



NYC Green Infrastructure Program

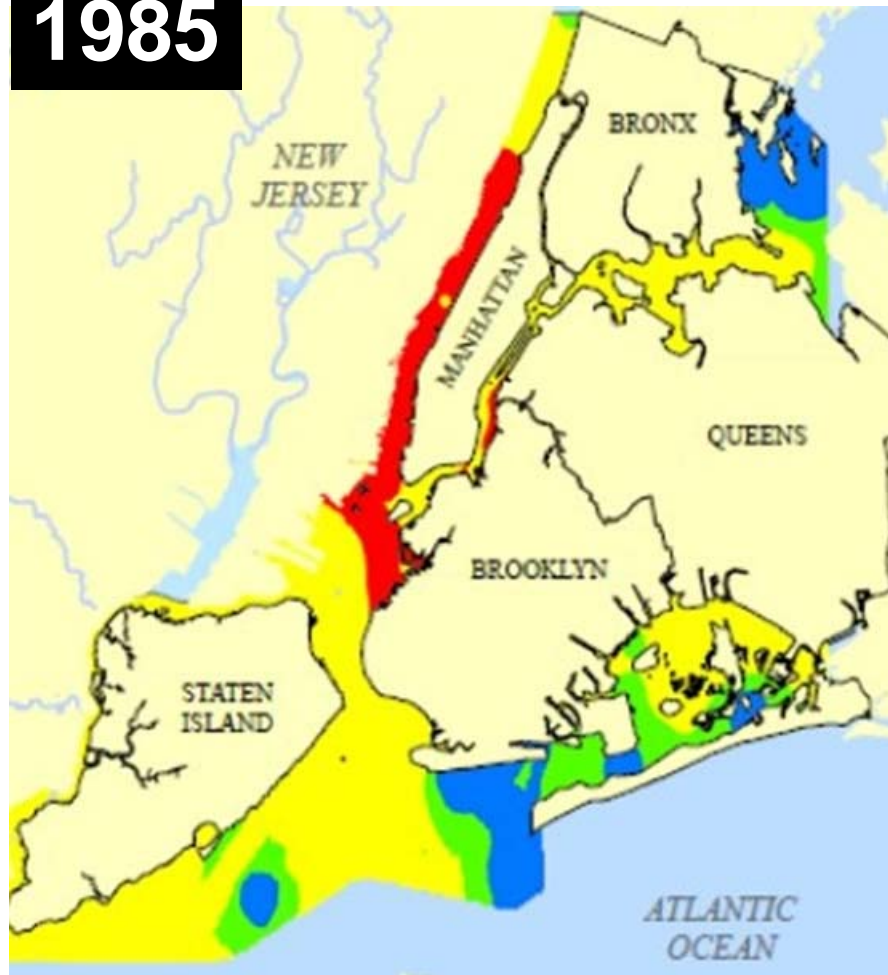
Parks Without Borders

May 24, 2016

NYC Water Quality Improvement Program

\$10B investment since the early 2000s has yielded the highest water quality observed in the NYC Harbor in recent history

1985



2015



Fecal Coliform Bacteria: ■ < 100 cfu/100 mL ■ 100 – 200 ■ 201 – 2,000 ■ >2,000

Data from Harbor Survey Program.

Using both Grey and Green Infrastructure



Paerdegat CSO Detention Facility



Staten Island Bluebelt



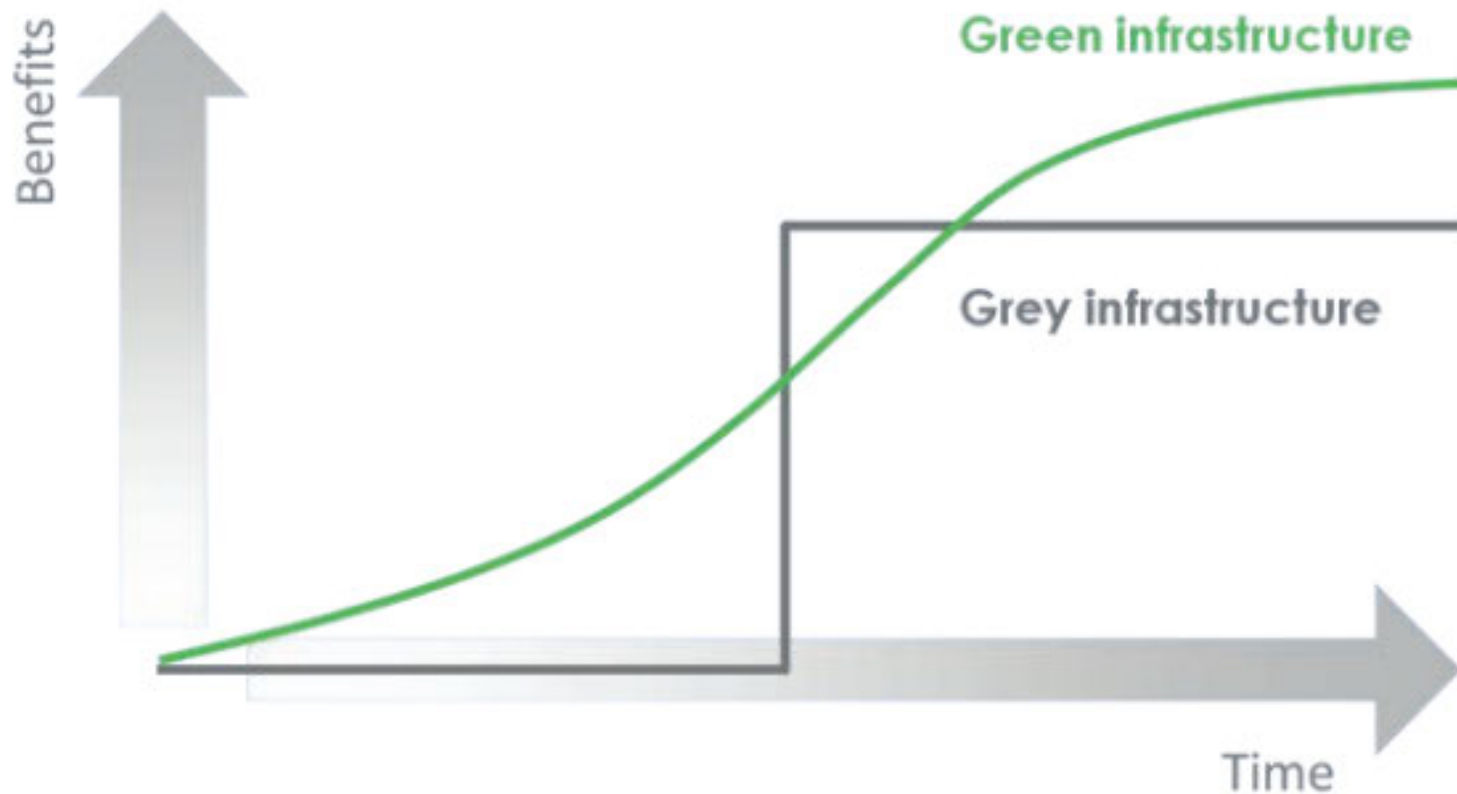
Catch Basins



Rain Gardens/Bioswales

Benefits of Green vs Grey Investments

Figure 2: Phasing of Green Infrastructure and Grey Infrastructure Benefits



Combined and Separate Sewer System in NYC

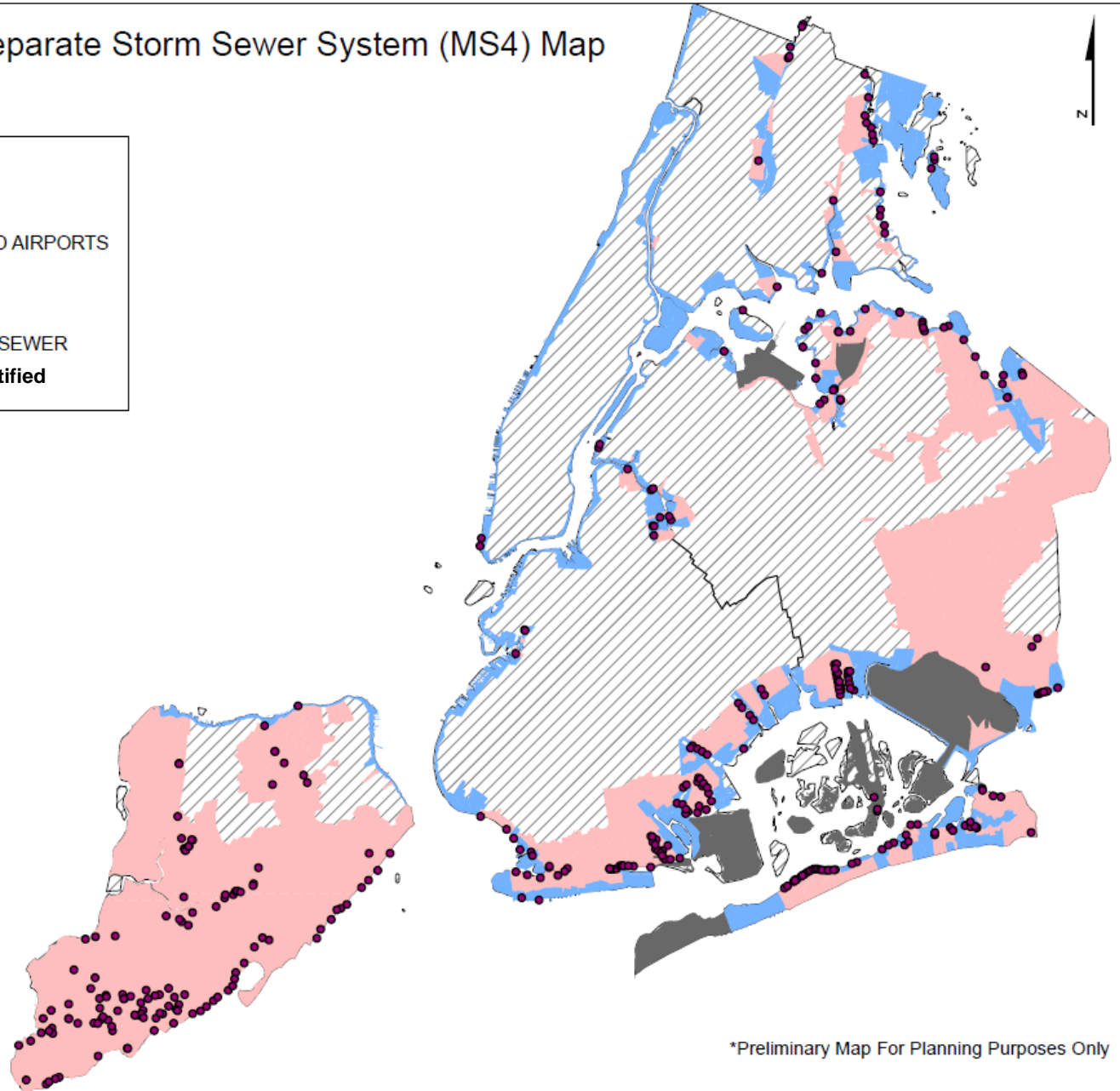
Draft Municipal Separate Storm Sewer System (MS4) Map

Not Covered

- COMBINED SEWER
- FEDERAL LAND AND AIRPORTS

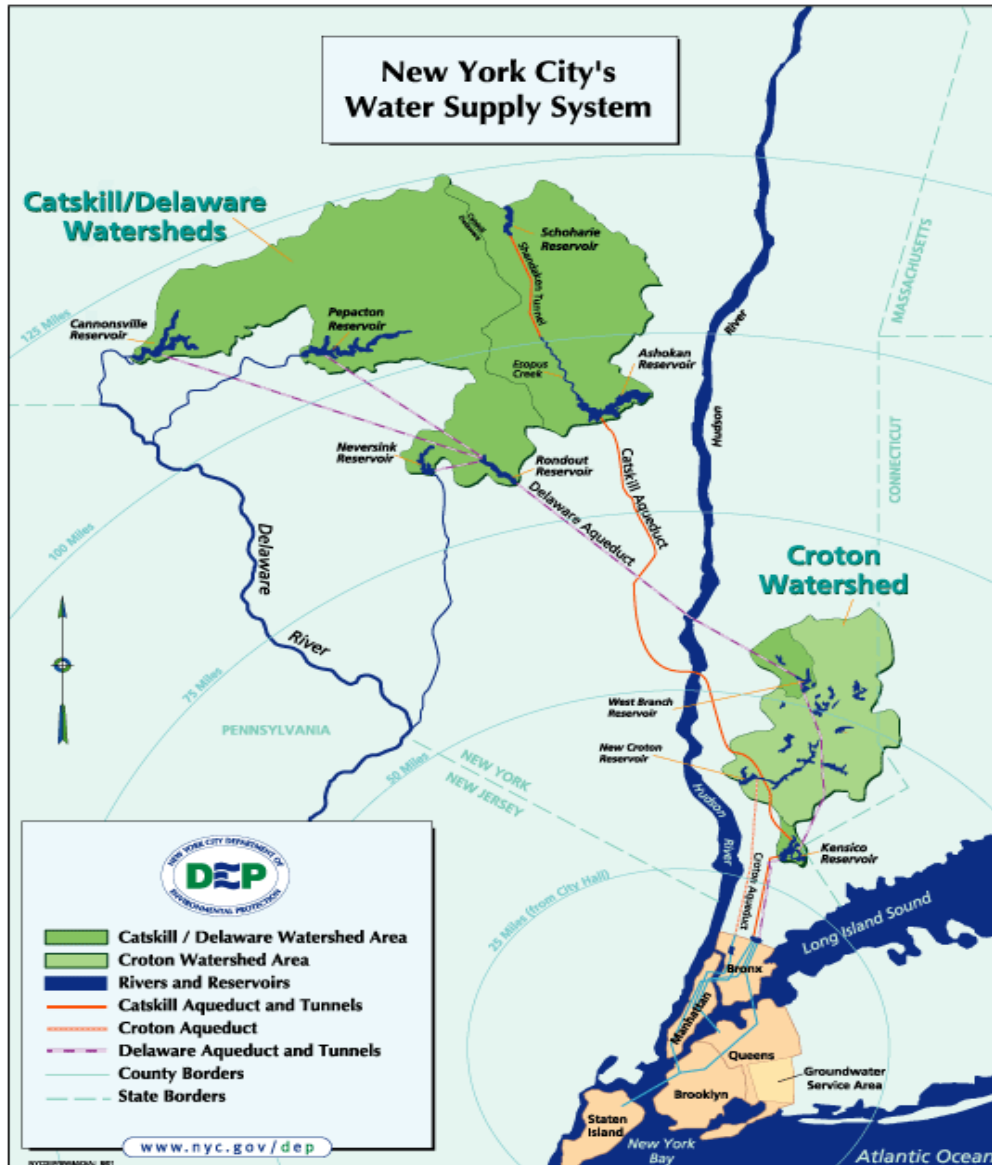
Covered

- DIRECT DRAINAGE
- SEPARATE STORM SEWER
- MS4 Outfalls **365 identified**



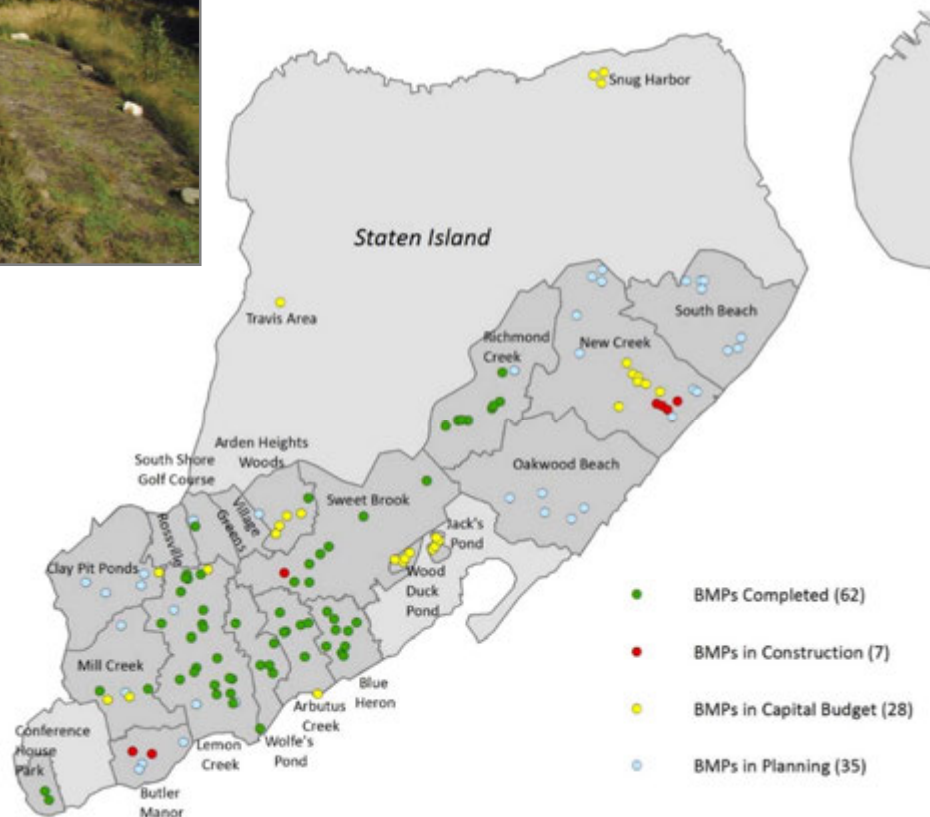
*Preliminary Map For Planning Purposes Only

Scaling Up Infrastructure Systems: FAD



- 2,000 square mile watershed
 - 580 billion gallon capacity
 - ~1 billion gallons/day
- Regulatory partnerships endorsed in 10-year filtration avoidance determination (2007 to 2017)
 - DEP Watershed Rules and Regulations
 - DEP Watershed Protection Programs
 - Stormwater Control Programs and Retrofits
 - Watershed Agricultural Program
 - WWTP and Septic Repair Programs
 - Waterfowl Management Program
 - Stream Management Program
 - Forestry Programs
- 109,000+ acres acquired since 1997
- \$1.5 billion spent to date

Scaling Up Infrastructure Systems: Bluebelt



Typical Schematic of Bluebelt Drainage Plans with BMPs

1. Outlet Stilling Basin
2. Retrofit of Existing Pond
3. Extended Detention Basin
4. Sand Filter
5. Pocket Wetland
6. Stream Restoration
7. Culvert Reconstruction
8. Meandering Stream



Scaling Up Green Infrastructure

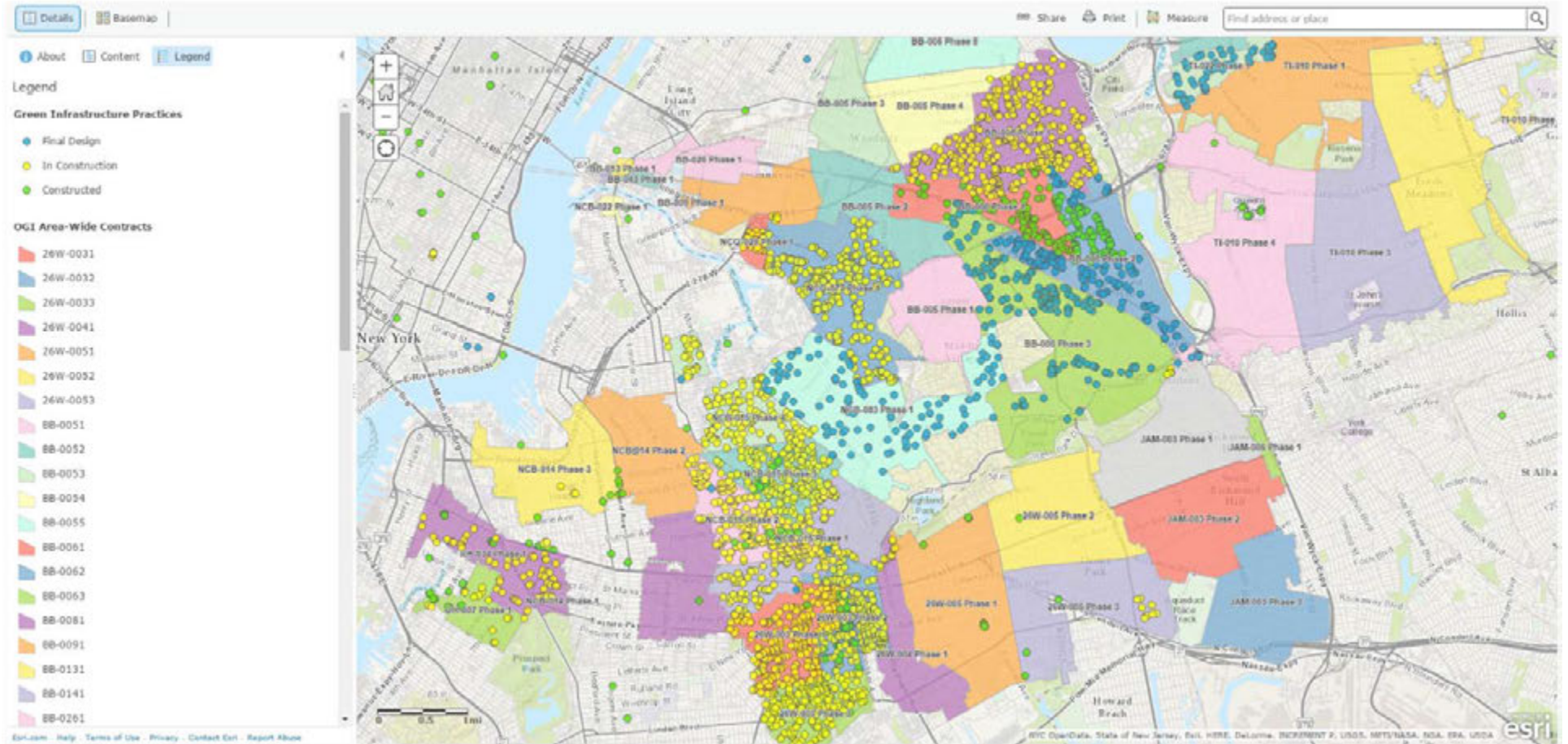


Scaling up Green Infrastructure

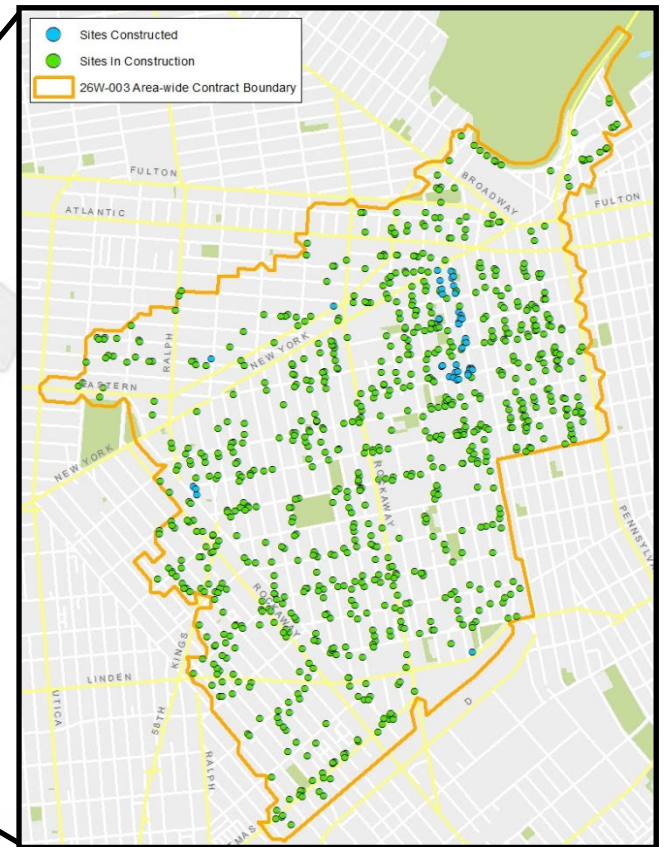
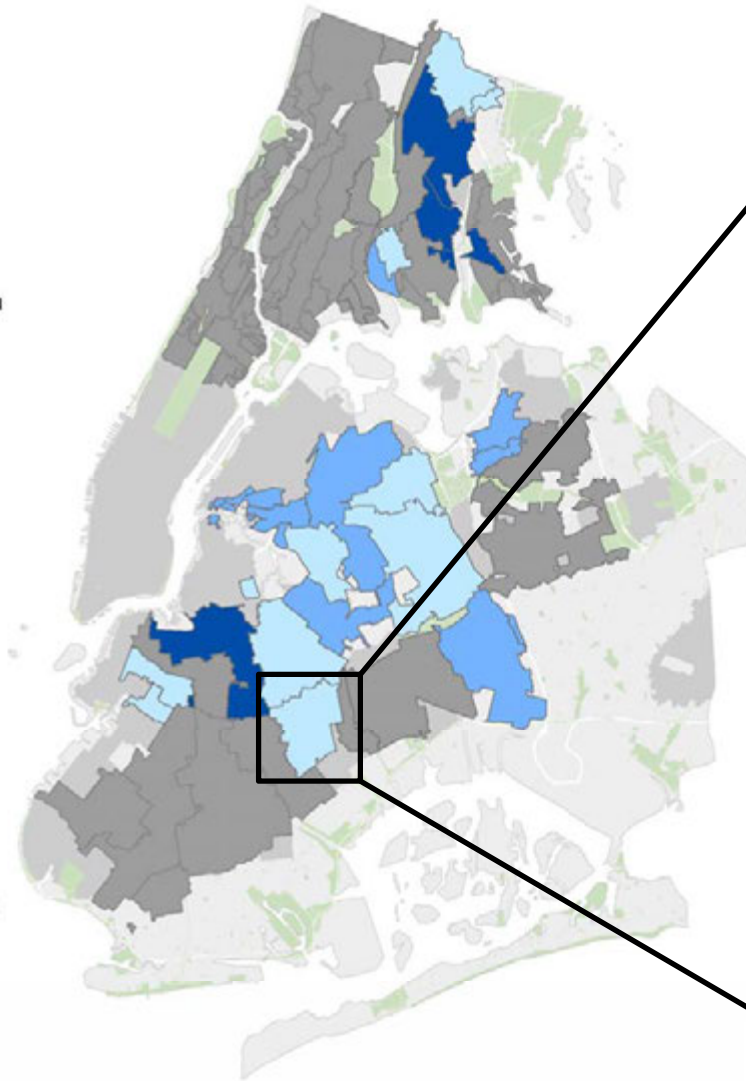
www.nyc.gov/dep/gimap

ArcGIS DEP Green Infrastructure Program Map

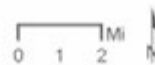
Sign In



Area-wide Implementation

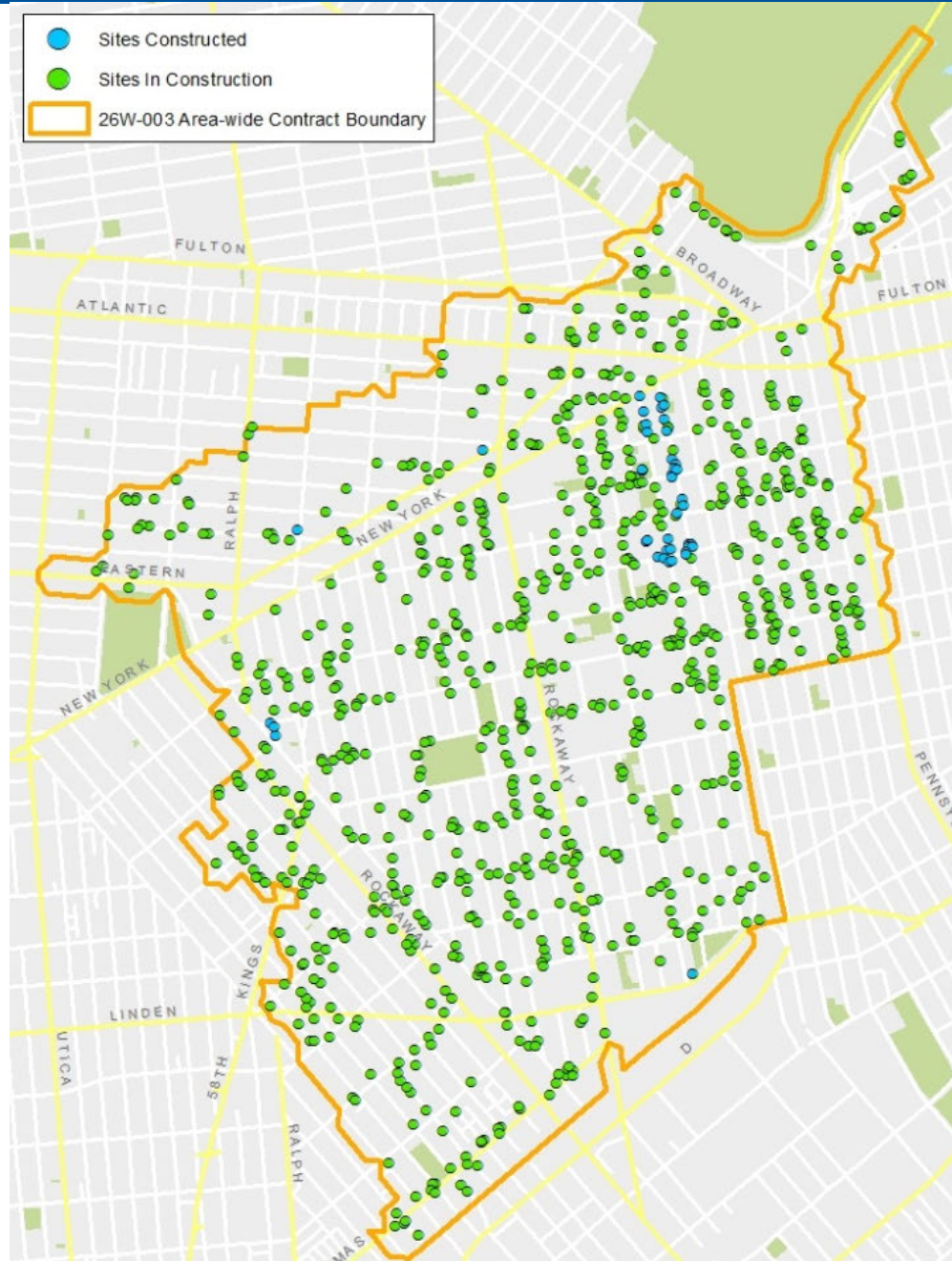


Example: 26th Ward/Jamaica Bay CSO Area
Anticipated construction completion December 2015



Measuring Co-Benefits of Green Infrastructure

Jamaica Bay/26W-003, CB 16 – Current Construction




Cost and Benefit Comparison Tool

NYC Green Infrastructure Cost-Benefit Comparison Tool

ROW Bioswales | Large Bioretention | Porous Pavement | Constructed Wetland | Green Roof | Blue Roof | Tool Setup

Co-Benefits

- Carbon Sequestration
- Urban Heat Island Mitigation
- Reduced Energy Demand
- Improved Ecosystem Services
- Improved Air Quality
- Improved Quality of Life
- Increased Property Value
- Reduced Treatment Needs
- Green Jobs



Co-Benefit Details

Urban Heat Island Mitigation

Description:
Thermal properties of common urban surfaces can lead to warmer air temperatures. By using natural surfaces that are cooler and reflect more solar radiation, green infrastructure can help reduce urban heat island impacts.

Literature:
Higher surface albedos are reported in the literature for vegetation and soil surfaces than materials like asphalt pavement. These higher albedos mean less heat is being captured by these materials.
[Details](#)

NYC Monitoring:
Infrared thermometer measurements confirmed that vegetation surfaces were cooler than bare soil and surrounding pavements. Air temperature reductions may not be consistently evident due to other site-specific factors.
[Details](#)

Calculator Inputs

Save Name: ROWB 1

50 ROWB Footprint (ft²)

2000 Managed Impervious Area (ft²)

25 Anticipated Lifespan (yrs)

75 Shrub and Herbaceous Cover (%)

10 Tree Canopy Coverage (%)

Flowering Vegetation: >75%

Native Vegetation: 100%

Plant Species: 2-10

Visible Greenspace: Corner Park

GI Accessibility: Accessible

Community District: Unknown

Unknown/General

Calculate

Calculator Outputs

Total Per ft² GI Per ft² Man. Per Gal.

Geographic need: High Low

Environmental

37,400	Gallons Managed (gal/yr)
180	CO2 Produced (lb/yr)
707	Carbon Sequestered (lb/yr)
4.36	Inferred CO2 Reduction (lb/yr)
2.14	Ozone Removed (lb/yr)
1.91	PM10 Removed (lb/yr)
1.73	NO2 Removed (lb/yr)
1.00	SO2 Removed (lb/yr)
0.51	CO Removed (lb/yr)
86 %	Urban Heat Island Potential
79 %	Ecosystem Services Score

Ecosystem Score Detail

High	Pollinator Support
High	Native Habitat Support
Medium	Biodiversity Support
Med-High	Greener Corridor Support

Social

Save/Open Mode Compare Mode Help Enabled [Tutorial](#)

Saved for Comparison: ROWB 1 ROWB 1 ROWB1 ROWB1 ROWB1 ROWB1 ROWB1 ROWB1 ROWB1 ROWB1

View Comparison

For the 423 bioswales and stormwater greenstreets to be installed in CB16, the possible co-benefits per year could be:

Public Health Benefits:

- Individual bioswales show
Temperatures can be 15% lower than sidewalk and street.
- 63 lbs of ozone removed per year
- 46 lbs of PM10 removed per year
- 46 lbs of nitrogen dioxide removed per year
- 25 lbs of sulfur dioxide removed per year

Ecosystem Benefits:

- Improved ecosystem, greenspace, and well being for residents and desirability of neighborhoods.

Economic Benefits:

- 245 jobs supported over lifetime

Unique Challenges/Opportunities to NYC for GI Implementation

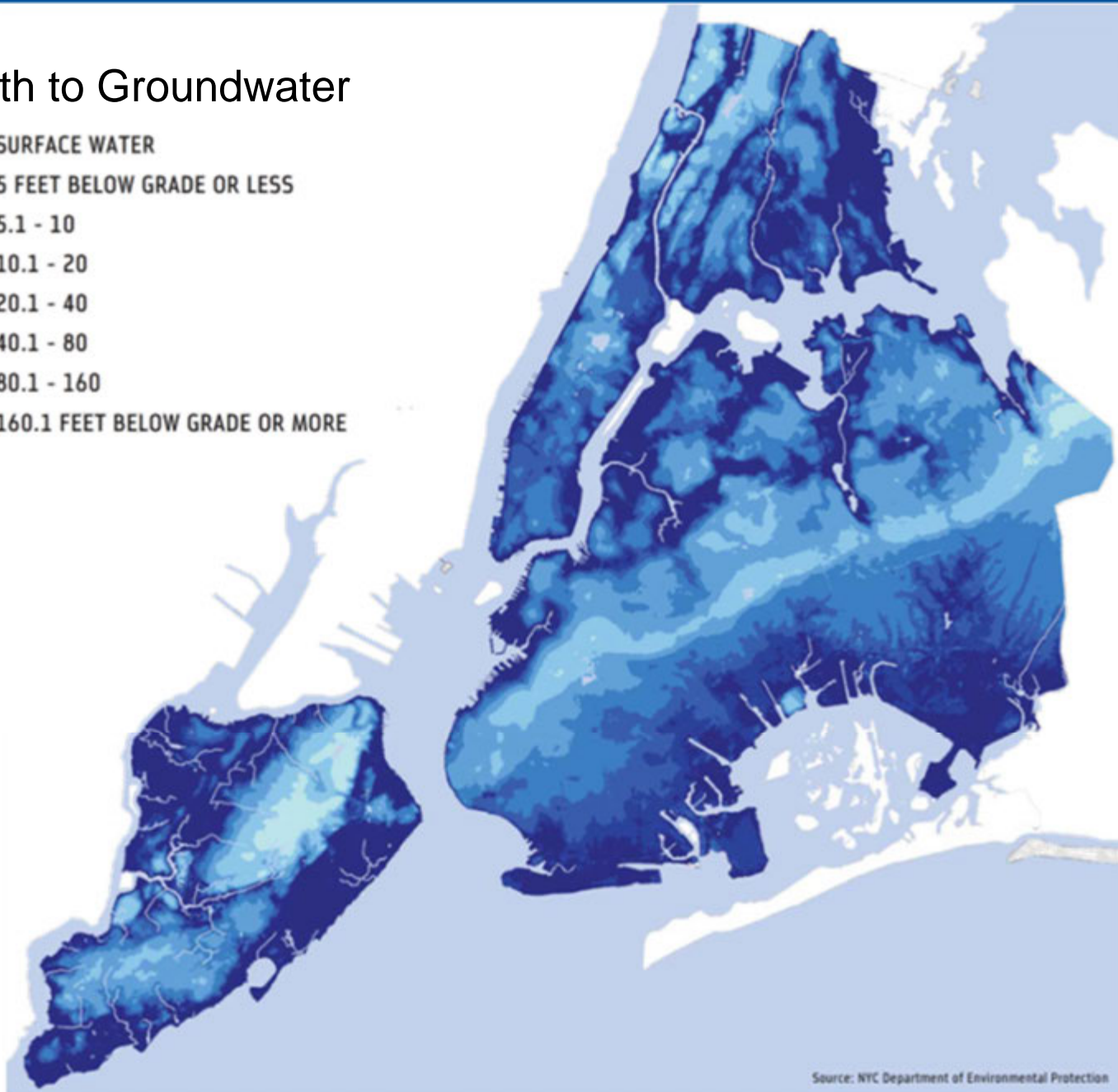
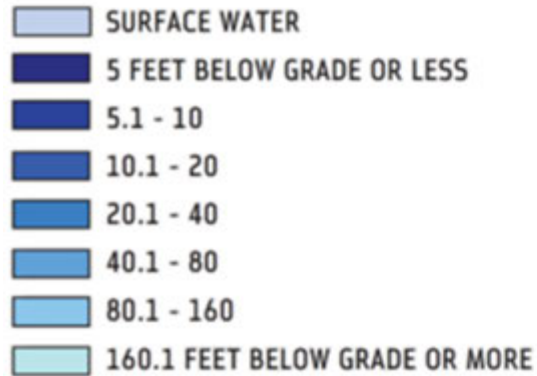
Impervious Surfaces & Dense Landscapes

Impervious surfaces cover 72%
of NYC's land area



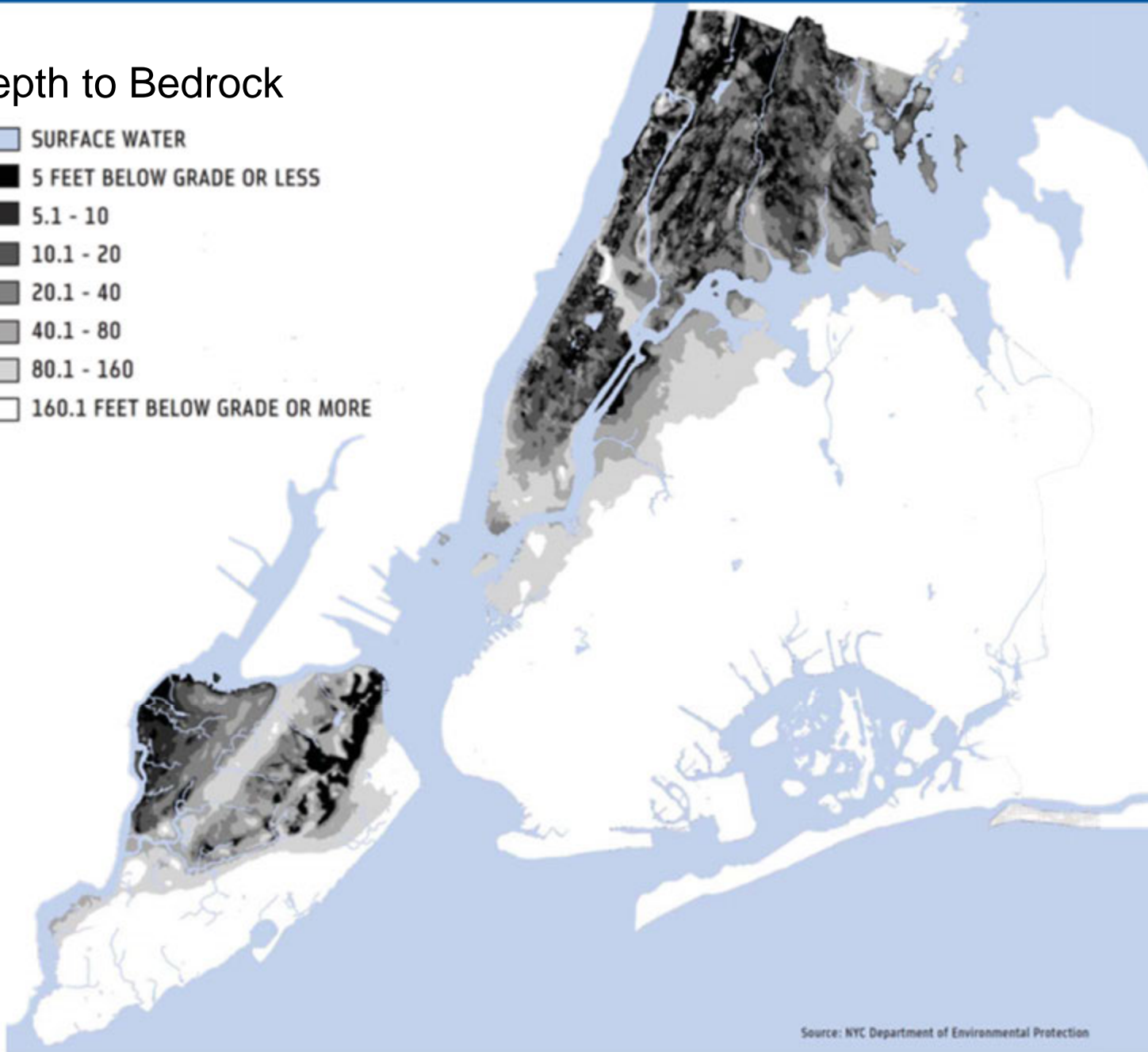
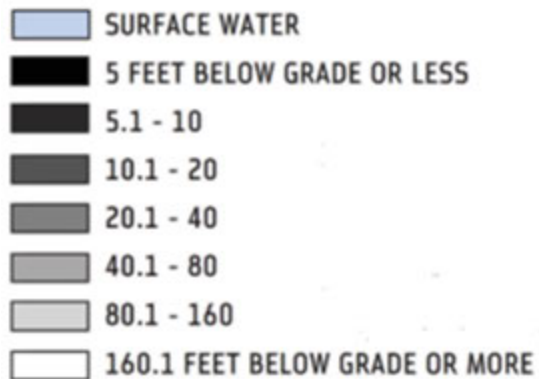
Infiltration Considerations - Groundwater

Depth to Groundwater



Infiltration Considerations - Bedrock

Depth to Bedrock

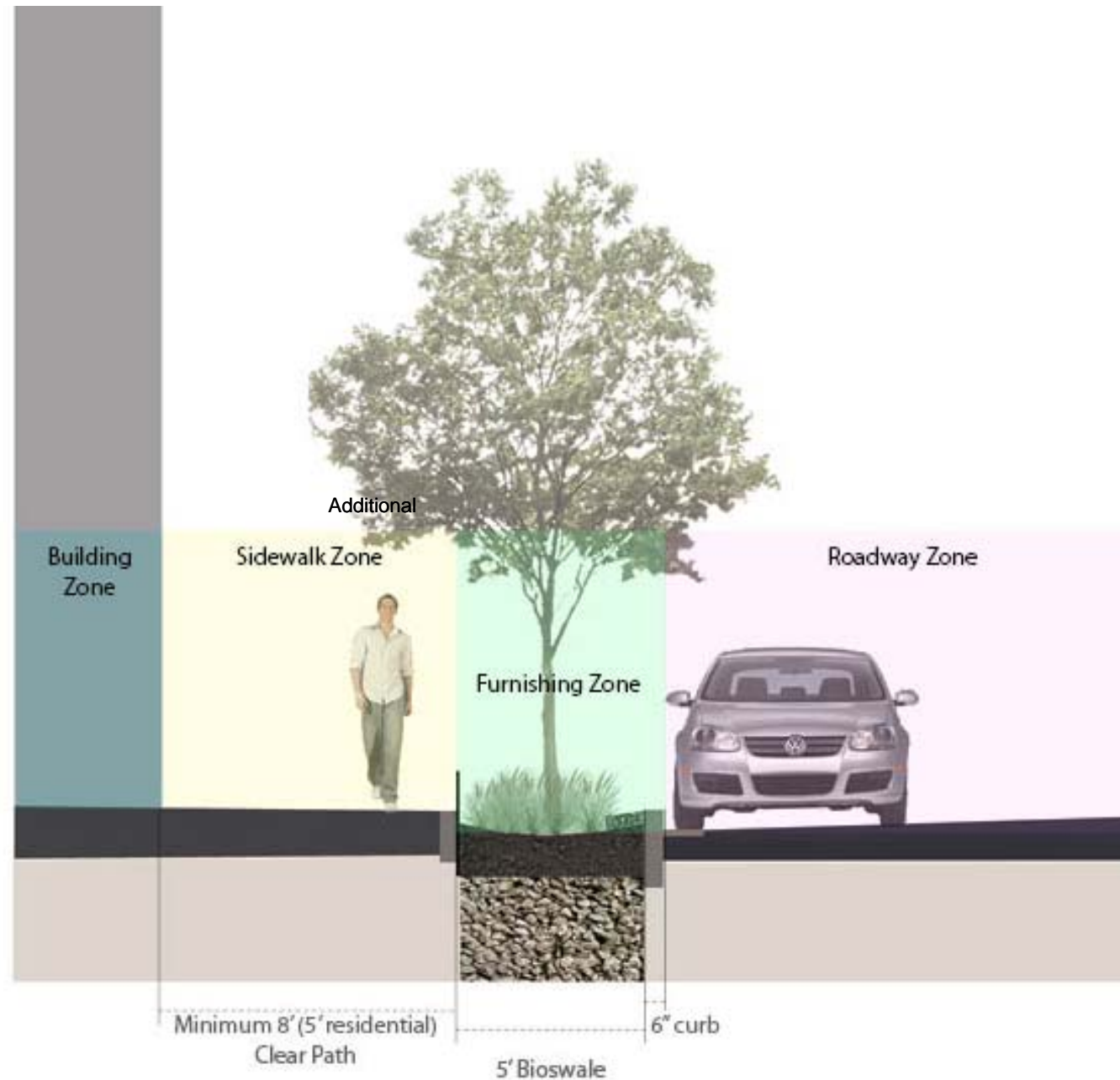


Source: NYC Department of Environmental Protection

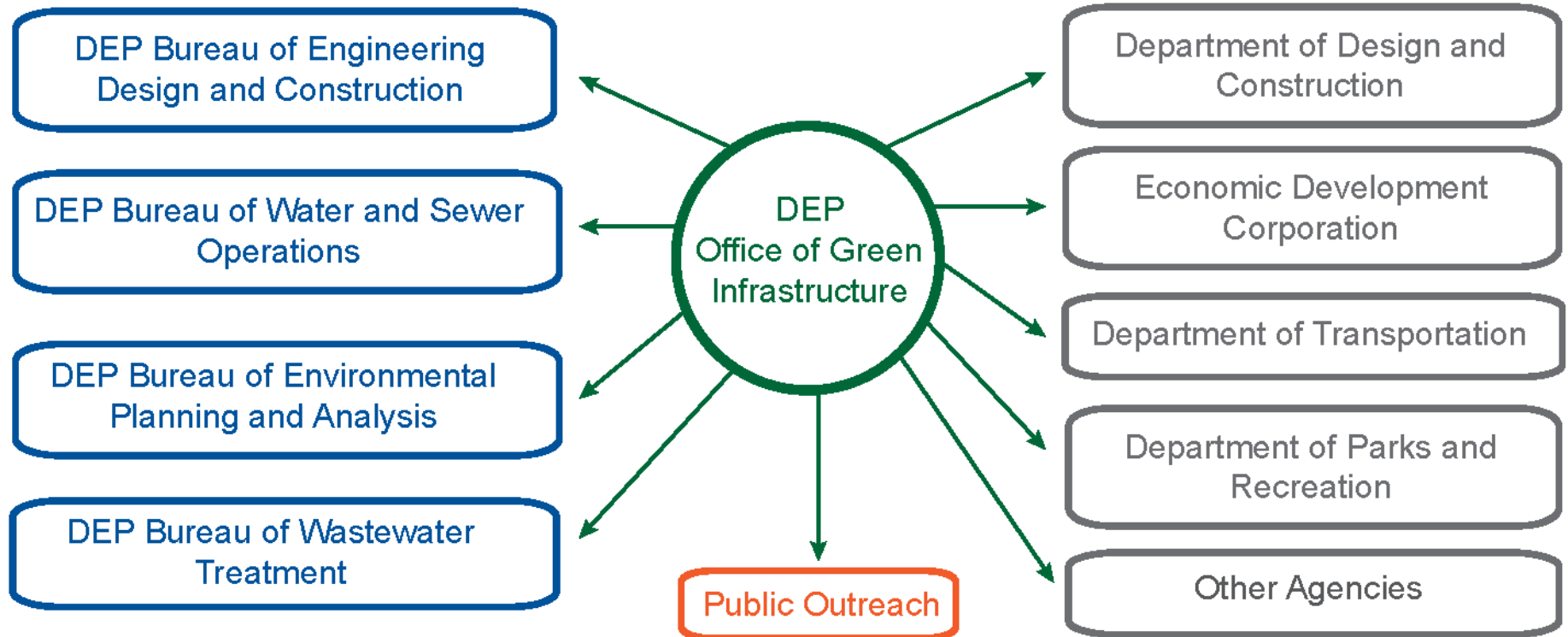
ROW Siting Criteria

ROW Siting Criteria challenges:

- Mature Trees
- Sidewalk widths (8' or 5')
- Fire Hydrants
- Pedestrian Ramps
- Building Entrances/Exits
- Driveways
- Muni Meters/ parking meters
- Bus Stops
- Unfavorable subsurface conditions
- Utility conflicts



Program Coordination



- Long-term maintenance and asset management
- Achieving greater efficiencies in design and construction; gaining economies of scale and experience, which will lead to lower costs in the medium to long-term
- Implementation of onsite opportunities to retrofit city-owned properties
- Development of additional GI tools particular to ultra-urban environments useful to other municipalities
- Outreach, education and public engagement are key in terms of preserving and maintaining GI projects
- Encouraging green jobs/training for all sectors involved in implementation

Right-of-way Bioswale

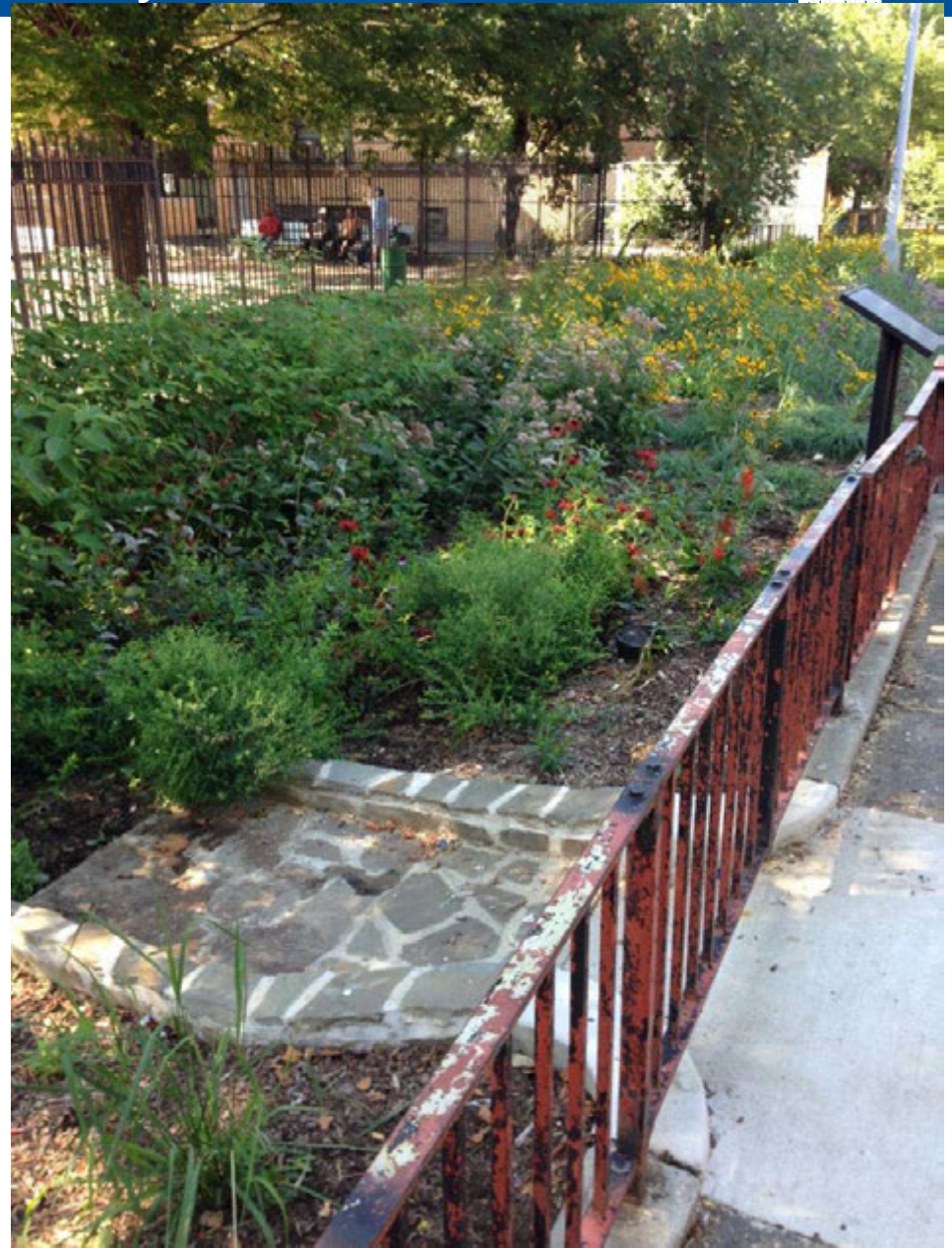


Stormwater Greenstreet



Public Property Retrofit Projects

Hope Gardens Houses, Brooklyn – Before/After



Edenwald Houses, Bronx

Construction Start:
Spring 2015

Construction End:
Spring 2017

Type of green infrastructure

-  Downspout Disconnect
-  Rain Garden
-  Porous Paving



Schoolyards with DOE and TPL

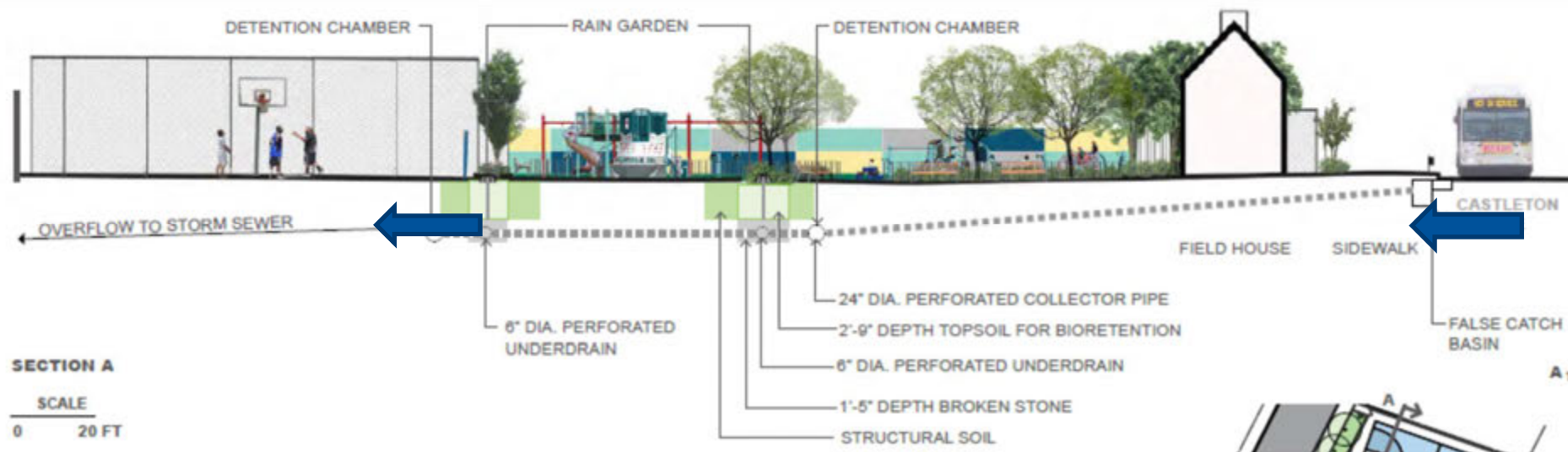


Before



After

Community Parks Initiative



- Provides \$285M in DPR Capital Funding to improve historically underserved parks in high-need neighborhoods. Phase I will redesign and reconstruction of 35 parks, 29 of which will have stormwater retrofits funded by DEP.
 - Designs intended to capture 1" of runoff from site and adjacent streets (~ 800,000 gal. from park and ~400,000 gal. from adjacent streets) for a total annual capture of ~58M gallons
 - DEP committed \$36.3M for Phase I with ~\$24M allocated. Construction Start anticipated for Fall 2016
 - Phase II has 32 sites and DEP has committed an additional \$14M. Construction start anticipated for Fall/Winter 2017.

Private Property Grant Projects

Brooklyn Navy Yard – Rooftop Farm



Bishop Loughlin – Green Roof



Queens College – Rain Garden and Pavers



Lenox Hill Neighborhood House- Green Roof



New York Restoration Project – Rain Garden/Pavers



Thank You.