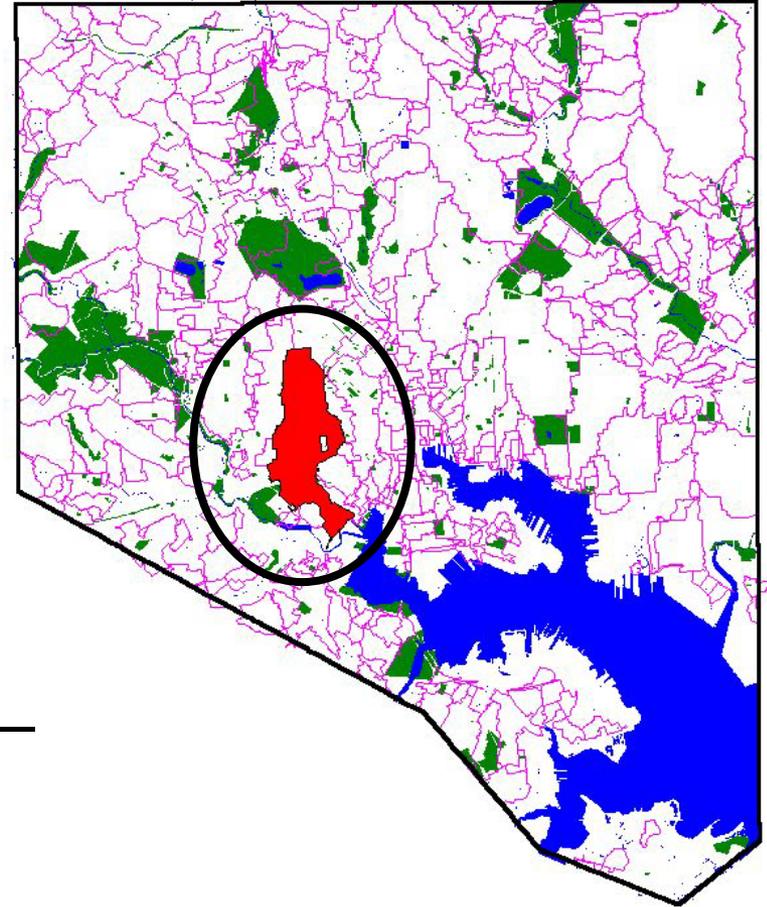


# Watershed Restoration



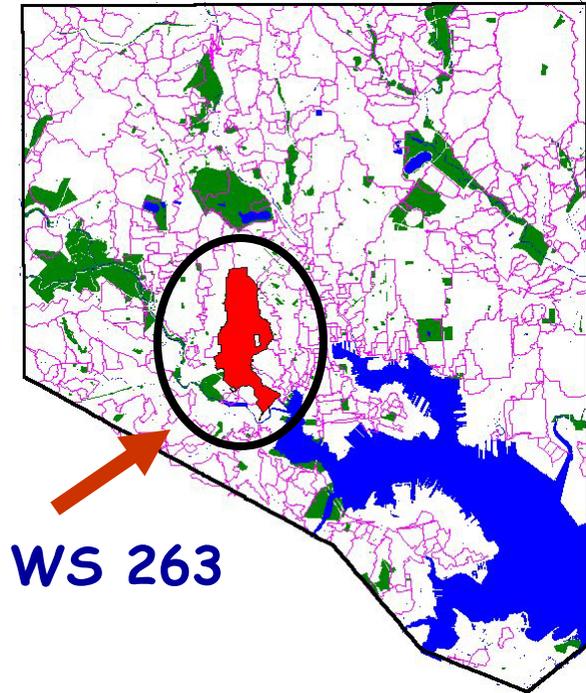
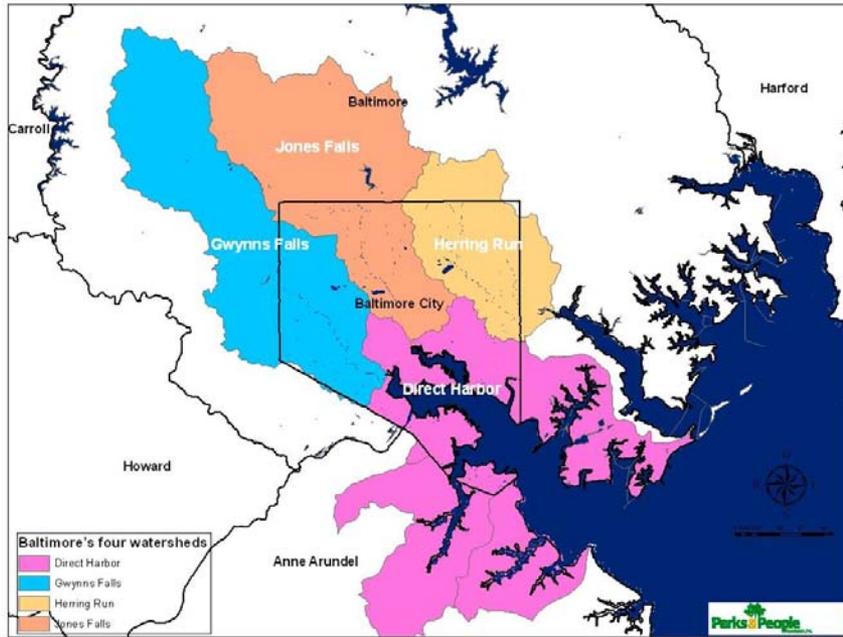
Enhancement of Water  
Quality and Quality of  
Life in an Ultra-Urban  
Stormshed No. 263



Begun in 2005 (so 7 years later) –  
Where are we? What have we  
learned? What's next?

Baltimore City

# Baltimore's watersheds & stormsheds



WS 263 demonstration project aims to show how to measure environmental and social outcomes using green solutions at a small urban watershed scale

# WATERSHED 263

- 11 neighborhoods in a 935 acre storm water sewershed.
- Entirely urbanized with mixed industrial, institutional, and residential land uses.
- High impervious surface (75%) and small area in ground cover (19%) and tree canopy (5.5%).
- Home to 27,870 people in minority and economically challenged neighborhoods. I population decline of 32% since 1990.
- Significant but dispersed public open space (parks and school) (about 30%) and over 2000 vacant lots (many owned by city).



# Project Background

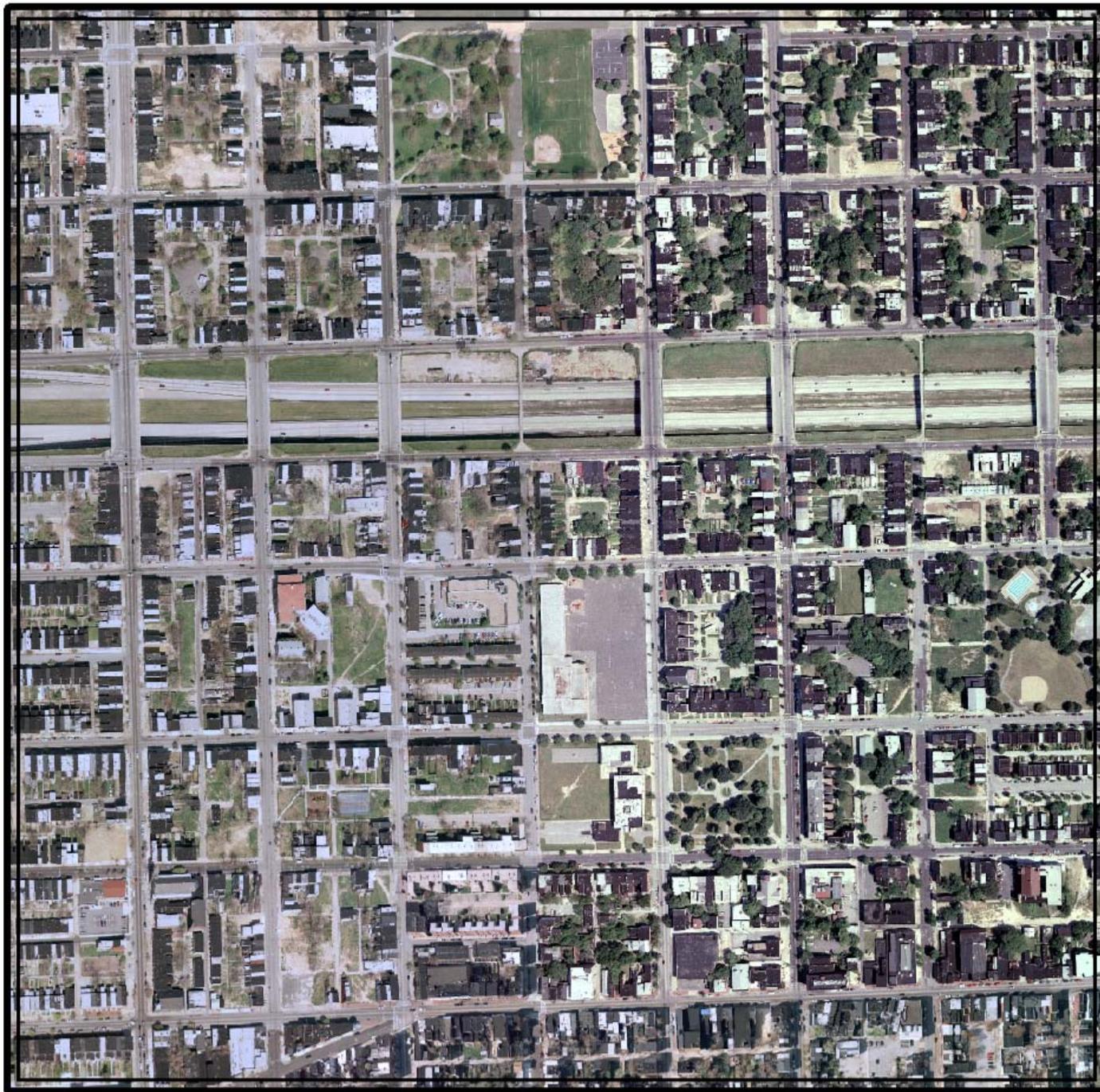
- Watershed 263 project had to fit with the Baltimore City Municipal Stormwater Permit Program by treating 25% impervious surface.
- Designed to meet MDE MS4 criteria and identify project sites on publicly-owned land.
- Key element was assumptions about readiness of community residents and organizations to undertake this project.
- A promise of transferability to other urban stormsheds.
- We knew we could learn a lot from this project with BES and USFS research assistance



Watershed  
263

1957  
Aerial

Mostly  
ornamental

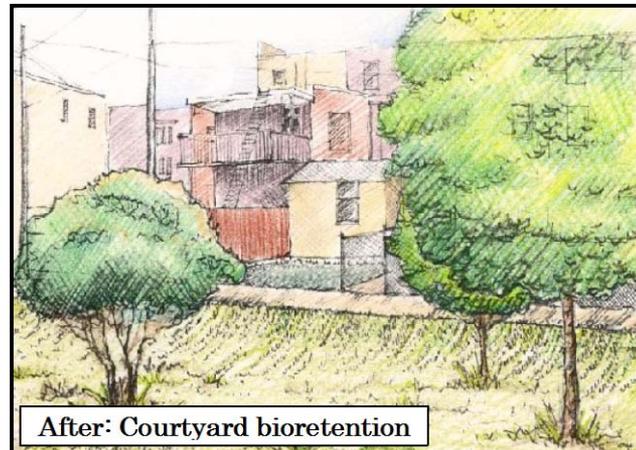


Watershed  
263

2010  
Aerial

Mostly  
pioneer  
vegetation

# The Vision is to Create Stormwater Filtering and Harvesting Systems



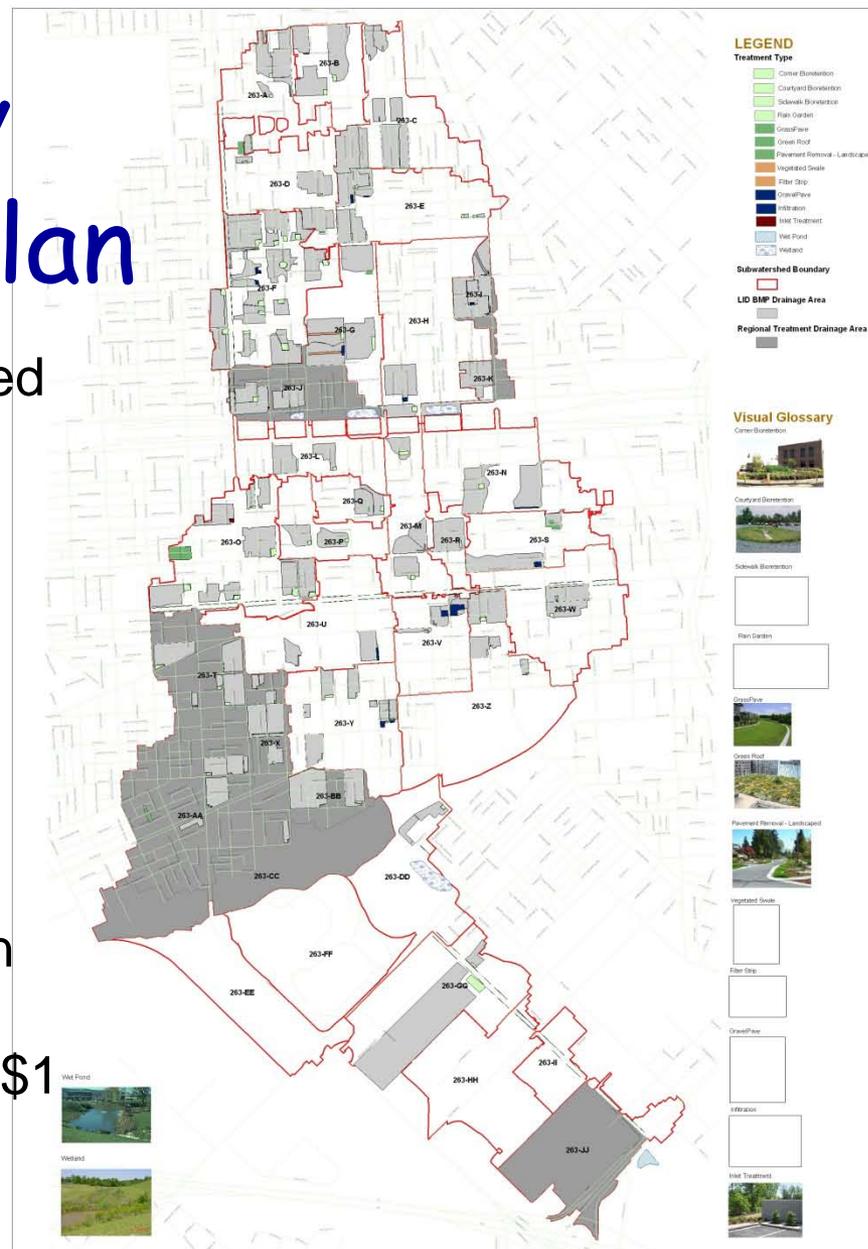
After: Courtyard bioretention

# Project Goals and Objectives

- Organize and educate watershed residents and organizations to effectively participate in the project and undertake an outreach campaign.
- Improve communications and coordination among all stakeholders and the general public.
- Short-term - undertake demonstration projects in one sub-drainage area and measure water quality change.
- Long-term – undertake as many different types of projects and measure quality of life changes.
- Identify a “universe” of cost-effective, community-based remediation activities that could be transferred to other city watersheds.

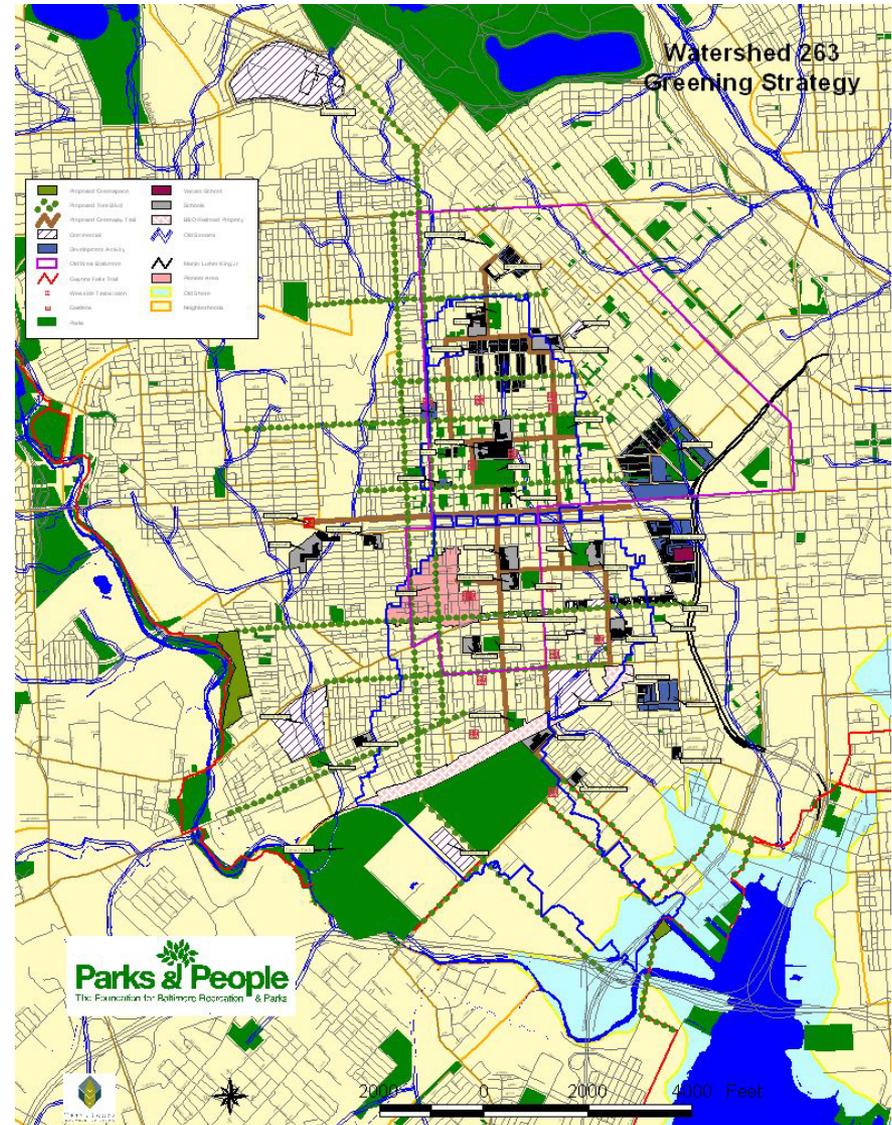
# Water Quality Management Plan

- 25% of impervious area treated
- 158 impervious acres treated
- 110 BMPs proposed
- 30% or more estimated reduction in pollutants
- Installation cost of \$7.5 million
- Annual maintenance costs of \$1 million



# Greening Framework Elements

- Pedestrian and bike greenway connecting
  - **Green schools**
  - **Park restoration**
- Green streets for auto travel ways
- Vacant lots restoration for repurposed community open space
- Commercial/industrial buildings (green roofs highly desired)
- Restore major ROWs such as B&O RR and Route 40
- Green new developments including UMd Biotech Park and Poppleton housing project

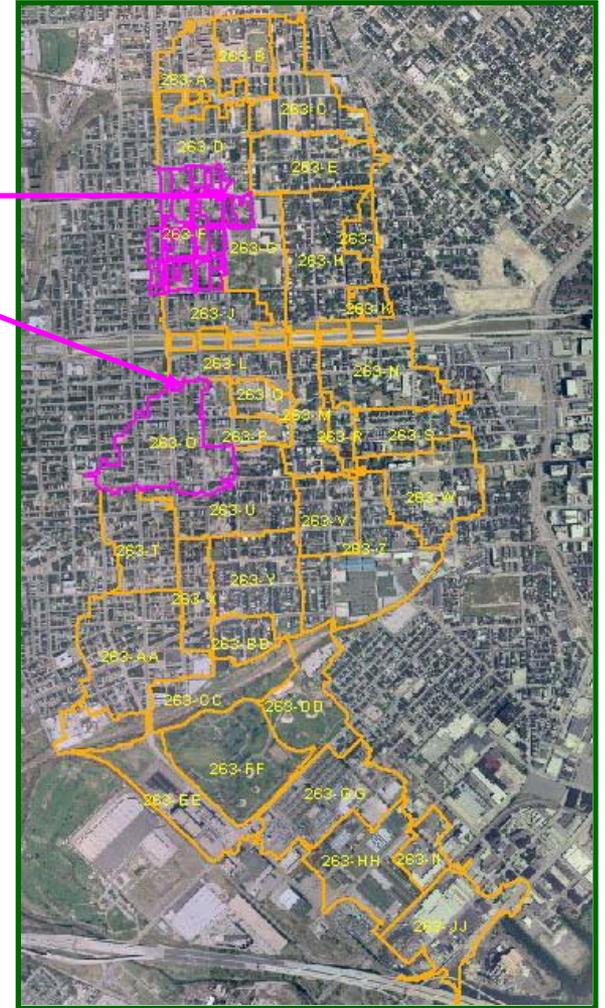


# City DPW and BES Set Up A Monitoring, Evaluation and Research Methods

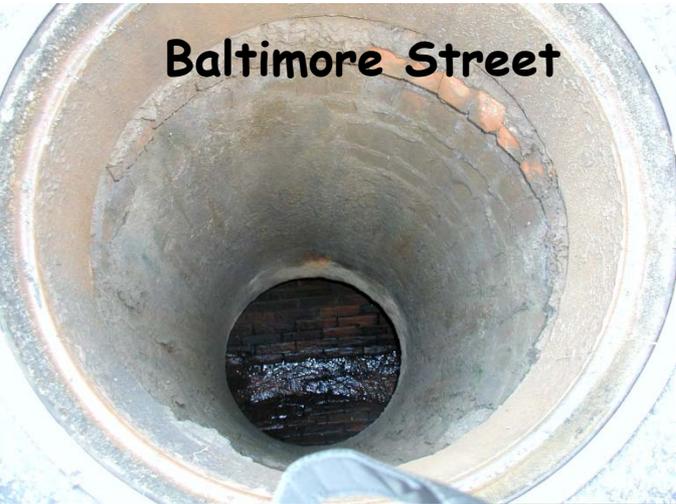
## Paired Sub-watersheds

were selected because

- ✓ They are similar in size, percent impervious, and restoration potential.
- ✓ Both were subjects of detailed surveying, modeling and study by project partners.



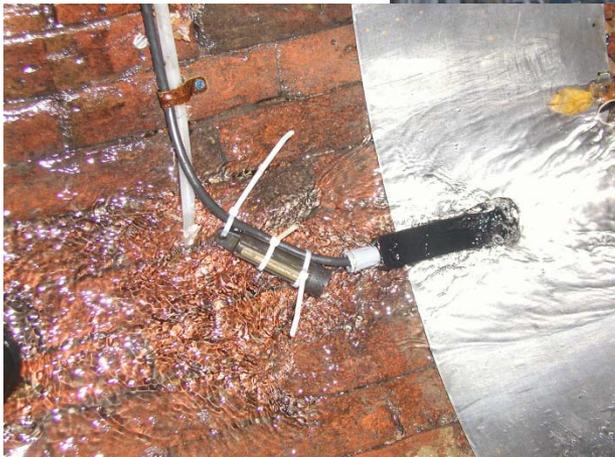
# Lanvale & Baltimore "stream" sampling sites



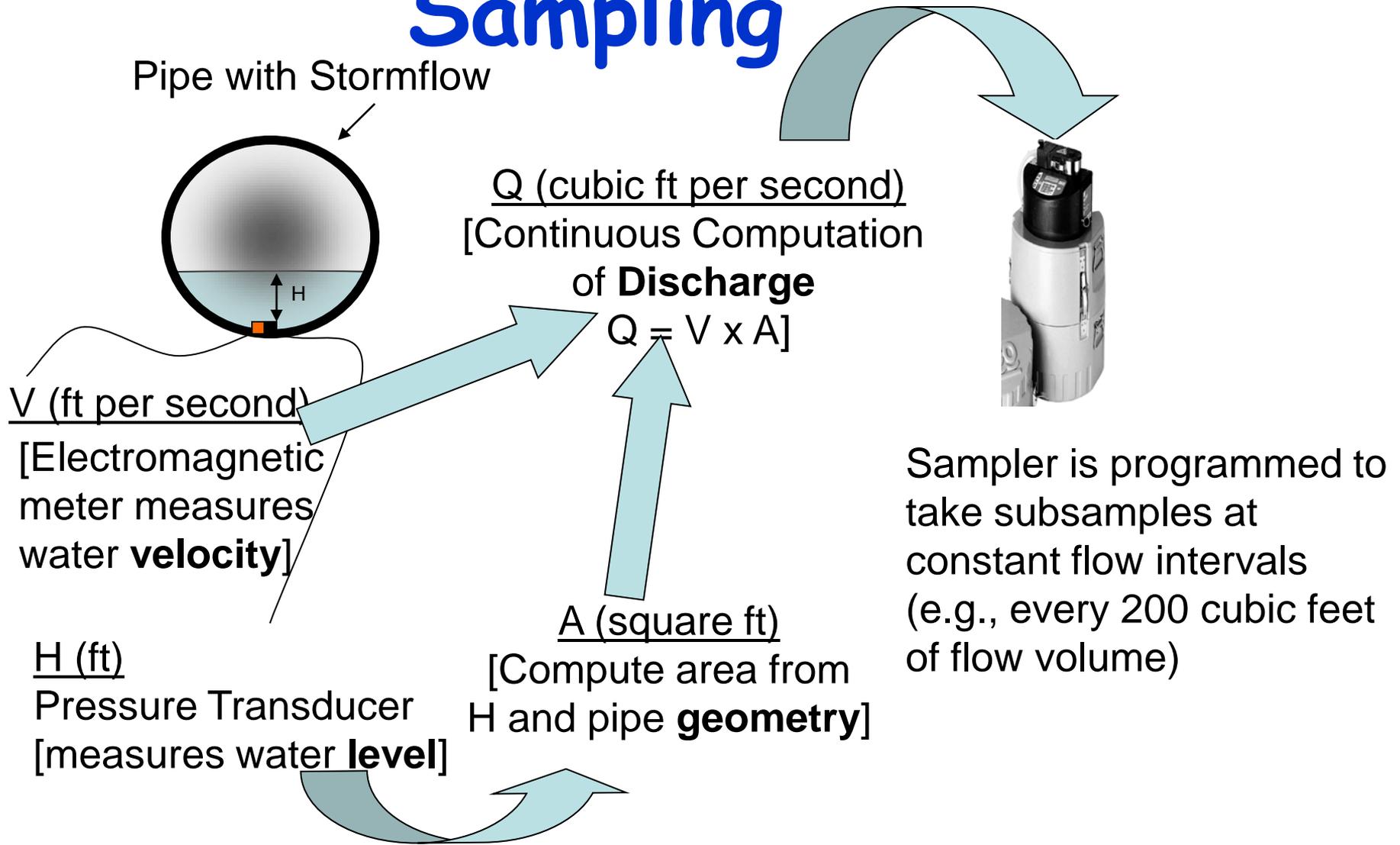
Lanvale Street



Baltimore Street



# Automated Flow Paced Sampling

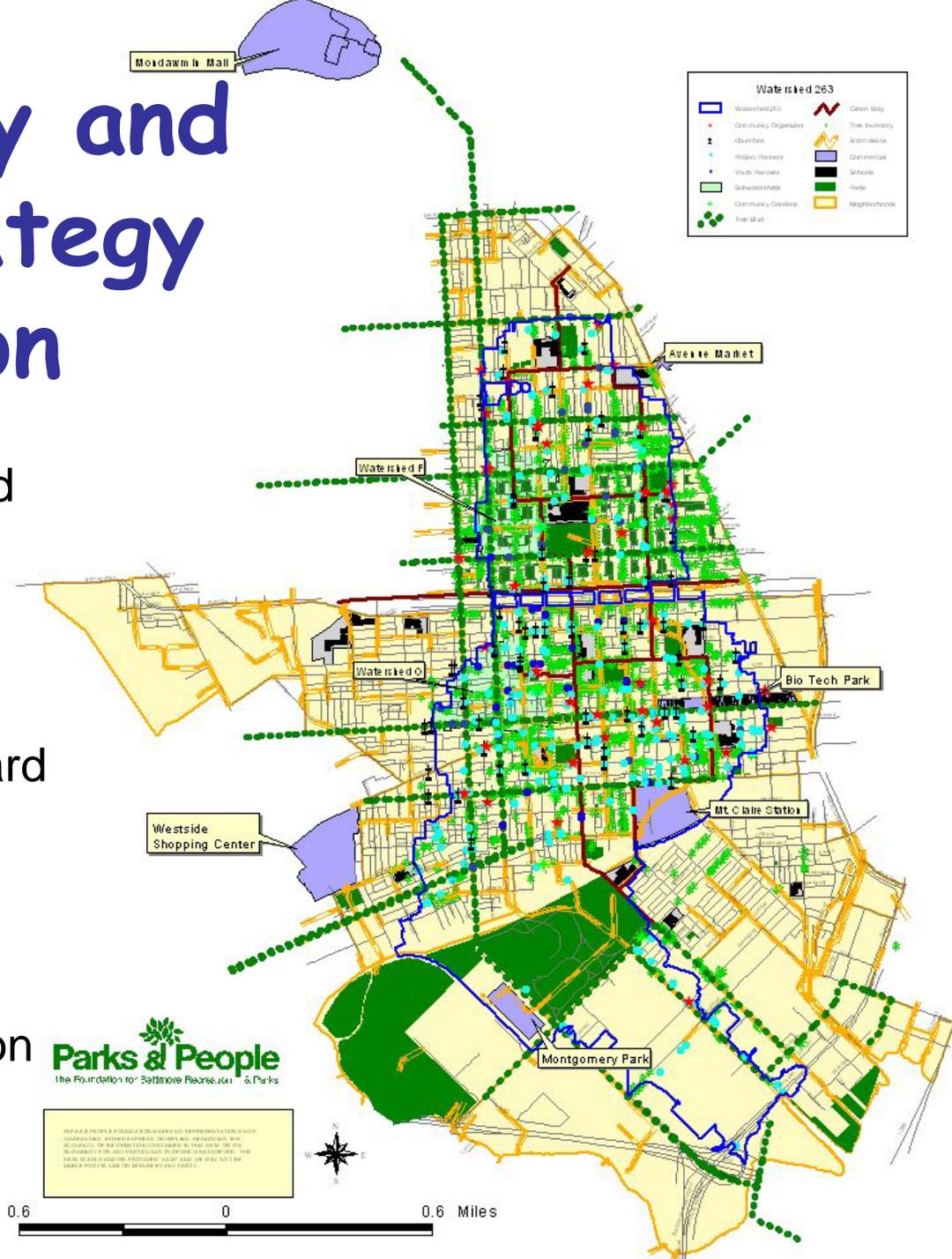


# Early Results

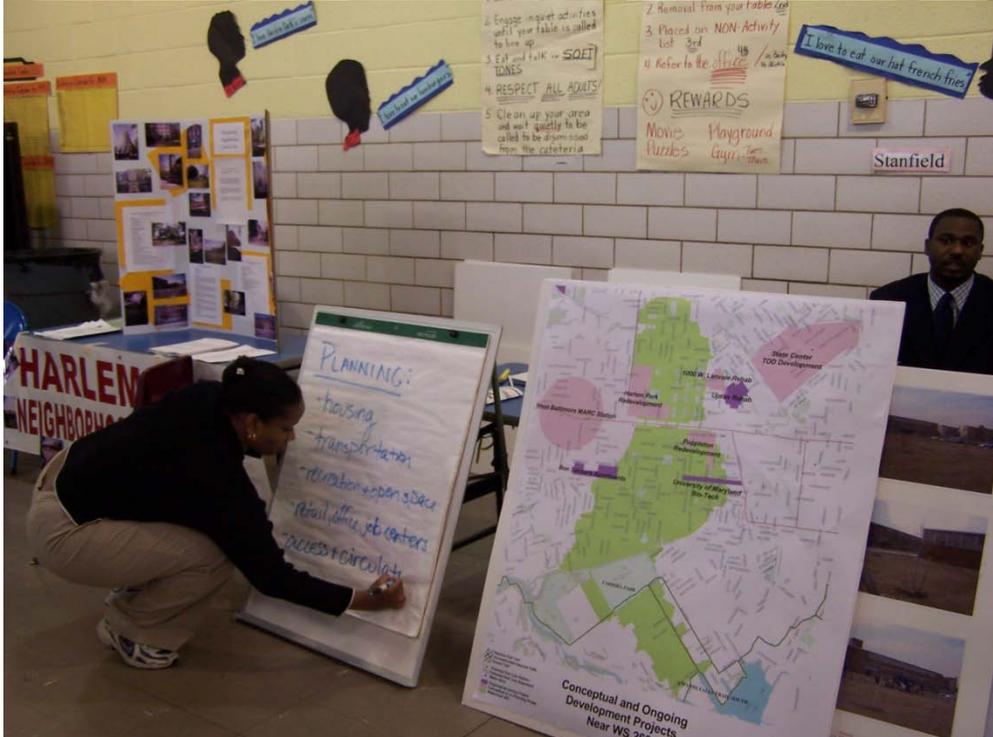
- Results from six years of sampling and analysis show that the two sub-drainage areas had higher concentrations of nitrogen and phosphorus than expected.
- Surprisingly, runoff response to rainfall was much more complex and variable than expected.
- In the area where 10 BMPs were installed, there was 50% reduction in N and P concentrations and none in the other drainage area – this was larger than expected.

# Water Quality and Greening Strategy Implementation

- 1000 street trees planted and many more mulched.
- Over 200 vacant lots maintained and cared for.
- Greened 4 acres of schoolyard where asphalt was removed.
- Implemented 30 community restoration projects.
- Implemented 12 bio-infiltration projects.



# Community meetings, workshops and voting forums



# Small scale community greening projects



# Small Street Alley Rain Garden



# Sandtown Community Center Asphalt and Concrete Removal



# Schoolyard Greening (22 acres of asphalt removed city-wide)

Baltimore City Sustainability Plan has recently set a goal of reducing impervious surface



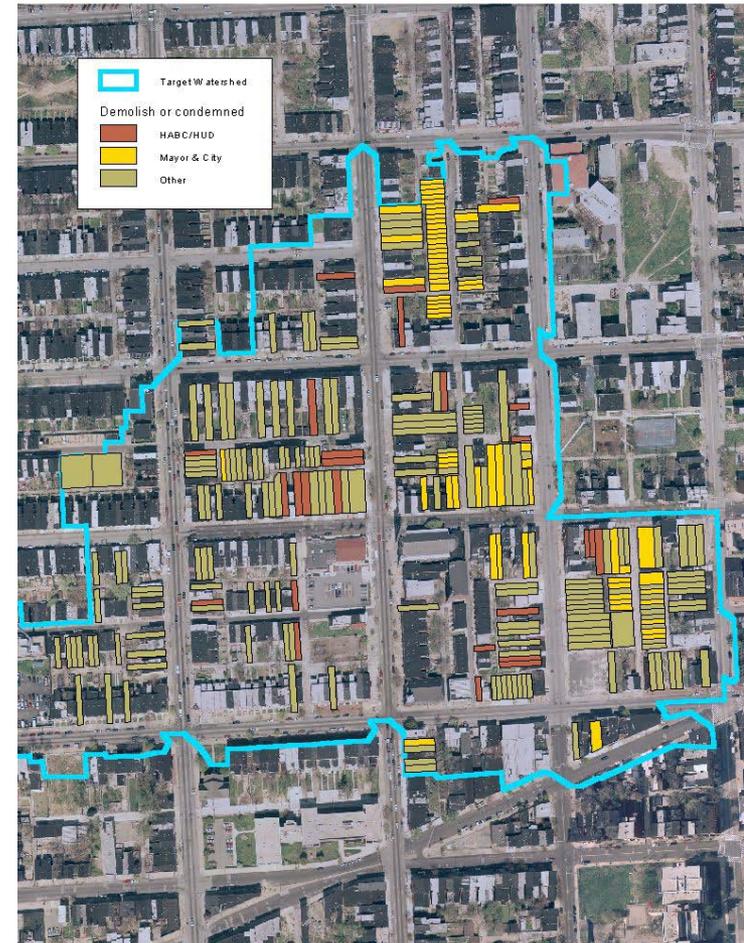
# Stormwater Retrofit "Theme Park"

## Funding

- Chesapeake Bay Trust
- Maryland Department of the Natural Resources
- City of Baltimore Department of Public Works

## Project Partners

- City of Baltimore Department of Public Works
- EA Engineering, Science and Technology, Inc.
- Center for Watershed Protection
- Parks & People Foundation

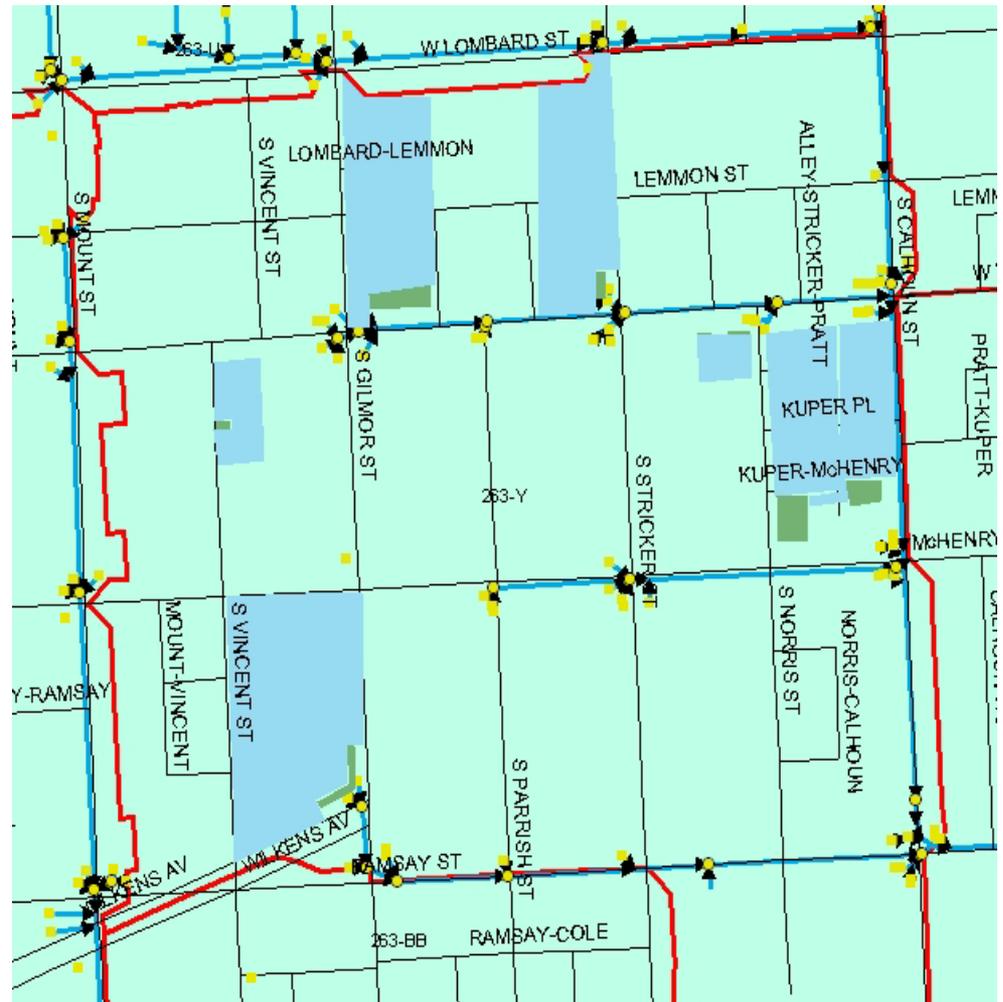


# "Theme Park" Goals

- To design and constructed 6 retrofits to treat stormwater runoff and work toward watershed restoration goals.
- Use stormwater BMPs that are new to the Chesapeake Bay watershed.
- Create a website "virtual tour" so others – including citizens and engineers – can apply these lessons we've learned
- [http://www.d2edesign.com/ws263\\_test2/index.html](http://www.d2edesign.com/ws263_test2/index.html)

# Typical Treatment Plan

- 7 Structural BMPs
  - 3 Corner Bioretention
  - 1 Sidewalk Bioretention
  - 2 Infiltration
  - 1 Rain Garden
- Treatment
  - $WQ_v = 11,900$  cf
  - 4.3 Acre treated area



# Typical Bio-Facility

- **Corner Bioretention**
  - Located at site of demolished building (Green)
  - 0.83 acre treated area (Blue)
- **Benefits**
  - Water Quality Improvements
  - Neighborhood Greening



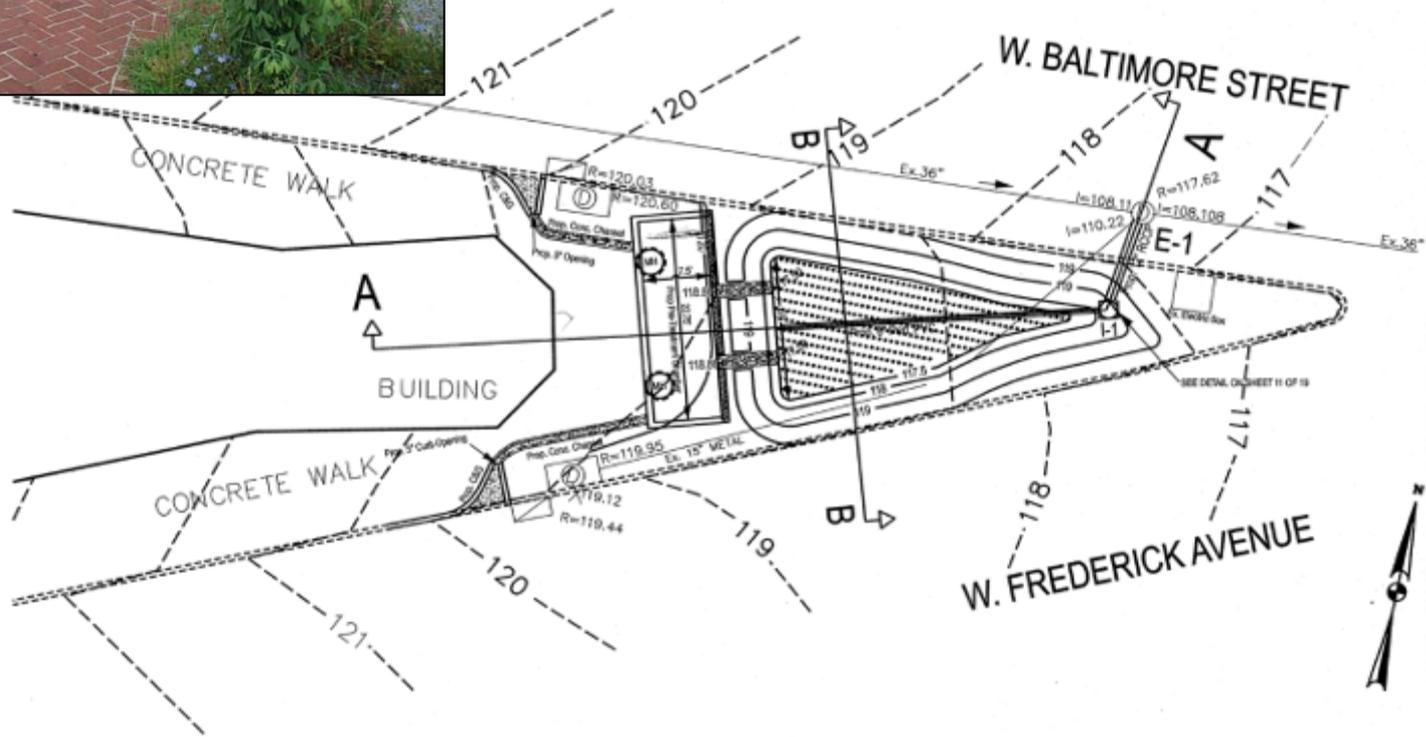
# Vincent Street Bio-retention facility by Parks & People





**LEGEND**

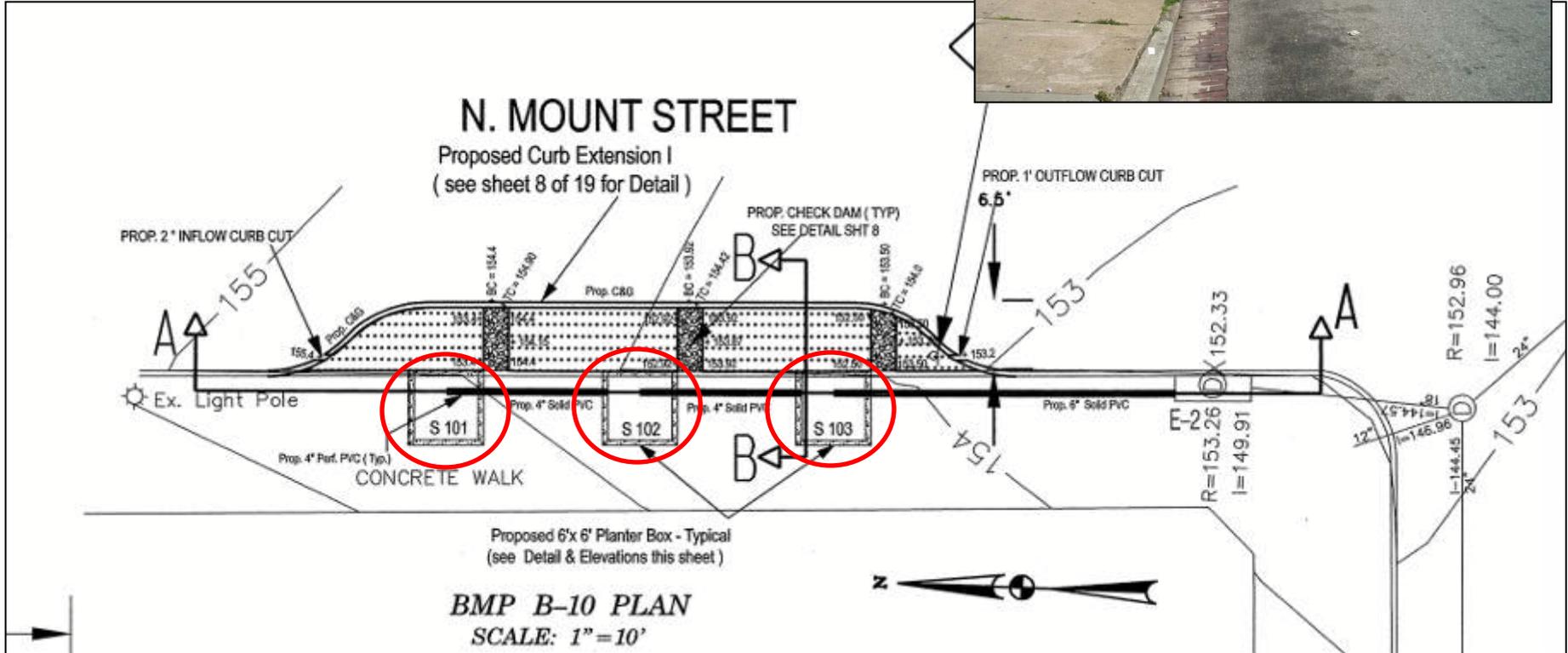
- EXISTING CONTOUR      --- 120 ---
- PROPOSED CONTOUR      ——— 119 ———
- EXISTING CURB AND GUTTER      - - - - -
- PROPOSED CURB AND GUTTER      ———
- EXISTING STORM DRAIN      ——— Ex. 36" ———>
- PROPOSED STORM DRAIN      ——— Prop. 12" RCSP ———>
- PROPOSED CONCRETE CHANNEL      ——— Prop. Conc. Channel ———>



**BMP B-1 PLAN**  
SCALE: 1" = 10'

**B-1: Plaza Bio-retention**

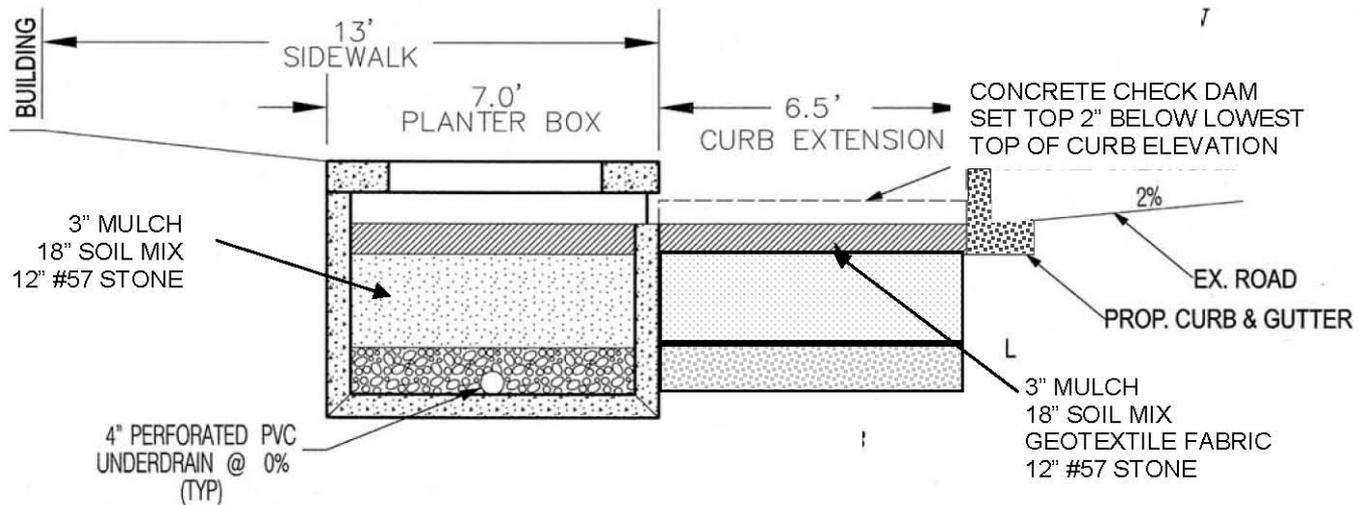
# B-10: Tree Box Inlet with Curb Extension







# Tree Box Inlet with Curb Extension - Cross Section Profile



CROSS-SECTION OF CURB EXTENSION WITH TREE BOX





# Construction: Spring / Summer 2009



# B-1 Plaza Bioretention



# B-10: Tree Box Inlet with Curb Extension



# B-13: Tree Box Inlet with Curb Extension



# B-15: Tree Box Inlet with Curb Extension



# C-13: Filterra Unit



# I-1: Impervious Cover Removal



# The following Spring....



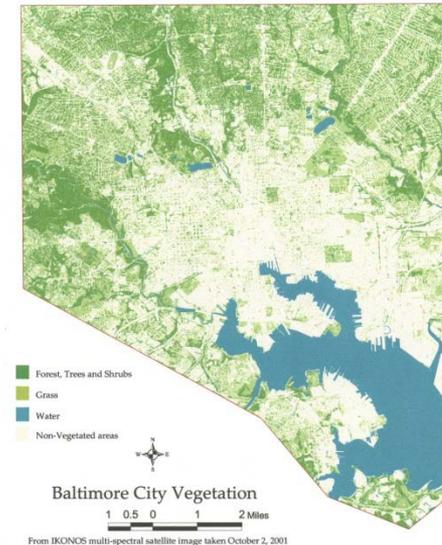
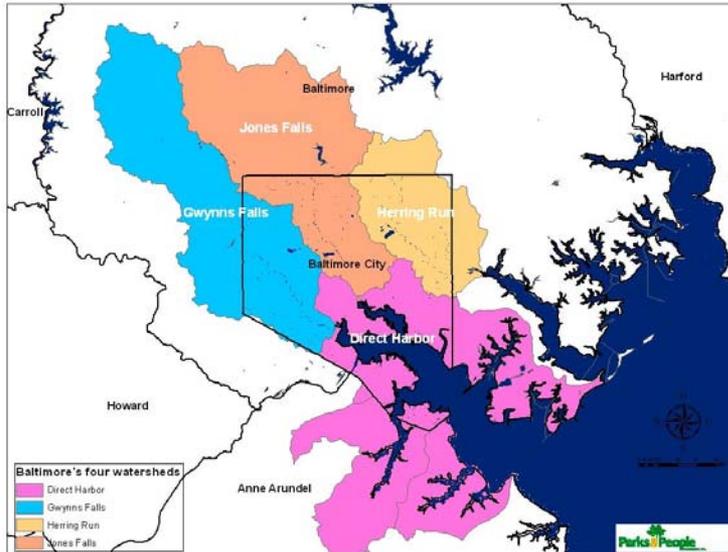
# The following Spring



# Keeping the trash out...



# Institutional and Policy Changes



- Baltimore City and County signed a Watershed Cooperation Agreement.
- Baltimore City set a long-term goal to double the urban tree canopy in accord with the Chesapeake Bay Agreement and an understanding of how urban storm water and riparian areas interact.

Greening has the power to build  
community and transform the  
health of urban watersheds

Presentation by  
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