



# **Green Infrastructure in New York City**

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Comprehensive Water Resource Management  
CSOs, Green Infrastructure and Stormwater

Hackensack Meadowlands Commission

Monday, April 29, 2013

# Overview

**Overview:** \$192 million is budgeted for green infrastructure in combined sewer areas through 2015, including Environmental Benefit Project funds.

## 1. Area-Wide Contracts

## 2. On-site Construction

## 3. Neighborhood Demonstration Areas

## 4. Green Infrastructure Grant Program:

- \$3.4 million committed for 2011
- \$3.4 million committed for 2012

## 5. Other programmatic areas include:

- DPR Maintenance Program
- Asset Management System
- Research & Development
- Outreach



*Plan included a citywide goal of managing runoff from 10% of impervious surfaces in combined sewer areas.*

# Wastewater Drainage & Collection

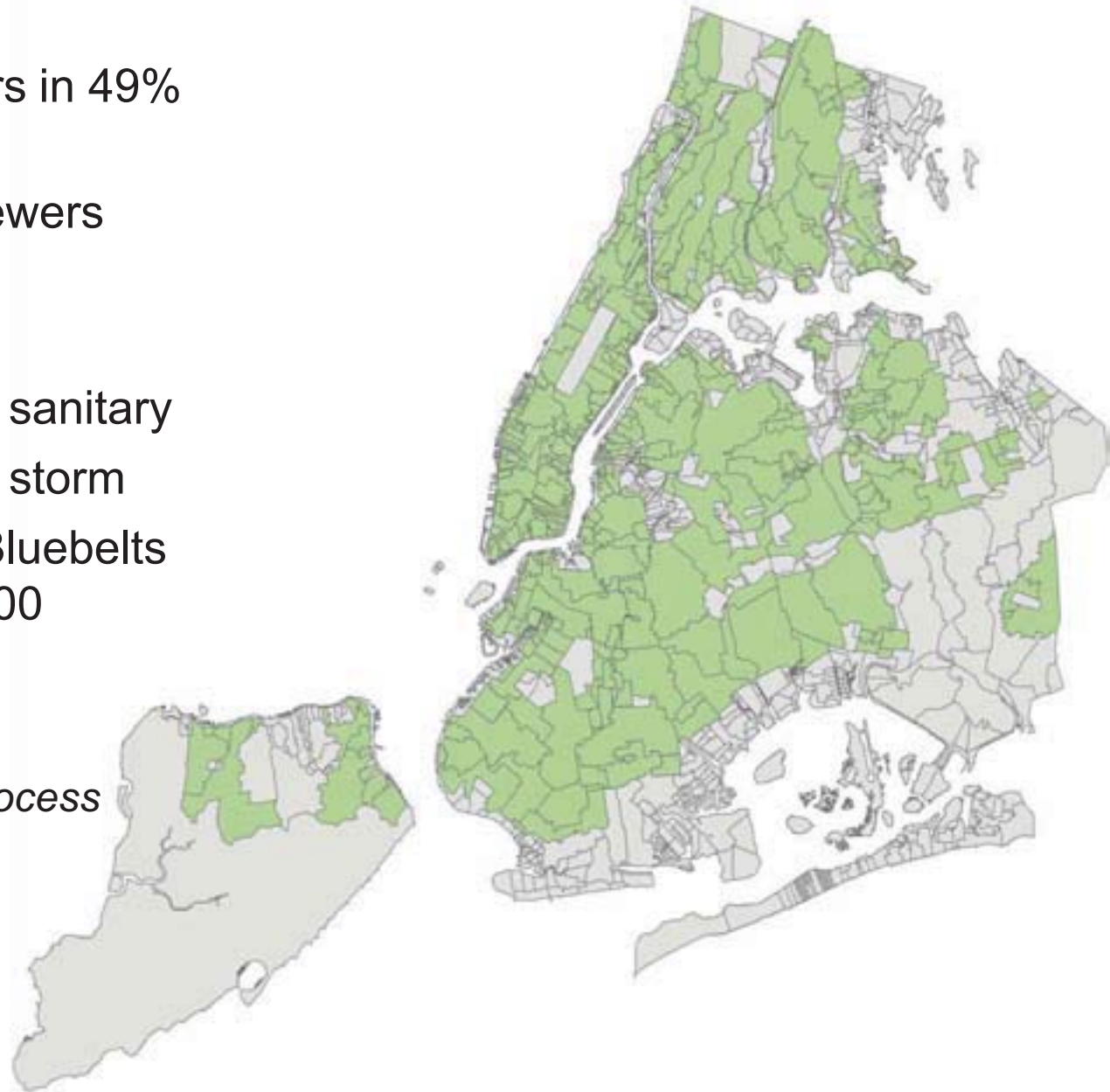
- ❖ DEP-operated facilities
  - 14 city treatment plants
  - 4 CSO retention facilities
  - 96 pumping stations
  - 514 sewer regulators
  - 426 combined sewer outfalls
- ❖ Treat 1.3 billion gallons of dry weather flow per day (permitted capacity equals 2 times dry weather flow)



# Sewer System

- ❖ Combined sewers in 49% of the city
- ❖ 7,400 miles of sewers
  - 3,337 miles of combined
  - 2,271 miles of sanitary
  - 1,801 miles of storm
  - 400 acres of Bluebelts (draining 14,500 acres)

*\*Above statistics in process of being updated*



# Modified 2012 CSO Order

- ❖ Builds upon success of 2005 CSO Order
  - Four major CSO storage facilities completed and online
  - Recommended plans from approved Waterbody/Watershed Facility Plans (WWFPs)
  - 12 of 16 CSO impacted tributaries projected to meet existing water quality standards



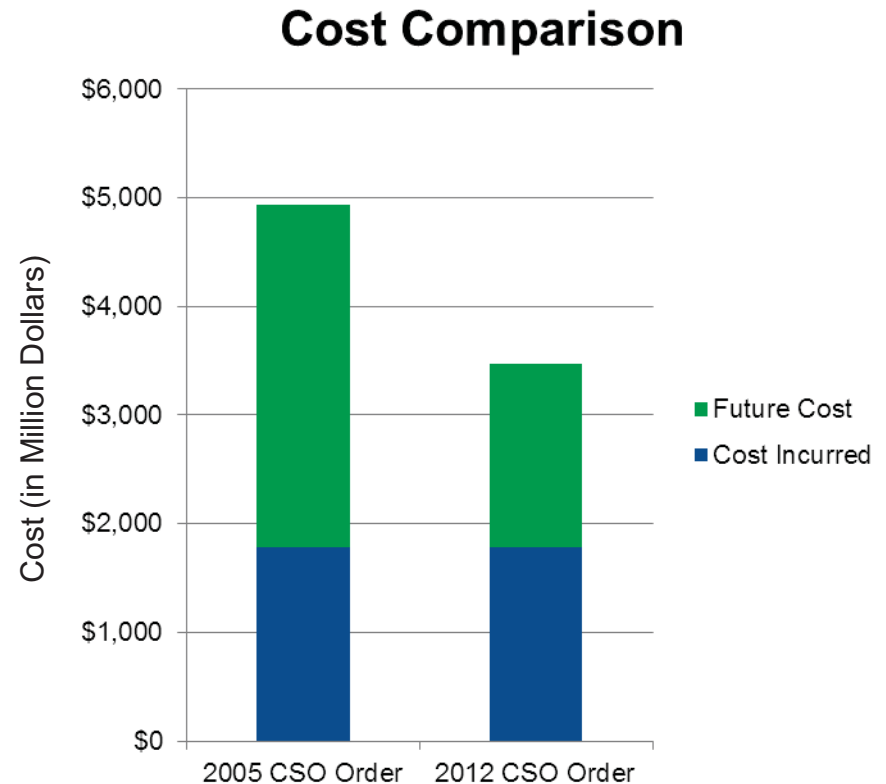
**Paerdegat Basin CSO Retention Facility**



**Flushing Bay CSO Retention Facility**

# Modified 2012 CSO Order (cont)

- ❖ Substitutes in more cost effective grey and green infrastructure projects
  - Eliminates \$1.4 billion of tanks and WWTP wet weather expansions in lieu of more cost effective CSO controls
  - Defers over \$2 billion in CSO tunnels
  - Green infrastructure investments over 20 years to manage runoff from impervious areas including commitment to spend \$187 million by 2015



*GI implementation would cost approximately \$2.4B beyond the 2012 CSO Order costs above; of which, \$1.5B would be public investment and \$0.9B would be private investment in GI by 2030.*

# Modified Consent Order 2012 (cont)

CSO Watershed	LTCP Due Date
Alley Creek LTCP	June 2013
Coney Island LTCP	June 2014
Hutchinson River LTCP	September 2014
Flushing Creek LTCP	December 2014
Bronx River LTCP	June 2015
Gowanus Canal LTCP	June 2015
Jamaica Tributaries & Bay LTCP*	June 2016
Westchester Creek LTCP	June 2016
Flushing Bay LTCP	June 2017
Newtown Creek LTCP	June 2017
Citywide LTCP**	December 2017

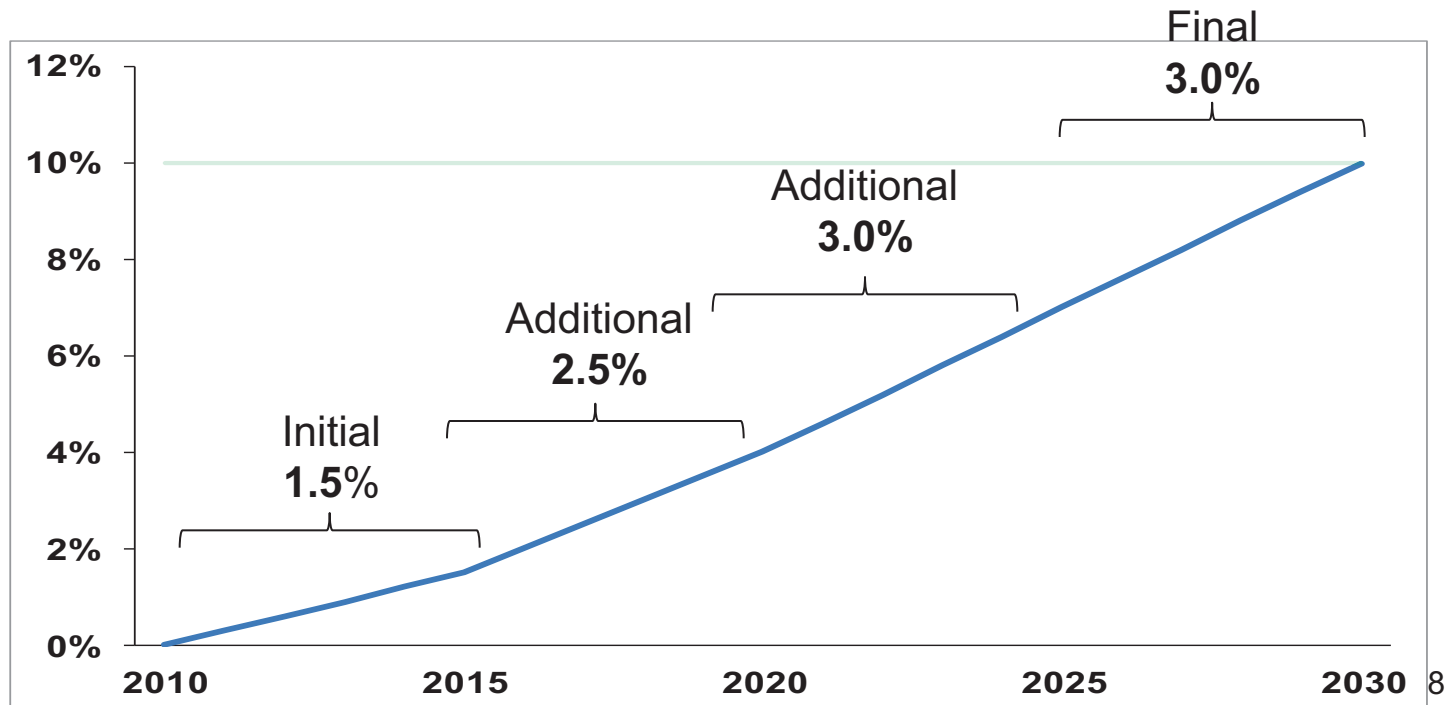
\*The 2005 Order required separate LTCPs for the Jamaica Tributaries and Jamaica Bay. They are now to be combined into a single LTCP under this Order.

\*\*The Citywide LTCP shall include the East River and Open Waters.

# Integrating GI into LTCPs

- ❖ Allows for the development of watershed-specific GI application rates for 2030 as part of baseline conditions and related CSO control credits for the development of specific LTCPs
- ❖ LTCPs will determine watershed specific relationship between stormwater management and CSO volume reductions based on area-wide GI demonstration projects and modeling
- ❖ Cumulative watershed-specific GI application rates must achieve citywide 10% application rate and modeled CSO volume reduction metrics of the CSO Order

**Green Infrastructure Application Rates and Milestone Schedule**





# Watershed Prioritization

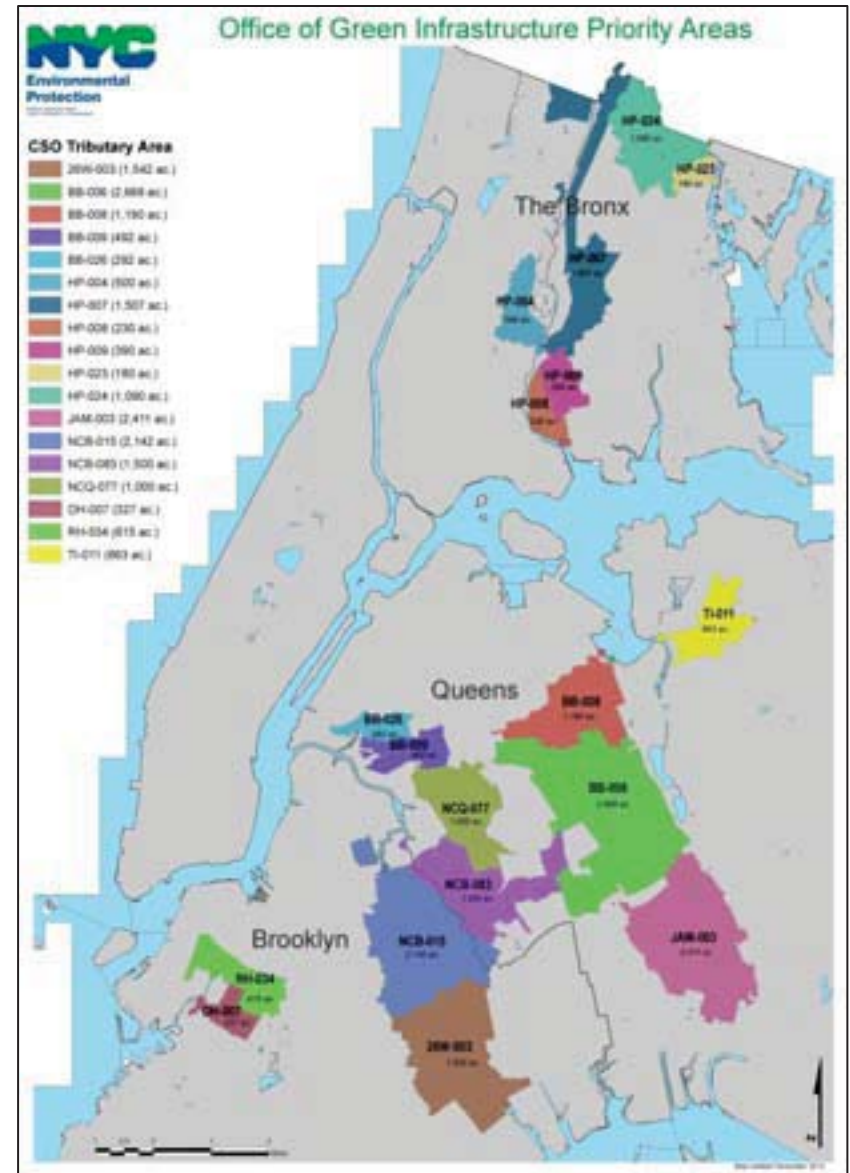
DEP has developed and applied water quality, CSO volume and other criteria to compare and prioritize watersheds for various GI application rates:

- Meeting water quality standards
- Planned/constructed grey controls including projected CSO volume reductions, remaining CSO volumes and capital costs
- Ratio of separate stormwater discharges to CSO discharges
- Preliminary information about watershed sensitivity to GI in terms of cost per gallon of CSO reduced



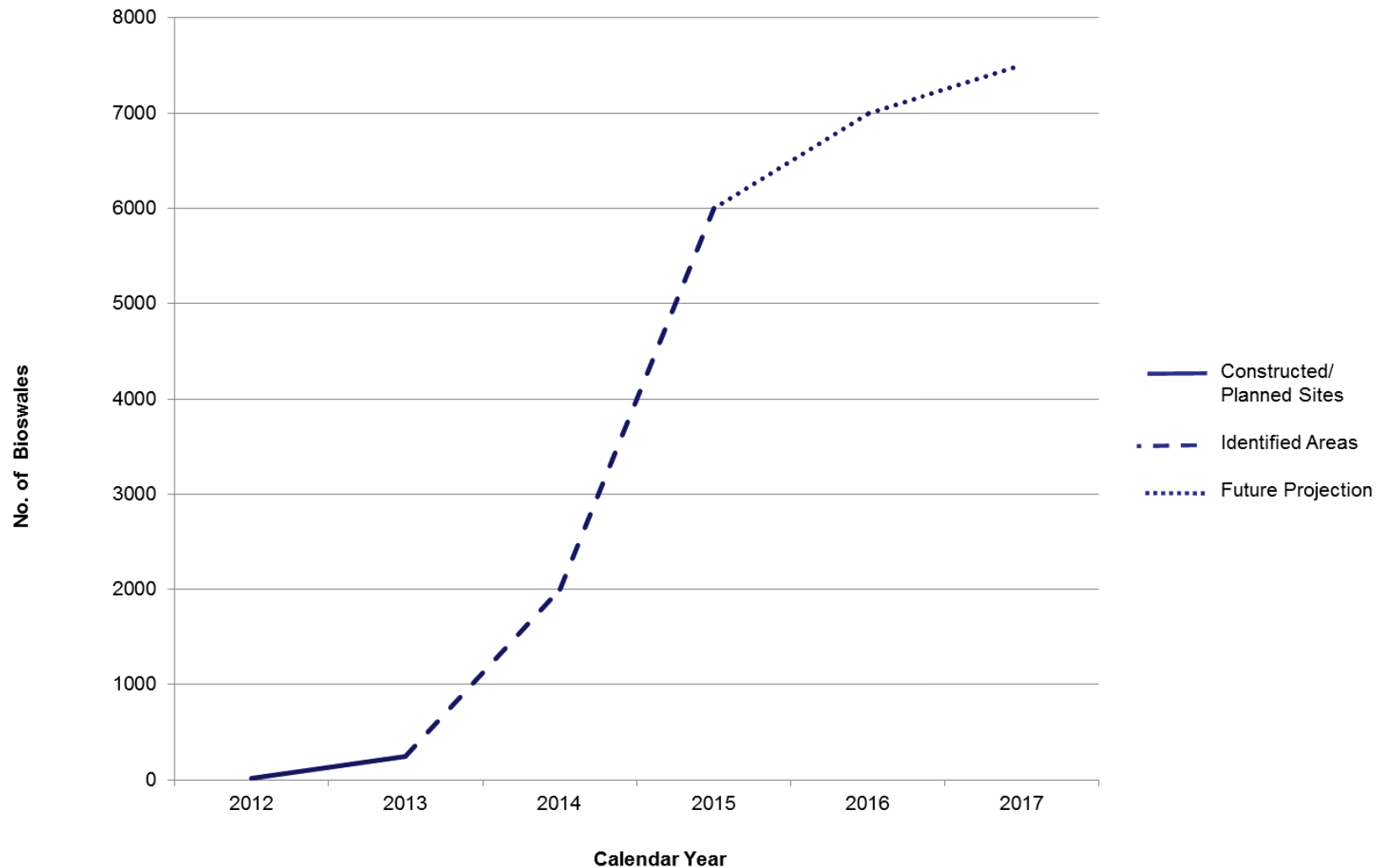
# DEP's Area-Wide Approach

- Initial priority combined sewer tributary areas were selected based on:
  - CSO volume
  - CSO frequency
  - Receiving water body quality
- Additional criteria included proximity to public access locations and locations of planned improvement projects
- DEP will utilize area-wide contracts for GI design and build-out throughout entire CSO subcatchment
- DEP is working with other agencies to construct Right of Way Bioswales (ROWBs) in priority areas to meet CSO Order targets



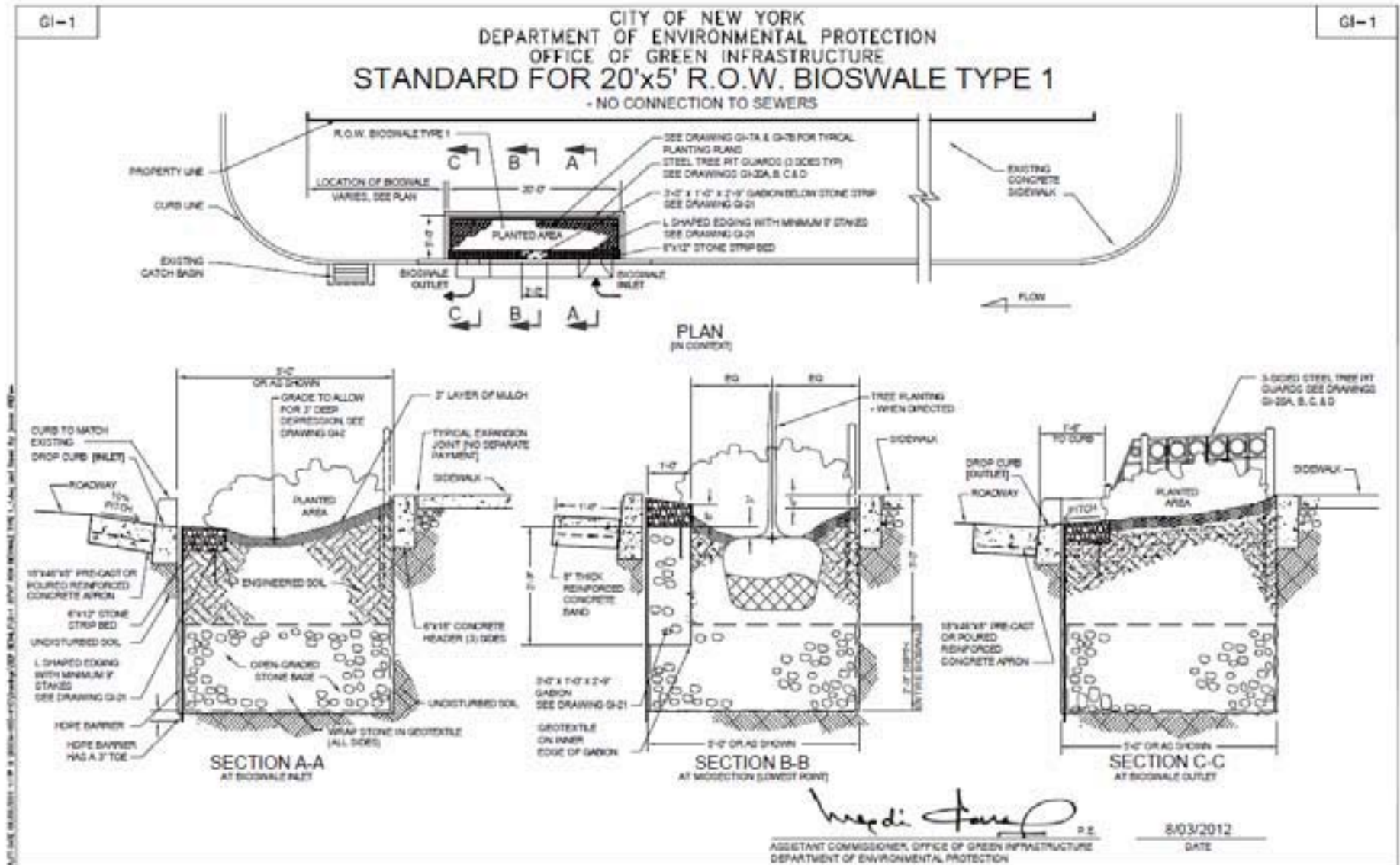
# Bioswale Projections for 2015

## Bioswale Construction Target\*



\*In partnership with EDC, DDC, DPR, other agency partners, and on its own, DEP's Office of Green Infrastructure has initiated many area-wide GI projects in priority CSO tributary areas. The final number of ROWBs to be constructed under these contracts is contingent upon the meeting of OGI standards, specifications, and siting criteria.

# Right of Way Bioswale (ROWB) Standards



# Right of Way Bioswale (ROWB) Rendering



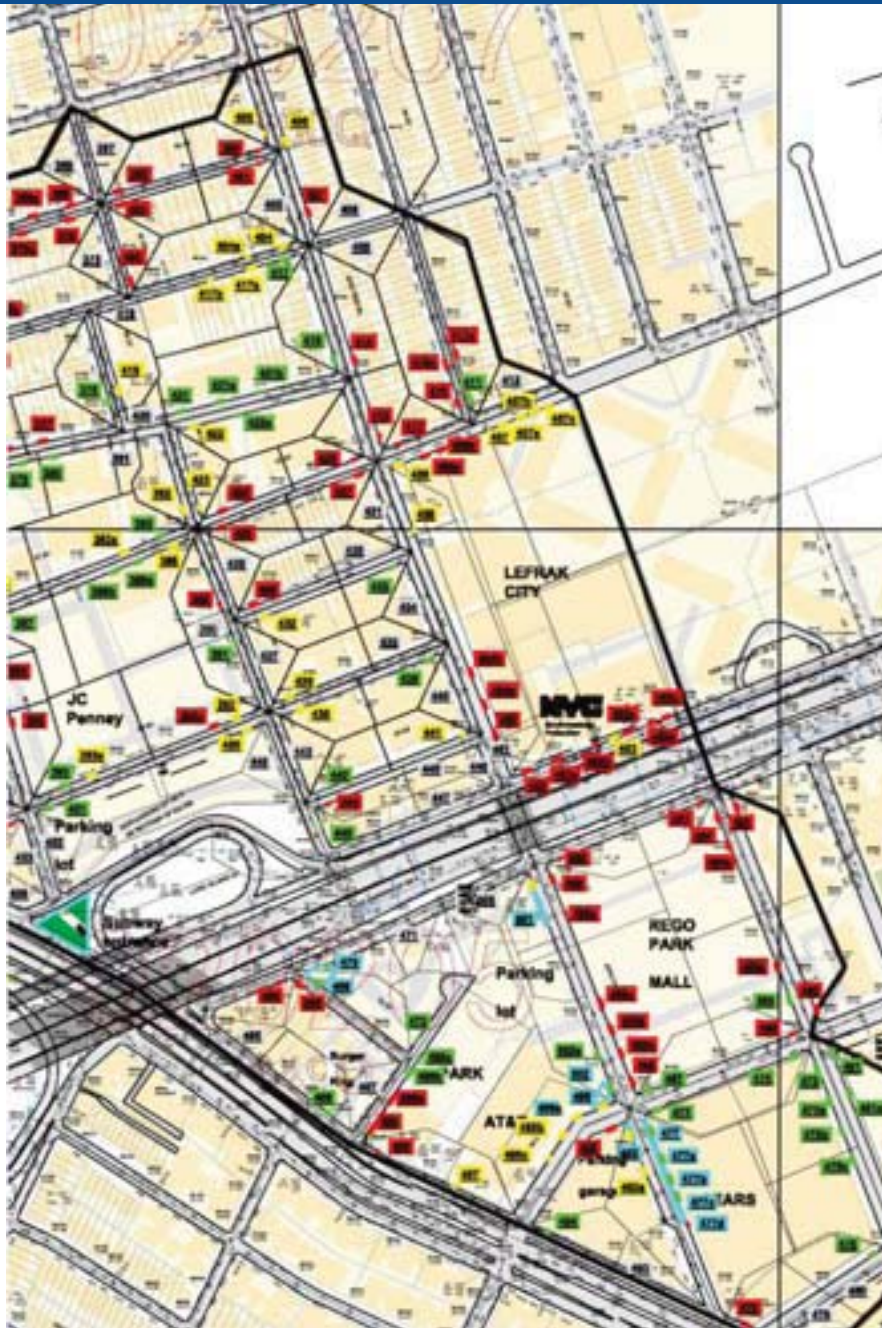
# Standard ROWB Components



# Bioswales In Action



# ROWB Site Selection Example: Flushing



## 1. Potential –

- Desktop Analysis
- Walkthrough

## 2. Preliminary –

- Survey
- Geotechnical Investigation

## 3. Final –

- Approved sites included in contract plans

Red = Eliminated Potential Sites

Yellow = Pending DOT Approval

Green = Preliminary Site

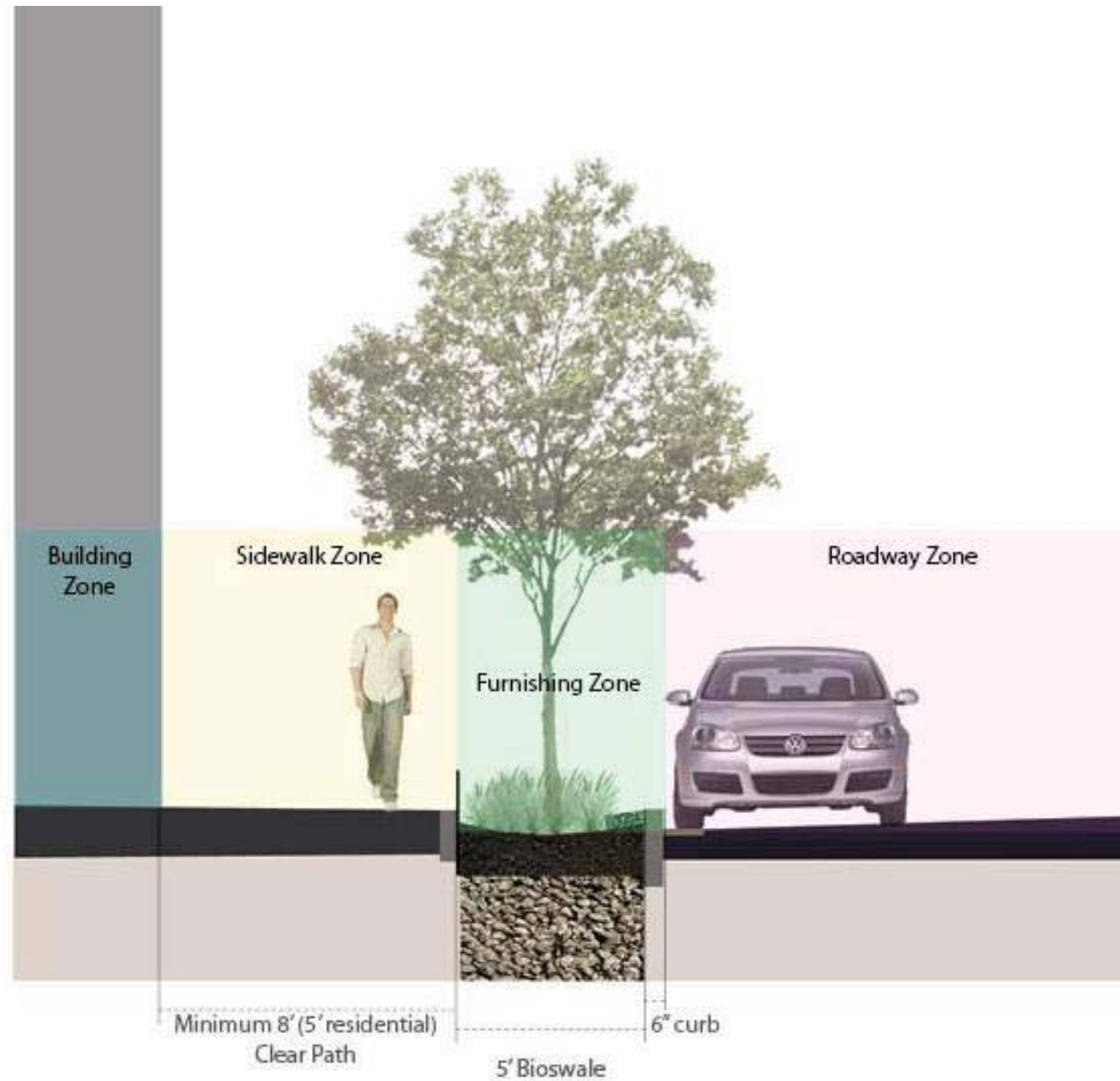
Blue = Proposed SW Greenstreet



# Bioswale Siting Criteria

ROW Siting Criteria examples:

- Mature Trees
- Sidewalk widths (8' or 5')
- Fire Hydrants
- Pedestrian Ramps
- Building Entrances/Exits
- Driveways
- Muni Meters
- Bus Stops



- Maintenance MOU between DEP, Department of Parks & Recreation and Department of Transportation signed November 2011:
  - Clearly defines roles and responsibilities for ROW installations
  - DEP will provide funding to DPR for maintenance based on DEP-approval of design and location in the right of way
  - DOT will maintain to the extent practicable the existing grades during milling and resurfacing operations when working around G.I. systems
  - DEP will continue to maintain catch basins and other existing roadway drainage elements
- DEP and NYCHA executed an MOU in January 2012.
- Pending MOUs with NYC HHC, DPR-Parklands, TPL/SCA/DOE.

# Other Public Projects & Interagency Coordination

## Jamaica Bay & CSO Tributaries Watershed

**Planned Right-of-Way  
Projects (DOT)**

**Parks & Playgrounds  
(DPR)**

**Multi-Family Residential  
Housing (NYCHA)**

**Public Schools  
(DOE)**



# Green Infrastructure Grant Program

\$6.8 million has been allocated to private property owners to build green infrastructure in the combined sewered areas of New York City in 2011 and 2012. Up to \$6 million is available in 2013. Applications are due February 19<sup>th</sup> and can be found at [www.nyc.gov/dep/grantprogram](http://www.nyc.gov/dep/grantprogram)



**Rooftop Farms/Green Roofs**

Brooklyn Navy Yard - Building No. 3



**Rain Gardens/Permeable Pavers**

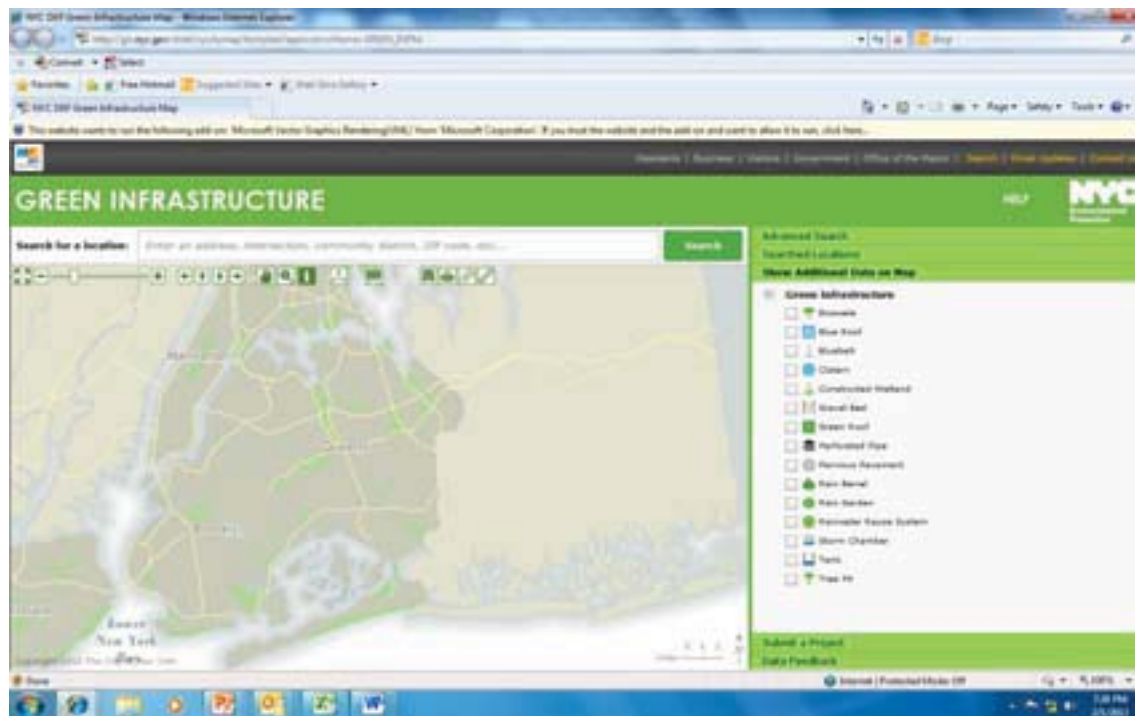
Queens College – Remsen Hall

- **Green Infrastructure Stakeholders**
  - Citizen's Group:  
*citywide public meeting and listserv*
  - Steering Committee:  
*focused on GI implementation related to Green Jobs, Technical Advice & Research, Education & Engagement*
- **Construction Notification**
  - “Bioswales are Coming to your Neighborhood” postcard mailed to 25,000 addresses in project areas
  - Presentations to Community Boards, Elected Officials, and Local Community Groups
- **Education and Engagement**
  - ROW Bioswale Care Stewardship Program with MillionTreesNYC
  - Rain Barrel Giveaway Programs



# GI Program Tracking & Webmap

- Project Tracking and Asset Management System in development
- GI Webmap Application
  - Public facing map for all GI projects built on public property and via grant program
  - Allows private property owners to add their GI projects
  - Users can click to identify specific projects and related info (project name, GI technology, location and available photos)



# Stormwater Performance Standard

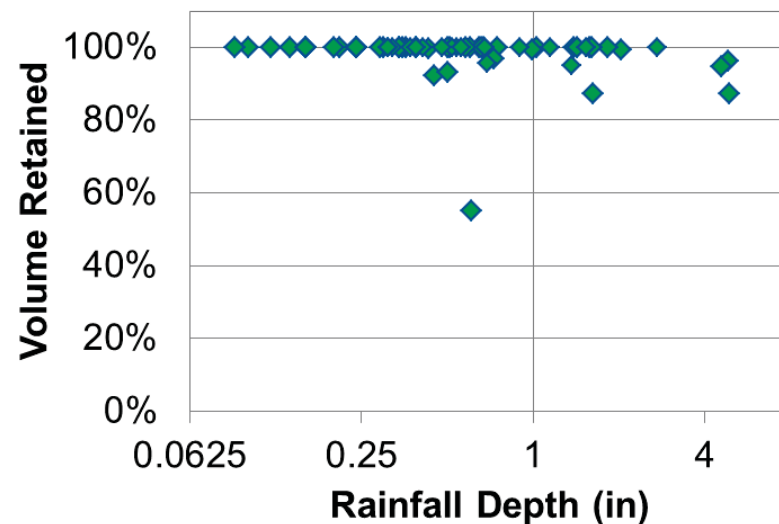
- Effective July 4, 2012 as amendment to Chapter 31, Title 15 of Rules of the City of New York
- Modifies the flow rate of stormwater to the city's combined sewer system for new and existing development, as part of sewer availability and connection approvals
- Provides incentives for green infrastructure, including recycling and infiltration systems
- Companion guidance document issued to assist applicants toward compliance



## Preliminary observations:

- All green infrastructure controls are providing stormwater management benefits
- Bioretention controls appear to come close to fully managing the 1-inch rainfall
- Streetside swales perform similar to bioretention except when inlets found to be clogged or large drainage area to footprint ratio
- There has been no measured flow from porous asphalt or pavement underdrain systems

Monitoring results for a rain garden with a drainage to GI footprint area ratio of 17:1.

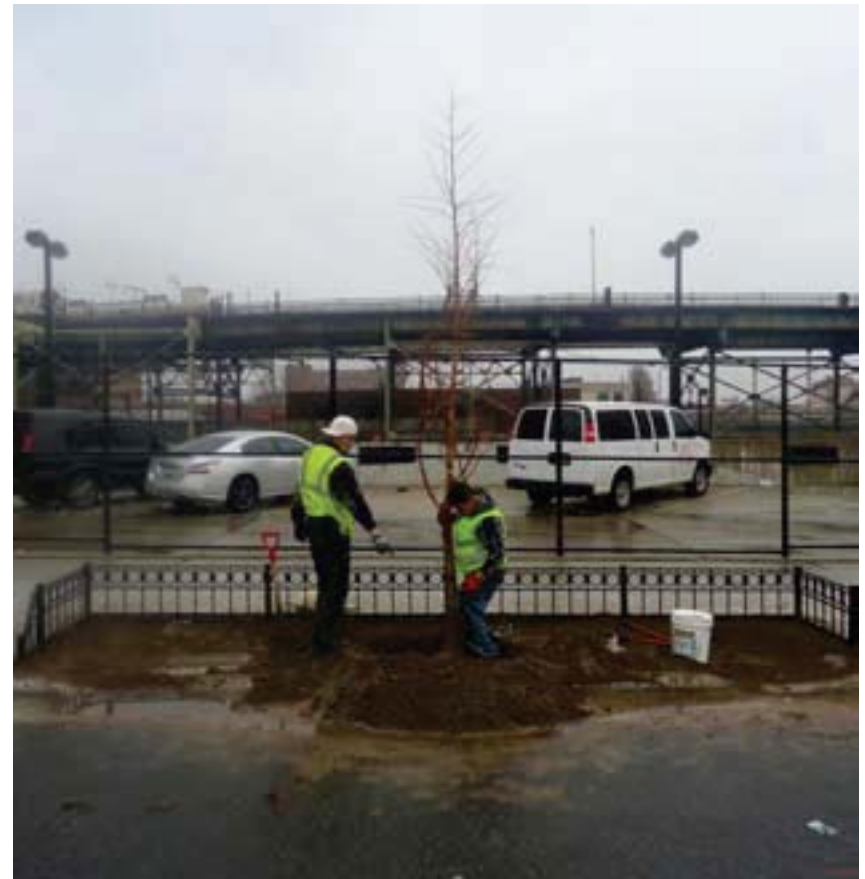




- Annual GI report
- Initial citywide GI application rate or expenditure of \$187 million to be achieved by 2015
- CSO reduction performance metrics by June 30, 2016
- Subsequent GI application rates and equivalent CSO reductions:
  - 4% by December 31, 2020
  - 7% by December 31, 2025
  - 10% by December 31, 2030
- Missed GI metrics require approvable contingency plans
- Cumulative watershed specific GI application rates to achieve 10% goal and equivalent CSO reductions

# Initial Programmatic Lessons Learned

- Since its inception in January 2011, OGI has progressed along the cost and learning curves associated to its GI program.
- Reengineering stormwater management in NYC has posed serious challenges but also led to significant opportunities and increasing gains.
- The decentralized and diverse nature of GI demands non-standard approaches to capital planning and streamlined processes to meet aggressive targets.
- As a result, DEP's program emphasizes the following:
  - CSO Tributary Area Prioritization
  - Area-Wide Design/Construction
  - Monitoring



# Next Steps

DEP's future R&D efforts will focus on long-term performance and optimization of GI as well as better understanding co-benefits:

- Continue to analyze data on stormwater quantity from pilot and demonstration projects
- Monitor and assess reductions in pollutant loads and water quality benefits
- Apply monitoring data and results to InfoWorks model to quantify benefits
- Improve methodologies for upscaling monitoring results and modeling GI performance at various spatial scales
- Gather data on sustainability co-benefits within localized areas of city
- Evaluate GI components to guide development of more efficient, better performing green infrastructure for NYC
- Continue to review standard designs and emerging technologies
- Review geologic, hydrologic and other data for more efficient site selection

# Questions?

Please contact:

Margot Walker  
Office of Green Infrastructure  
[margotw@dep.nyc.gov](mailto:margotw@dep.nyc.gov)

Pinar Balci  
Bureau of Environmental Planning & Analysis  
[pbalci@dep.nyc.gov](mailto:pbalci@dep.nyc.gov)

Julie Stein  
Bureau of Environmental Planning & Analysis  
[julies@dep.nyc.gov](mailto:julies@dep.nyc.gov)

Or, look for information and updates on DEP's website:

[nyc.gov/dep/greeninfrastructure](http://nyc.gov/dep/greeninfrastructure)