A National and International Review of Stormwater Management Programs

Innovative & Integrated Stormwater Management

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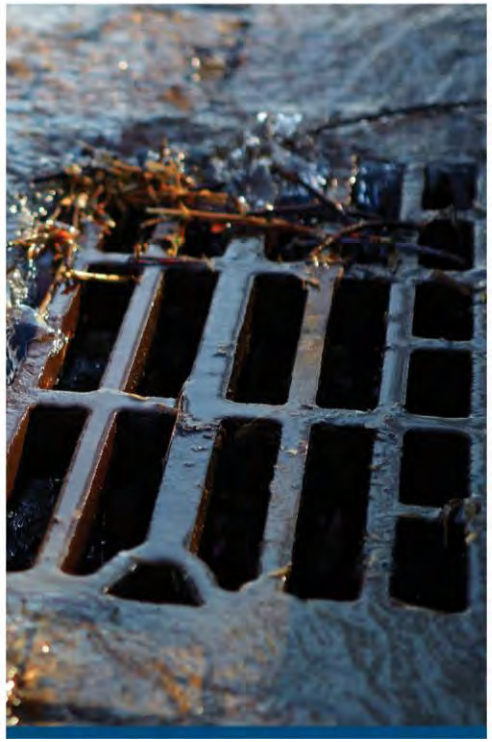
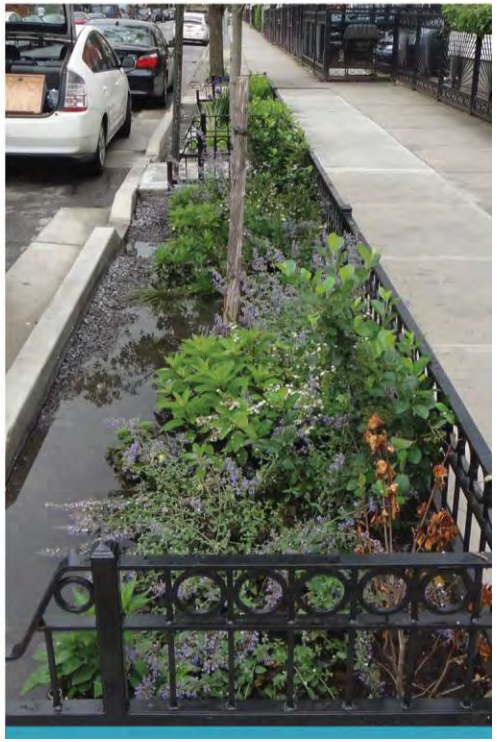
Vote Link: https://tinyurl.com/ycuv3aj2

Introduction

DEP examined national and international stormwater programs to:

- enhance understanding of innovative and integrated stormwater solutions
- refine the approach to the city-wide stormwater program
- move forward with proven solutions that are both integrated and innovative





34 Participating Communities

Acknowledgements

- Department of Environmental Services, Arlington County, Virginia
- Department of Watershed Management, City of Atlanta, Georgia
- Aurora Water, City of Aurora, Colorado
- Department of Environmental Protection and Sustainability, Baltimore County, Maryland
- Department of Public Works, City of Baltimore, Maryland
- Boston Water and Sewer Commission, Massachusetts
- Department of Water Management, City of Chicago, Illinois
- Metropolitan Water Reclamation District of Greater Chicago, Illinois
- Stormwater Management Utility, City of Cincinnati, Ohio
- Metropolitan Sewer District of Greater Cincinnati, Ohio
- Department of Public Works and Environmental Services, Stormwater Management Division, Fairfax County, Virginia
- Department of Public Works and Environmental Services, Wastewater Management Division, Fairfax County, Virginia
- Department of Public Works, Sustainability Division, City of Fort Lauderdale, Florida
- Department of Public Works and Engineering, City of Houston, Texas
- Department of Public Works, City of Indianapolis, Illinois
- King County, Department of Natural Resources and Parks, Wastewater Treatment Division, Washington
- Public Works and Utilities Department, City of Lincoln, Nebraska
- Department of Public Works, Bureau of Sanitation, City of Los Angeles, California
- Department of Public Works, City of Milwaukee, Wisconsin
- Public Works Department, City of Minneapolis, Minnesota
- Metropolitan Government of Nashville and Davidson County, Tennessee
- Metro Water Services, City of Nashville and Davidson County, Tennessee
- Northeast Ohio Regional Sewer District, Ohio
- Planning Commission, City of New Orleans, Louisiana
- Sewerage and Water Board of New Orleans, Environmental Affairs Department, Louisiana
- Department of Water Environment Protection, Onondaga County, New York
- Philadelphia Water Department, Pennsylvania
- Bureau of Environmental Services, City of Portland, Oregon
- Department of Public Utilities, City of Richmond, Virginia
- San Francisco Public Utilities Commission, California
- Port of San Francisco, California
- Sanitation District No. 1 of Northern Kentucky
- Seattle Public Utilities, Washington
- Department of Energy and Environment, Washington D.C.
- City Development, City of Copenhagen, Denmark
- Halifax Water, Halifax Regional Municipality, Nova Scotia, Canada
- Melbourne Water, Melbourne, Victoria, Australia
- Toronto Water, City of Toronto, Ontario, Canada

Key Elements

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2. **Innovative Stormwater Planning, Policy, and Regulations**
3. Public Involvement and Education Programs
4. Illicit Discharge Detection and Elimination Programs
5. Construction and Post-Construction Stormwater Management Programs
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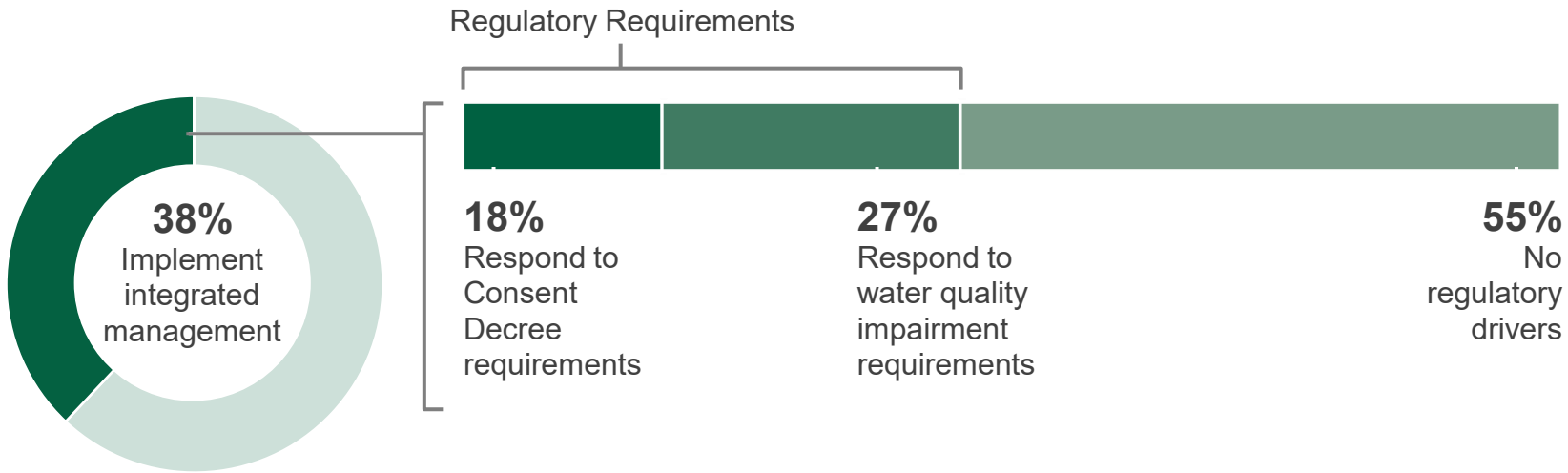
Integrated Management

38% of respondent communities use an integrated management approach



Question 1

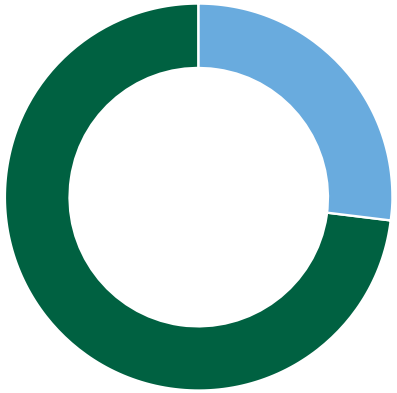
Integrated Management

56% of integrated management communities include stormwater and wastewater

56%
Include stormwater and wastewater

22%
Include stormwater and drinking water

22%
Include stormwater, wastewater, and drinking water



73%
Follow community-specific Integrated management and planning approach

27%
Follow EPA guideline approach

Seattle Case Study

Integrated Plan:

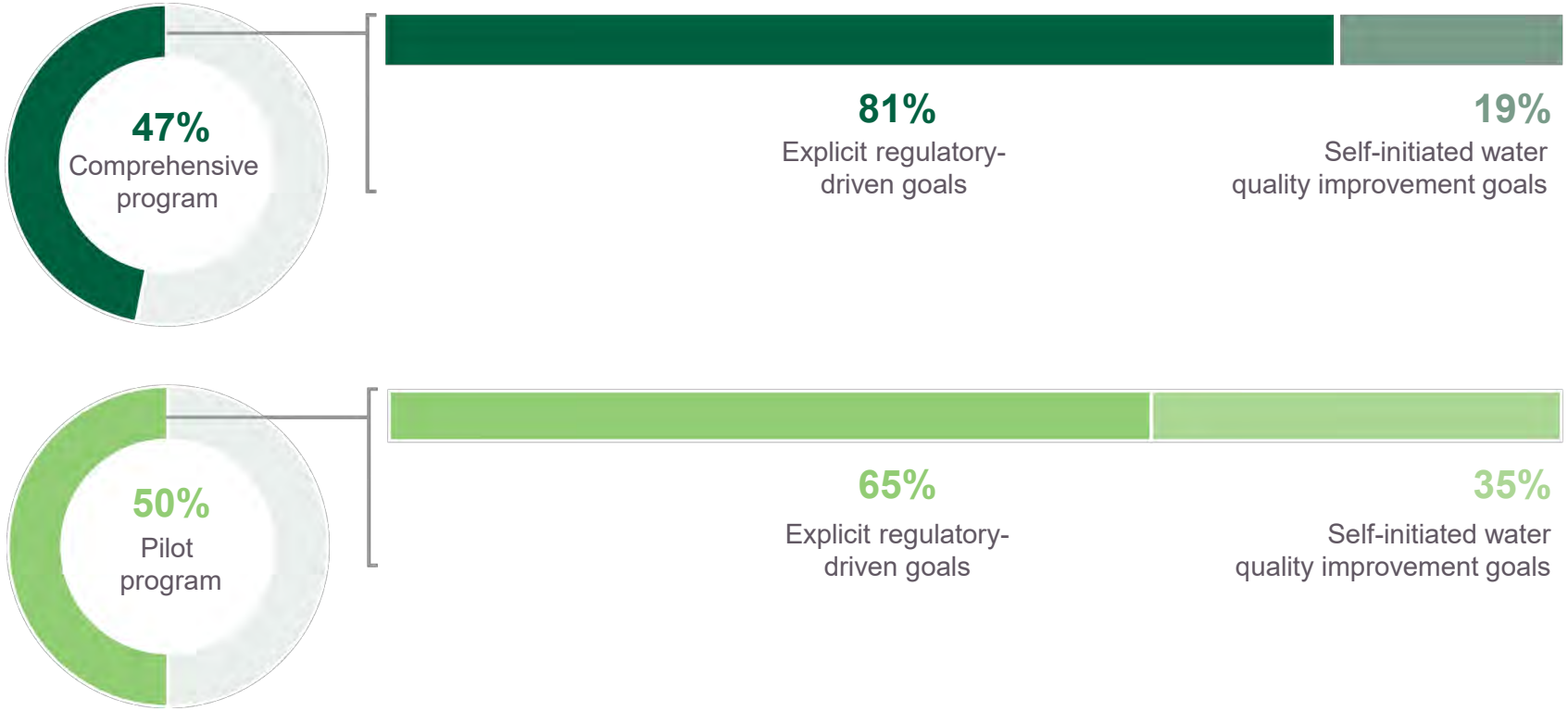
- Drivers: Regulatory driven
- Use customized plan
- Defines structural stormwater control projects that provide significant benefits beyond approved CSO projects alone
- Some of the Integrated Plan stormwater projects include:
  - Capitol Hill Water Quality Project: Four blocks of biofiltration swales
  - Venema Natural Drainage System: Five blocks of roadway to include natural drainage systems
  - South Park Water Quality Project: Regional stormwater quality facility
  - Street Sweeping: 560 lane miles per year

- **Catch Basin Inspection:** Inspected annually and fixed within six months if they do not pass inspection. Seattle has 22,000 catch basins in the MS4 areas.

Green Infrastructure

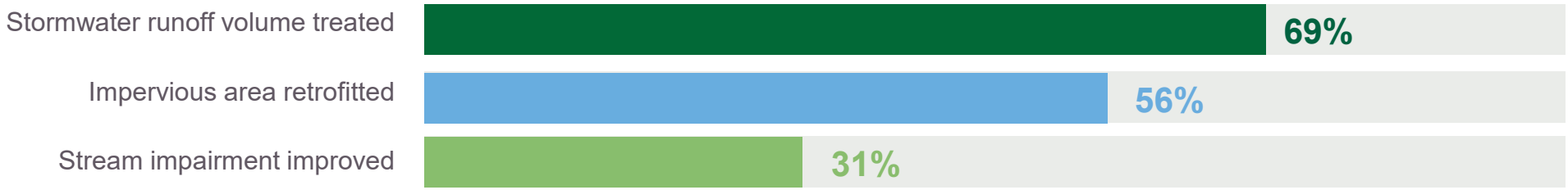
97% of respondent communities implementing some green infrastructure

47% have comprehensive green infrastructure programs



Question 2

Success Measure Distribution



Green Infrastructure Case Studies

Portland, OR

Green Street Policy: Encourages implementation of GI, such as green streets, in the right-of-way.

The Building Code prioritizes the use of GI for stormwater management on private property and in the right-of-way.

New York, NY

Area-wide Approach: Implements GI in Combined Sewer Overflow priority watersheds to meet Consent Decree milestones. NYC has standardized right-of-way GI for streamlined siting and design. NYC is also implementing customized green infrastructure on many public properties.

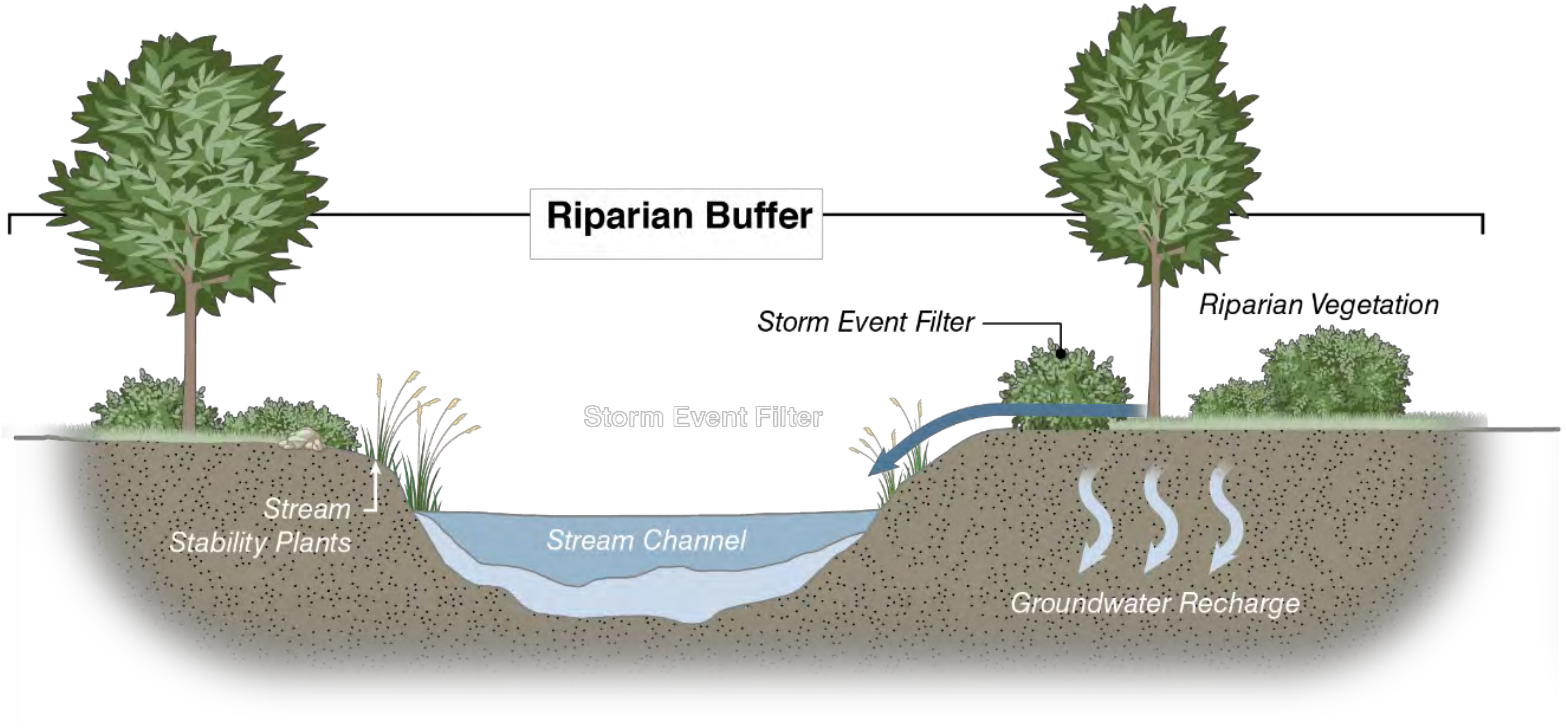
Philadelphia, PA

Neighborhood Area Opportunity Analysis: Assesses GI opportunities by an area wide approach with targeted design and implementation throughout combined sewer neighborhoods. PWD uses a decentralized and creative approach to planning and design of right-of-way and parcel GI.

Riparian Buffers

56% of respondent communities are experiencing significant new development

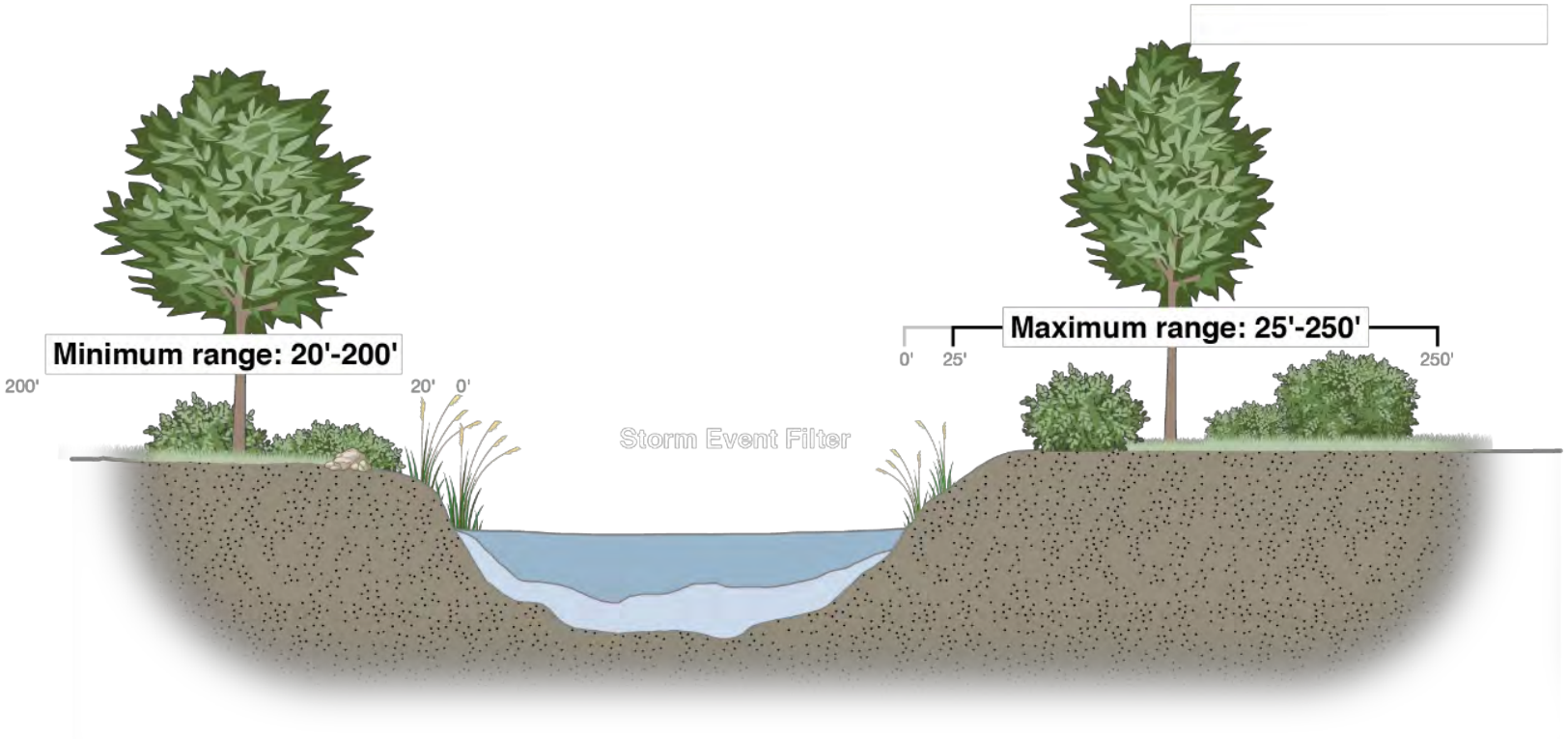
63% implement riparian buffers



Riparian Buffers

Minimum Riparian Buffer Widths: 20’ to 200’

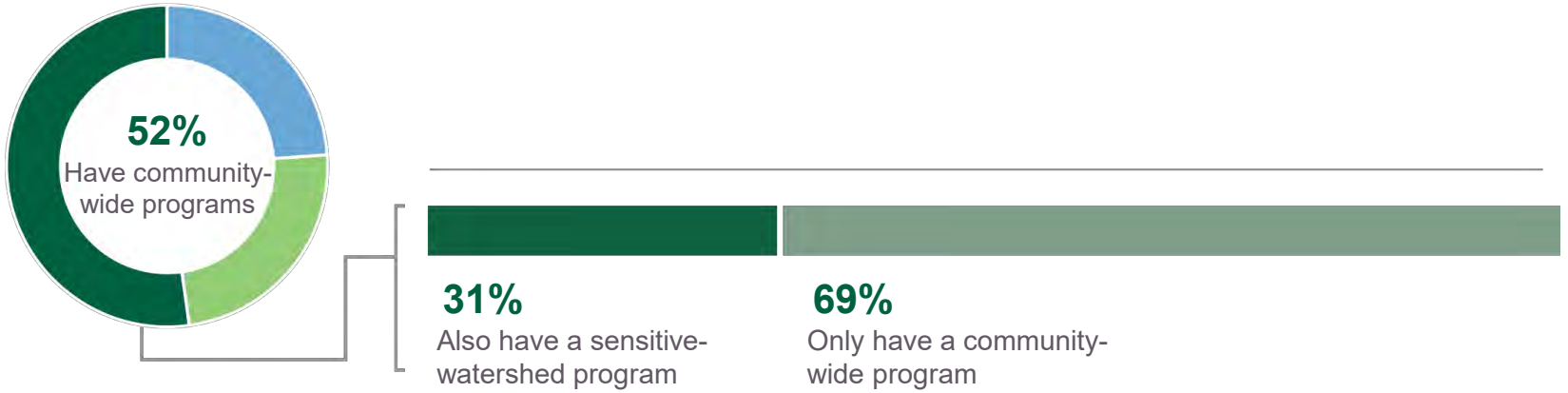
Maximum Riparian Buffer Widths: 25’ to 250’

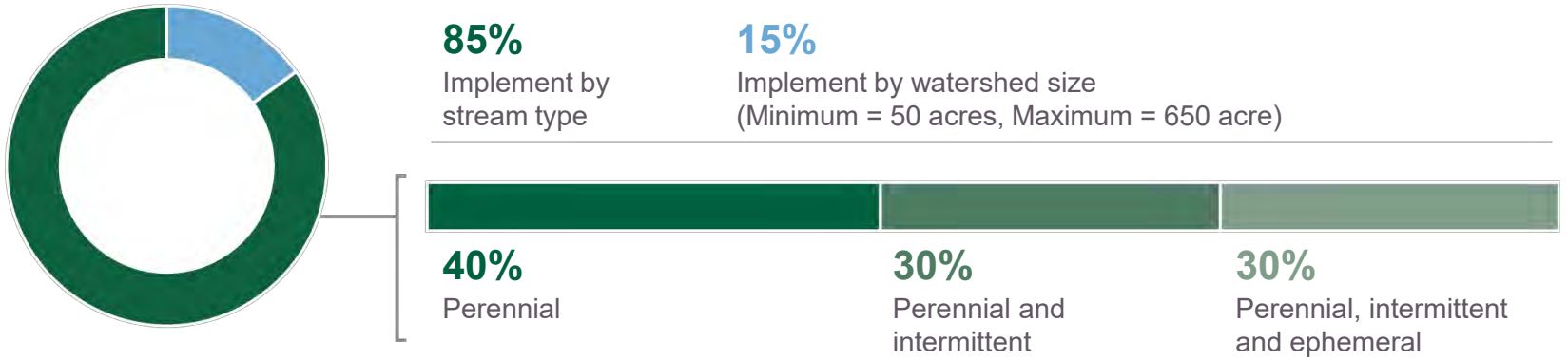


Riparian Buffers

52% of respondent communities have community-wide programs

24% of respondent communities have only sensitive-watershed programs





Floodplains

80% of respondent communities implement floodplain regulations that are more protective than FEMA baseline standards

50% of respondent communities elect to be more protective by preserving floodplain storage

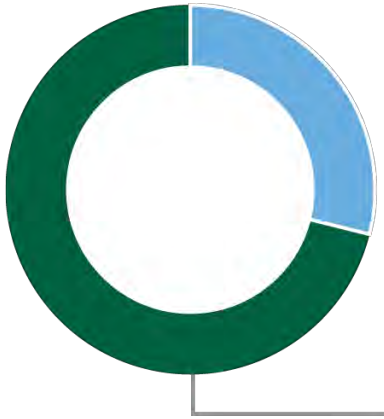
95% of respondent communities elect to use only existing land use flows for floodplain regulation

32% of respondent communities implement a program to retrofit or remove buildings from the floodplain

Question 3

Floodplains

71% of respondent communities elect to further increase the FEMA baseline freeboard value to provide an additional factor of safety



71%
Implement freeboard above 1 ft

29%
Implement FEMA baseline freeboard of 1 ft

18%
Implement freeboard ≥ 3 ft

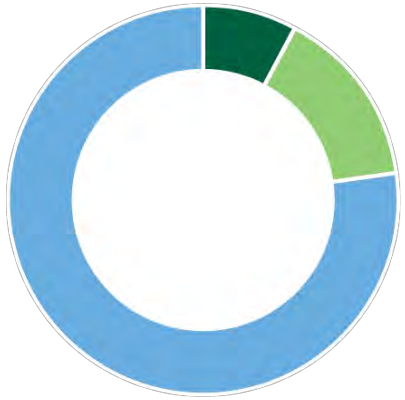
58%
Implement freeboard between 2 ft to < 3 ft

24%
Implement freeboard above 1 ft to < 2 ft

[Question 4]

Floodplains

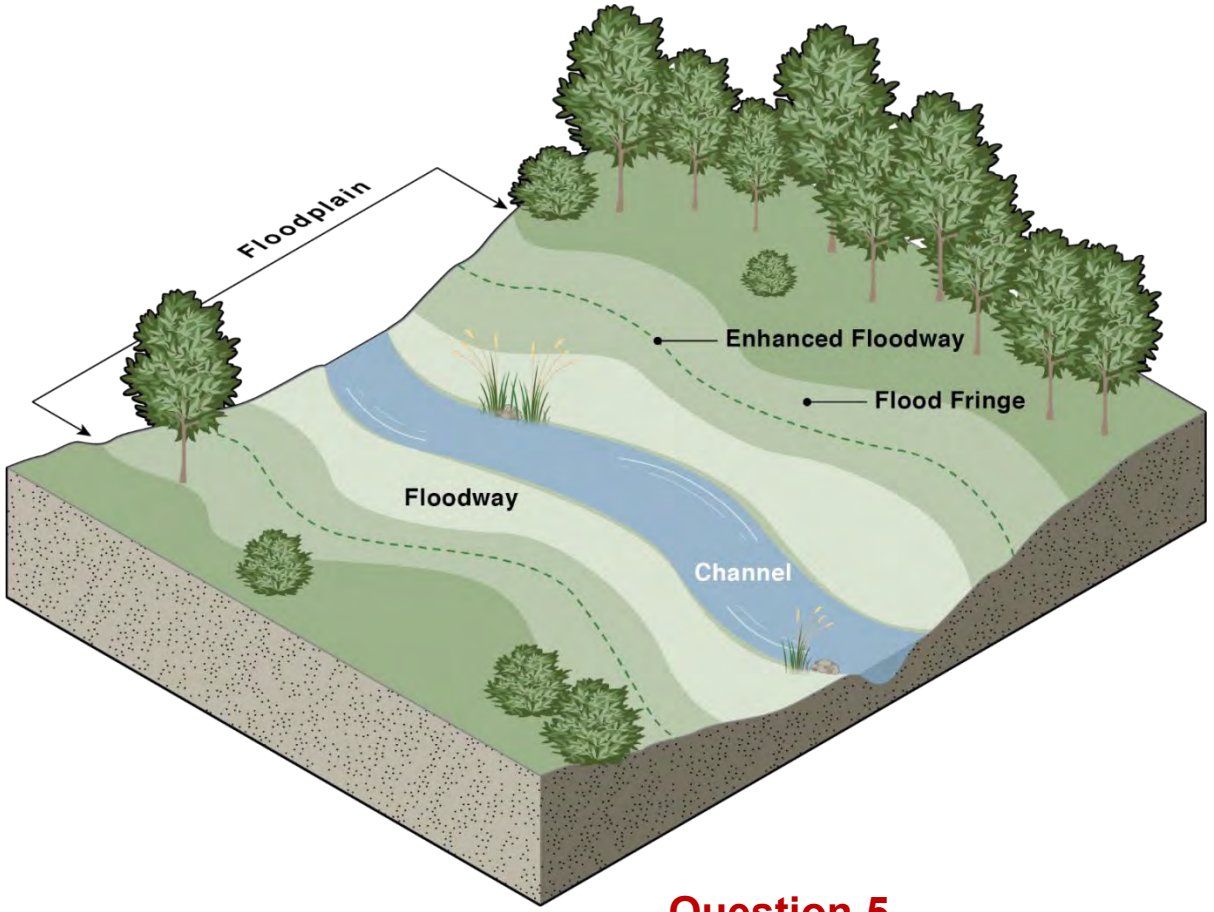
23% of respondent communities are more protective by implementing wider floodways



8%
Define the floodway as the floodplain

15%
Define an enhanced floodway width

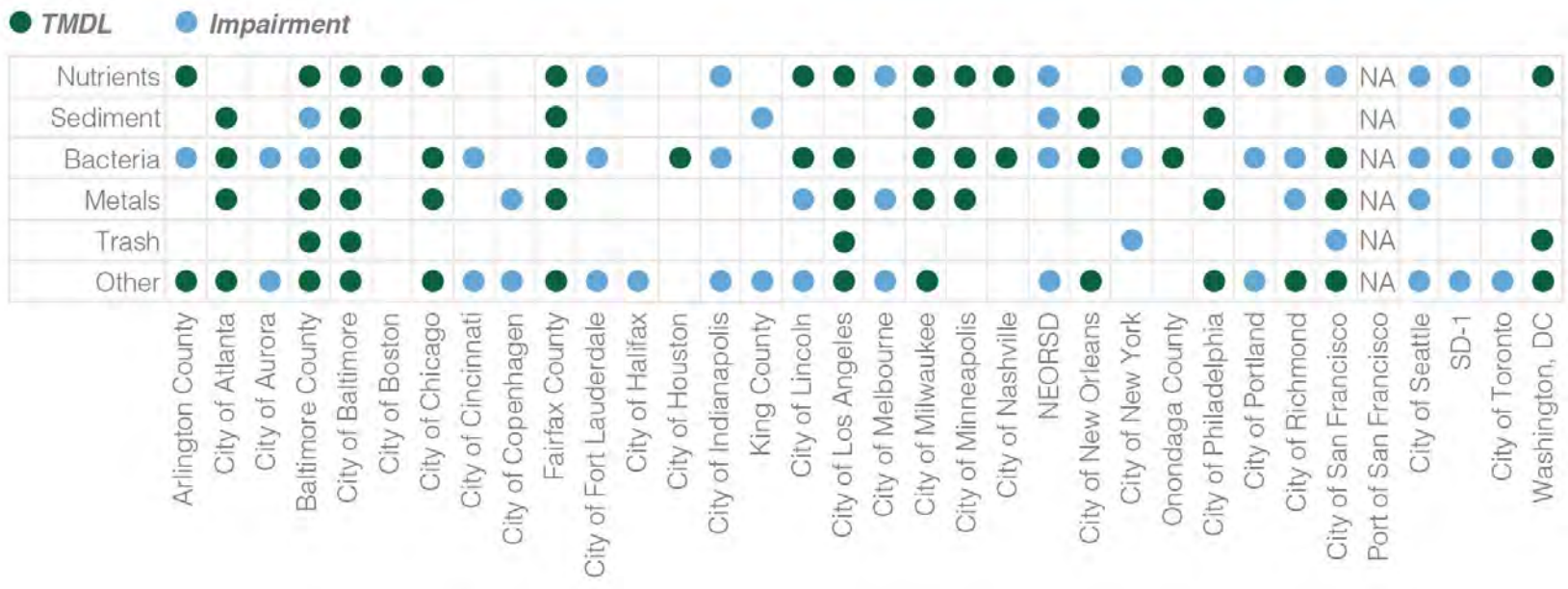
77%
Define the floodway width according to FEMA minimums



Question 5

TMDL Compliance

59% of respondent communities have active TMDLs



73% of respondent communities implement local monitoring to better measure the watershed plan effectiveness

Nashville Case Study

Goal: Remove all streams from the 303(d) list by 2050.

Tools:

- Green infrastructure
- Robust Urban Forestry Program
- Preserved Open Spaces

Source Water Protection

80% of respondent communities with sensitive drinking water sources that can be impacted by stormwater pollution have protection programs.

Common Tools:

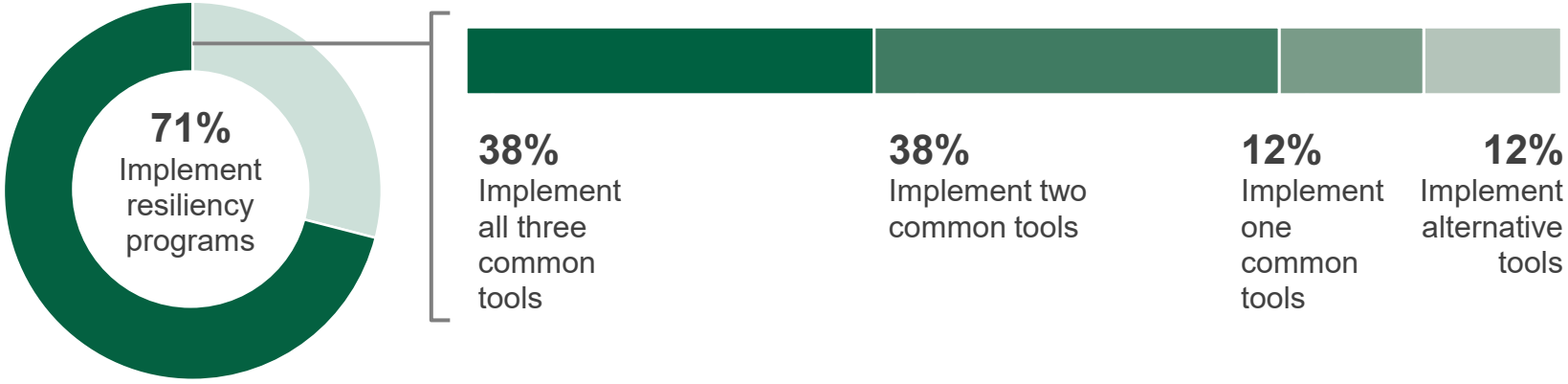
- Land Use Controls
- Riparian Buffers
- BMPs

Climate Change

Main drivers are:

- Drought
- Sea Level Rise
- Heavy Precipitation Events

71% of respondent communities are implementing climate change resiliency programs



Common tools:

- Design standard revisions
- Scenario planning
- Vulnerability/ risk assessments on critical infrastructure

[Question 6]

Copenhagen Case Study

Climate Change Adaptation Plan: Prepared innovative plan to adapt to climate change that considers:

– Increasing precipitation (mainly as rain)

– More intense weather (cloudbursts, storms etc.)

– Summers with dry spells interspersed by heavy thunderstorms

– More annual rain (expected about a 30% increase)

– Rising sea levels

– Rising ground water levels

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Public Education and Outreach

100% of respondent communities have customized public education programs to address local conditions such as pollutants, receiving water, and audience

Common Tools:

- Branding
- Regional Consortiums
- Watershed Signage
- Pollutant-focused Campaigns
- Media

58% of respondent communities participate in regional consortiums to coordinate regional public education

83%
Use only pollutant-focused campaigns

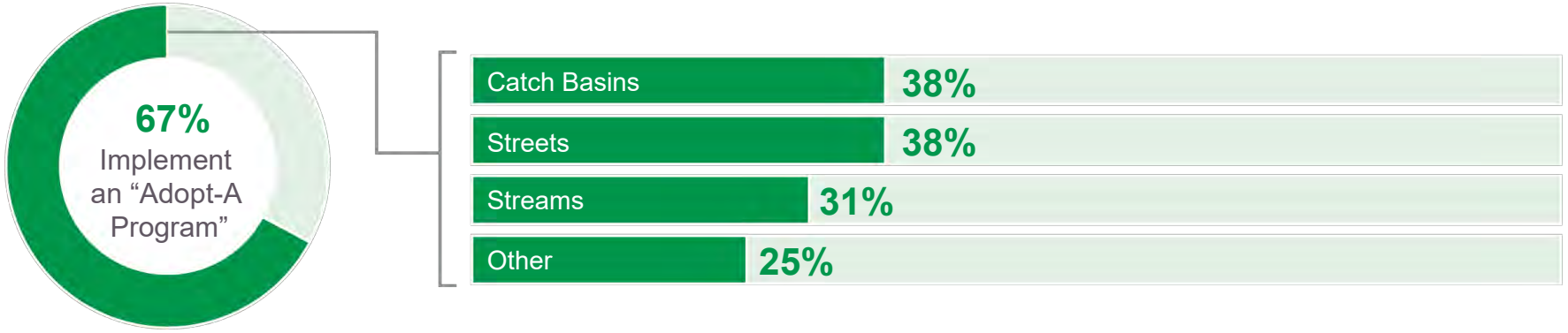
17%
Both pollutant-focused and watershed-focused campaigns

Public Participation and Involvement

87% of respondent communities partner with schools and/or with parks to provide opportunities for public involvement in stormwater pollution prevention.

Other Common Tools:

- Appointed Stakeholder Group Roles
- Rain Barrel Giveaway Programs
- Catch Basin Marking
- “Adopt-A” Programs



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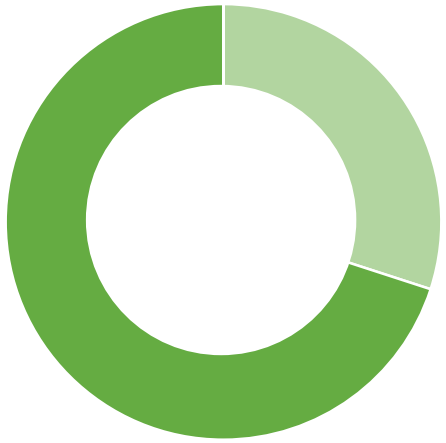
Illicit Discharge Detection Elimination

64% of respondent communities implement a consistent community-wide program

36% of respondent communities implement a watershed-focused IDDE program



69% of respondent communities use monitoring to target future IDDE program efforts to increase effectiveness

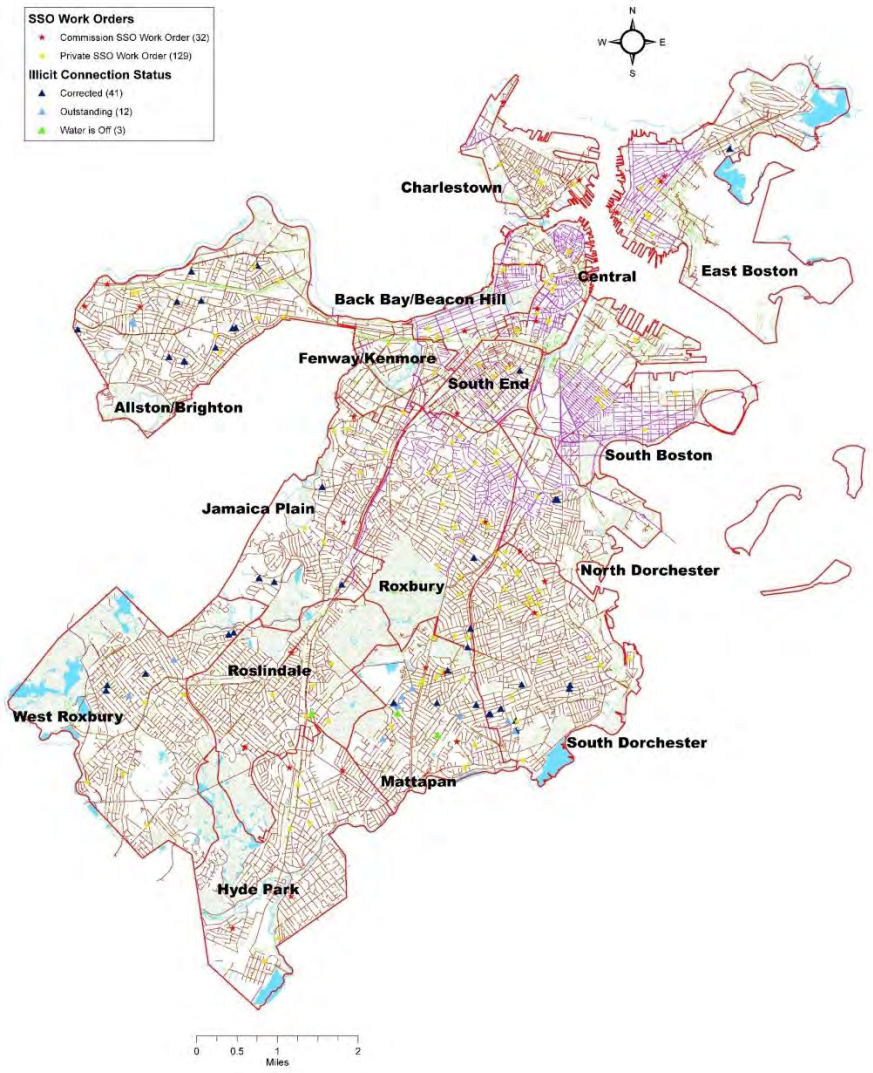
41% of respondent communities perform dry weather screening annually or more-frequent basis

Boston Case Study

Urban Runoff Water Quality Project: Water quality sampling from manholes, outfalls, and gutters. Explores use and effectiveness of alternate parameters to determine sources of bacteria.

Samples are analyzed for:

- Bacterial indicators
- Human DNA markers
- Pharmaceuticals
- Personal Care Products
- Nutrients
- Other Common Parameters



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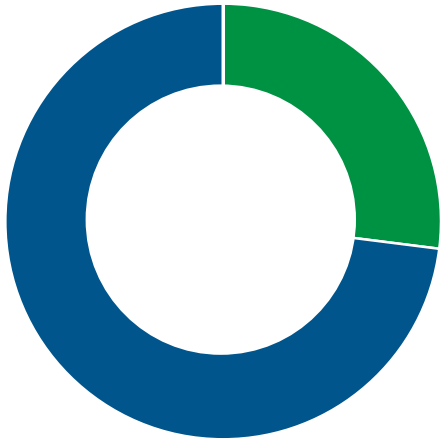
Erosion and Sediment Control

73% of respondent communities are more protective than federal requirements of 1-acre of disturbed area



73%
Have a threshold of < ¼ acre

0%
Have a threshold of ¼ acre to < ½ acre

0%
Have a threshold of ½ acre ≤ 1 acres

27%
Have a threshold of ≥ 1 acres

28% of respondent communities implement enhanced erosion and sediment control such as watershed specific requirements or receiving stream assessments

Question 7

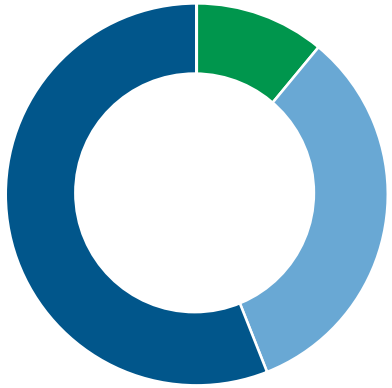
Erosion and Sediment Control

100% of respondent communities encourage compliance by implementing fines for violations of erosion and sediment control requirements

[Question 8]

Post-Construction Stormwater Management

72% of respondent communities are more protective than typical state requirements of 1-acre of disturbed area or 10,000 sf of impervious area



56%
Require both pollutant removal and retention

33%
have only a retention requirement

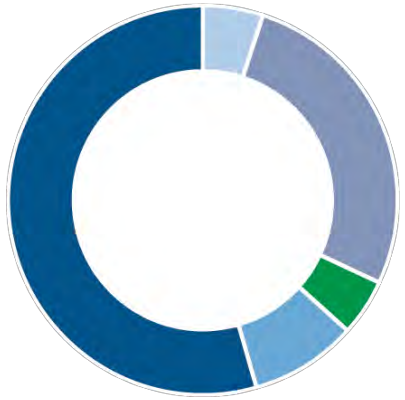
11%
Have only a pollutant removal requirement

43% of respondent communities implement enhanced post-construction stormwater management requirements to protect sensitive watersheds

Post-Construction Stormwater Management

55% of respondent communities have a disturbed area threshold lower than ¼ acre
53% of respondent communities have an impervious area threshold lower than 2,500 sf

Disturbed Area Thresholds



55%
Have a threshold < ¼ acre

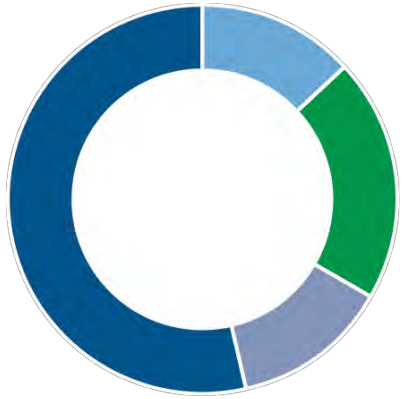
8%
Have a threshold from ¼ acre to < ½ acre

5%
Have a threshold from ½ acre < 1 acre

27%
Have a threshold of 1 acre

5%
Have a threshold > 1 acre

Impervious Area Thresholds



53%
Have a threshold < 2,500 sf

13%
Have a threshold from 2,500 sf to < 5,000 sf

21%
Have a threshold from 5,000 sf to < 10,000 sf

13%
Have a threshold ≥ 10,000 sf

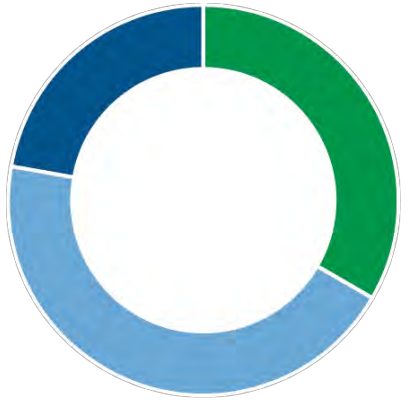
Questions 9 and 10

Post-Construction Stormwater Management

23% of respondent communities that require pollutant removal focus on both nutrients and sediment

The median retention design depth is **1.0 inch.**

The average detention time is **34 hours.**

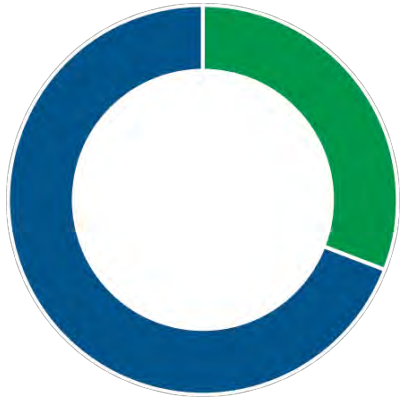


23%
Require both nutrient and sediment removal

44%
Require only nutrient removal

33%
Require only sediment removal

Redevelopment



69%
Require meeting all design goals

31%
Flexible requirements meeting design goals

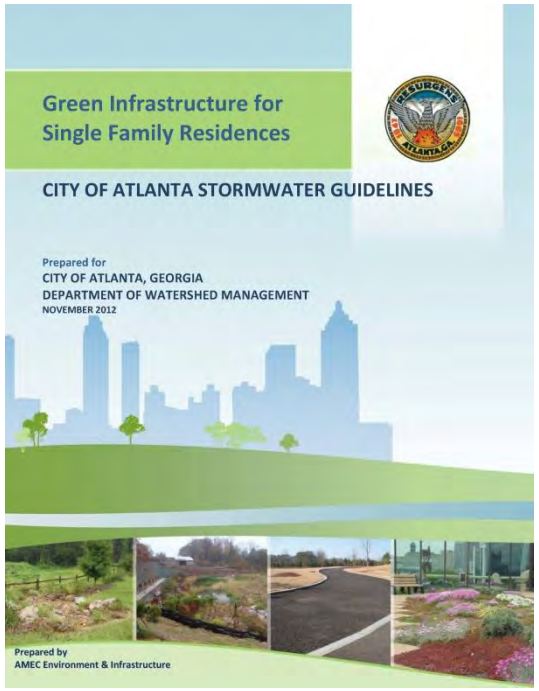
Questions 11 and 12

Atlanta Case Study

Post-Construction Stormwater Ordinance

2004:

- Focused on water quality
- Retention Requirement for 1.2-inches of runoff
- Remove 80% of TSS



2013:

- New non-residential development that involves creation of impervious cover
- Redevelopment that includes creation, addition, or demolition and replacement of ≥ 500 sf of impervious cover
- Demolition that leaves in place ≥ 500 sf of impervious cover
- Single family residential development for new homes and large additions ≥ 1000 sf
- Water quality requirements include treating the 1st 1-inch of runoff with green infrastructure

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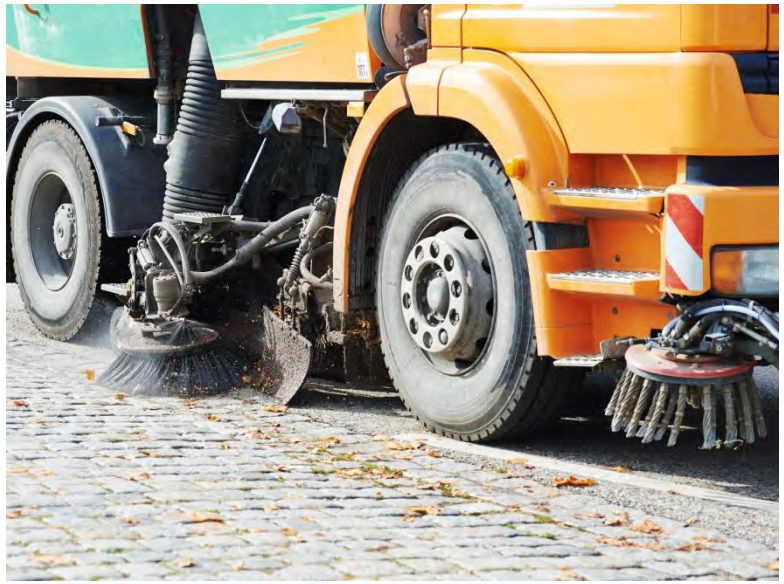
Municipal Facilities Pollution Prevention

62% of lead agencies prioritize facilities with high potential for release of pollutants of concerns

86% of communities have changed their operational methods to reduce pollution



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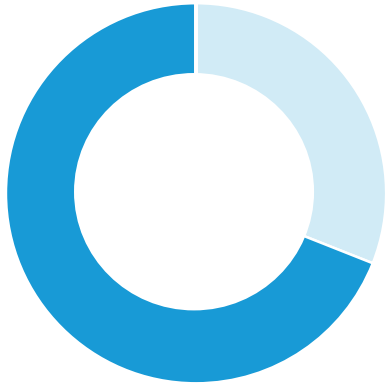
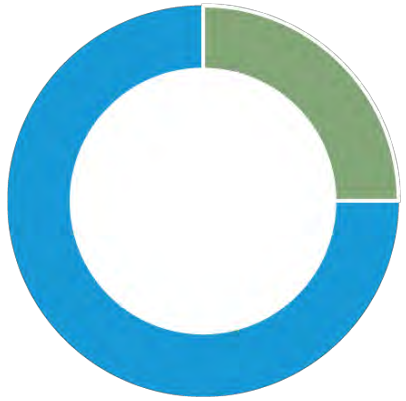
Industrial Stormwater Management

15% of respondent communities perform inspection and enforcement of privately-owned industries;
52% perform only inspections

69% of respondent communities prioritize high pollutant potential facilities





75%
Include non-traditional industries

25%
Include only NPDES industrial permit holders

33% of respondent communities complement city-wide monitoring with industrial facility monitoring

Question 13

Indianapolis Case Study

Program Requirements:

- Identification of sources
- Maintenance of an inventory/database of sources
- Inspections of sources at least once during the permit term
- Annual inspections of 10 automobile service facilities
- Annual inspections of 10 retail gasoline stations
- Support enforcement actions

2005 Efforts and Results:

- 27 automobile facilities inspected in 2005
- 27 retail gasoline facilities inspected in 2005
- Results did not indicate that these facilities are significant sources
- Led to comprehensive outreach and education

Restaurant Inspection Program:

- 1,421 restaurants
- Inspections at least once each permit term
- Parameters:
  - Trash
  - Vehicle residue
  - Grease
- Focus Areas:
  - Parking lot
  - Trash dumpster
  - Grease dumpster

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Floatables

76% of the programs implement a floatable program. **57%** of programs responding to regulatory requirements also have a floatables TMDL

70% of respondent communities implement structural controls for floatable reduction

Floatable Controls (most common to least common)

- Public Education
- Netting or Litter Traps
- Focused street sweeping
- Volunteers
- Catch Basin Inserts or Hoods
- Bag Tax and Styrofoam Laws

47% of respondent communities prioritize hot spot areas for floatable reduction

Los Angeles Case Study

Floatable Structural Control:

Flow Activated Catch Basins are used to maximize the amount of trash kept on the street and minimizes flooding. Los Angeles sets the trigger at which the screen will swing open.

New York City Case Study

Floatable Media Campaign:

In partnership with the Wildlife Conservation Society and centered around the New York Aquarium in Coney Island, this media campaign highlights the impact of litter on local waterways and wildlife, and aims to reduce littering behavior.

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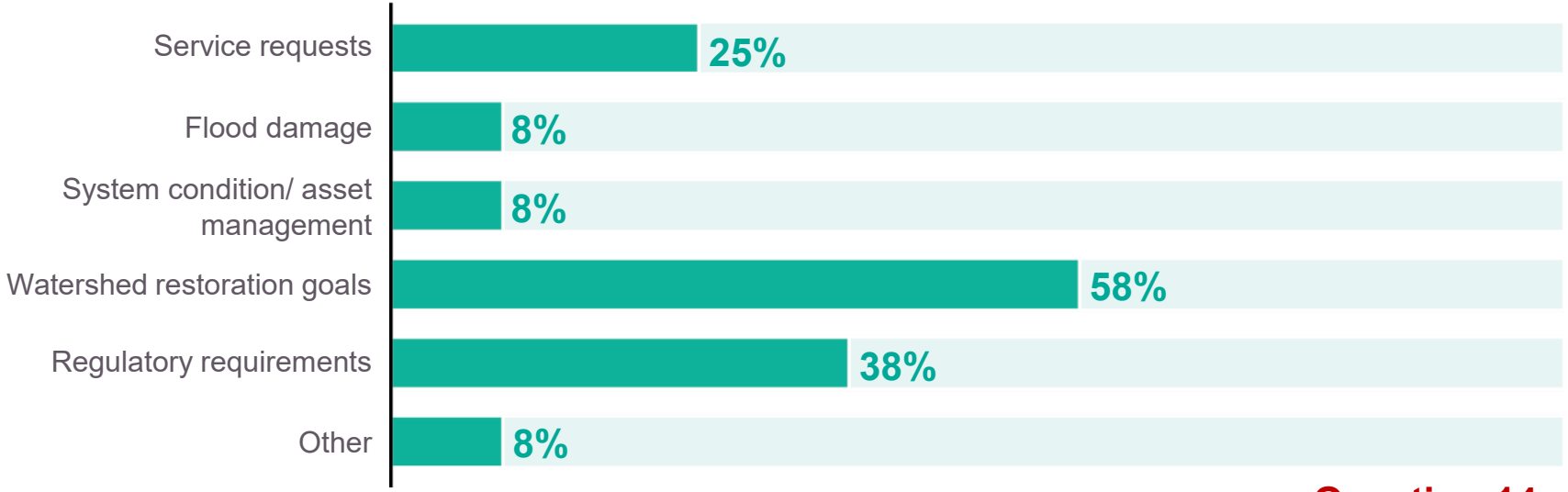
Structural Stormwater Controls

100% of communities implement a structural stormwater management program; **94%** of these use a combination of green and gray infrastructure

50% of communities implement structural control programs on the entire system (public and private property)

Structural Control Program Drivers



Question 14

New York City Case Study

Staten Island Bluebelt: drainage infrastructure to mitigate flooding issues for approximately 1/3rd of Staten Island's land area

Stormwater BMPs
- Constructed wetlands
- Outlet stilling basins
- Stream restorations

Provide:
- Water quality treatment
  - Nutrient Removal
  - Bacteria Removal
  - Organics Removal
- Extended detention

Scale:
- 62 BMPs of 124 constructed to date
- Capital program extends to 2043

Key Elements

1. Introduction
2. Innovative Stormwater Planning, Policy, and Regulations
3. Public Involvement and Education Programs
4. Illicit Discharge Detection and Elimination Programs
5. Construction and Post-Construction Stormwater Management Programs
6. Municipal Facilities Pollution Prevention Programs
7. Industrial and Commercial Stormwater Management Programs
8. Floatables and Street Litter Reduction Programs
9. Structural Stormwater Controls
10. **Stormwater Monitoring**
11. Funding Sources and Financial Incentive Programs

Stormwater Monitoring

44% of respondent communities perform land use/ wet weather monitoring
80% of respondent communities perform in-stream monitoring

The average number of land use monitoring sites is 5 with an average annual monitoring frequency of 7.

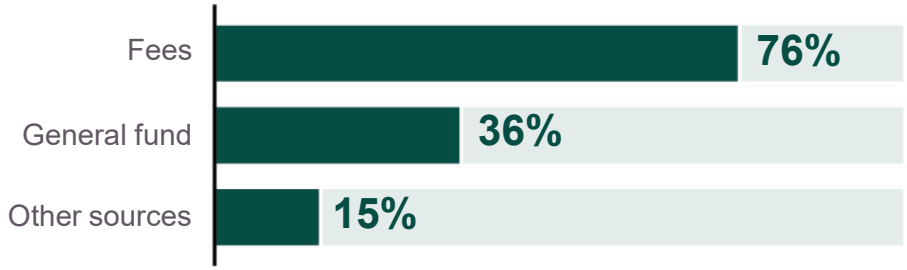
The average number of in-stream monitoring sites is 30 with an average annual monitoring frequency of 8.

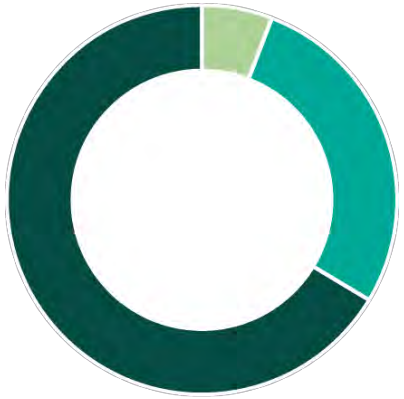
Key Elements

1. Introduction
2. Innovative Stormwater Planning, Policy, and Regulations
3. Public Involvement and Education Programs
4. Illicit Discharge Detection and Elimination Programs
5. Construction and Post-Construction Stormwater Management Programs
6. Municipal Facilities Pollution Prevention Programs
7. Industrial and Commercial Stormwater Management Programs
8. Floatables and Street Litter Reduction Programs
9. Structural Stormwater Controls
10. Stormwater Monitoring
11. **Funding Sources and Financial Incentive Programs**

Funding Sources

76% of communities use a stormwater fee to fund stormwater management programs





66%
Impervious-based stormwater utility

28%
Flat rate utility

6%
Development intensity-based stormwater utility

The **average monthly** residential stormwater fee is **$8.79** for the communities that utilize a stormwater fee.

Question 15

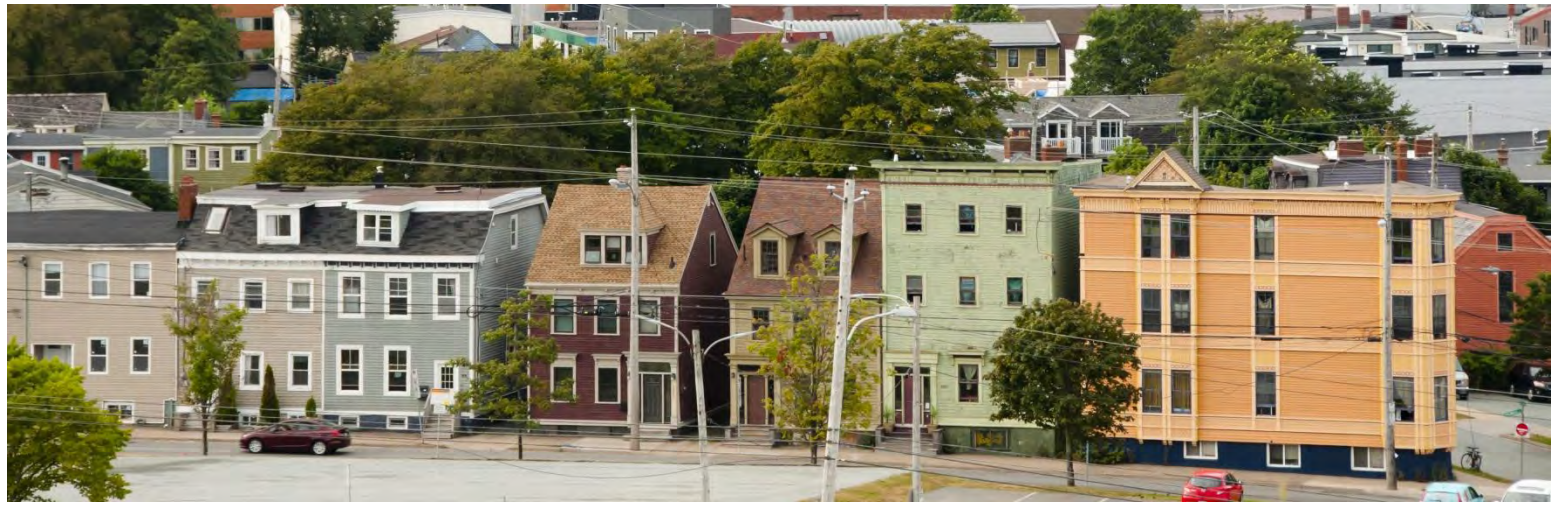
Halifax Case Study

Change: Went from a flat rate stormwater fee to a tiered system.

Basis of Tiered System - Residential: Median impervious area associated with residential properties

Basis of Tiered System – Non-Residential: Exact calculated impervious area

- Previously billed per 1 m^2, change to billed per 10 m^2
- Charge each unit based on the contribution it makes



Financial Incentive Programs

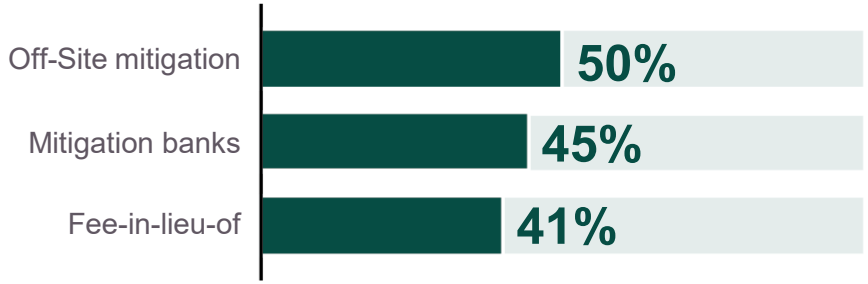
Types of Financial Incentive Programs

- Stormwater Fee Credits
- Off-site Mitigation Programs
- Fee-In-Lieu-Of Programs
- Green Infrastructure Grant Programs

62% of communities with stormwater fees offer a stormwater fee credit program

Average maximum fee credit is **70%** of the stormwater fee

65% of communities offer a green infrastructure grant program



Questions 16

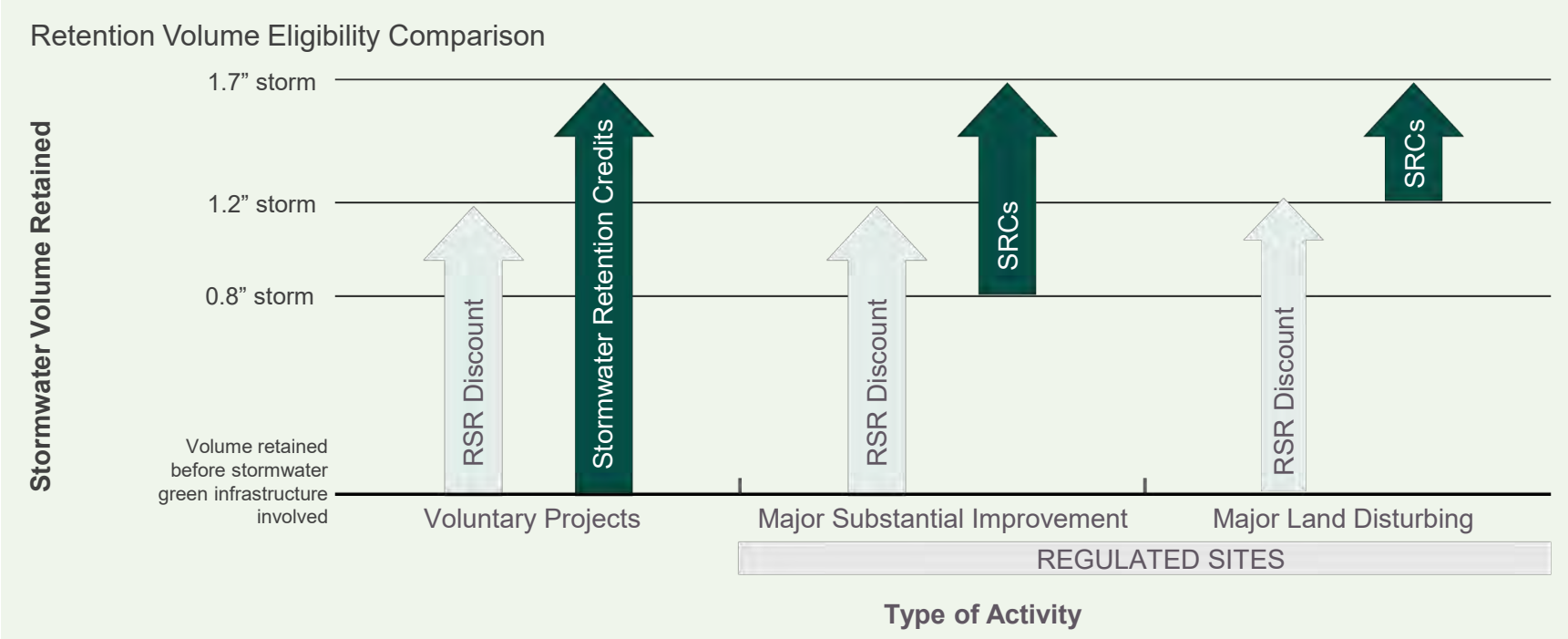
Washington, DC Case Study

Stormwater Retention Credits

- Earn credits by doing voluntary retrofits with green infrastructure
- Buy and sell credits to properties that are subject to regulation
- DOEE oversees the exchange through a registry

RiverSmart Rewards

- Private property rebates for green roofs, rain barrels, newly planted trees, and stormwater management facilities
- Has to manage impervious surface



Lessons Learned and Conclusions

Comprehensive planning of permit compliance, consent decree compliance, TMDL compliance, etc. allows for efficiencies to be identified and overall goals coordinated while also meeting minimum regulatory requirements.

Post-construction requirements that target specific waterbody impairments, not just state minimums, better leverage community investment.

Co-assessing all three water infrastructures results in cost-savings and co-benefits.

Comprehensive **monitoring programs** that assess all monitoring needs and measure actual receiving waterbody improvements provide the basis for more cost-effective programs.

waterrf.org/resources/pages/NYC-Stormwater-Report.aspx