Mayor Keisha Lance Bottoms

Building Green: Atlanta's Green Infrastructure Approach

1/23/2018

COMPOST 2018

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CITY OF ATLANTA DEPARTMENT OF watershed management

Kishia L. Powell, Commissioner
Department of Watershed Management

Presentation Outline

Overview of Atlanta's Green Infrastructure Program

- What is Green Infrastructure?
- Why Green Infrastructure in Atlanta?
- What are the standards?

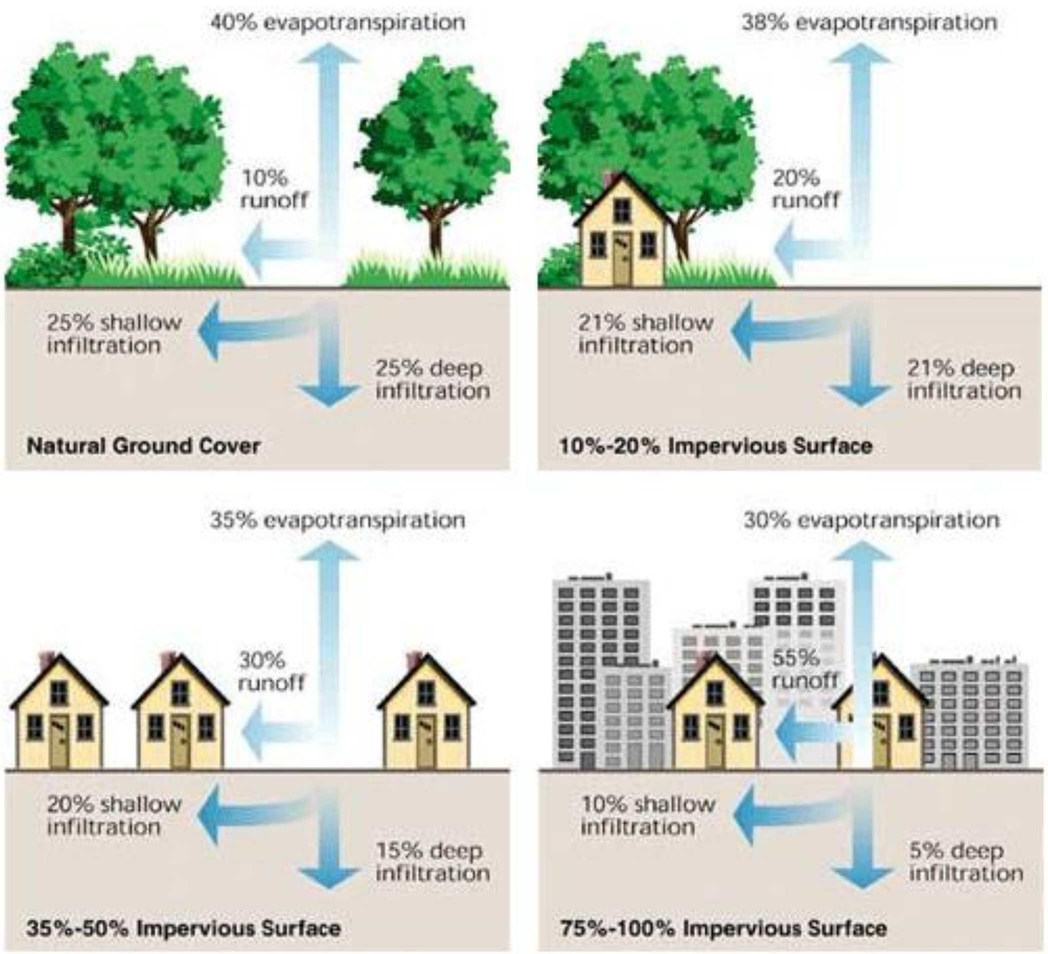
First five years of implementation

- Single Family and Small Commercial Design manuals
- Lessons Learned

Addressing Neighborhood Flooding

- Historic 4th Ward – economic and social benefits
- Southeast Atlanta Green Infrastructure Initiative – combined sewer capacity relief
- Upper Proctor Creek Capacity Relief: Rodney Cook, Sr. Park in Historic Vine City

How Urbanization Causes Flooding



Problems of Urban Watersheds

'Flashy' stream hydrology causes in stream erosion and low base flow

What is Green Infrastructure?

Gray **vs.** **Green**

Slow, Infiltrate, and Clean Stormwater

What is Green Infrastructure?

An interconnected natural or engineered system that mimics undeveloped hydrologic functions

Capture the first 1.0" of rainfall

- Infiltration
- Evapotranspiration (uptake of water by plants + evaporation)
- Reuse through rainwater harvesting

Examples of Green Infrastructure

- Soil Restoration
- Bioretention
- Green Roofs
- Permeable Pavements
- Undisturbed Pervious Areas (greenspace)
- Vegetated Filter Strips
- Dry Swales
- Site Reforestation
- Downspout Disconnection
- Rain Gardens
- Stormwater Planters
- Dry wells
- Rainwater Harvesting
- Infiltration Practices

Amended Stormwater Management Ordinance

Requires Green Infrastructure on single family infill and commercial development/redevelopment

- 1.0" Runoff Reduction Volume (RR_v)
- Mandatory versus voluntary
- No direct financial incentives
- Low threshold for compliance

Process for success

- Technical Advisory Committee
- Robust stakeholder involvement
- 'Give and take' approach
- Outreach, education, and technical guidance documents


infill
historic

Recent Examples

Porous Concrete - Delia's Chicken Sausage Stand

Bioswale - Edgewood Townhomes

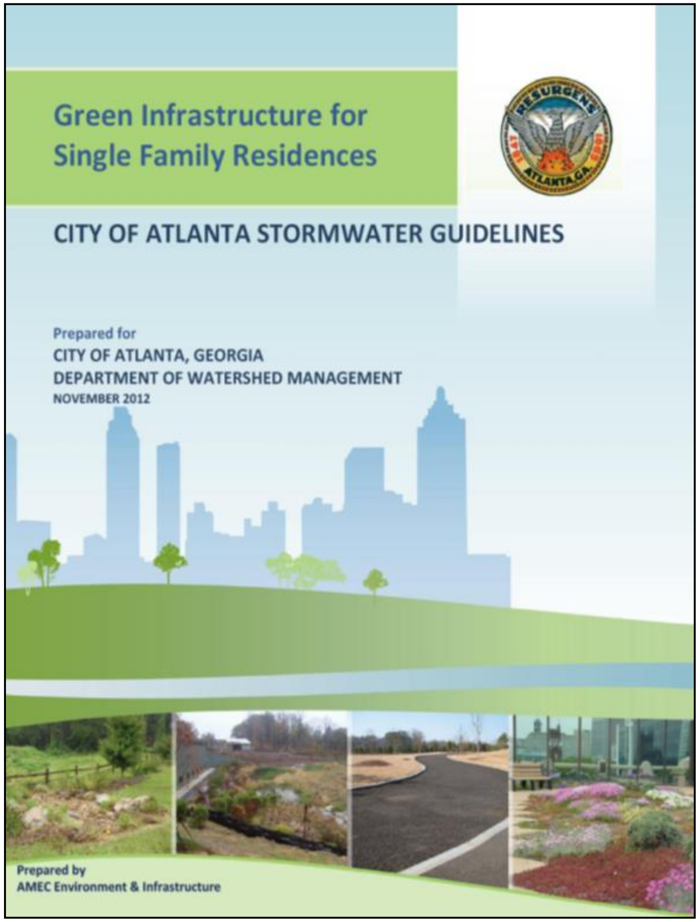
Permeable Pavers - Urban Market on Howell Mill

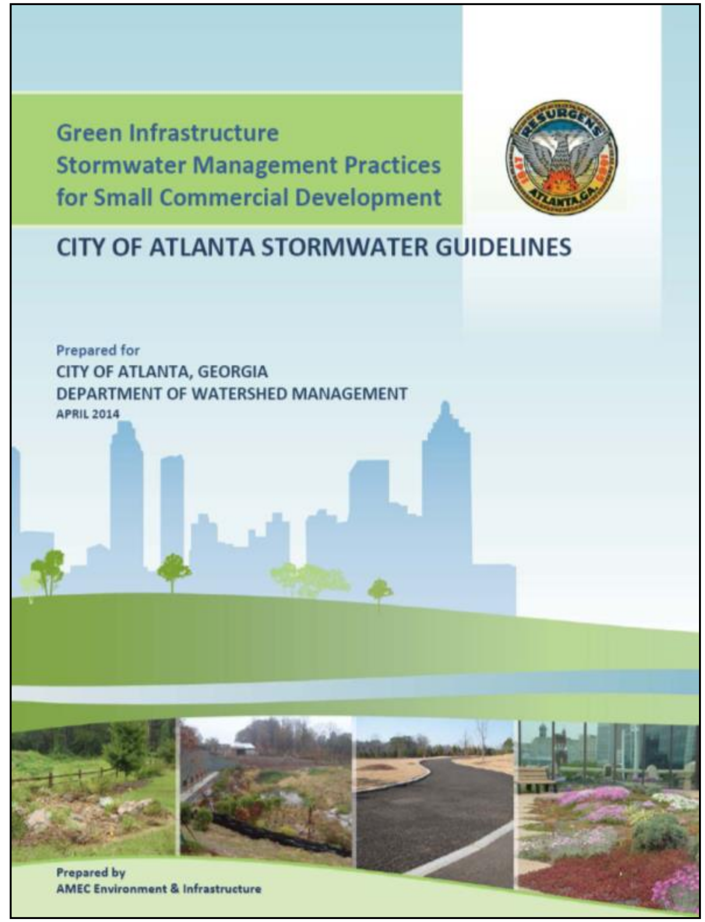
Bioretention - Whitehall Terrace ROW

Permeable Pavers - 6^{th} and Juniper

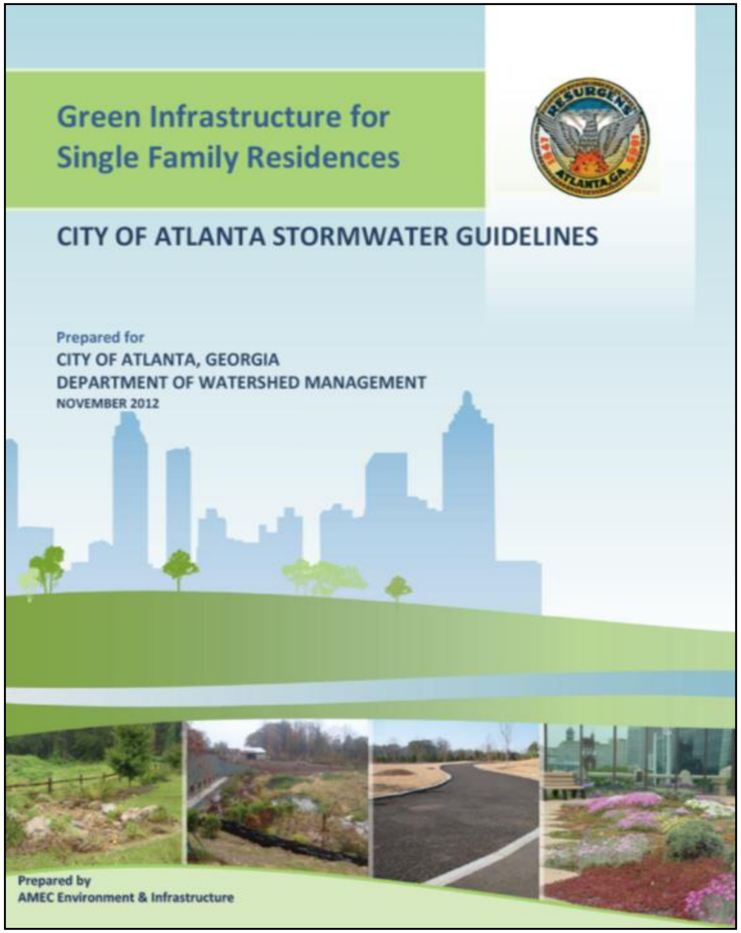
Permeable Pavers - Lakemoore Townhomes

Simplified Design Approach





SFR Manual



GI for Single Family Residences

- Provides a list of acceptable practices
- Reduces the need for complicated calculations
- Provides tear-off details and construction specification for each practice
- Simplifies the review and approval process

General Info & Tear-off Details

DRY WELL

SINGLE FAMILY RESIDENTIAL GUIDE
CITY OF ATLANTA, GEORGIA
DEPARTMENT OF WATERSHED MANAGEMENT

Dry wells are comprised of seepage tanks set in the ground and, in Atlanta's tight soils, surrounded with stone that are designed to intercept and temporarily store stormwater runoff until it infiltrates into the soil. Alternately the pit can be filled with stone with water entering via a perforated pipe with a perforated standpipe in place of the tank.

Dry wells are particularly well suited to receive rooftop [...] entering the tank via an inlet grate (shown right) or dire[...] downspout connection (below right). When properly size[...] out dry wells can provide significant reductions in storm[...] and pollutant loads.

Location

- Dry wells must be located at least 10 feet from buil[...] foundations and 10 feet from property lines.
- To reduce the chance of clogging, dry wells should [...] impervious areas, and runoff should be pretreated w[...] one of the leaf removal options to remove debris an[...] particles.
- The height of the tank should not exceed 45 inches [...] infiltration testing has been done to insure a drain t[...] hours or less.
- Dry wells should be located in a lawn or other pervi[...] (unpaved) area and should be designed so that the [...] as possible.
- Dry wells should not be located: (1) beneath an imp[...] water table or bedrock less than two feet below the[...] above a septic field. Always call 811 to locate utility[...]

Construction

- Consider the drainage area size and the soil infiltrat[...] (see table on next page).
- The sides of the excavation should be trimmed of al[...] permeable drainage fabric used to line the sides an[...]
- The dry well hole should be excavated 1 foot deepe[...] allow for a 12 inch stone fill jacket.

RAIN GARDENS

SINGLE FAMILY RESIDENTIAL GUIDE
CITY OF ATLANTA, GEORGIA
DEPARTMENT OF WATERSHED MANAGEMENT

Rain gardens are small, landscaped depressions that are filled with a mix of native soil and compost, and are planted with trees, shrubs and other garden-like vegetation. They are designed to temporarily store stormwater runoff from rooftops, driveways, patios and other areas around your home while reducing runoff rates and pollutant loads in your local watershed. A rain garden can be a beautiful and functional addition to your landscape.

Location

- Rain gardens should be located to receive the maximum amount of stormwater runoff from impervious surfaces, and where downspouts or driveway runoff can enter garden flowing away from the home.
- Swales, berms, or downspout extensions may be helpful to route runoff to the rain garden.
- Locate at least 10 feet from foundations, not within the public right of way, away from utility lines, not over septic fields, and not near a steep bluff edge. Call 811 before you dig to locate the utility lines on your property.
- Rain gardens on steep slopes (>10%) may require an alternative design with terracing.

Design

- The size of the rain garden will vary depending on the impervious surface draining to it and the depth of the amended soils. Use the table to determine the required surface area.
- A maximum ponding depth of 6 inches is allowed within rain gardens. On average, rain gardens drain within a day which will not create a mosquito problem.
- Design rain garden entrance to immediately intercept inflow and reduce its velocity with stones, dense hardy vegetation or by other means.
- If sides are to be mowed rain gardens should be designed with side slopes of 3:1 (H:V) or flatter.

Contributing Drainage Area (square feet)	Depth of Amended Soil (inches)			
	18	24	30	36
	Area of Rain Garden (square feet)			
100	6.6	5.7	5.1	4.6
500	35	30	25	23
1000	65	60	50	45
2000	135	115	100	90
3000	200	170	150	140
4000	250	230	200	185
5000	330	290	255	230

- For best results, it is suggested to test your soil characteristics as you would for a garden, or contact your local County Extension Service for help www.caes.uga.edu/extension/fulton.
- Soils for rain gardens should be amended native soils containing: 2/3 native soils and 1/3 compost.

SKETCH LAYOUT

PROVIDE PLAN VIEWS OF RAIN GARDEN AND HOUSE SHOWING DRAINAGE AREA DIRECTED TO RAIN GARDEN AND KEY DIMENSIONS AND OVERFLOW AREA RELATIVE TO PROPERTY LINE.

SIZING CALCULATION:

Contributing Drainage Area (square feet)	Depth of A[...]	
	18	[...]
	Area of Ra[...]	
100	6.6	[...]
500	35	[...]
1000	65	[...]
2000	135	[...]
3000	200	[...]
4000	250	[...]
5000	330	[...]

MEASURE CONTRIBUTING DRAINAG[...] FOR GIVEN MEDIA DEPTH.

CONTRIBUTING DRAINAGE AREA= _
DEPTH OF SOIL MEDIA= ________ I[...]
AREA OF RAIN GARDEN= ______ S[...]

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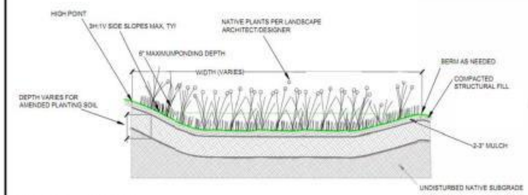
MANAGEMENT



CONSTRUCTION STEPS:

1. Locate rain garden(s) where downspouts or driveway runoff can enter garden flowing away from the home. Locate at least 10 feet from foundations, not within the public right of way, away from utility lines, not over septic fields, and not near a steep bluff edge.
2. Measure the area draining to the planned garden and determine required rain garden surface area from the table on the next page and your planned excavation depth.
3. Optionally, perform infiltration test according to Appendix A. If the rate is less than 0.25 in/hr an underdrain will be necessary. If the rate is more than 0.50 in/hr the size of the garden may be decreased 10% for every 0.50 in/hr infiltration rate increase above 0.50 in/hr.
4. Measure elevations and stake out the garden to the required dimensions insuring positive flow into garden, the overflow elevation allows for six inches of ponding, and the perimeter of the garden is higher than the overflow point. If the garden is on a gentle slope a berm at least two feet wide can be constructed on the downhill side and/or the garden can be dug into the hillside taking greater care for erosion control at the garden inlet(s).
5. Remove turf or other vegetation in the area of the rain garden. Excavate garden being careful not to compact soils in the bottom of the garden. Level bottom of garden as much as possible to maximize infiltration area.
6. Mix compost, topsoil, and some of the excavated subsoil together to make the 'amended soil'. The soil mix should be 1/3 compost, 2/3 native soil (topsoil and subsoil combined).
7. Fill rain garden with the amended soil, leaving the surface eight inches below your highest surrounding surface. Eight inches allows for 6 inches ponding and 2" of mulch. The surface of the rain garden should be as close to level as possible.
8. Build a berm at the downhill edge and sides of the rain garden with the remaining subsoil. The top of the berm needs to be level, and set at the maximum ponding elevation.
9. Plant the rain garden using a selection of plants from elsewhere in this manual.
10. Mulch the surface of the rain garden with two to three inches of non-floating organic mulch. The best choice is finely shredded hardwood mulch. Pinestraw is also an option.
11. Water all plants thoroughly. As in any new garden or flower bed, regular watering will likely be needed to establish plants during the first growing season.
12. During construction build the inlet feature as a pipe directly connected to a downspout or use a rock lined swale with a gentle slope. Use of an impermeable liner under the rocks at the end of the swale near the house is recommended to keep water from soaking in at that point. Test the drainage of water from the source to the garden prior to finishing.
13. Create an overflow at least 10 feet from your property edge and insure it is protected from erosion.

CITY OF ATLANTA DEPARTMENT OF WATERSHED MANAGEMENT	NAME/ADDRESS:	RAIN GARDEN SPECIFICATIONS PAGE 1 OF 2

November 2012

Easy-to-Use Sizing Tables

Impervious Area Treated

Design Options

Sizing Charts

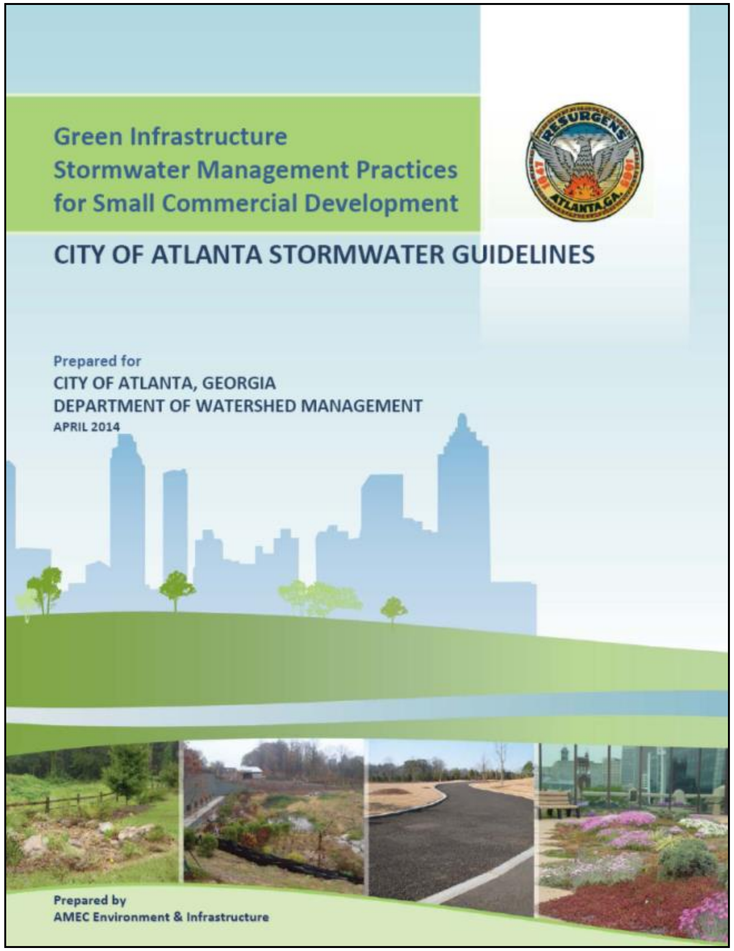
- Options within practical range
- Accommodate actual rainfall and runoff data
- Allows for median infiltration duration
- Assumes 0.25-0.50 in/hr infiltration rate

Rooftop Area (square feet)	Depth of Gravel From Top of Pipe (inches)			
	18	24	30	36
	Required Linear Feet of MFD			
100	6	5	4	3
500	30	25	20	15
1000	60	45	40	35
2000	120	95	75	65
3000	185	140	115	100
4000	245	190	155	130
5000	305	235	195	165

Practice Size

Modified French Drain Example

Small Commercial Manual



GI for Small Commercial

- For projects that add/replace between 500 and 5,000 ft^2 of impervious surface
- Catered to small urban redevelopment and addition projects
- Supplement to CSS and Blue Book
- Provides clarification to specific issues

Sizing Charts for each Practice

BIORETENTION TABLE A Bioretention Surface Storage Volumes (cubic feet)																	
Bioretention Typical Dimensions (feet)	5x10	5x15	5x20	5x30	10x10	10x15	10x20	10x30	10x40	10x50	10x60	10x70	10x80	20x20	20x30	20x40	30x30
surface area (square feet)	50	75	100	150	100	150	200	300	400	500	600	700	800	400	600	800	900
Surface Storage at 6" Depth (cubic feet)	25	38	50	75	50	75	100	150	200	250	300	350	400	200	300	400	450
Surface Storage at 9" Depth (cubic feet)	38	56	75	113	75	113	150	225	300	375	450	525	600	300	450	600	675
Surface Storage at 12" Depth (cubic feet)	50	75	100	150	100	150	200	300	400	500	600	700	800	400	600	800	900

GI Practice 1

BIORETENTION TABLE B Bioretention Soil Storage Volumes for all Infiltration Rates (cubic feet) 100% RRv Credit by Volume																	
Bioretention Typical Dimensions (feet)	5x10	5x15	5x20	5x30	10x10	10x15	10x20	10x30	10x40	10x50	10x60	10x70	10x80	20x20	20x30	20x40	30x30
surface area (square feet)	50	75	100	150	100	150	200	300	400	500	600	700	800	400	600	800	900
Soil Storage at 18" Depth (cubic feet)	24	36	48	72	48	72	96	144	192	240	288	336	384	192	288	384	432
Soil Storage at 24" Depth (cubic feet)	[illegible]	[illegible]	64	96	64	96	128	192	256	320	384	448	512	256	384	512	576
Soil Storage at 36" Depth (cubic feet)	48	72	96	144	96	144	192	288	384	480	576	672	768	384	576	768	864
note: table assumes a void ratio of 0.32																	

GI Practice 1

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Example Design

Example Site Information

Size = ½ acre
Existing Impervious Surface= 100%
Tested Soil Conditions = Infiltration rate 0.15 inch/hour (Type C)
Proposed building addition = 1,000 square feet
Pre-development pavement area impacted = 7,500 square feet
Proposed net impacted impervious change (see Table A-1 and Figure A-2) = 4,700 square feet

Table A-1. Example Site Impervious Surface

	Site element	Area (square feet)
A	Building addition	1000
B1	Demolished pavement for island	- (500)
B2	Demolished pavement for island	- (900)
B3	Demolished pavement for green buffer	-(1800)
B4	Demolished pavement for green buffer	- (600)
C	Replaced Pavement	3,700
	Impacted Impervious Surface	**4,700**

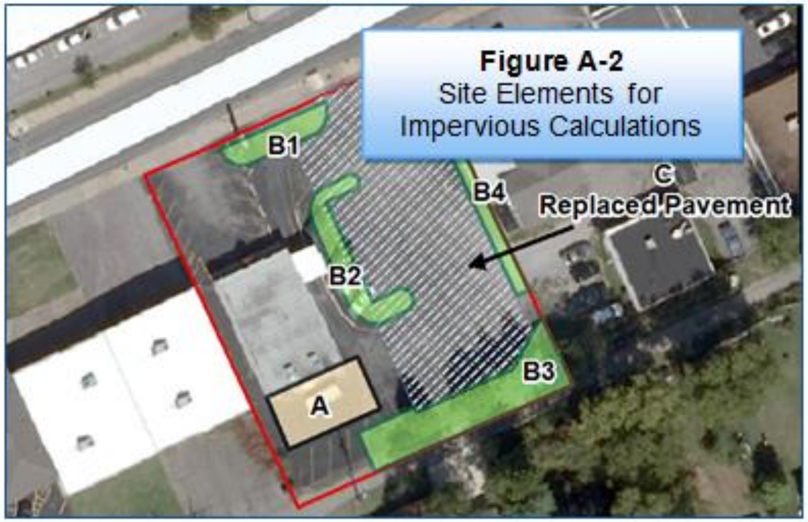
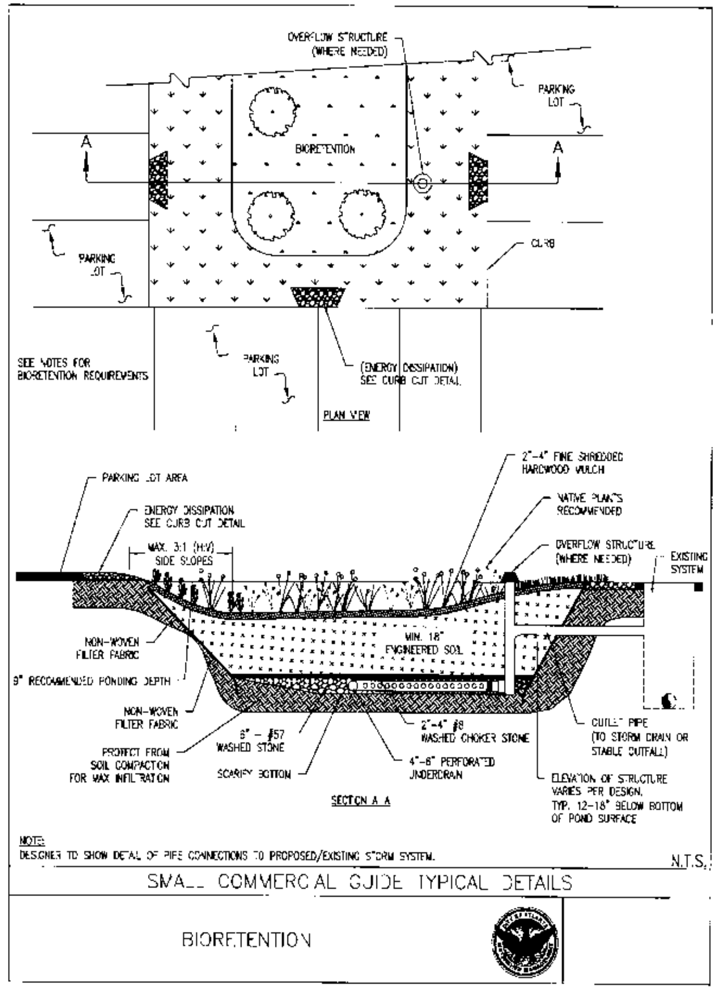


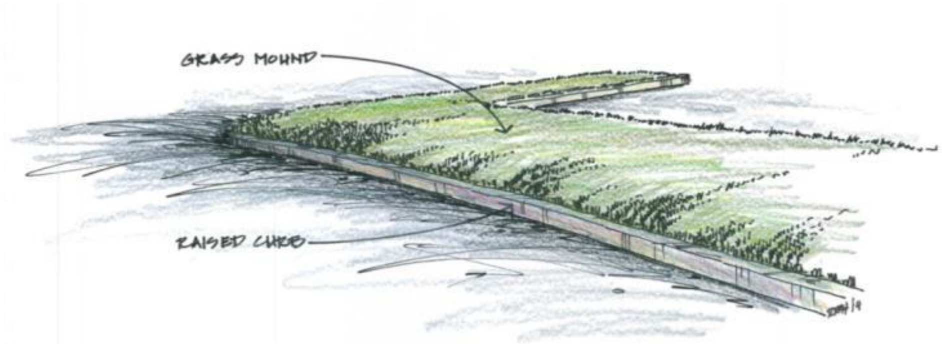
Figure A-2
Site Elements for Impervious Calculations

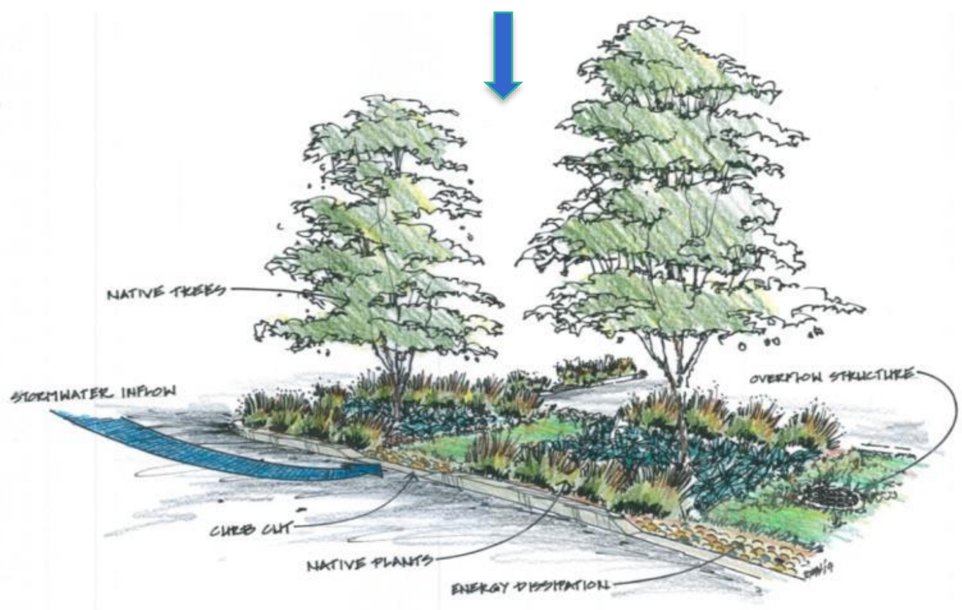
(Note: This manual applies because the net impacted impervious area is less than 5,000 square feet.)

Typical Details

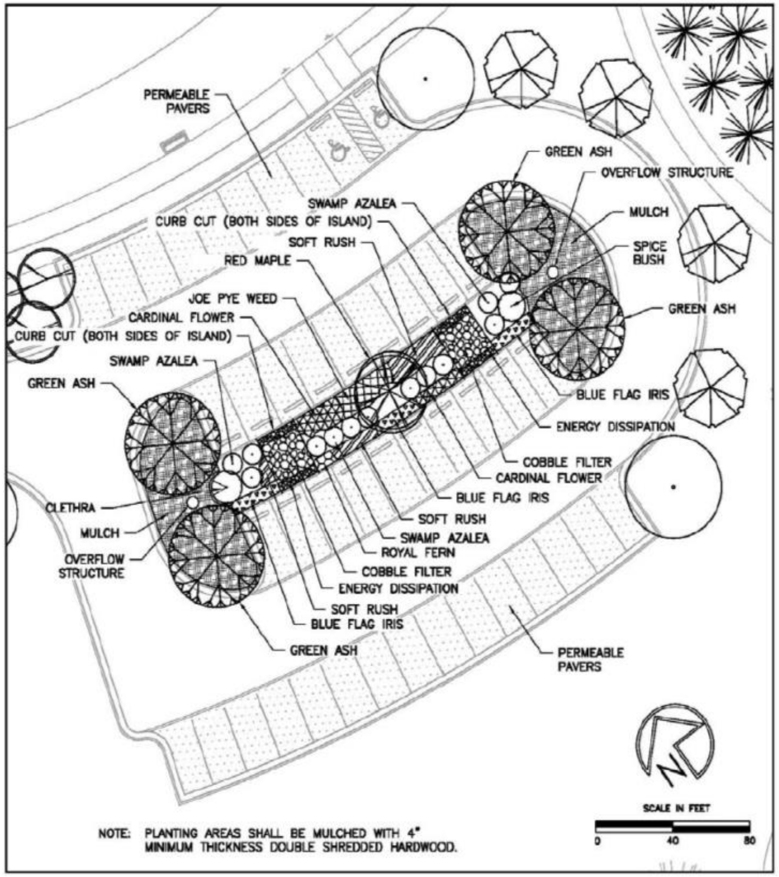


Retrofit examples: Landscape Islands



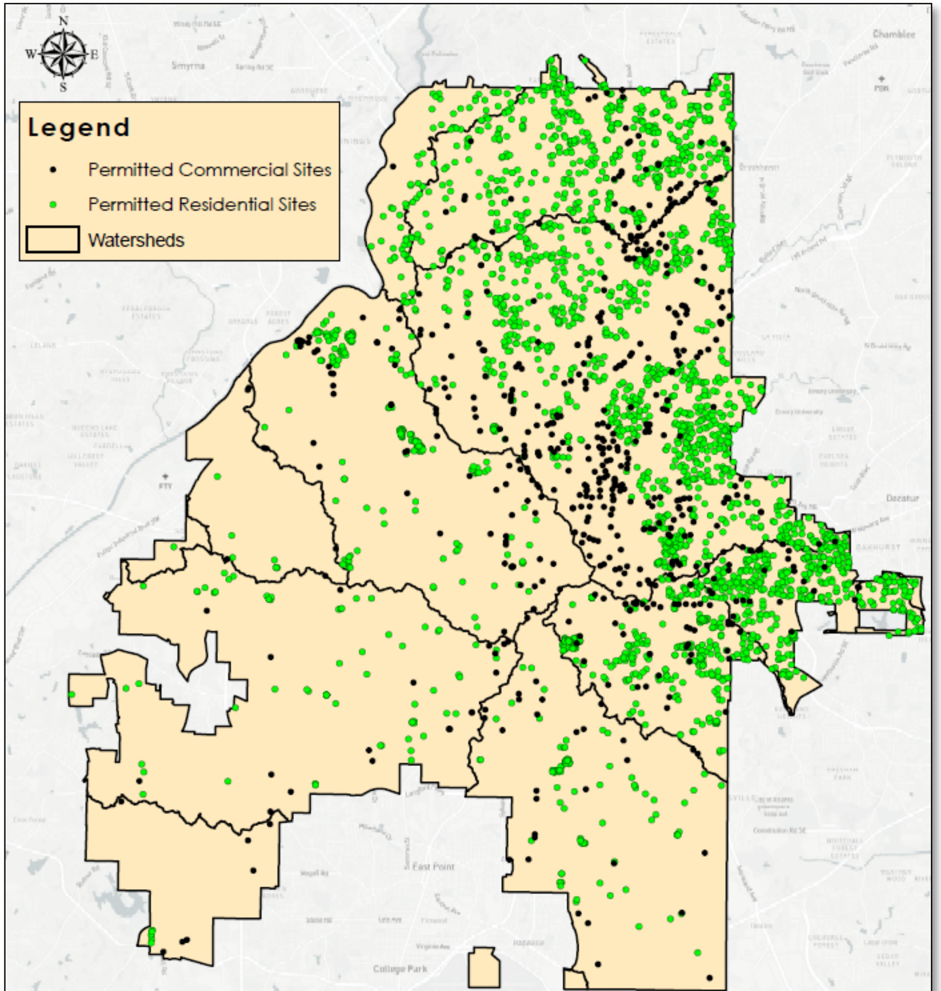


Example Landscape Plans



EXAMPLE #1: PARKING ISLAND BIORETENTION PLANTING

Tracking Green Infrastructure with GIS



Permitted Sites Since Feb 2013

- 700+ Commercial
- 3,200+ Single Family Residential

GIS attributes contain:

- Owner
- Date of completion
- Copy of I&M agreement
- Inspections information
- Green infrastructure BMPs
- Detention BMPs
- Runoff Reduction Volumes

Green Infrastructure can compete for space

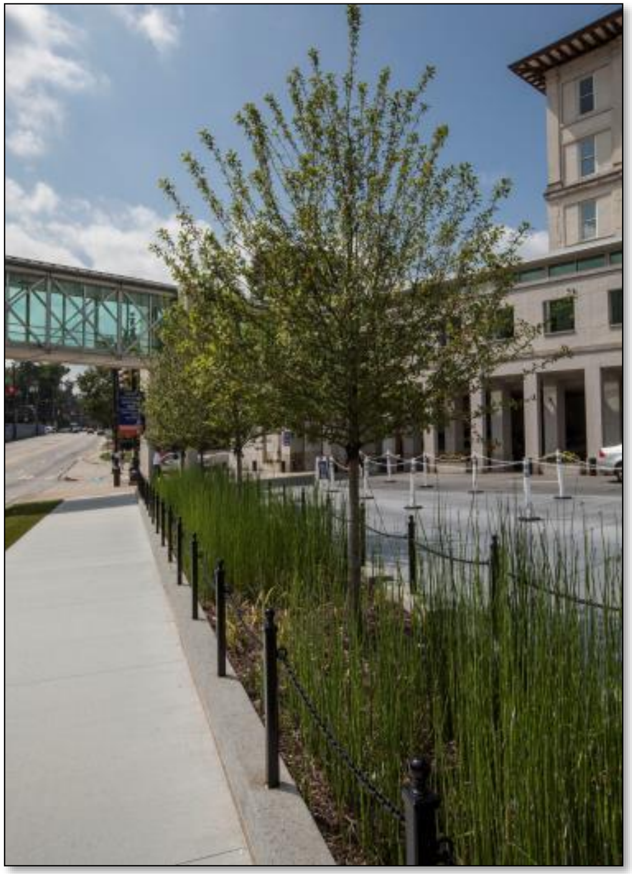
Creativity with site layout

- Upfront coordination between Civil, LA, and Architect

Dual purpose practices:

- permeable pavement
- landscape islands → bioretention
- green roof
- underground detention/infiltration systems

Able to meet tree planting and runoff reduction requirements with one practice



Infiltration Practices in Atlanta

Soils analysis required for all commercial sites

- Infiltration rates, high water table, bedrock, contaminated soils

Compaction of Silt and Clay soils

- Loosening compacted soils on redevelopment sites
- Prevent compaction during construction
- Innovative designs (upturned underdrain) to encourage surface drainage and promote infiltration in clay soils

Erosion control

- Phasing installation to prevent sedimentation issues
- Installation of appropriate BMPs

Erosion Control and Phasing

Green Infrastructure Task Force

City staff plus partners

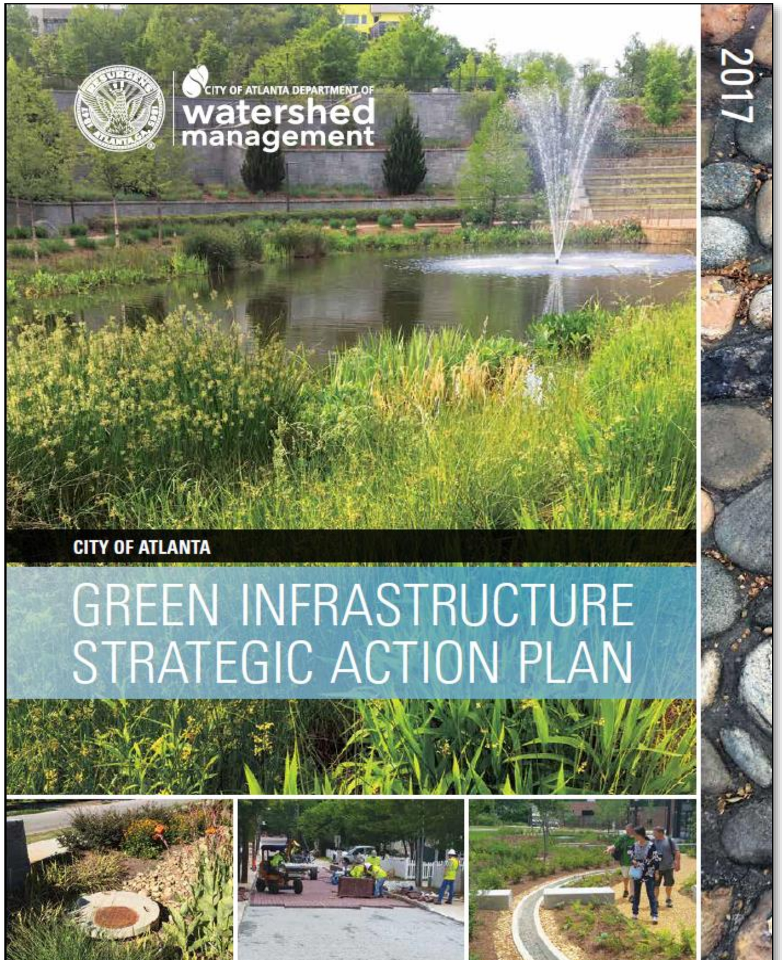
- Watershed, Public Works, Parks & Recreation, Mayor's Office of Resilience, Planning and Community Development, Aviation
- Atlanta Beltline, The Conservation Fund, American Rivers, Invest Atlanta, Chattahoochee Riverkeeper, Trees Atlanta, etc.

Task Force Origins and Goals

- Began through a Peer Exchange trip (2012) to Philadelphia
- Create 'Best-in-Class' program
- Focus on CIPs and processes
- Recently published Strategic Action Plan

Strategic Action Plan

GREEN INFRASTRUCTURE GOAL:
225 Million Gallon Reduction of Runoff Annually
(Annual 1% reduction in volume of runoff from a 1" storm)



Strategic Action Plan Goal

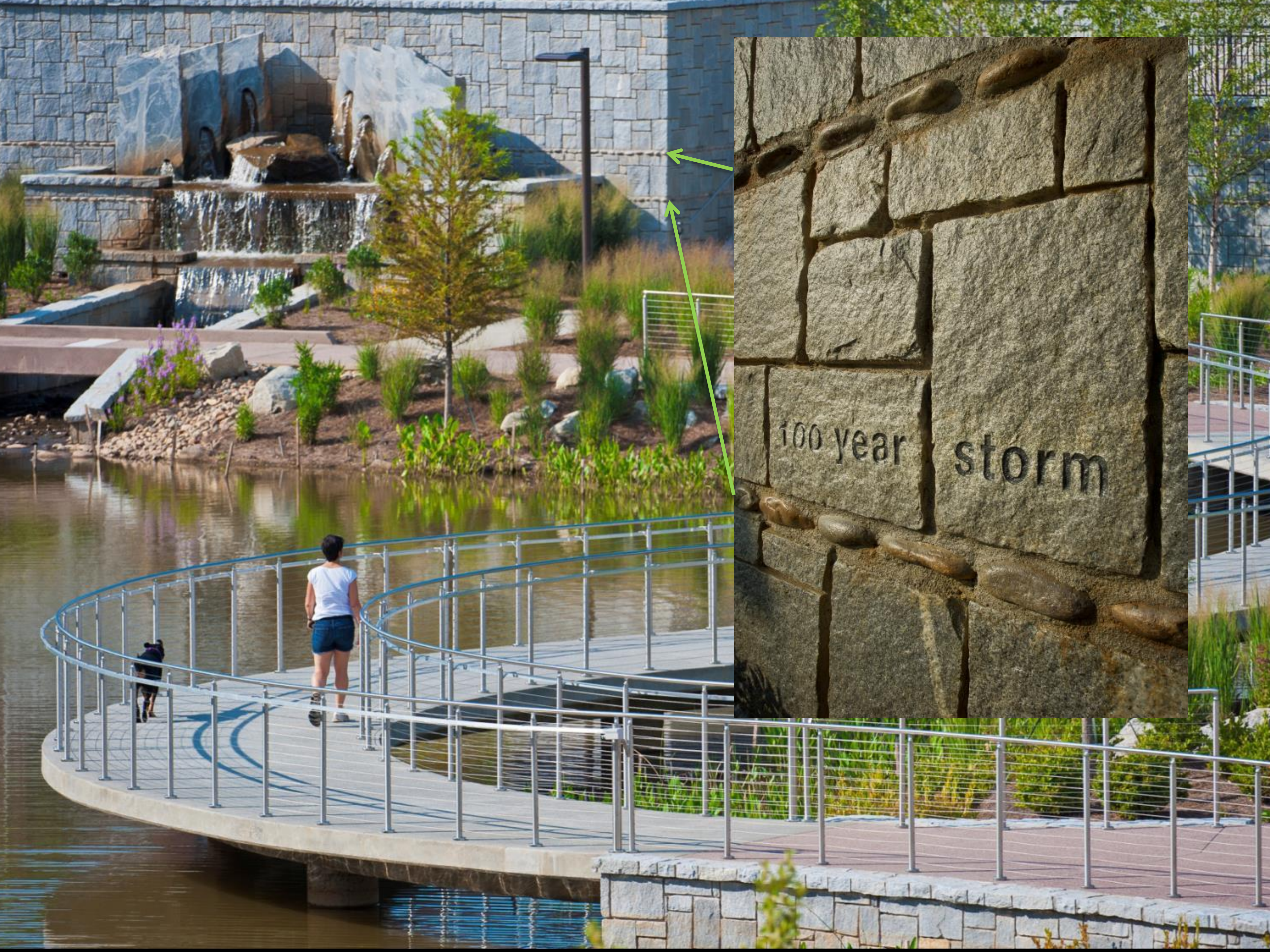
- Through policies, projects, and partnerships, install enough GI to reduce an additional 225 MG runoff volume each year

Actions - Subcommittees

- Project Implementation
- Policy, Funding, & Planning
- Partnering & Outreach
- Data Tracking & Technical Analysis

Historic 4th Ward Neighborhood - 2008

Combined Sewer Capacity Relief - Today


100 year storm

Nature Influenced Design

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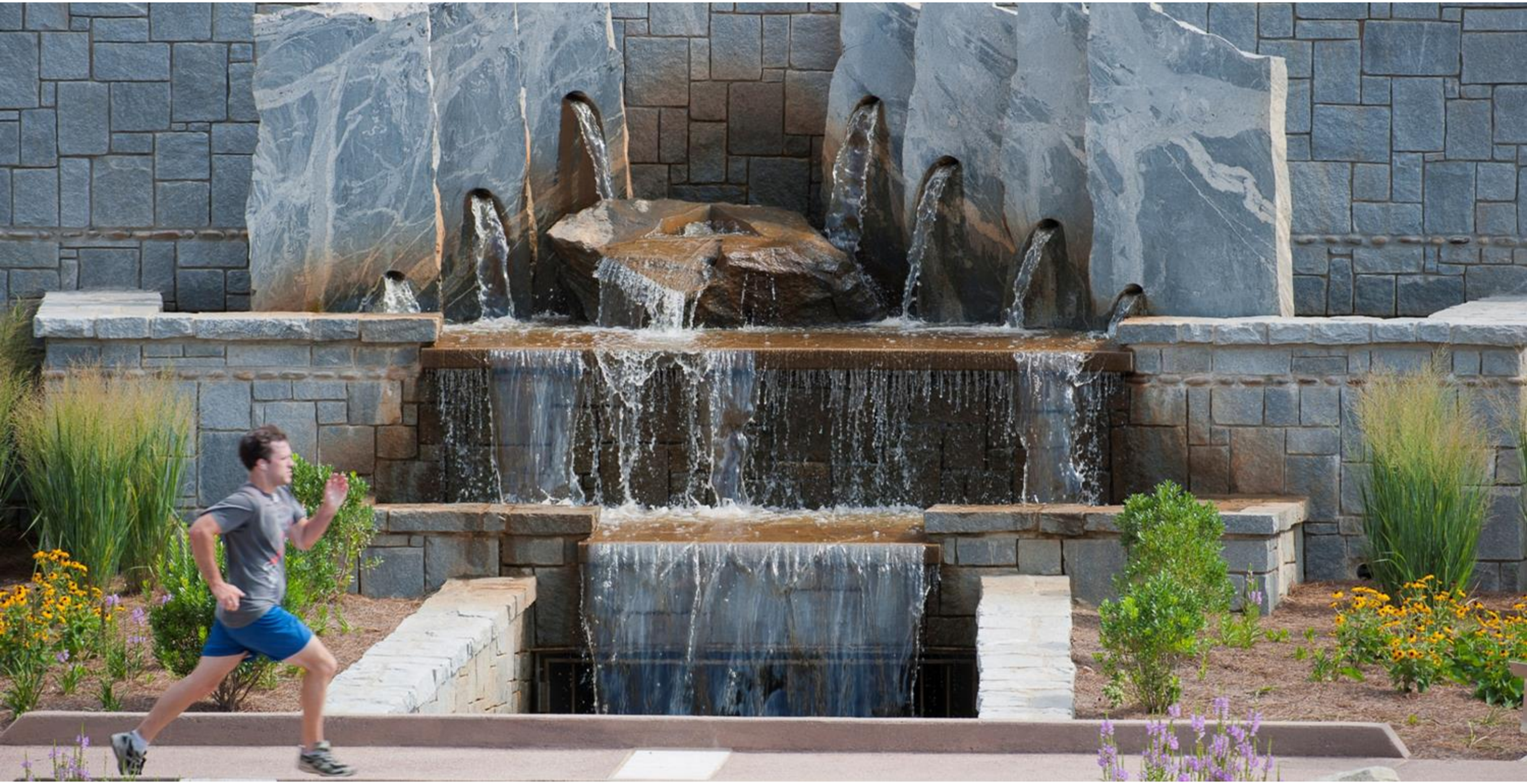
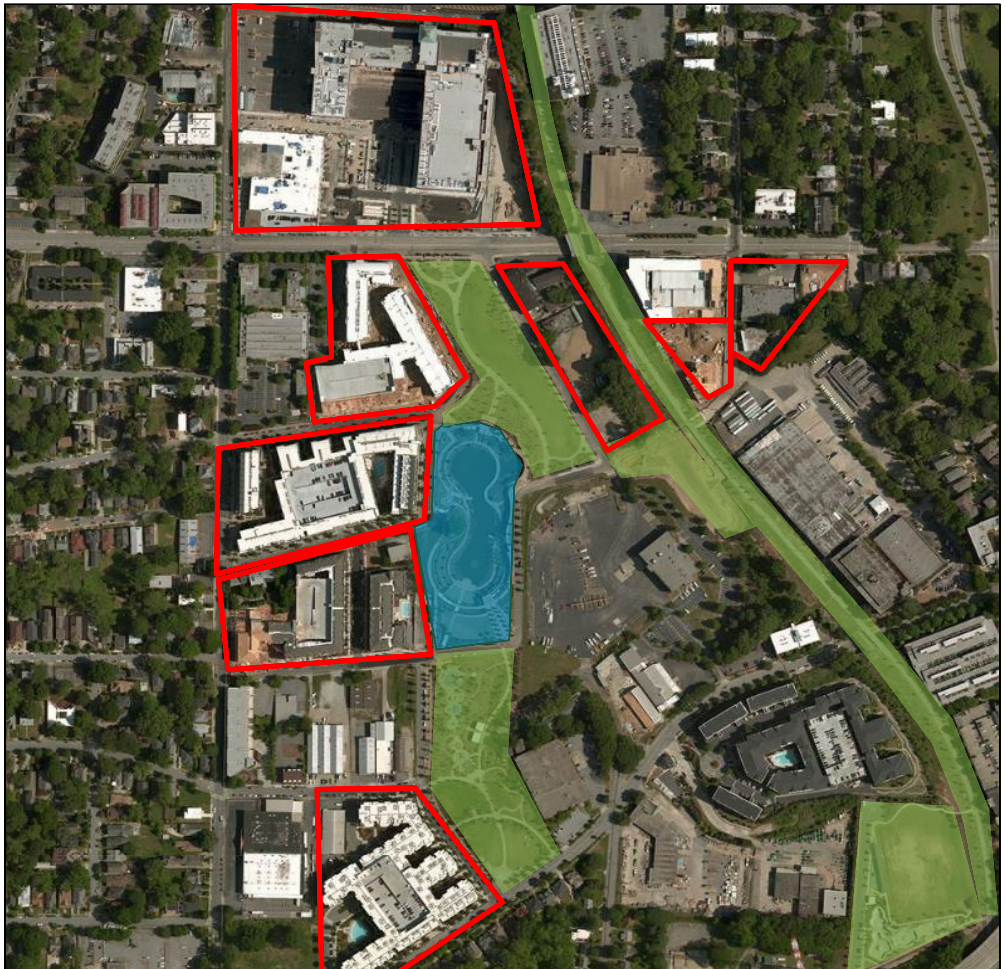
Aerating Fountain



Which would you prefer?

Spurring Economic Development



$500M in Redevelopment

- Apartments
- Condos
- Ponce City Market

April 16, 2017 – 4” rain event

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Three days later…

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April 16, 2017 – 4" rain event

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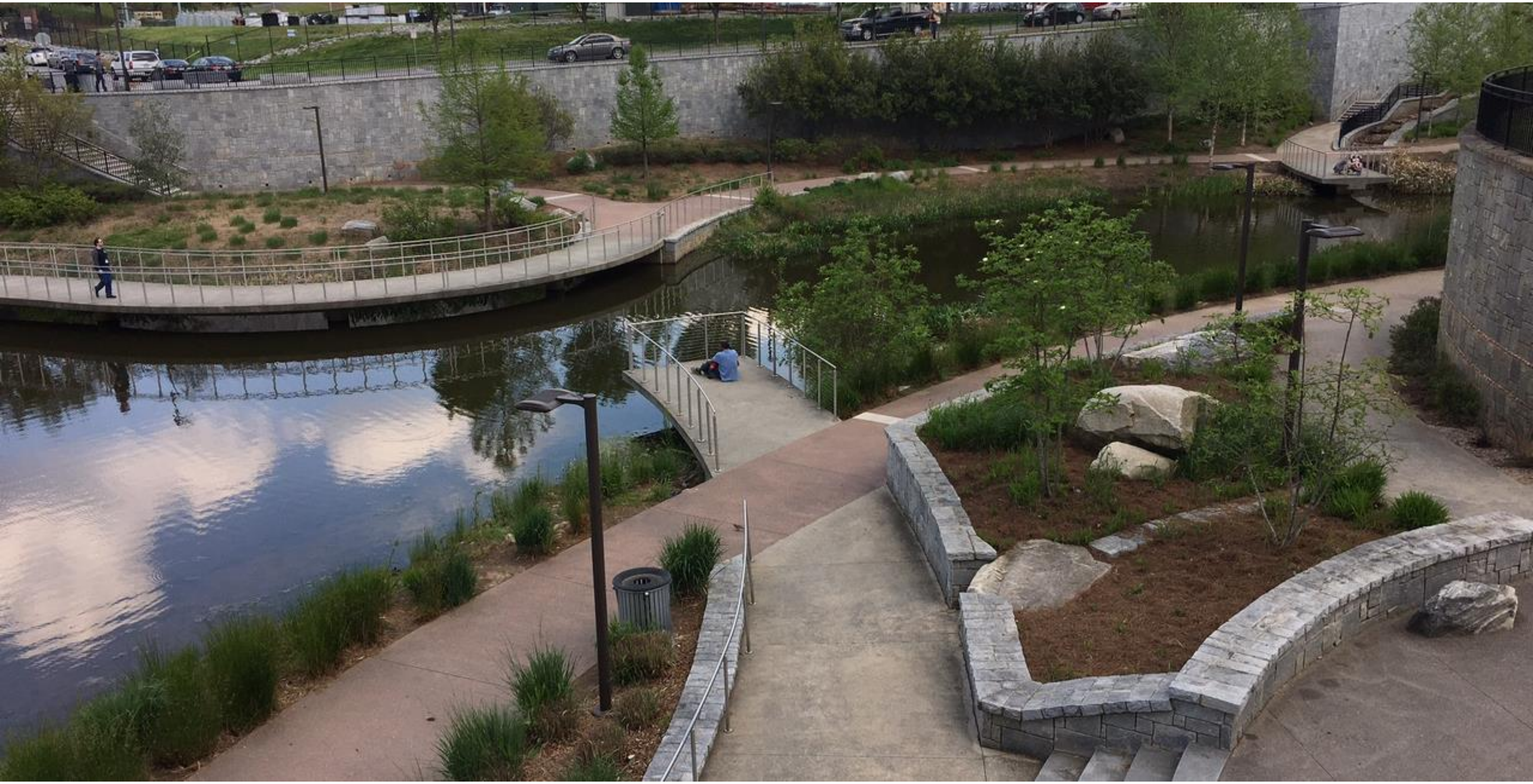
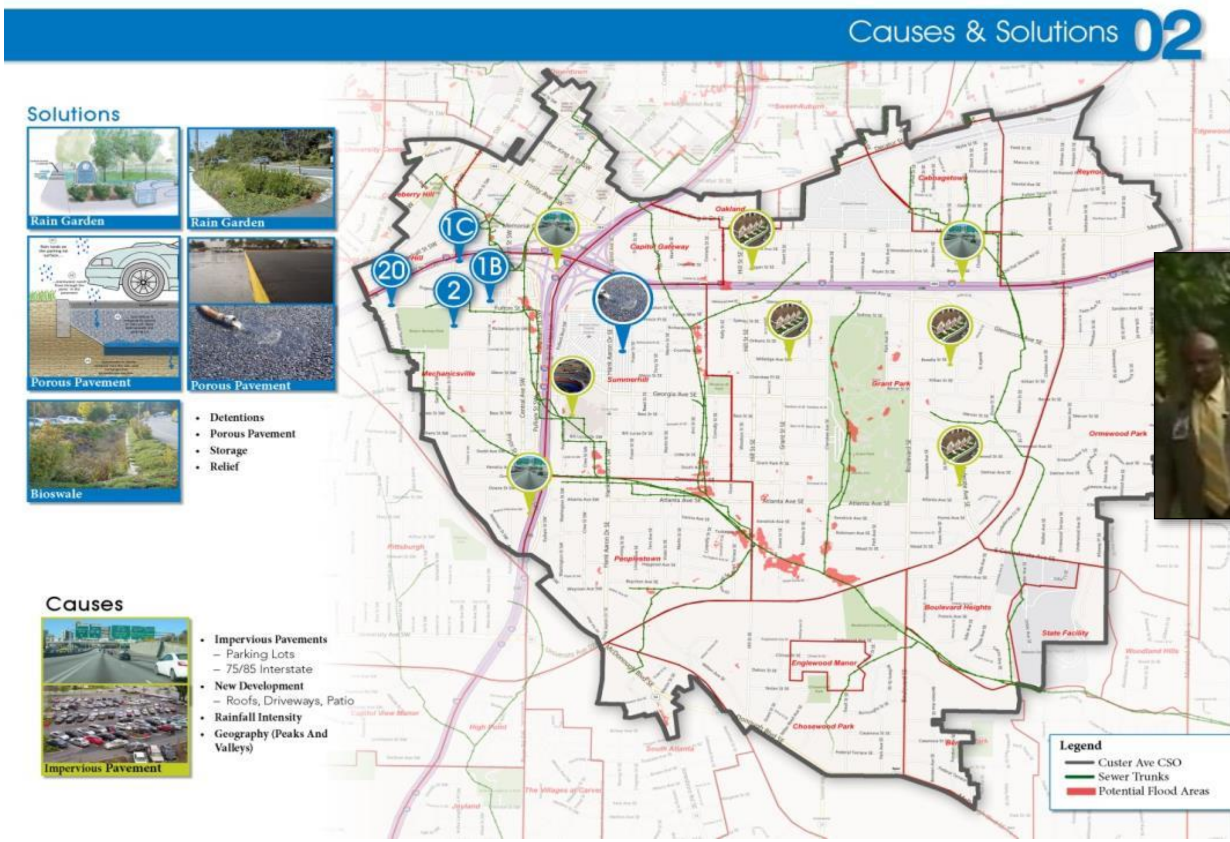
Three days later…



Southeast Atlanta Green Infrastructure Initiative

Combined Sewer Capacity Relief



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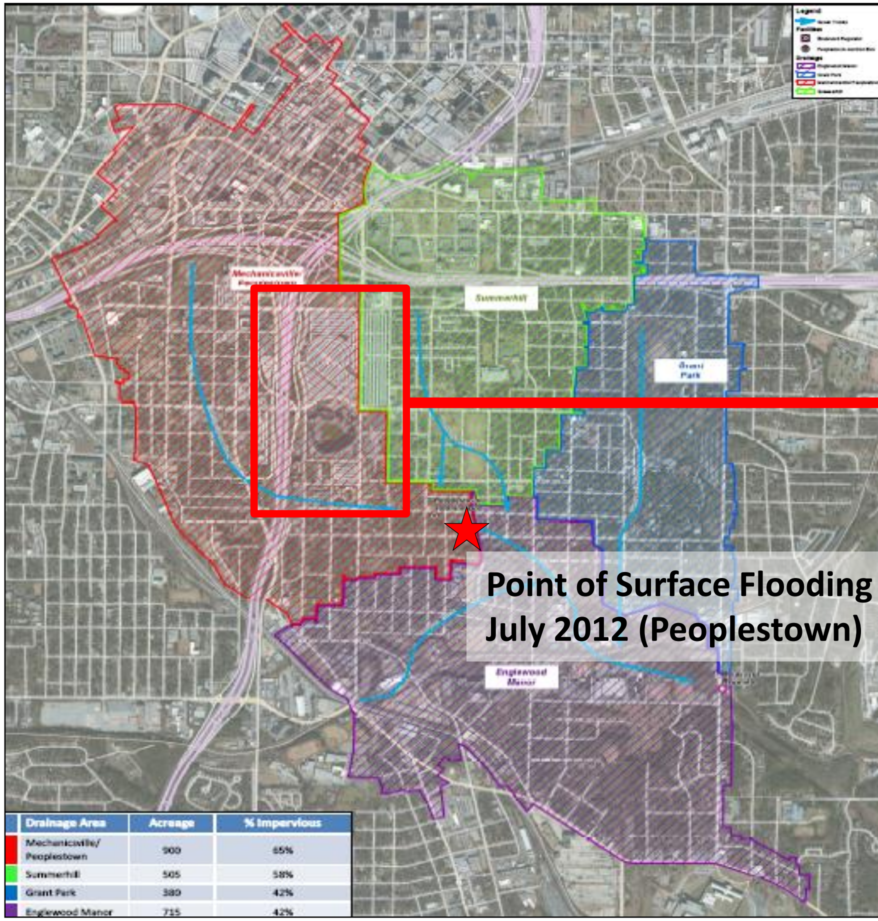
Contributing Conditions

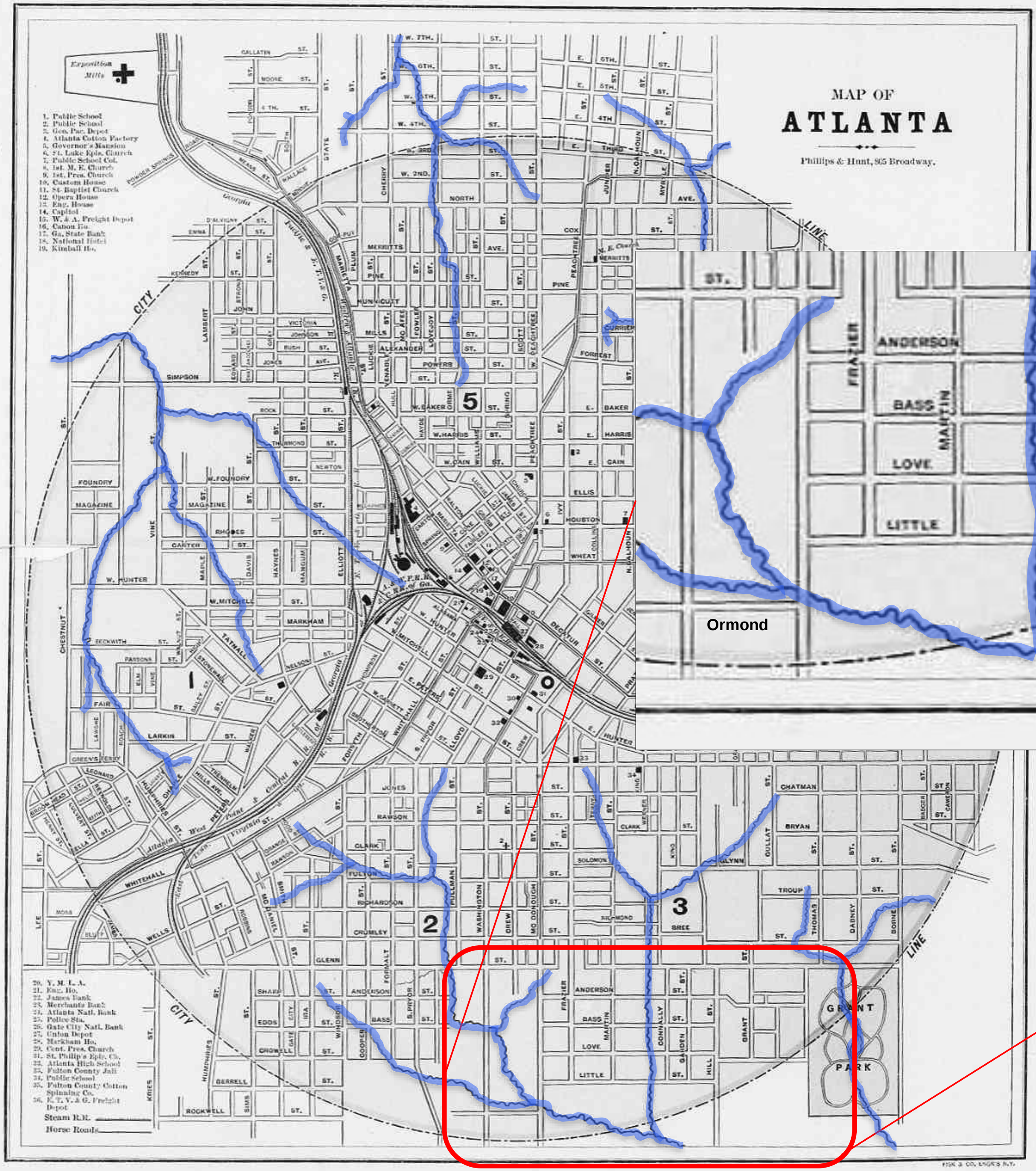


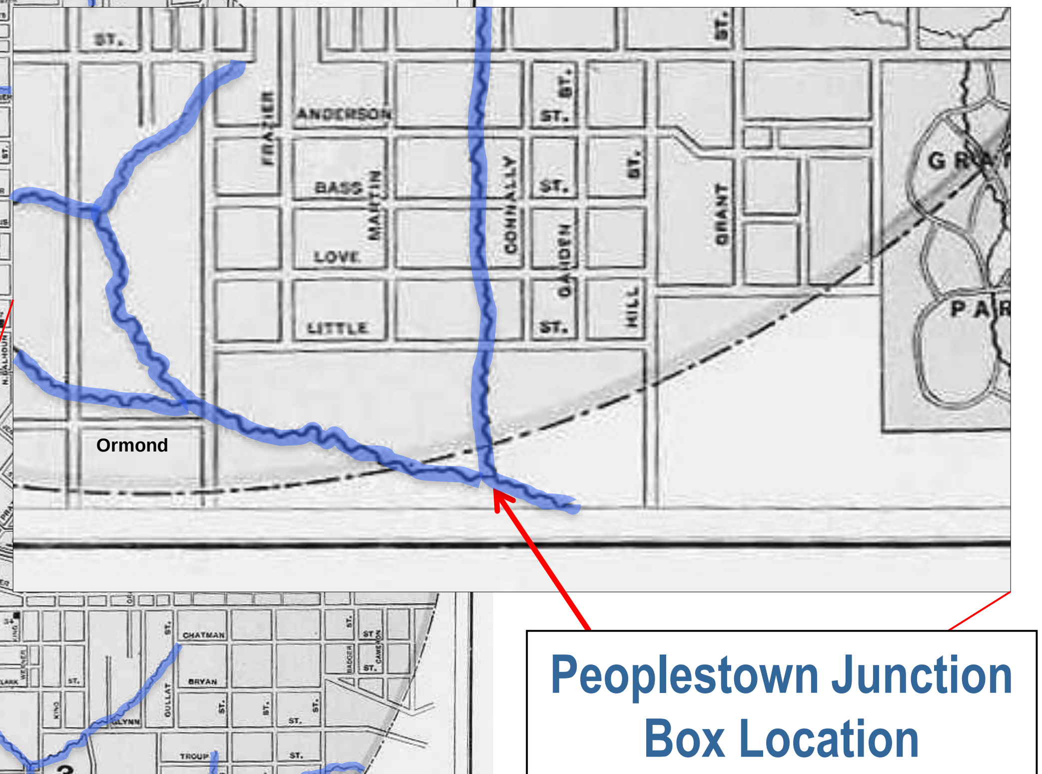
Drainage Basin	Total Area (acres)	% Impervious	Impervious Area (acres)	Roadway Area (acres)
Mechanicsville / Peoplestown	900	65%	582	220
Summerhill	505	58%	293	110
Grant Park	380	42%	162	55
Englewood Manor	715	42%	301	62

Historical Perspective

Map of Atlanta

1886



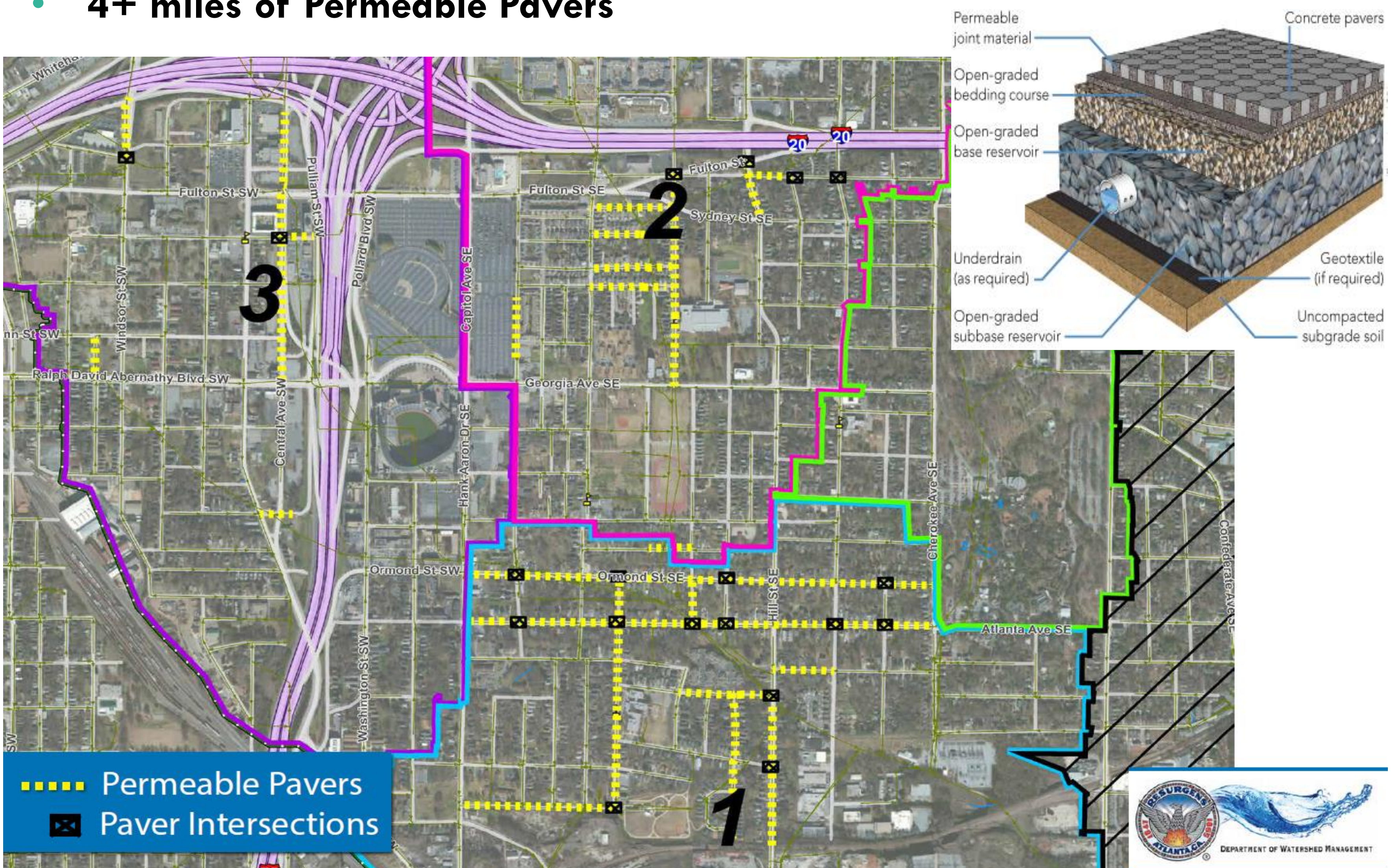


Peoplestown Flooding

Phase 1 Projects- Completed

Phase 2: Permeable Roadways

- **4+ miles of Permeable Pavers**



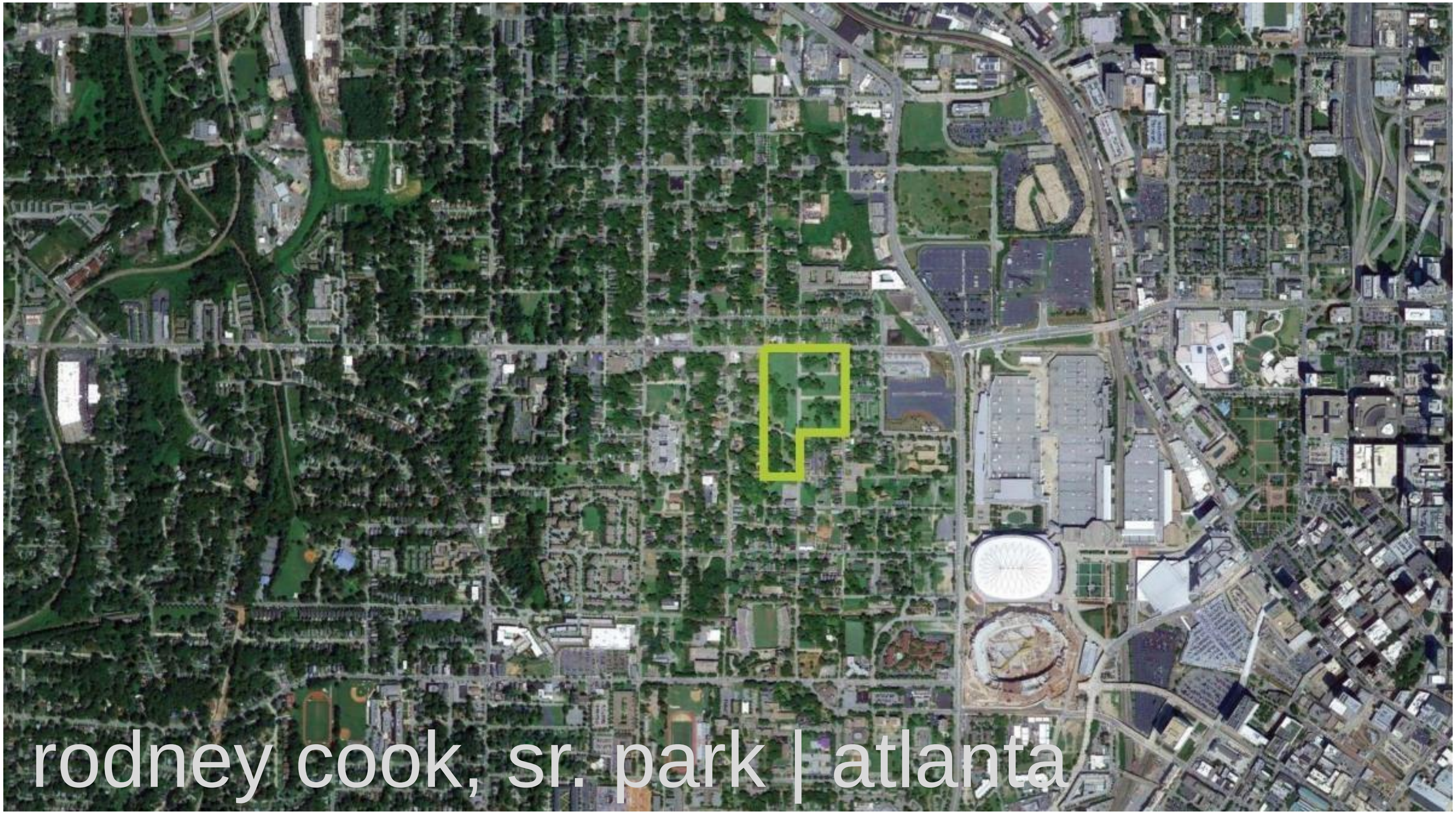
Department of Watershed Management

Construction Sequence

- **Excavation, aggregate reservoir, paver installation**

Completed Streets

Rodney Cook, Sr. Park in Historic Vine City



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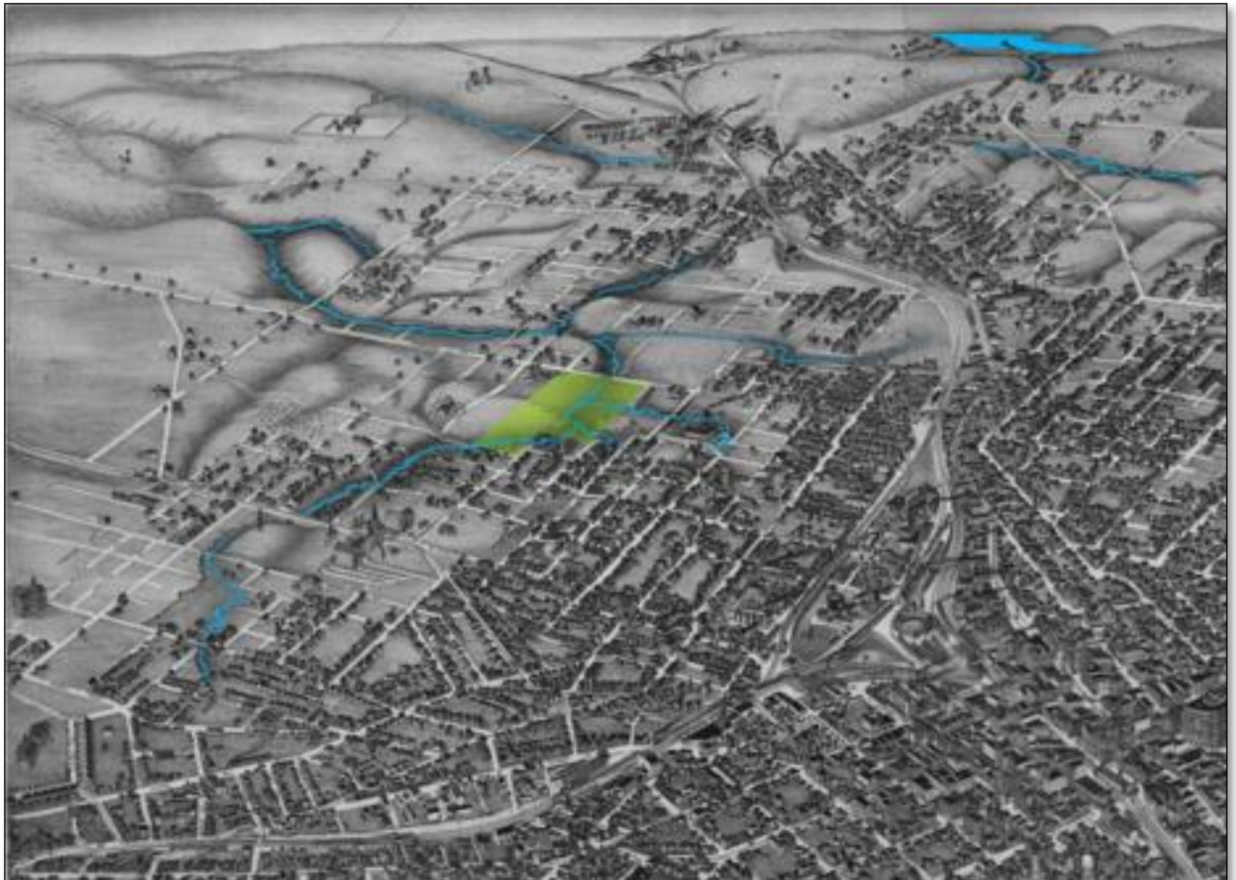
Upper Proctor Creek Capacity Relief



History

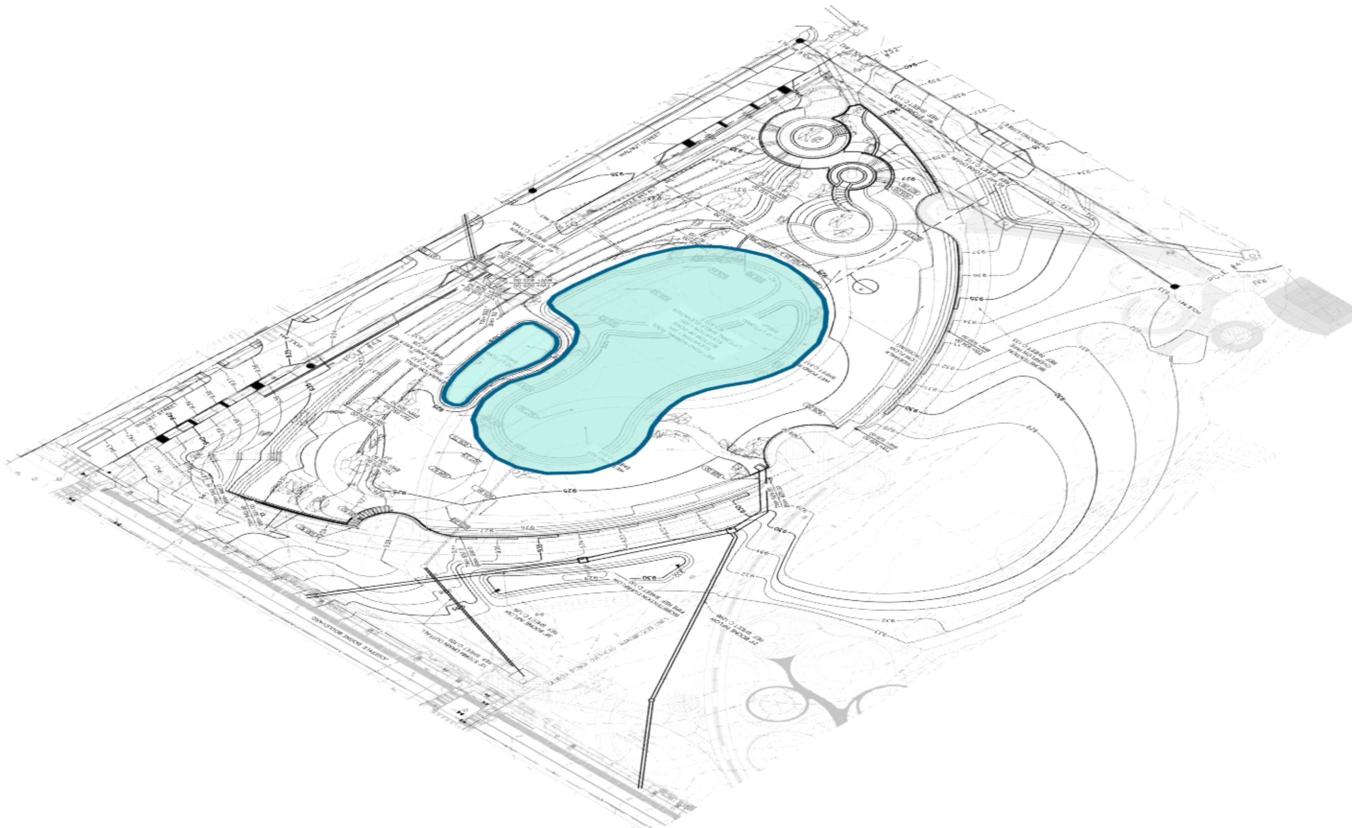
- 2002 storm event caused catastrophic flooding in the Vine City neighborhood
- Over 60 homes were purchased by the City as a result
- Combined sewer basin
- Opportunity for multiple partnerships to resolve flooding concerns and restore community health

Rodney Cook, Sr. Park in Historic Vine City

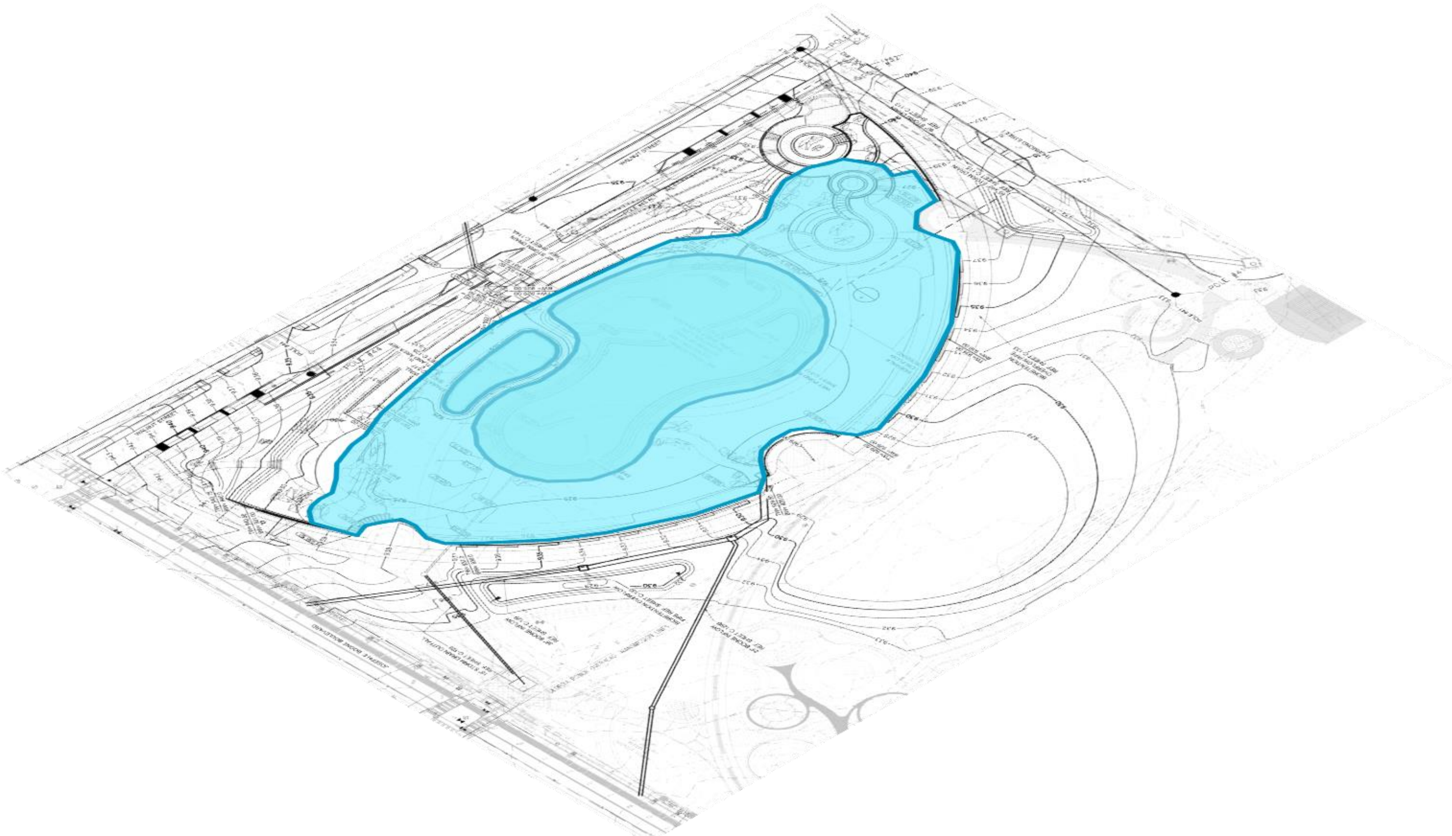
DWM Components of the Project

- 9+ MG stormwater wet pond with littoral shelf and created wetlands
- Green Infrastructure including bioretention, stormwater planters, rainwater harvesting cisterns, and soil restoration
- Rerouted combined sewer trunkline (96")
- Aerating water features
- New sidewalks and roadway improvements
- Separated storm drain pipelines

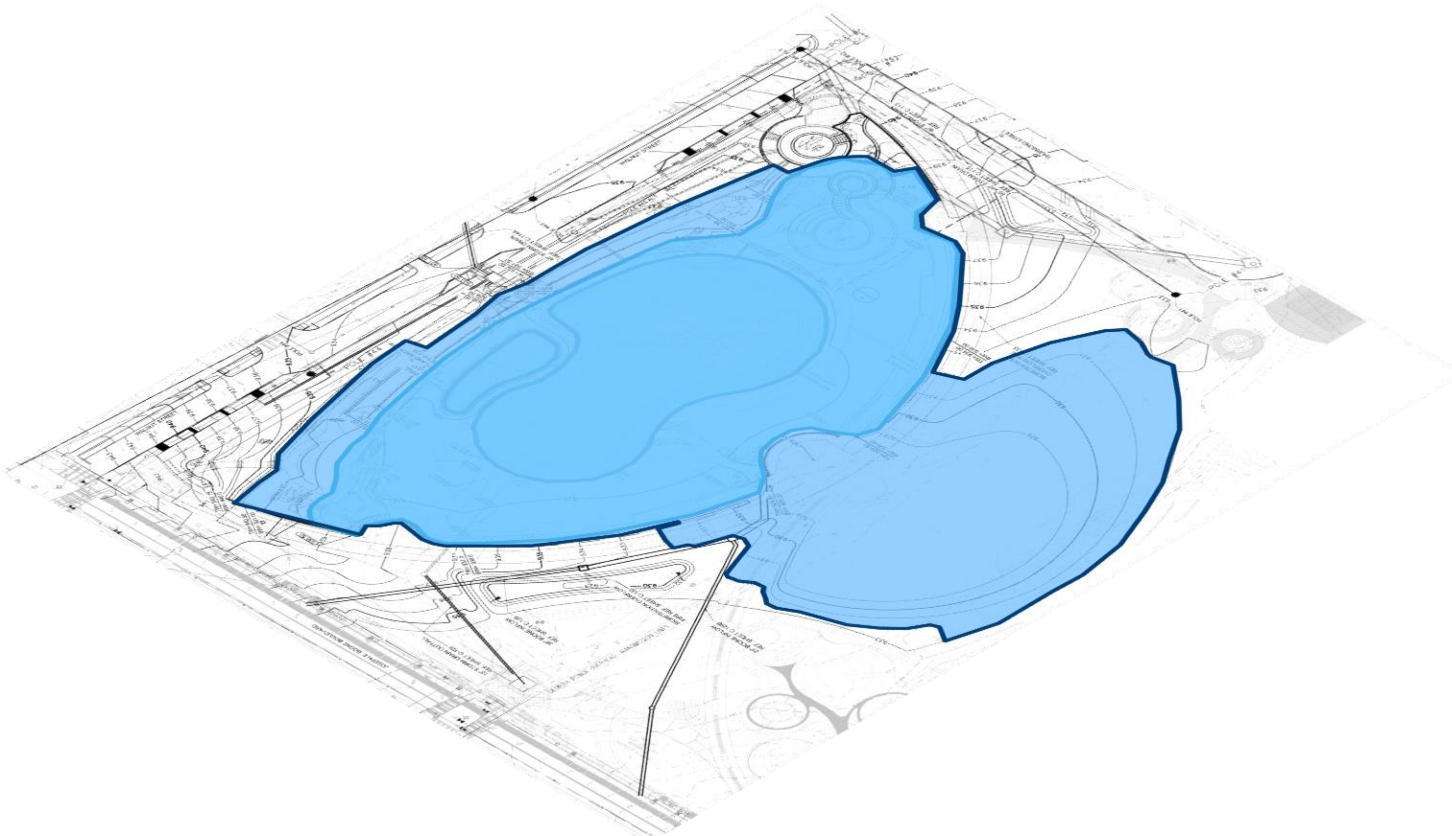
Normal Pool



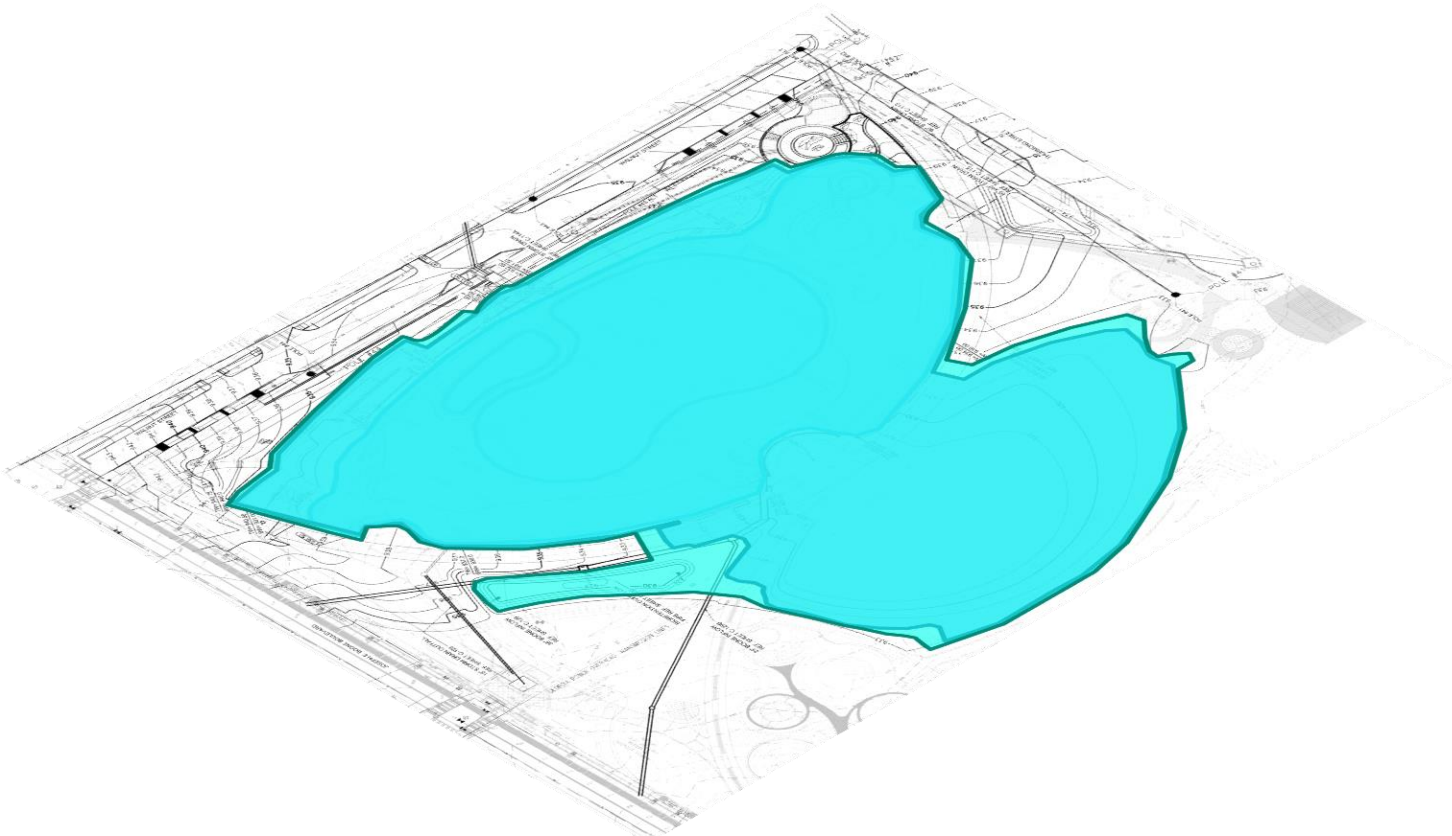
2-year Storm



25-year Storm



100-year Storm

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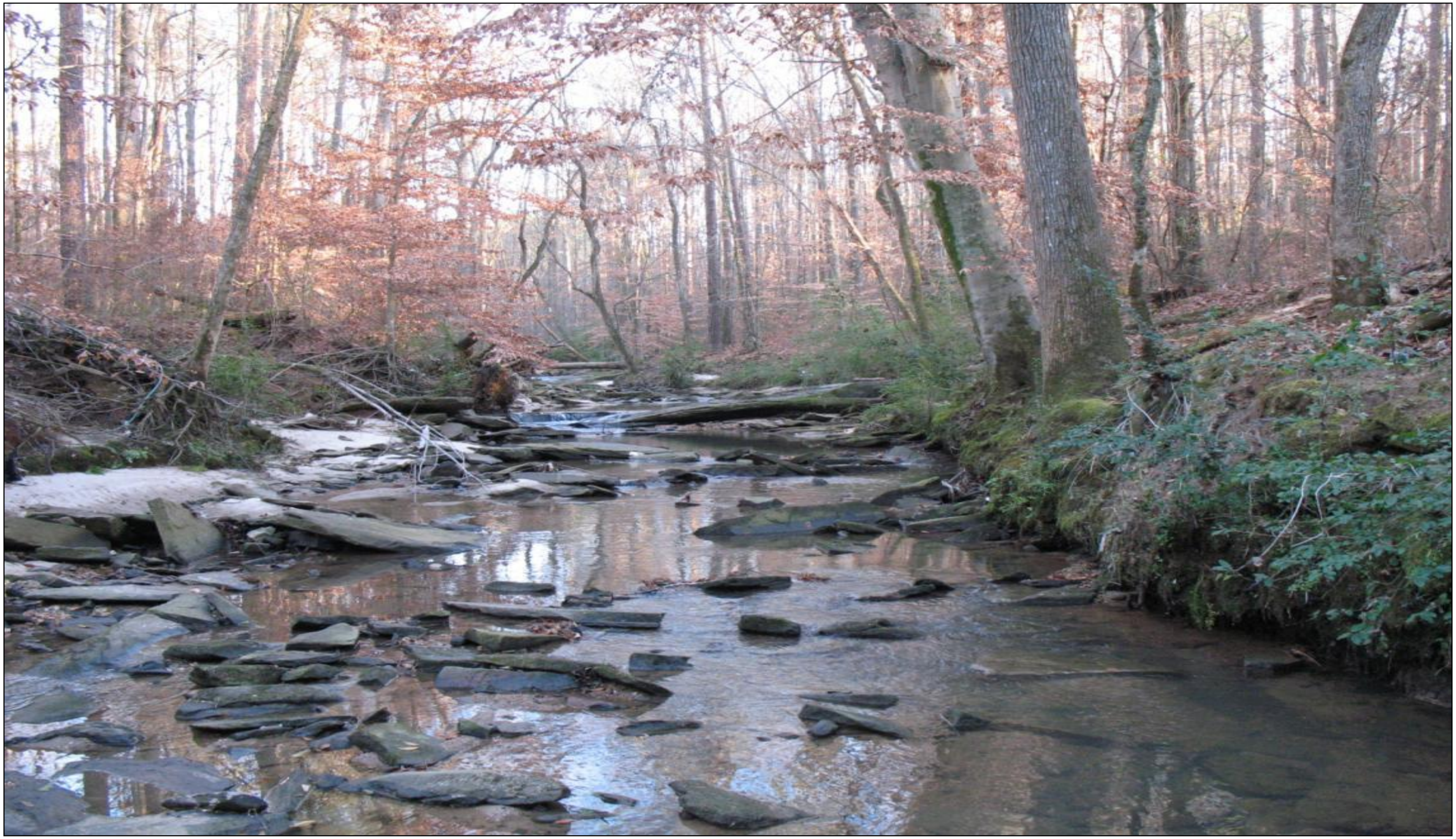
CITY OF ATLANTA DEPARTMENT OF
watershed
management

In Summary…

- Utilizing green infrastructure as a tool to address historic drainage issues and water quality is possible, practical, and can spur economic growth
- Coordinating w/ other City Departments and developing partnerships is vital
- Providing a robust outreach and education program and developing relevant guidance documents aids in transition
- Leading by example is key

Questions?



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