

Clean Water ... Green City



Blending the interests of land and water in Philadelphia

*Howard M. Neukrug, PE
Director, Office of Watersheds*

A Timely Convergence of Events

- Urban Waterfront Redevelopment / Recreation
- Sustainable City Movement
- Global warming and water
 - Sea level rise
 - Increased storm intensities
 - Water resource concerns
- Carbon footprint / energy / water
- Interest in Green Infrastructure solutions to CWA
 - CSOs, SSOs, storm flood relief
 - \$ billions for new (grey or green??) infrastructure

We are on the verge of BIG CHANGE...



MSU Green Roof Research Program
(courtesy Old House Journal)

Philadelphia Water Department Office of Watersheds



- An integrated utility:
 - Drinking Water
 - Wastewater
 - Stormwater



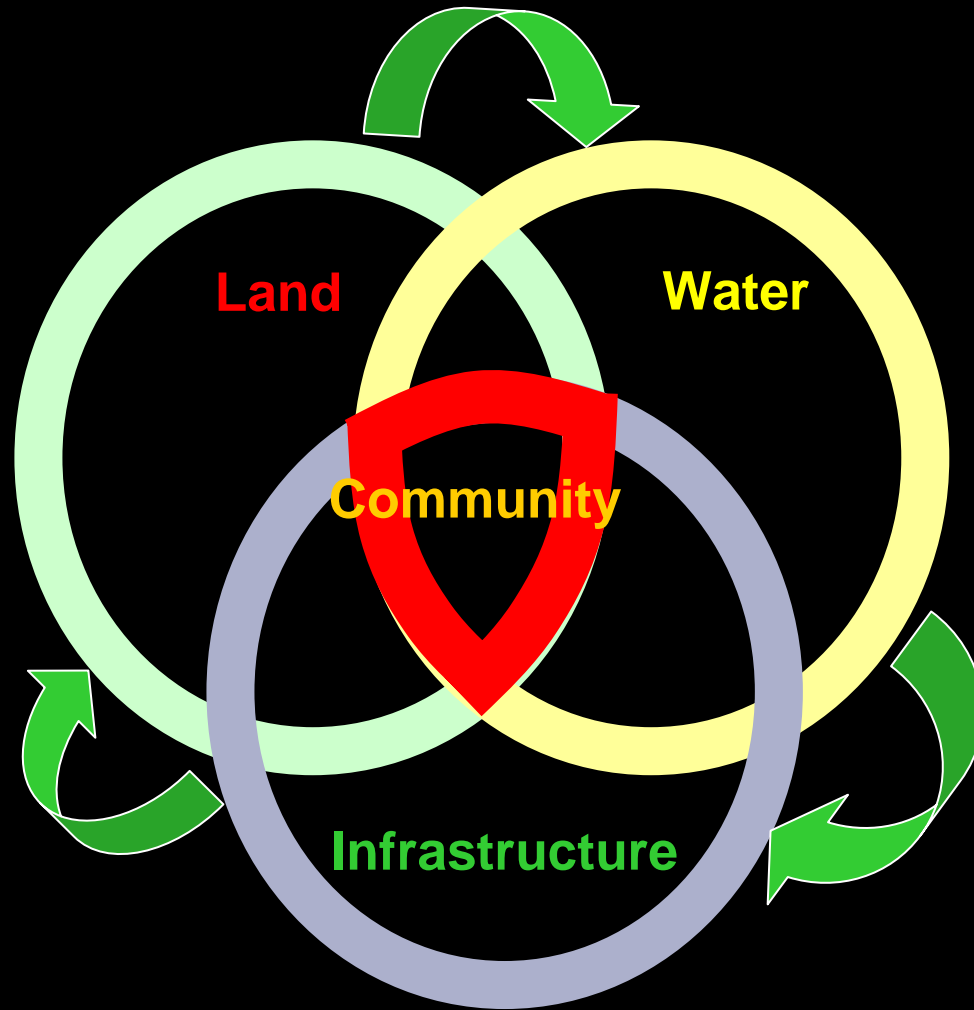
- A new integrated approach:
 - Land
 - Waterways
 - Infrastructure
 - Community

Clean Water ... Green City



- Unite the City with its water environment
- Create a green legacy for future generations
- Incorporate a balance between ecology, economics and equity

Linking land and water



Linking land and water



Why Manage Stormwater?

High Storm Flows Destroy Valuable Aquatic and Riparian Habitat





How to Manage Stormwater

Old Approach –

Collect it and pipe it away quickly!



How to Manage Stormwater

New Approach –

Temporarily hold it on site to allow it to:

Infiltrate

Evaporate

Be Reused

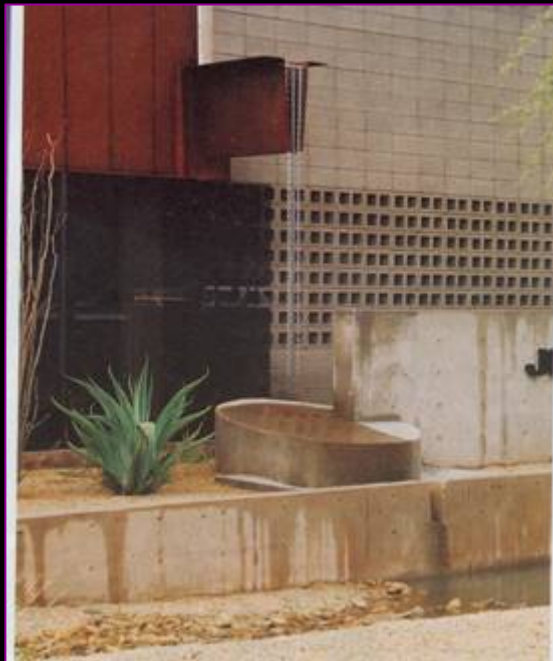


Green infrastructure is recognized as:

- Cost effective,
- Environmentally preferable, and
- An acceptable solution to Clean Water Act goals

Disconnectivity

Instead of being directly connected to stormwater infrastructure, rain leaders are “disconnected” and allowed to discharge across a lawn or into a rain garden, swale or infiltration bed.



Tucson, AZ



Portland, OR

Rainwater Harvesting

Put that rainwater to work! Collected rainwater can be used to water your garden or houseplants, for washing the car, or even for flushing toilets.



Bioretention Areas (Rain Gardens)

Stormwater directed to these shallow topographic depressions in the landscape is filtered, stored, and infiltrated into the ground using specialized vegetation and soils.

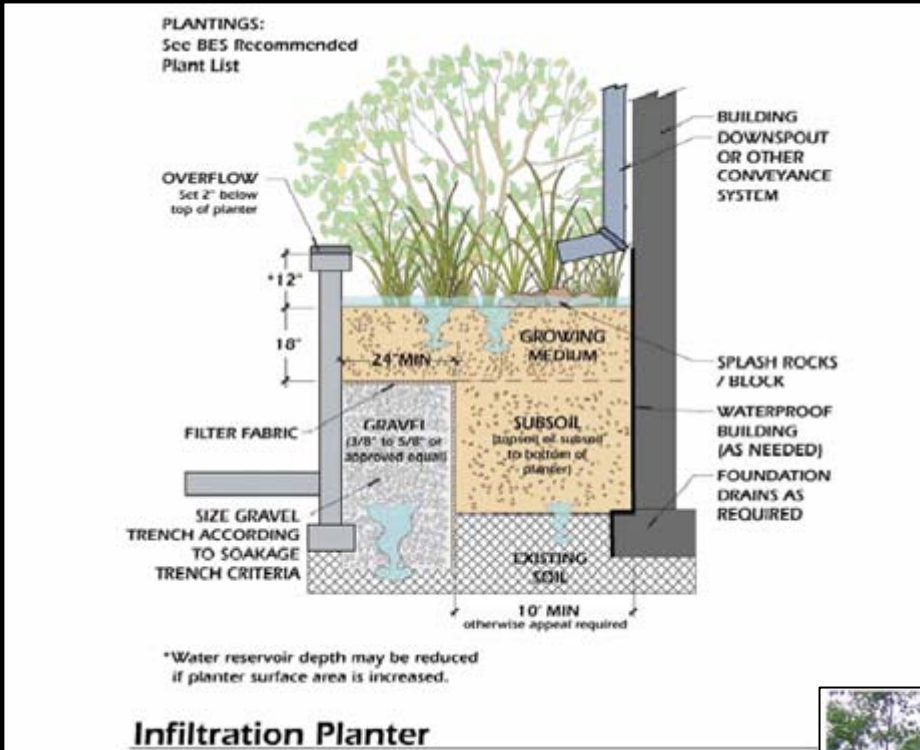


Bioretention and Urban Streetscape

(Portland, OR)



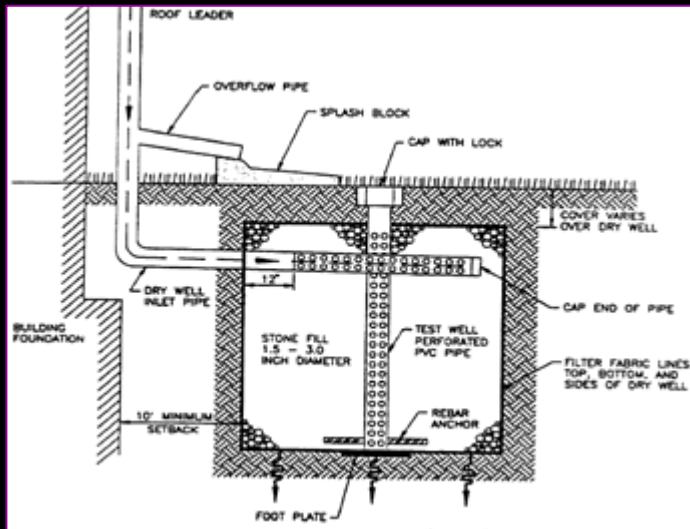
Bioretention and Architecture



Portland, OR

Infiltration Systems

Any system designed to promote stormwater infiltration into groundwater. Include basins, trenches, drywells, stone beds beneath pervious pavement, etc.



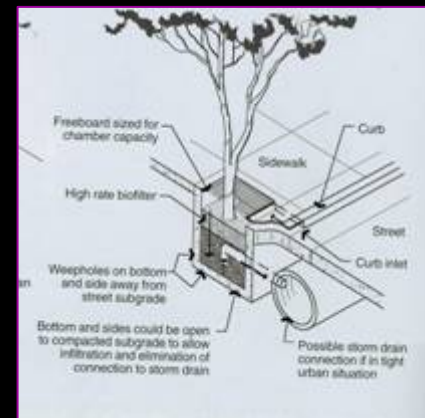
Example of Residential Drywell (US EPA)



Recharge Bed under Porous Pavement Play Yard (Penn Alexander Elementary School, Philadelphia)



Stone Infiltration Trench at Edge of Parking Lot



Specialized Tree Pit / Storm Inlet Design

Open Swales/Surface Channels

A swale is a long, shallow depression used to direct water along the surface of the ground. Stormwater is slowed, cleaned, and absorbed into the ground and/or evaporated.



Porous Pavements

A type of pavement that allows rain or snowmelt to pass through it. Can be specialized asphalt or concrete, dry-laid interlocking pavers, or other materials.

Sidewalks & Walkways



Parking Lots

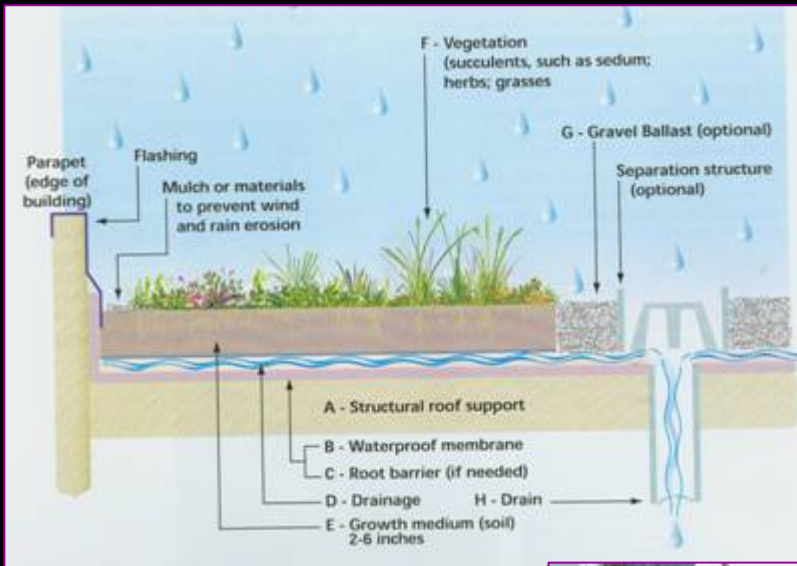


Driveways & Patios



Green Roofs

Roofing systems specially designed to grow vegetation, normally consisting of a special waterproof and root repellent membrane, drainage system, filter cloth, lightweight growing medium, and plants.



Philadelphia Fencing Academy



Wellness Center
Sugarloaf, PA

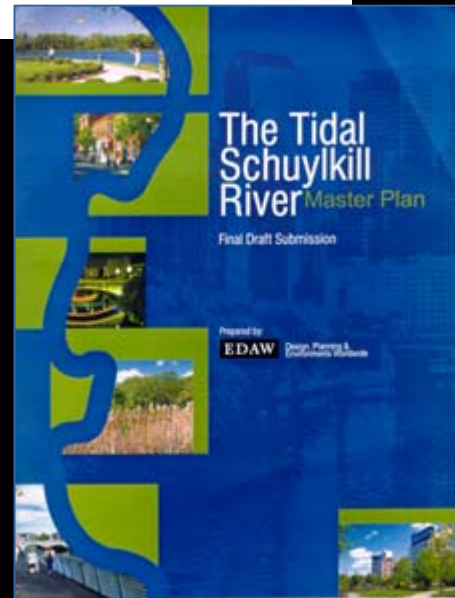
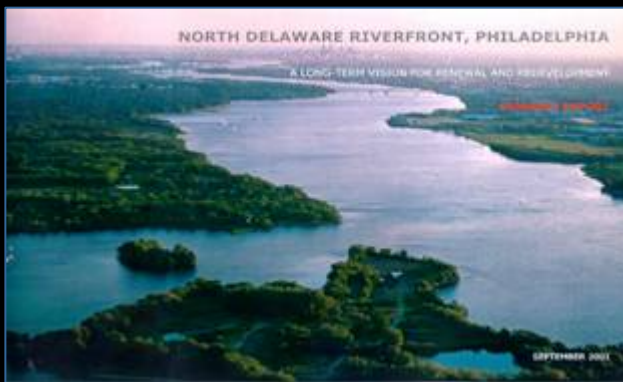
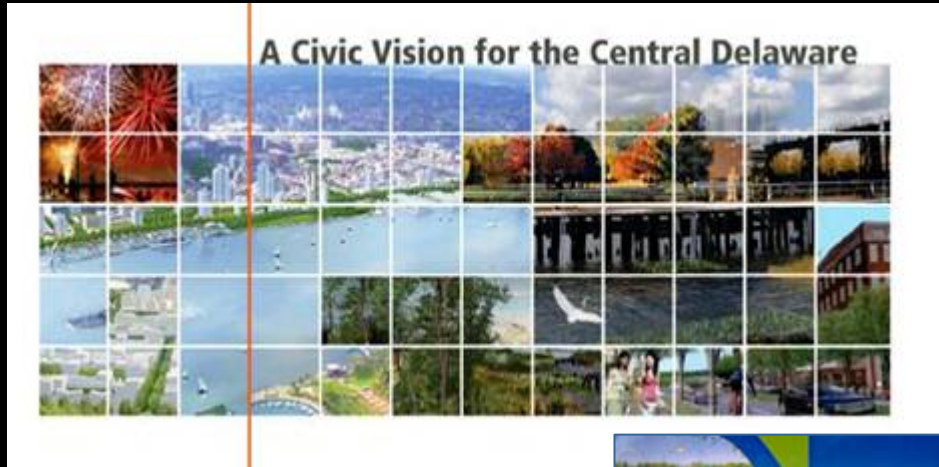
Heinz 57 Center
Pittsburgh



Why are we here?

- New convergence of water and land issues
 - Everything we are looking to do to improve our water environment depends on our approach to land management
- We need to work together if we want to realize a green vision for our cities
- Recognizing the full cost of service for SW management
 - Encourage conservation
 - Fair and equitable distribution of costs
 - Incentives for land-based green infrastructure

There is a real connection of planning between land and water



Planning for land can improve our water



Grand Prize Winner
Urban Voids Competition
The Van Alen Institute

Juliet Geldi
Chariss McAfee
Charles Loomis
Gavin Riggall

WATERWORK

Philadelphia + vacant land + water = stormwater management + civic beauty + fun!

For more information:
Project team contact:

www.vanalen.org/urbanvoids
Charles Loomis, charlesl@loomismcafee.com

Planning for our water can improve our land



Civic Vision for the Central Delaware

There are significant issues ahead of us for improving the water environment

philly.com

"It's like Katrina – but underground."
Margaret Kalalian, East Passyunk Crossing Civic Association



MICHAEL BRYANT / Inquirer Staff Photographer

Mario Frisbie of the 100 block of West Allen Street in Northern Liberties adjusts a lightbulb in her basement. Floods of sewage during increasingly frequent big rains have ruined most of the belongings she stores there.

More rain, old sewers make for nasty story



1 28 '9

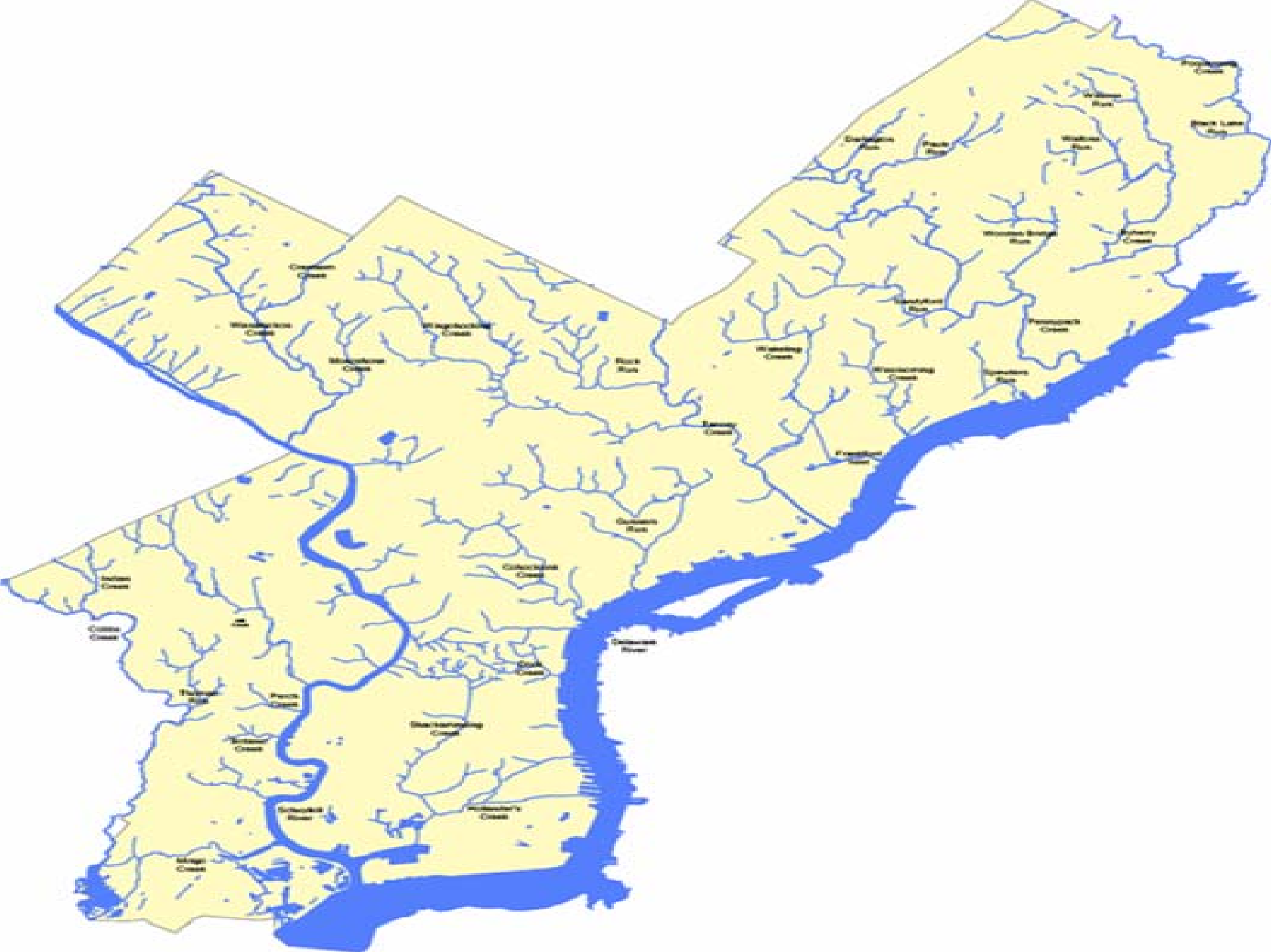


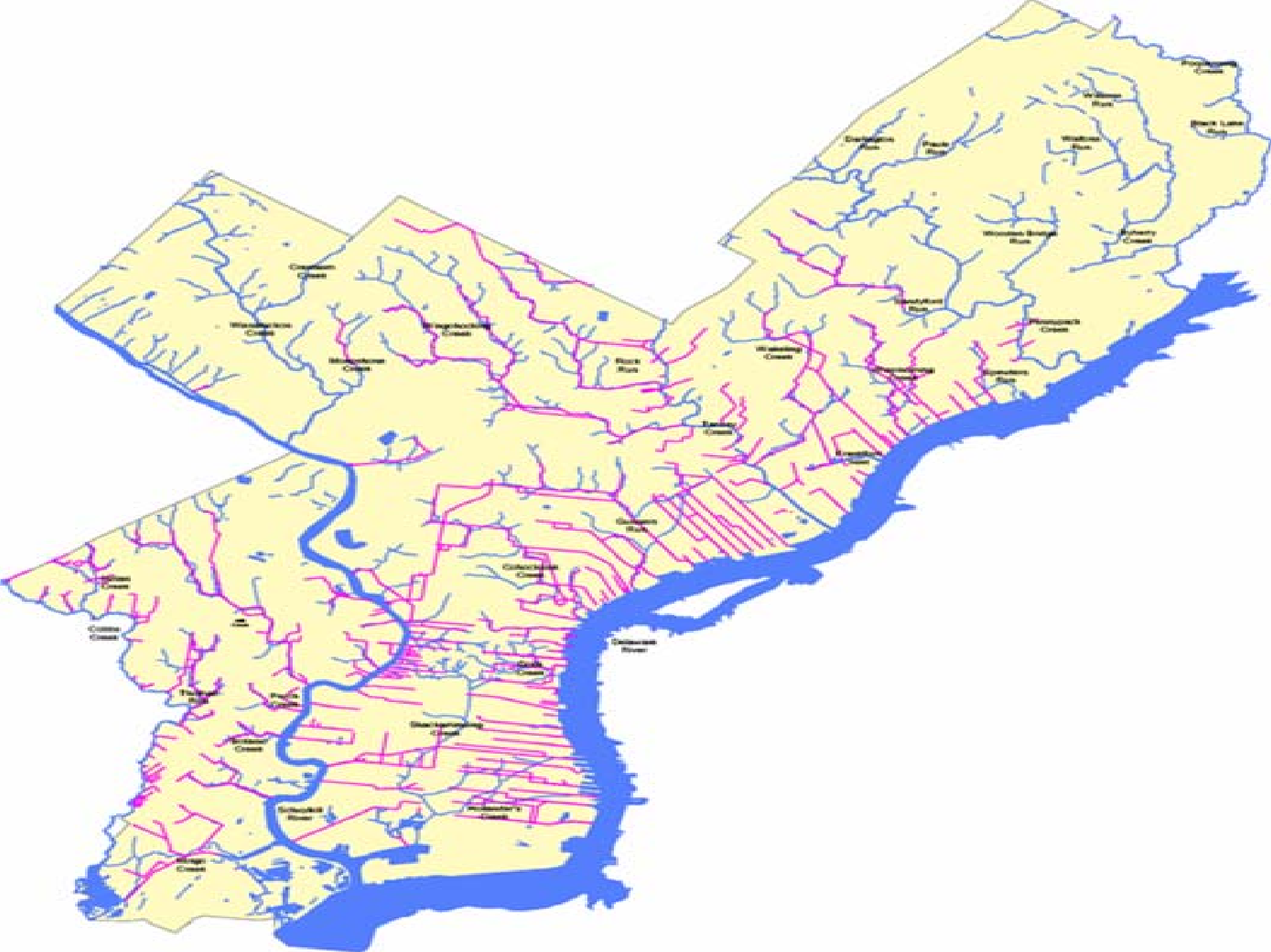




How did we get here?









התעוררות העיר העתיקה





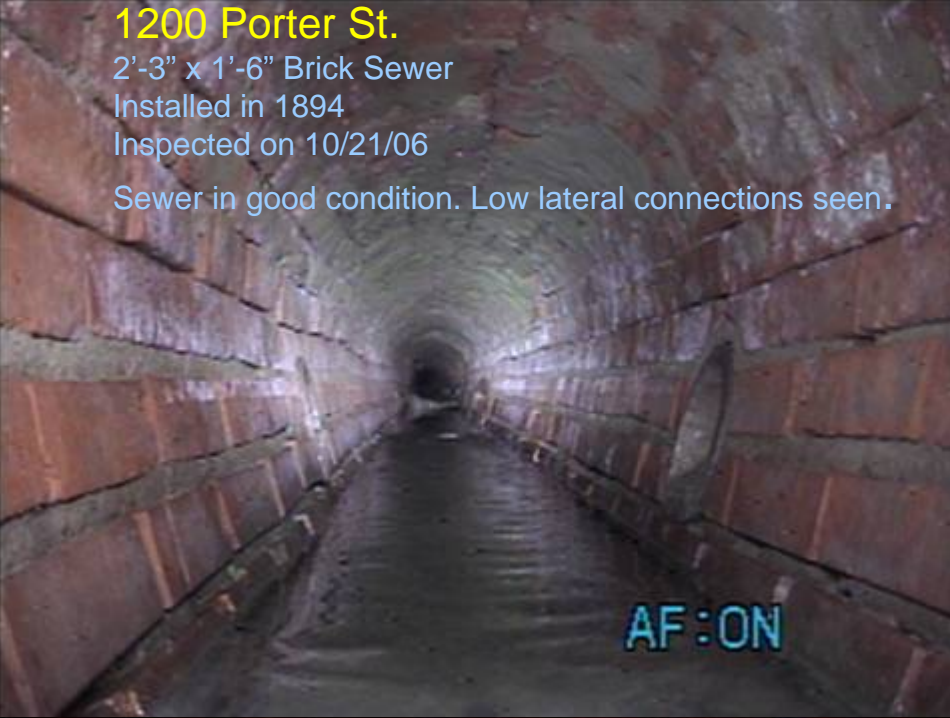
1200 Porter St.

2'-3" x 1'-6" Brick Sewer

Installed in 1894

Inspected on 10/21/06

Sewer in good condition. Low lateral connections seen.







Outfalls in South Philadelphia



Overflow Compliance Costs

	Washington	Pittsburgh	Philly
Population (million)	2	0.850	2
Service Area (mi²)	725	200	286
CSO Area (mi²)	19.5	60	64
Number of CSOs	53	> 300	166
Overflow Volume (BG/Yr)	2.5	14	16
Compliance Costs	\$ 2.65 Billion	\$2 - \$3 Billion	\$ BILLIONS

This is the moment to work together

- How do we encourage the best use of our limited environmental dollars to provide maximum community sustainability?
- How does our land based approach contribute to a green vision of our future?
- How do we create a cross-over between our laws, regulations, codes and costs?

Here's a Watershed vision of our future...





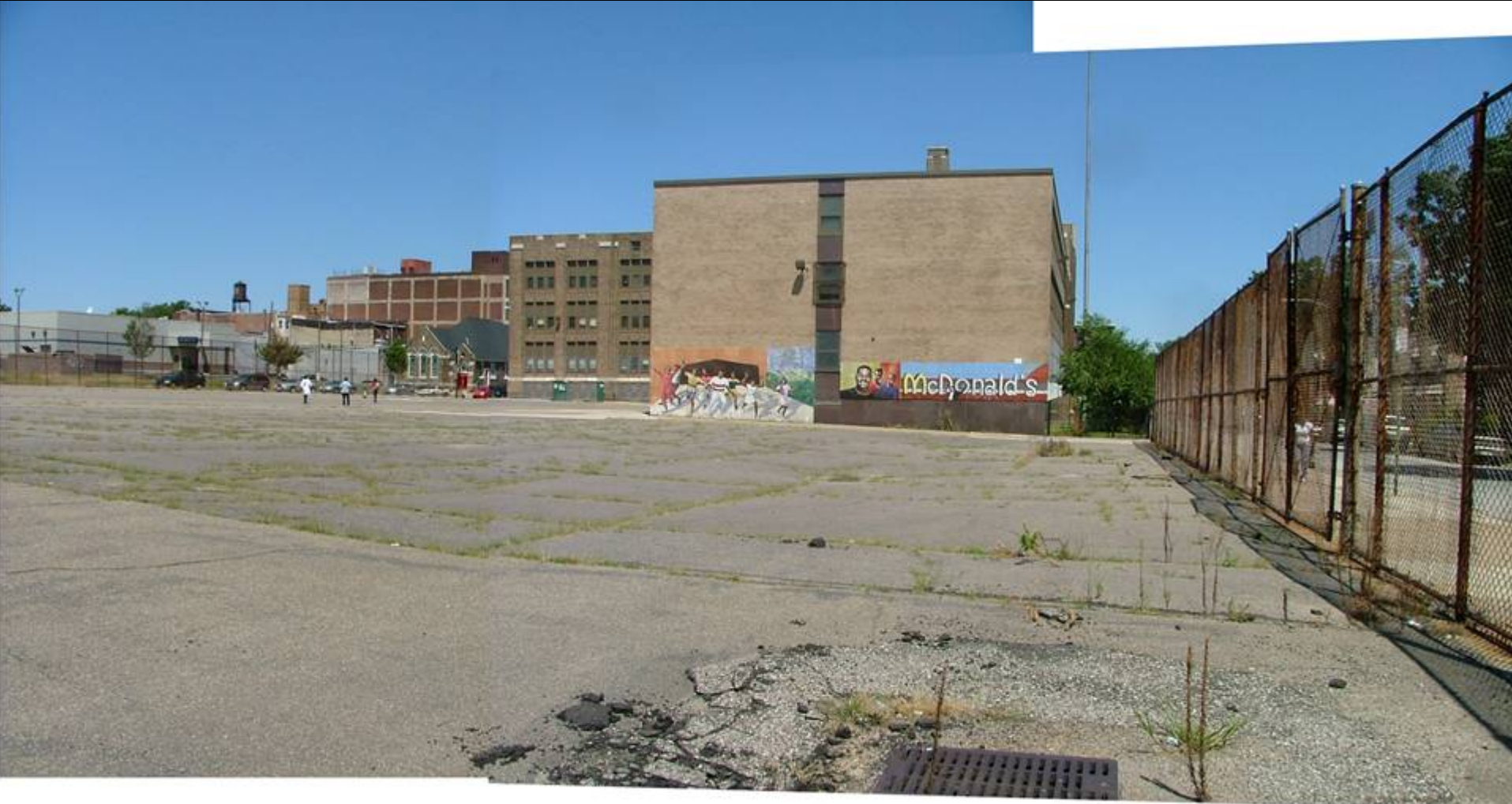








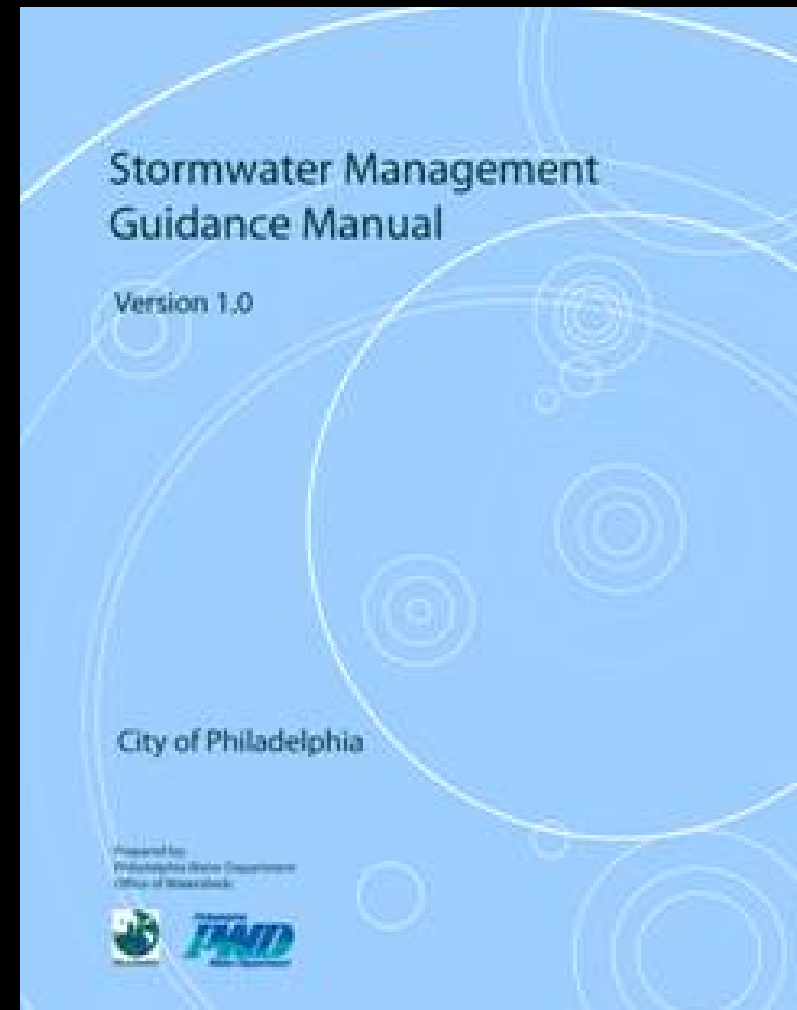




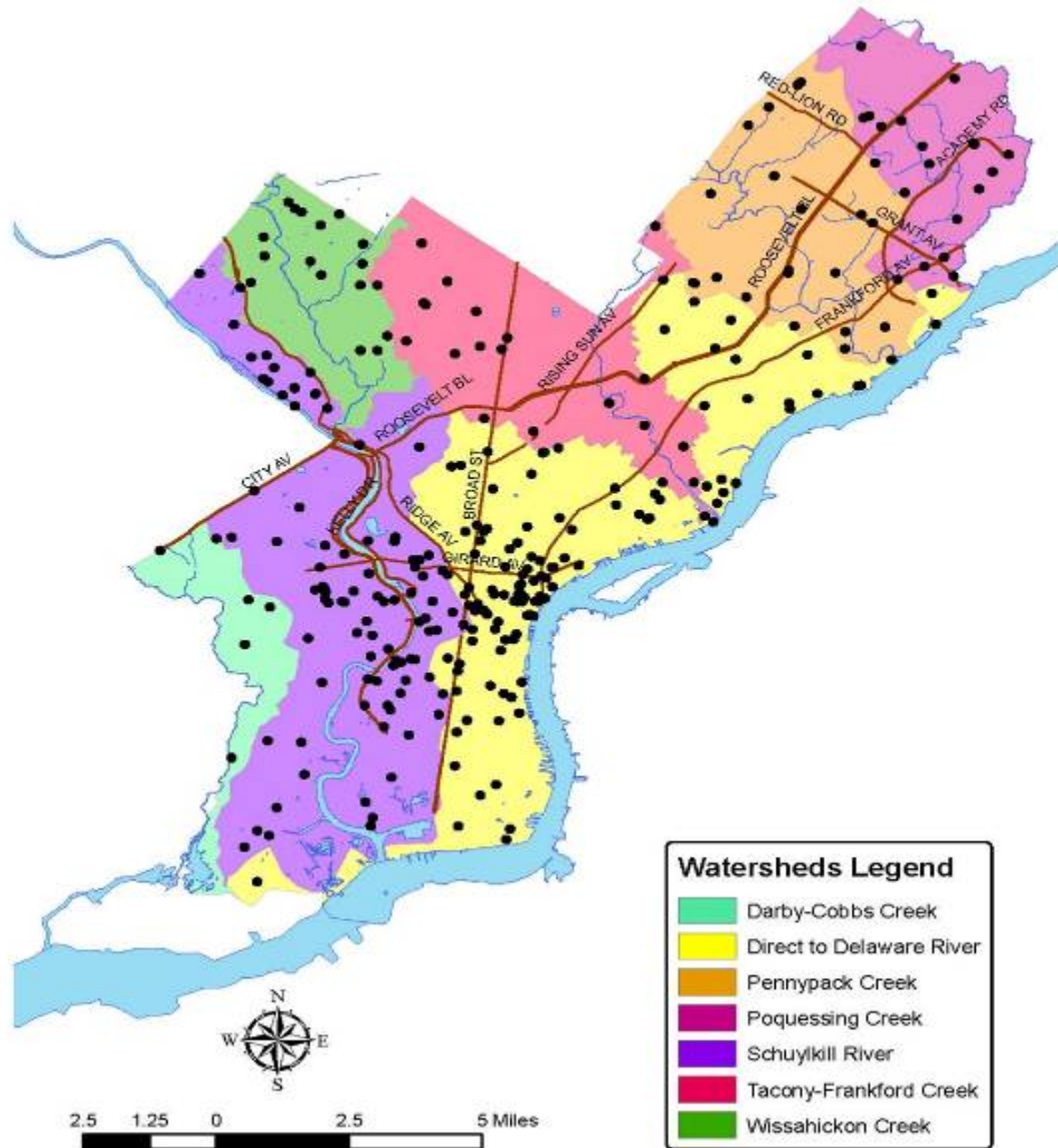


What is the common link that joins the water and land programs?

- Stormwater Management
- PWD has addressed this with new SW Regulations

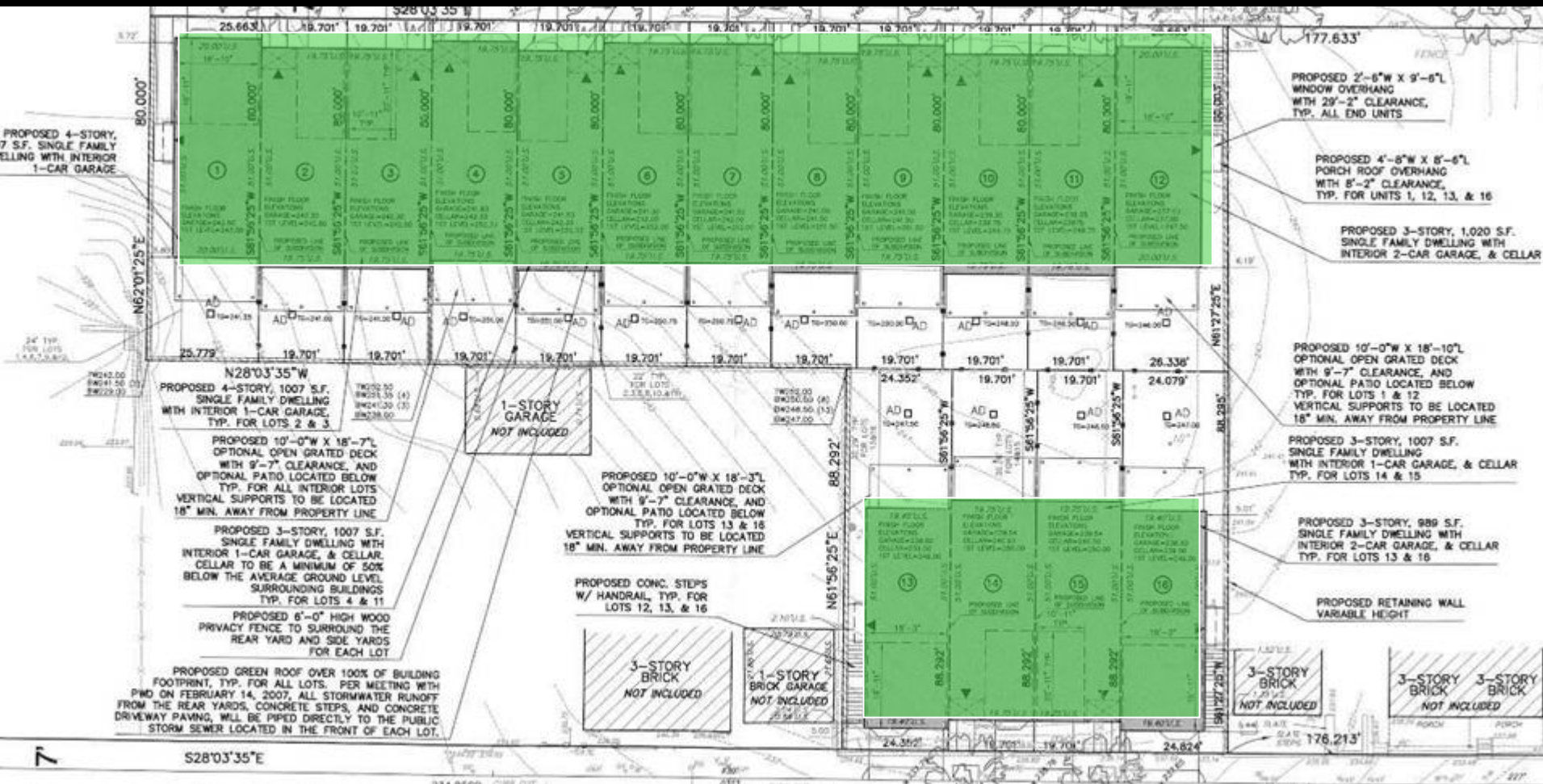


PWD Conceptual Submittals 2006



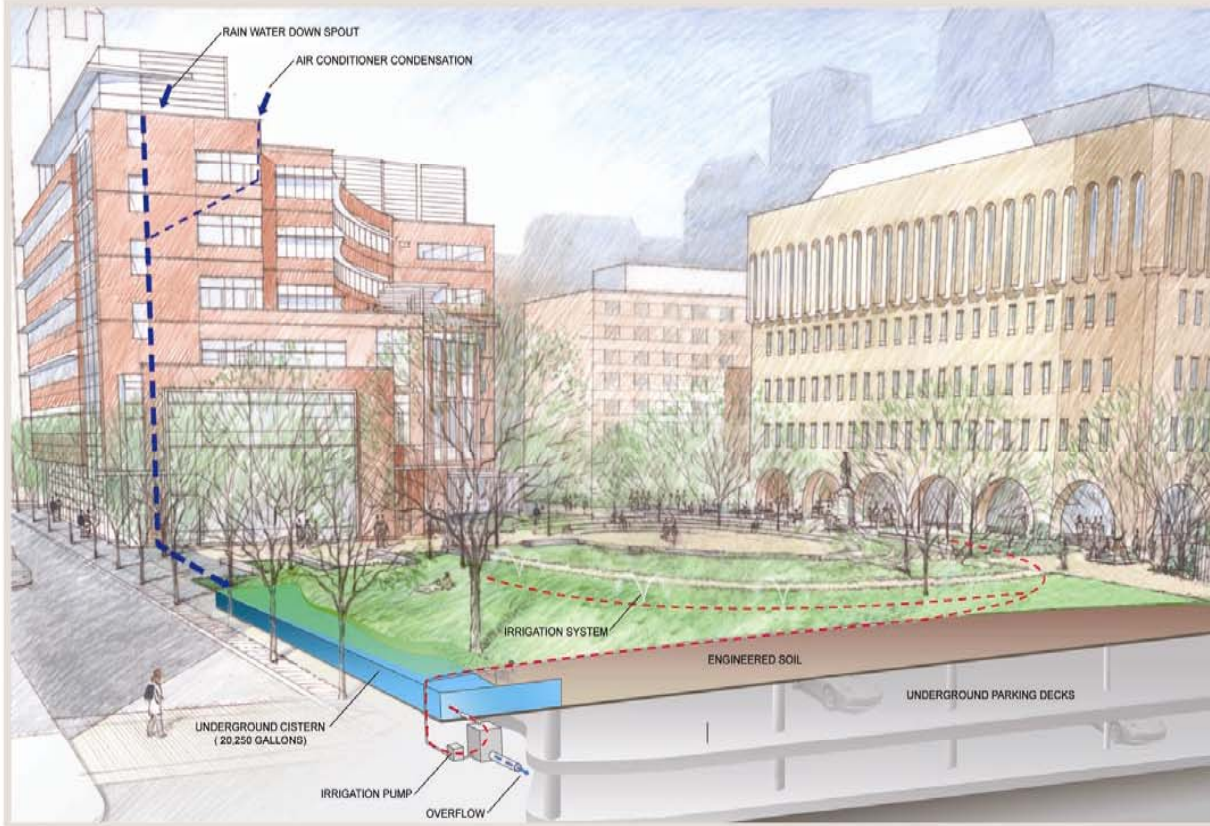
Green Incentives through Stormwater Regulations

- LEED certification
- Building green roofs
- Brownfield re-development
- Rain Water Harvesting
- Compact development
- Shading hardscapes
- Increasing tree canopy
- Encouraging native plant choices
- Reduced parking footprint
- Minimize site disturbance
- Water conservation



4 acres of Green Roofs Coming to Philadelphia

simple, sustainable, urban : a project for the 21st century



PROJECT CONTRIBUTIONS:

The plaza & green will add 1.3 acres of open space to the city fabric while promoting water conservation

Greening Philadelphia: A 1.8 acre project site, formerly 7% pervious, becomes 40% pervious

Landscape integrated stormwater management system reduces stormwater volume & delays peak flow discharge through storage & re-use for irrigation

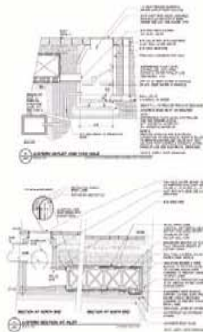
Enhances Water Quality: "First Flush" is captured and filtered by plants and soils

Contributes to the elimination of combined sewer overflow discharge to the Delaware River.

PROJECT WATERSHED:



This urban watershed produces 95 million gallons of stormwater per year with an average of 29 overflow events



PROJECT TECHNICAL FEATURES:

Capacity to store & re-use over 20,000 gallons of storm water and air conditioner condensate for irrigation

Gravity-fed cistern, easy to drain and maintain

Engineered soils to hold up to 11,500 gallons of water per each % organic matter at 12" depth



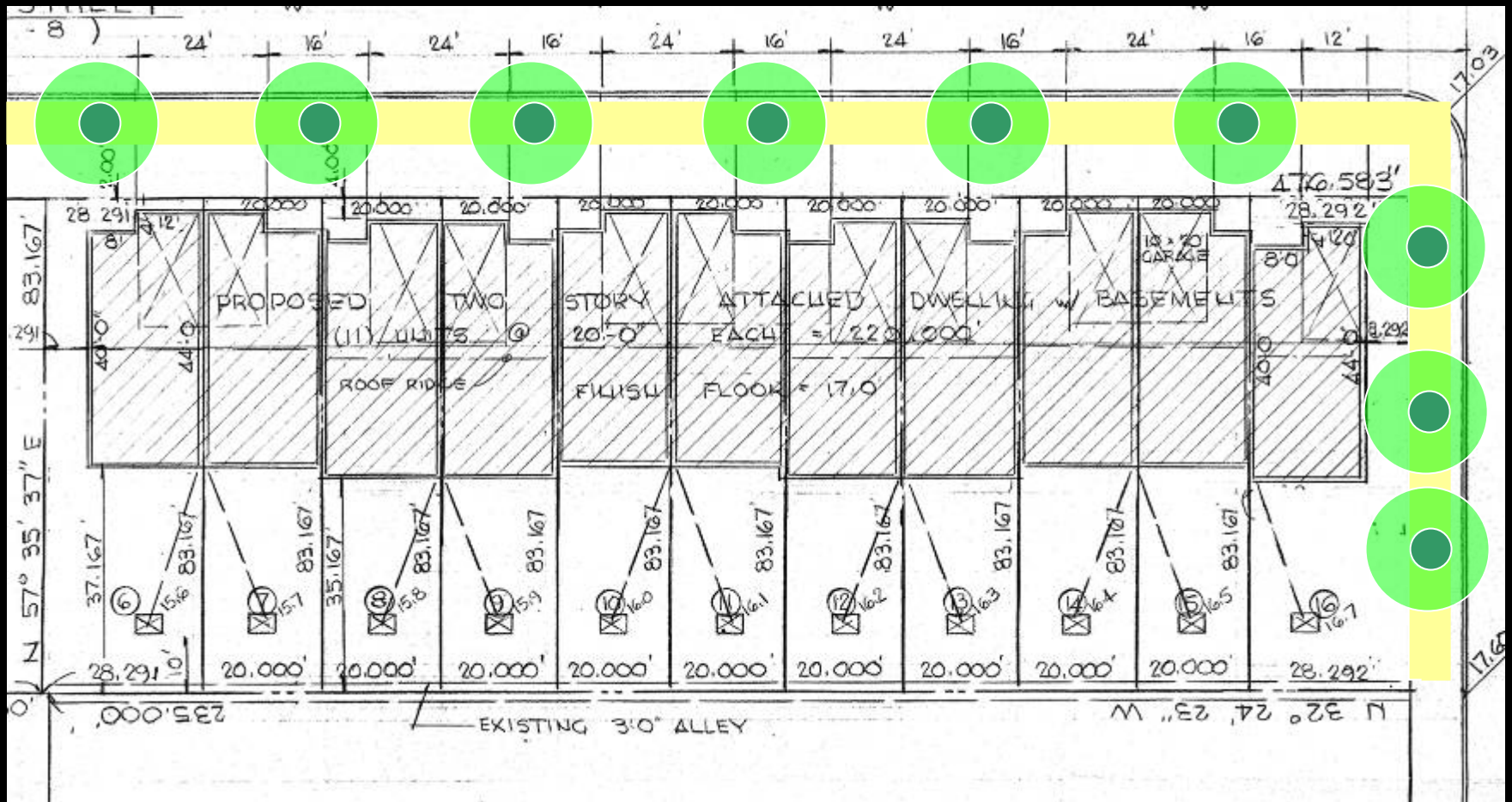
Evapotranspiration further reduces stormwater volume with over 55 canopy trees & nearly 1 acre of lawn

University Partners @ 3925 Walnut



Pennoni Engineers / emArchitecture

Tree Trenches and Green Sidewalks



Potential Impact of New SW Regs

First Inch Capture

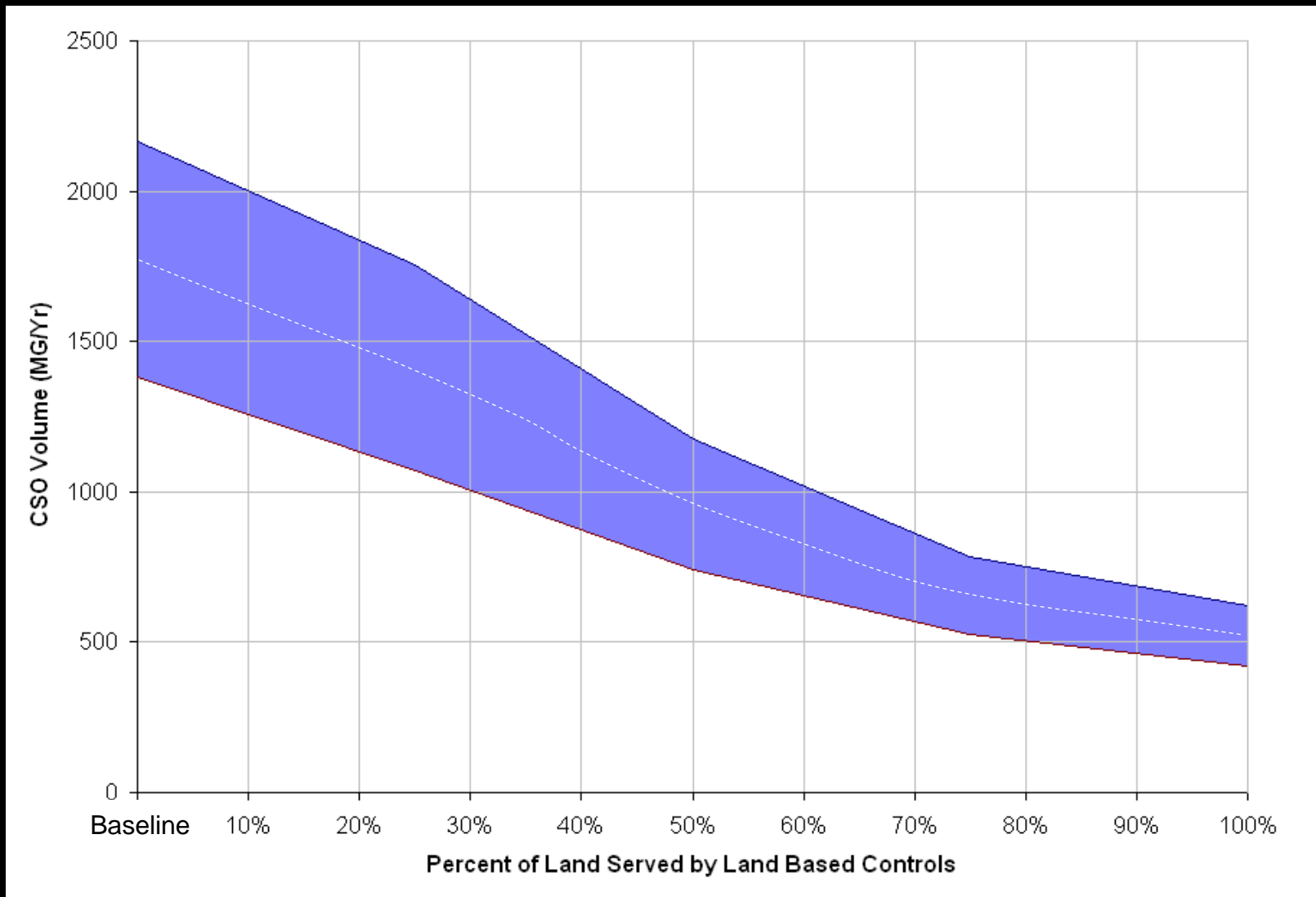
	2006		
Re-development Rate (1 mi ² / yr)	1 mi ²		
Captured Runoff (per 1" event)	17 MG		
Avoided Tank Costs (@ \$2/gal)	\$34 M		

Potential Impact of New SW Regs

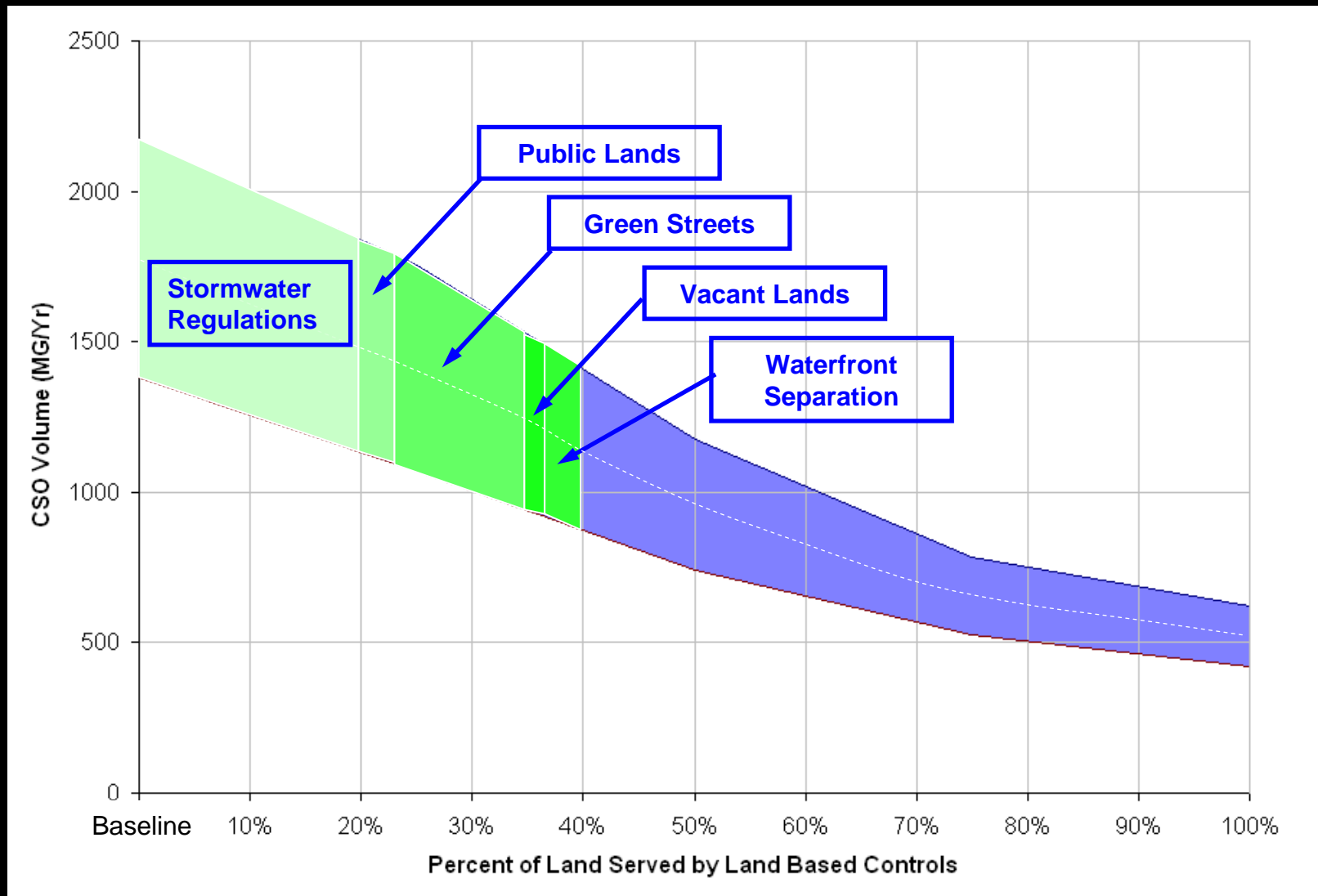
First Inch Capture

	2006	20 years
Re-development Rate (1 mi ² / yr)	1 mi ²	20 mi ²
Captured Runoff (per 1" event)	17 MG	340 MG
Avoided Tank Costs (@ \$2/gal)	\$34 M	\$680 M

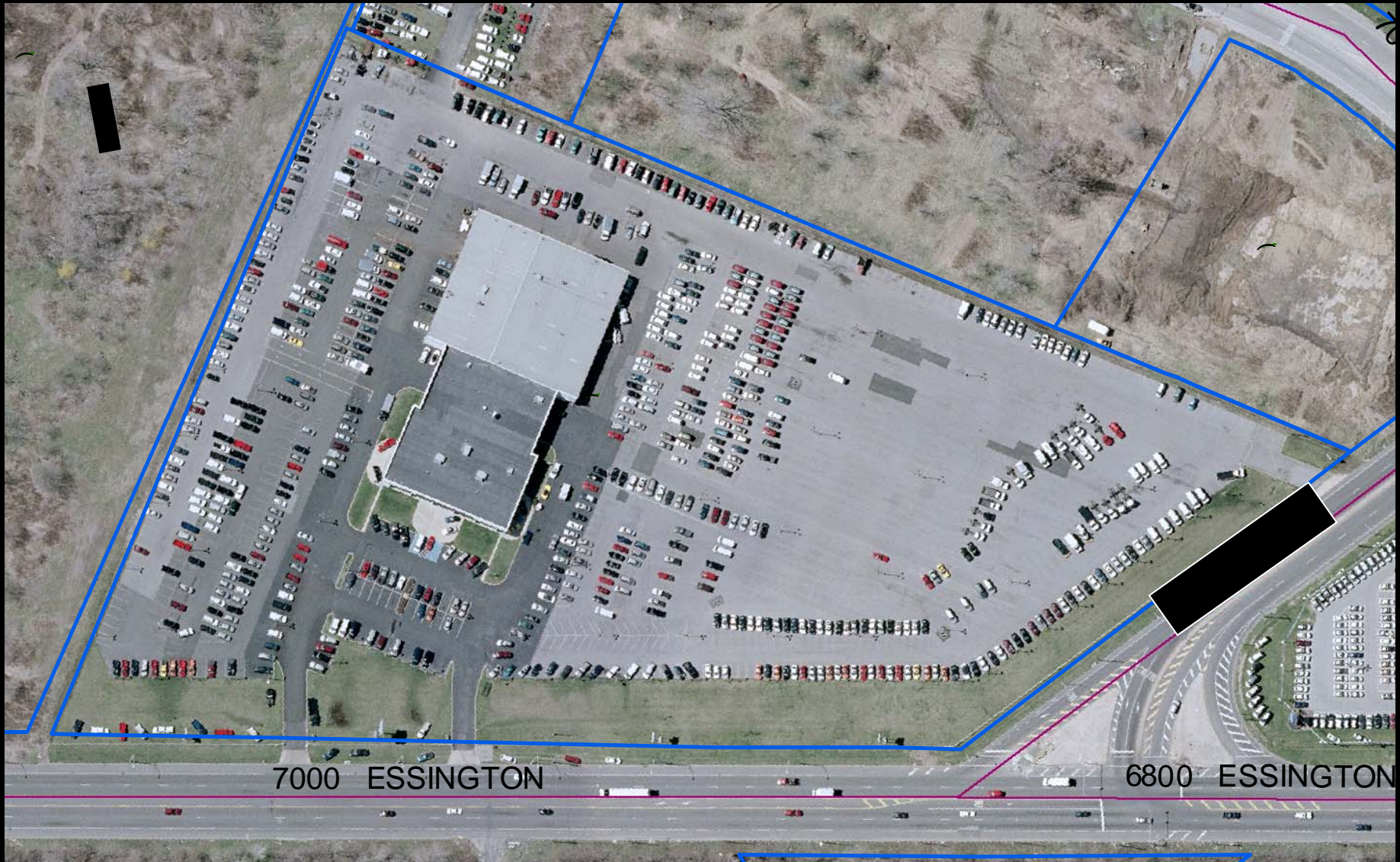
Typical LID Performance



Typical LID Performance



Creating Financial Incentives for Better Land Management



SW Rate Reallocation

Citizens Advisory Council (CAC)

- **Commercial and Water-Only Customers concerned over meter-size basis of SW charges**

Meter Size (Inches)	Meter Code	Monthly Water Charge	Monthly Sewer Charge	Combined Monthly Charge
5/8	R	\$5.10	\$16.59	\$21.69
3/4	Z	\$5.91	\$86.24	\$92.15
1	Q	\$7.88	\$140.01	\$147.89
1 1/2	P	\$12.29	\$273.41	\$ 285.70
2	X	\$18.22	\$434.70	\$452.92
3	O	\$31.33	\$809.69	\$841.02
4	W	\$54.53	\$1,353.88	\$1,408.41
6	N	\$105.58	\$2,701.17	\$2,806.75
8	V	\$164.76	\$4,313.96	\$4,478.72
10	E	\$239.01	\$6,205.43	\$6,444.44
12	T	\$418.94	\$11,548.42	\$11,967.36

SW Rate Reallocation

Citizens Advisory Council (CAC)

- **1994 – 1996 diverse group of stakeholders formed**
 - Review fairness and equity of SW rate allocation
 - Developed new structure
- **Recommendation: Base stormwater costs on**
 - 20% of the gross size of a customer's property
 - 80% of the imperviousness cover
 - Breakout residential from non-residential
- **Unable to implement because of inadequacies of GIS and parcel databases**

SW Rate Reallocation CAC Recommendations

- **Shortcut for residential customers in 2002**
 - **Treat all 450,000 residences as a single entity**
 - **Calculate TOTAL gross and impervious cover**
 - **Total costs divided among all residences.**
- **Residential rates set at \$9.12 / house / month**
- **Still unable to implement CAC recommendations because of inadequacies of GIS and parcel data**
- **Now we do.**
- **Now looking to implement non-residential rates**

SW Rate Reallocation CAC Recommendations

- **Work almost complete**
- **Available for the next rate tariff (July, 2008)**
- **Phase-in over 3 years, starting July, 2009**
- **Include properties that currently do not have a meter**
 - **parking lots, vacant land, utility right of ways**
- **A more equitable Approach to Cost Recovery**
- **Increased cost incentives for landowners to move to green infrastructure**
- **Potential for added grants or incentives**

Estimated Parcel-Based Charge for Residential Accounts

- **SW Utility Costs** = \$100 M
- **Impervious Area** = \$100 M x 80% = \$ 80 M
- **Gross Area** = \$100 M x 20% = \$ 20 M
- **Residential Gross Area** = 2.6 Msf
- **Residential Impervious Area** = 1.2 Msf
- **Unit Stormwater Costs:**
 - **Impervious Area** = \$80M / 2.6 Msf = \$5.14/1000sf/mo
 - **Gross Area** = \$20M / 1.2 Msf = \$0.59/1000sf/mo
- **At 1360 sq ft average house**
- **Residential rates set at \$9.12 / house / month**

Typical property with increased stormwater fee – large site, small meter



Gross Area = 599,744

Imperv Area = 491,035

Existing Charge = \$ 377.23

New Charge = \$ 2,496.42

Typical property with decreased SW fee – large site with large meter(s)



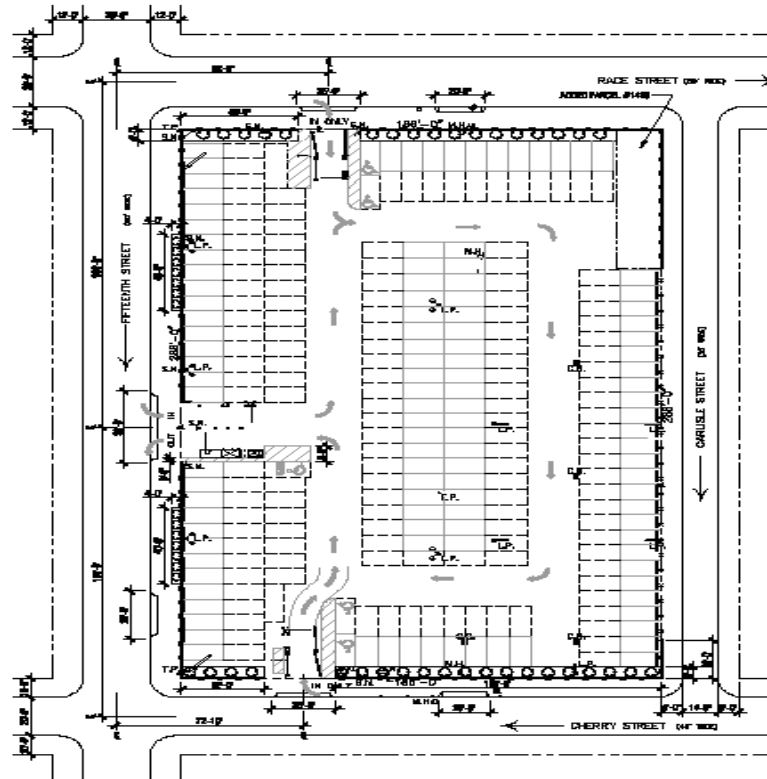
Gross Area = 90,915

Imperv Area = 90,915

Existing Charge = \$ 10,582.69

New Charge = \$ 449.17

Parkway Corp. – 15th & Cherry



AREA: 63,000 SF
TOTAL CAPACITY: 292 SPACES

133-43 N 15TH STREET THRU TO RACE & CHERRY ST. DMCY.
148-49 CHERRY ST., 148-24 RACE ST. & 124 CARLELE ST.



15TH & CHERRY STREET PARKING LOT

EXISTING CONDITIONS - SITE PLAN - 7-24-07

SCALE: 1" = 60'-0"

181EDR-21-CURRENT PLAN/90

This drawing is prepared by Parkway Corp. and is not to be used for any other project without the written consent of Parkway Corp. The user of this drawing is responsible for verifying the accuracy of the information provided and for obtaining all necessary permits and approvals. Parkway Corp. is not responsible for any errors or omissions in this drawing.

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New Total Annual Charge \$5,000.

Credit / Incentives

- **Provide incentives for stormwater retrofits that infiltrate or detain first 1 inch of runoff**
- **Provide incentives for use of Low Impact Development (LID) practices**
- **Retrofits must be approved and meet regulations**
- **Development of Retrofit Assistance Program**

How to make Green Roofs happen in Philly?

Financial incentives

Regulations

Encourage LEED



Credit: Maurer, City of Linz

Clean Water Green City



Impervious Cover Shares

