction to Stormwater/Definitions
- Goals of Stormwater Management
- Challenges
- Centralized Vs. Decentralized
- Green and Grey Infrastructure
- Treatment
- Best Management Practices (BMP)
- Operations and Maintenance
- Resources

Environmental Finance Center Network (EFCN) will provide a presentation on funding options later in the webinar.

What is Stormwater? Where does it come from and where does it go?

Stormwater Defined

- Stormwater is rainwater or melted snow that runs off streets, lawns and other sites. When stormwater is absorbed into soil, it is filtered and ultimately replenishes aquifers or flows into streams and rivers.
- The U.S. Environmental Protection Agency defines stormwater as “rain and snowmelt that flows over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, and does **not** soak into the ground.

Runoff

- The movement of water across the land's surface. Instead of being absorbed by the soil, the water flows over the ground eventually making its way into streams, rivers, lakes, or other water bodies
- Runoff can pick up and deposit harmful pollutants like trash, chemicals, and dirt/sediment into streams, lakes, and groundwater

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Impervious Surface

- Impervious surface is an alteration to the ground that makes it a hard surface where precipitation does not soak in
- For example, pavement
- Expressed in square units such as square feet
- Typically excludes lawns, landscape areas, and gardens

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This Presents some Challenges

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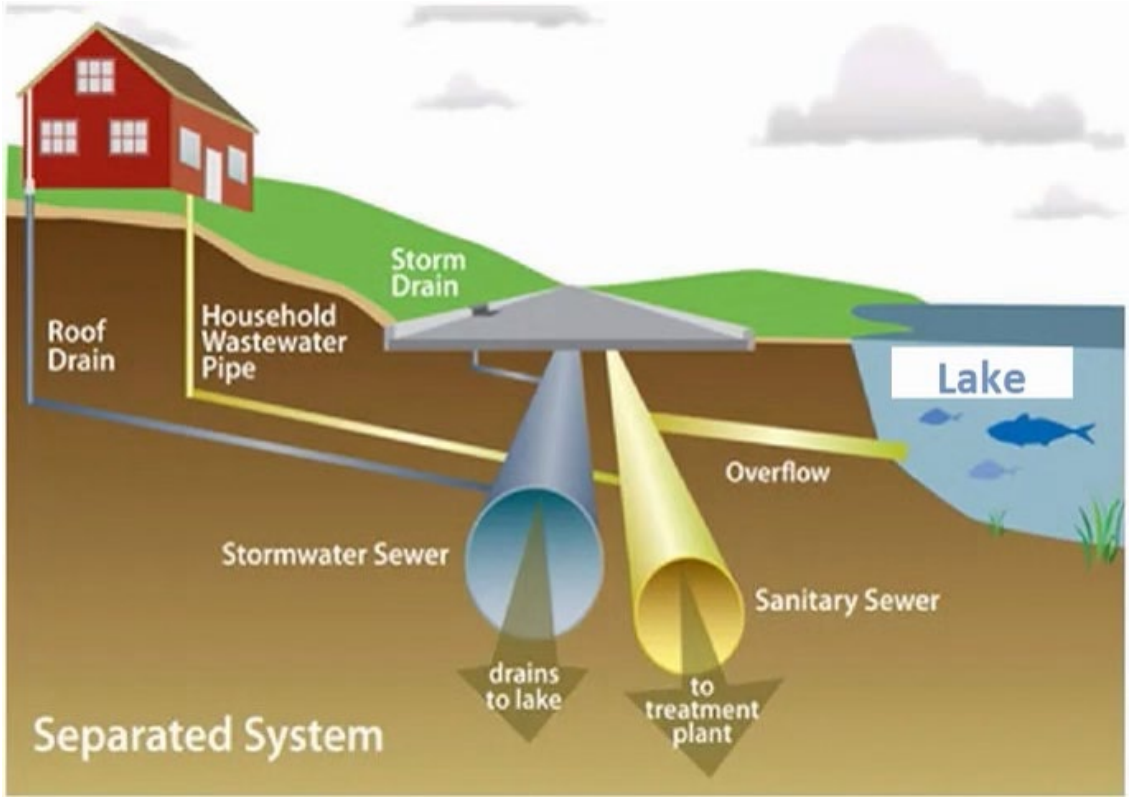
What is the Goal of Stormwater Management?

Stormwater Treatment

- Most of the untreated runoff is directly discharged into nearby waterbodies.
- In the over 700 combined sewer systems nationwide, stormwater flows with wastewater and is treated at a water resource recovery facility.



Stormwater Treatment

Physical

- Erosion and sediment control
- Filtration
- Sedimentation
- Thermal

Biological

- Degradation of organic matter
- Denitrification
- Plant growth and nutrient uptake

Chemical

- Coagulation
- Precipitation
- Oxidation
- Ion exchange

Stormwater Management Goals

- Reduce peak flows
- Protecting water quality
- Providing treatment

Green and Grey Infrastructure

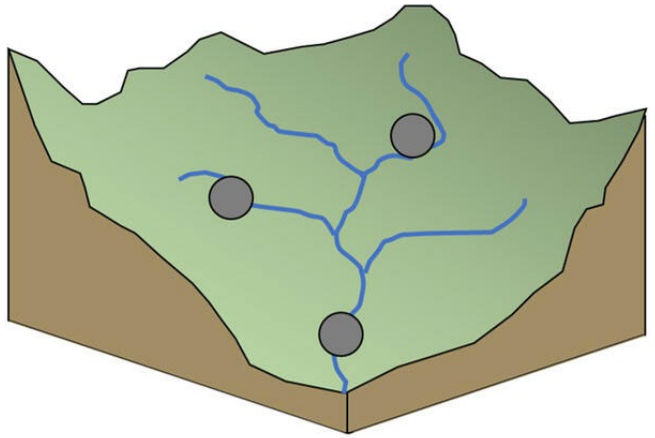
Centralized vs. Decentralized

Gray infrastructure

Gray infrastructure is traditional stormwater infrastructure in the built environment such as gutters, drains, pipes, and retention basins.

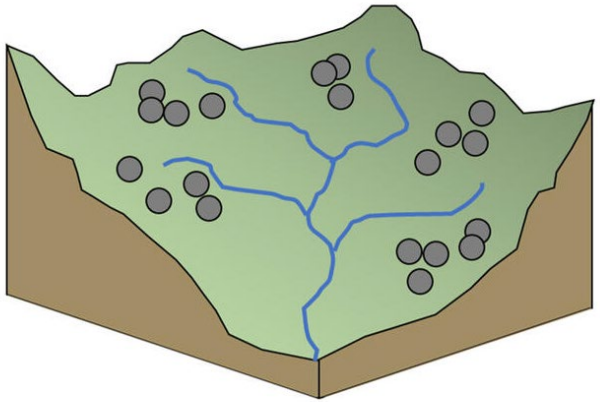
Centralized Stormwater Management

- A network of piping in a watershed or sub-watershed that comes together with a common endpoint.
- The endpoint may include green infrastructure or treatment but is often simply a pipe leading to a river or lake.



Centralized stormwater management
A few, large practices USGS

Decentralized Stormwater Management



Distributed stormwater management
Many, smaller practices USGS

- Manages stormwater through collection, storage and cleaning using cost effective solutions that mimic natural systems.
- Allows for as much water to remain on site and slowly filter back into the watershed.

Decentralized Stormwater Examples

- Rain gardens
- Rain harvesting
- Bioswales
- Constructed wetlands
- Detention basin

Green Infrastructure

- Green infrastructure has been shown to often be more cost-effective when compared with traditional gray infrastructure approaches, and green infrastructure offers numerous ancillary benefits.

- The visible, above-ground and accessible qualities of green infrastructure, as opposed to gray infrastructure, provide many benefits such as improving air and water quality, improving quality of life, and offering public education opportunities

Green Infrastructure Legal Requirements

- It is advisable to first check if local codes, design standards, or planning documents pose barriers to implementing green infrastructure projects.
- Some entities may be required to implement green infrastructure (MS4, TMDL)

https://www.massriversalliance.org/rainwater-readiness-2025

Not legal advice!

Green Infrastructure: Examples/Benefits

Green Roofs

- Have a longer lifespan than traditional roofs
- Reduce energy costs
- Buildings with green roofs can command rental premiums
- Vegetation provides habitat for wildlife

Rain Barrels and Cisterns

- Reduce water consumption and associated costs
- Reduce demand for potable water
- Increase available water supply for other uses
- Can significantly reduce stormwater discharges from roofs

EPA, 2015, "Green Infrastructure Opportunities that Arise During Municipal Operations", https://www.epa.gov/sites/default/files/2015-09/documents/green_infrastructure_roadshow.pdf

Green Infrastructure: Examples/Benefits

Trees

- Intercept and absorb rainfall
- Reduce urban heat island
- Improve habitat and aesthetic value
- Provide shade in summer and block wind in winter, reducing heating and cooling costs
- Reduce greenhouse gases by absorbing CO_2
- Capture urban air pollutants (dust, O_3, CO)

Bioswales and Rain Gardens

- Improve property and neighborhood aesthetics
- Reduce localized flooding
- Promote infiltration and groundwater recharge
- Enhance pedestrian safety when used in traffic calming applications

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Green Infrastructure: Examples/Benefits

Permeable Pavements

- Reduce stormwater runoff and standing water
- Promote infiltration and groundwater recharge
- Improve the longevity of infrastructure
- May be easier to maintain than standard pavement

Green Space

- Increase soil porosity
- Reduces stormwater runoff volume
- Reduces peak stormwater flows
- Helps reduce the risk of flooding

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Green Infrastructure

Improved Air Quality/Climate Change

Urban Heat Island

Green infrastructure practices that include trees and other vegetation can reduce the urban heat island effect, which reduces energy use and the incidence and severity of heat-related illnesses.

Air Quality

Green infrastructure improves air quality by increasing vegetation, specifically trees, that absorb air pollutants, including CO_2, NO_2, O_3, SO_2, and PM_{10}.

Greenhouse Gases

Green infrastructure's ability to sequester carbon in vegetation can help to meet greenhouse gas emission goals by contributing to a carbon sink.

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Green Infrastructure

Water Quality and Quantity

Water Conservation

Green infrastructure that incorporates locally adapted or native plants reduce the need for irrigation, which reduces demand for potable and recycled water. Rain barrels and cisterns that capture rainwater also reduce water use.

Water Quality and Flood Mitigation

Green infrastructure can decrease the frequency and severity of local flooding by reducing stormwater discharge volumes and rates.

Habitat

Vegetated green infrastructure can provide habitat for wildlife, particularly birds and insects, even at small scales of implementation.

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Green Infrastructure

Quality of Life

Public Health
Residents have more recreational opportunities in the presence of large-scale green space in their community, which can improve public health and well-being.

Public Safety
Green streets that include curb bump-outs at pedestrian crossings improve pedestrian safety by slowing traffic and decreasing the distance that pedestrians must travel in the roadway.

Recreational Opportunities
Larger-scale green infrastructure facilities that include public access, such as constructed wetlands, offer recreational opportunities.

Property Aesthetics
Green infrastructure that includes attractive vegetation can improve property aesthetics, which can translate into increased property values.

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Green Infrastructure

Educational Opportunities

Public Education

The visible nature of green infrastructure offers enhanced public education opportunities to teach the community about mitigating the adverse environmental impacts of our built environment. Signage is used to inform viewers of the features and functions of the various types of facilities.

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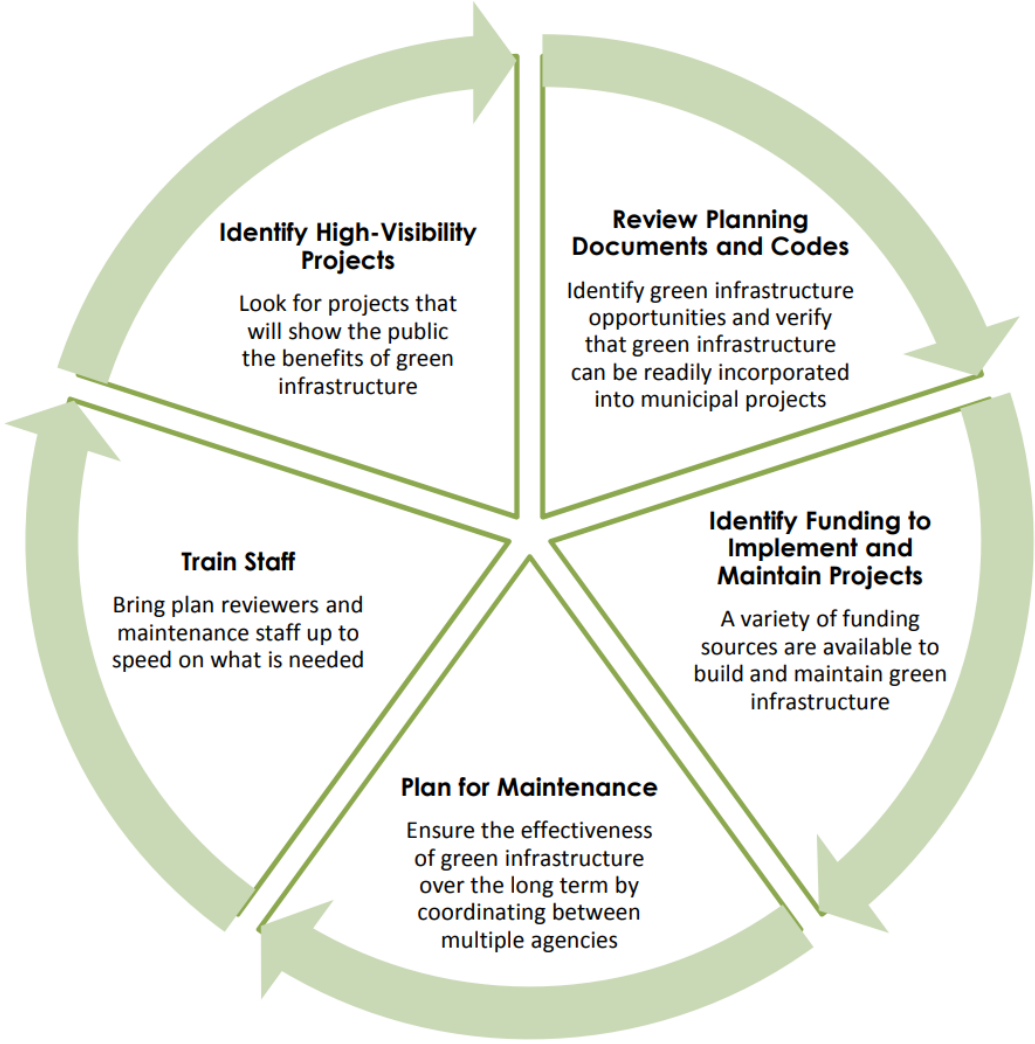
Green Infrastructure



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Operations and Maintenance (O&M)

Best Management Practices (BMPs)

Stormwater O&M

All stormwater management systems, whether grey or green, require some maintenance.

- Identification of the parties responsible for maintenance
- Maintenance schedules
- Inspection requirements
- Frequency of inspections
- Easements or covenants for maintenance
- Identification of a funding source
- Description of basic maintenance activities like weeding, mulching, trimming of shrubs and trees, replanting, sediment and debris removal, and inlet/outlet cleaning

Activities of Stormwater Programs

- Construct and maintain stormwater drainage systems
- Street sweeping
- Construct and maintain water quality installations on public property
- Approve and evaluate water quality installations on private property
- Regulatory compliance

Best Management Practices (BMP's)

- Technical term for the water quality installations/equipment
- Devices, practices, or methods that are used to manage stormwater runoff by controlling peak runoff rate, improving water quality, and managing runoff volume
- Dozens of different BMP types

BMPs Can Also Be a Design Choice

Nonpoint Source Outreach Toolbox

The Nonpoint Source (NPS) Outreach Toolbox is intended for use by state and local agencies and other organizations interested in educating the public on nonpoint source pollution or stormwater runoff. The Toolbox contains a variety of resources to help develop an effective and targeted outreach campaign.

https://www.epa.gov/nps/resources-students-and-educators-about-nonpoint-source-nps-pollution

Key Resources

- List of key resources for more information:
  - https://www.epa.gov/sites/default/files/2015-09/documents/green_infrastructure_roadshow.pdf
  - https://wefstormwaterinstitute.org/
  - https://stormwater.wef.org/

Thanks for Coming!

Andrew Evans
RCAP Solutions
NORTHEAST
aevans@rcapsolutions.org
978-350-4669

Any Questions

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