Urban Stormwater Governance and Green Infrastructure Adoption

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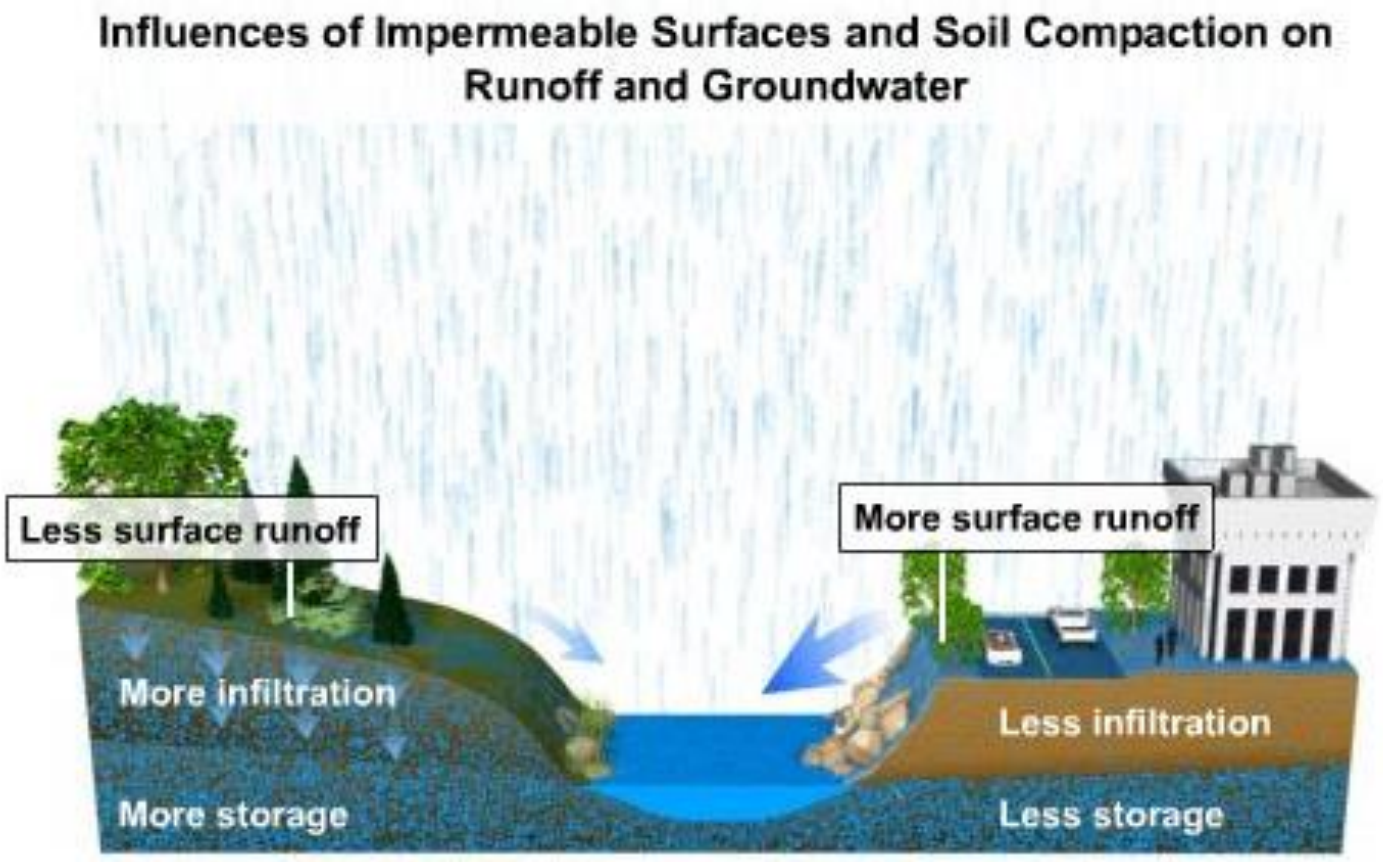
Urban Water Management

Water as a resource vs. a “waste”

- Not enough water?
  - Water scarcity
  - Resource = water

- Too much water?
  - Runoff problems
  - Resource = storage

Urban Stormwater Runoff

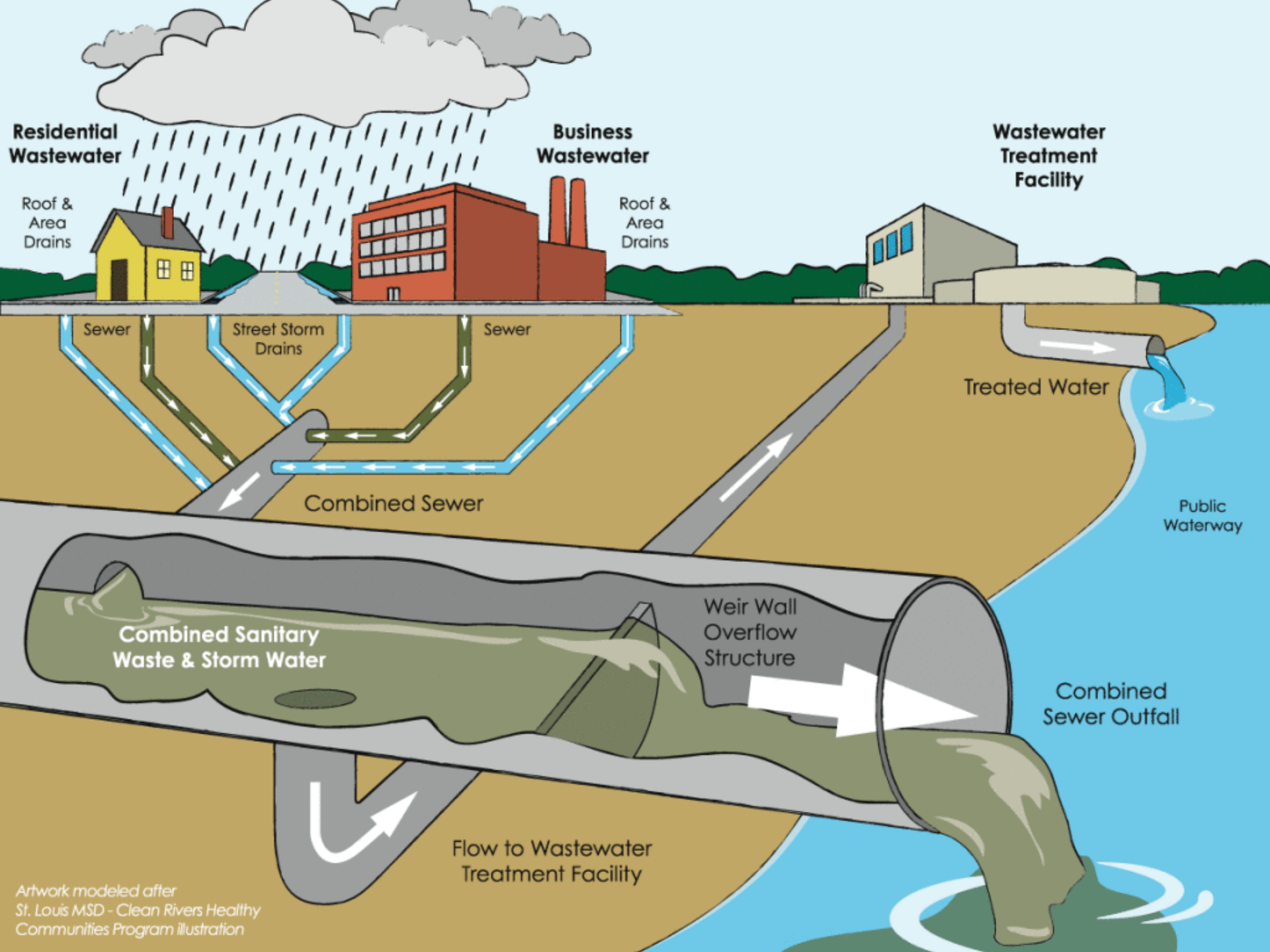


Stormwater Infrastructure

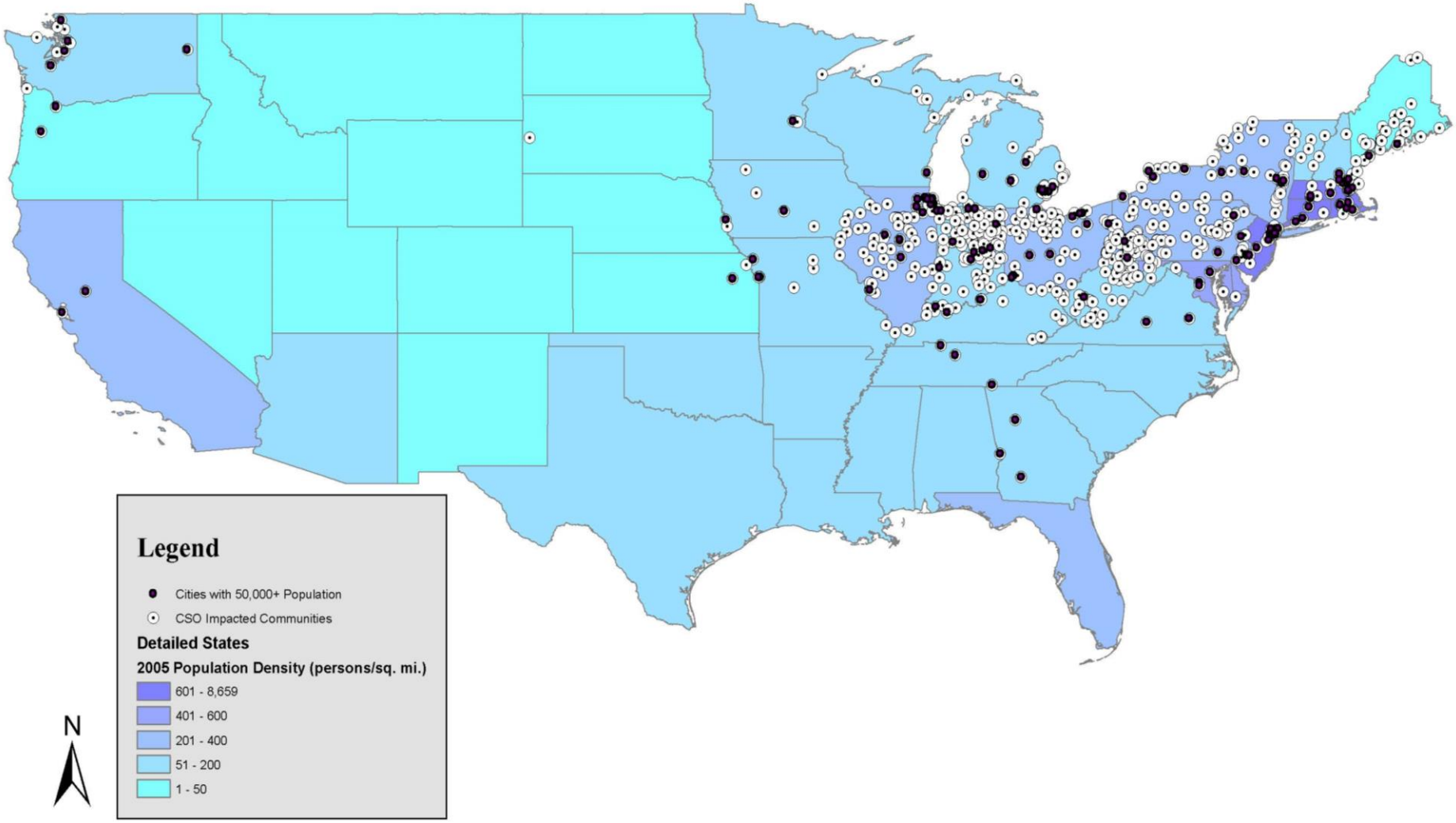
- **Municipal Separate Storm Sewer System (MS4)**

Stormwater and CSOs

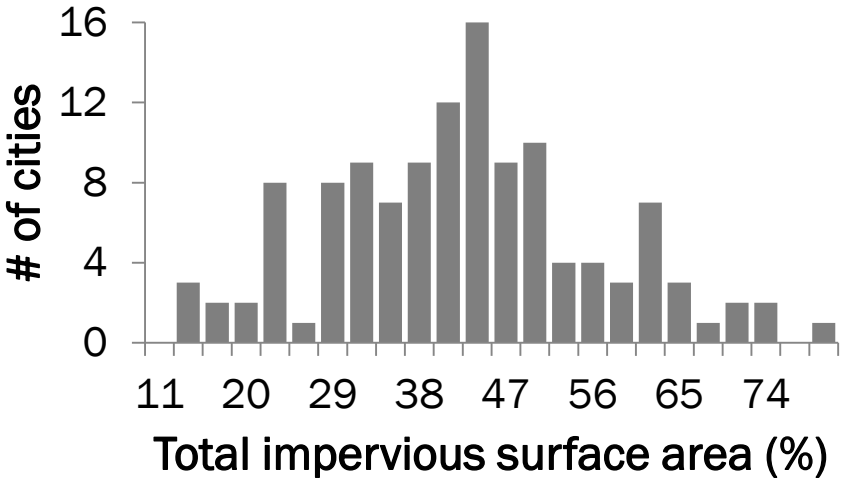
- **Combined sewer overflow (CSO)**
  - Runoff enters combined sewers where sewage is flowing
  - Large volumes exceed capacity of sewers and treatment plant
  - Diluted sewage goes into water bodies

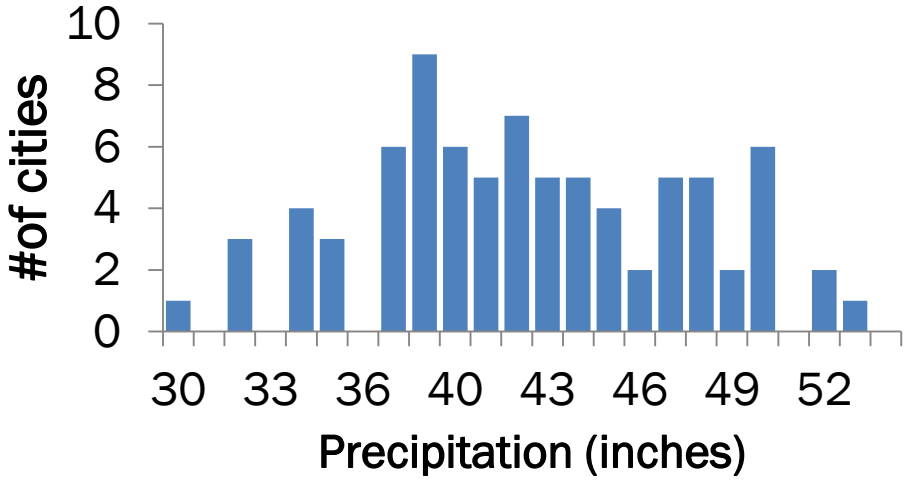

Residential Wastewater
Business Wastewater
Wastewater Treatment Facility
Roof & Area Drains
Roof & Area Drains
Sewer
Street Storm Drains
Sewer
Treated Water
Combined Sewer
Public Waterway
Combined Sanitary Waste & Storm Water
Weir Wall Overflow Structure
Combined Sewer Outfall
Flow to Wastewater Treatment Facility
Artwork modeled after St. Louis MSD - Clean Rivers Healthy Communities Program illustration

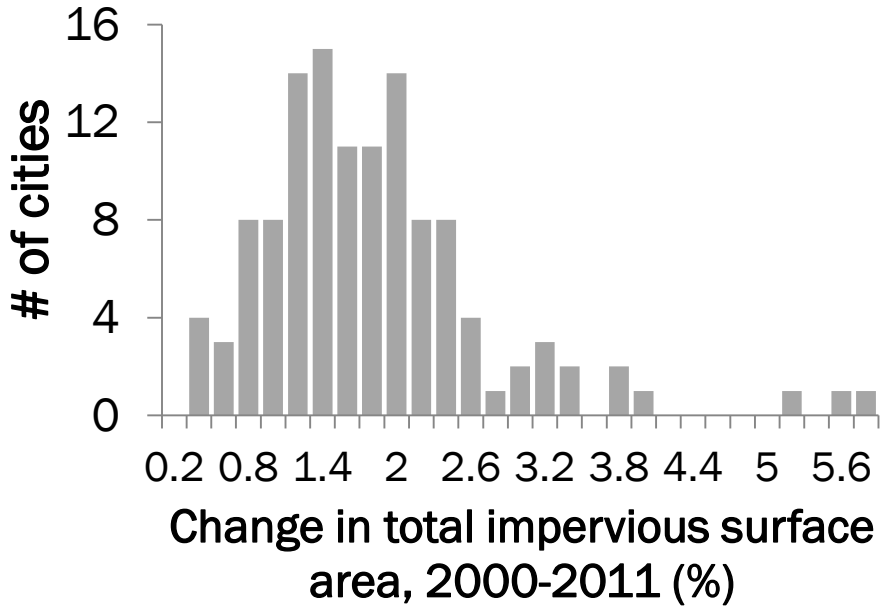
CSO Communities in the US

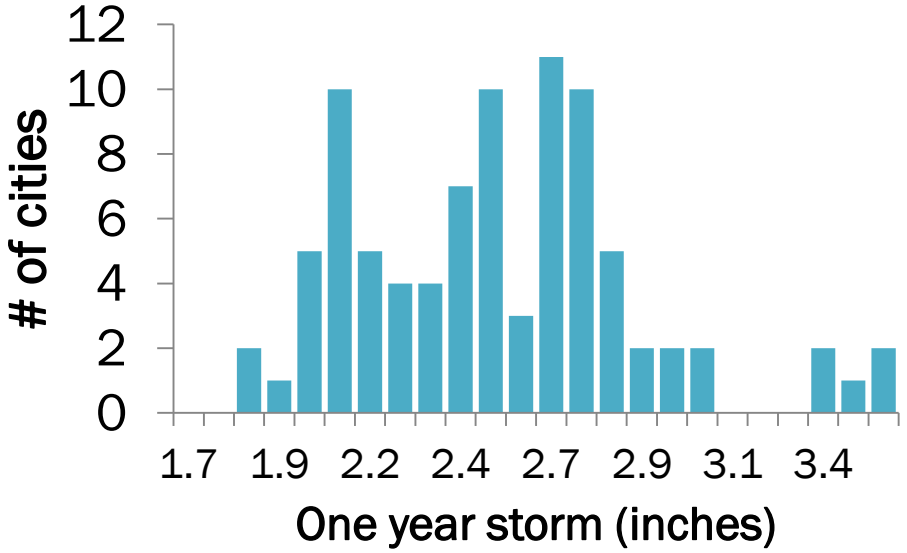


CSO Communities (50,00+ residents)





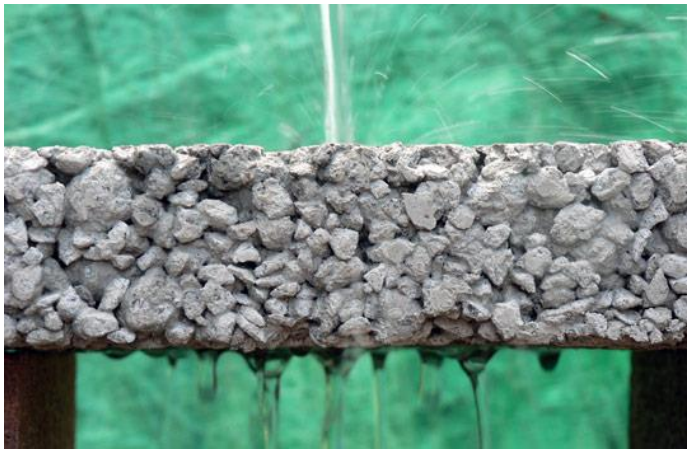


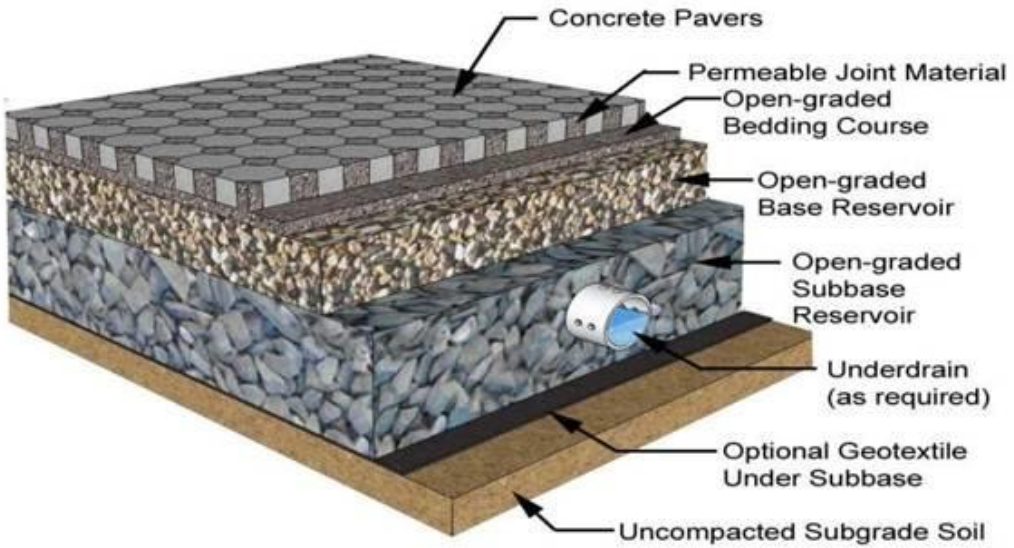


Engineering Solutions

- **Gray Infrastructure**
  - Network of pipes, tanks and facilities designed to collect and treat stormwater and wastewater

- **Green infrastructure (GI)**
  - Designed to protect or restore the natural hydrology of a site




Concrete Pavers
Permeable Joint Material
Open-graded
Bedding Course
Open-graded
Base Reservoir
Open-graded
Subbase
Reservoir
Underdrain
(as required)
Optional Geotextile
Under Subbase
Uncompacted Subgrade Soil

Research Questions

There is a need to research the growing adoption an implementation of GI programs.

- To what extent are GI technologies being integrated into CSO management plans?
- What are the key factors that influence municipal stormwater managing agencies' decision to implement GI strategies for CSO mitigation?

Research Design – Mixed Methods

- **Sampling**
  - Case study on Onondaga County
  - CSO Communities with populations over 50,000

- **Methods**
  - Comparative case studies
  - SES framework to provide the concepts and terms that will be used to construct theoretical relationships
  - Data collection from municipal planning documents
  - Survey of sewer management authorities
  - Statistical analysis to determine importance of multiple variables on the adoption of GI

Case Study: Onondaga County

Onondaga Lake

- 100+ years of pollution:
  - **Industrial**
    - Superfund site
  - **Municipal**
    - WTP
    - CSOs

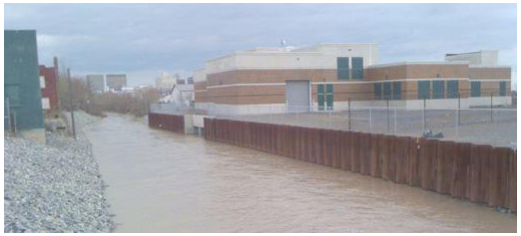
Onondaga County Government

- **County owns the combined sewer system and treatment plant**
- **CSO legislation**
  - 1988 - Charges of Clean Water Act violations
  - County must reduce **400 MGY of CSO volume** to decrease bacteria, phosphorus and trash loadings to lake using **proven technologies** in a **cost effective manner**

Key Stakeholders

- Governing bodies
  - Local, State & Federal; Funding Agencies
- Engineering firms
- NGOs
  - Community groups, national groups
- Scientific community
- Businesses
- Public
- Indigenous groups

Past SWM Plans



- **Consent Judgment**
  - 1988 - Charges of Clean Water Act violations
  - 1989 - First consent judgment in 1989
    - Has since been amended four times

- **Important features of past plans**
  - Gray infrastructure solutions
  - Few select engineering firms
  - Conservative leadership
  - Rejected alternative plans that were supported by community groups


JUSTICE FOR
STOP
ENVIRONMENTAL
NO SEWAGE

GI in Onondaga County

- **2009: 4th Consent Judgment Compliance**
- **10% CSO reduction**
  - 6.3% by green
  - 3.7% by gray
  - First time in the U.S. that GI was listed as a direct legal requirement in the reduction of CSOs
- **Save the Rain Campaign**
  - Over 175 projects completed

Save the Rain

Case Study Findings

- **GI adoption in Onondaga County can be traced to a number of important variables:**
  - GI accepted as an effective suite of technologies
    - Change in the repertoire of norms and strategies
  - Increased leadership, trust, and inclusion among actors
    - Cross-cultural policy entrepreneurship coalition
  - Economic opportunities
    - Cost savings
    - Grants reduced financial barriers
  - Social criteria in decision making