Green Highways and Green Streets for 21st Century Infrastructure: Strategies, Technologies and Future Directions

April 13, 2010
Dominique Lueckenhoff, Associate Director, Water Protection Div., EPA, R3
Sustainable Concrete Pavements Session
Concrete Sustainability Conference
Why “Infrastructure”?

“The substructure or underlying foundation, especially the basic installations and facilities, on which the continuance and growth of a community or state depends”.

(Source: Webster’s New World Dictionary)
The Other Infrastructure
WHY GO GREEN!? 

The global market for environmental products and services is projected to double from $1,370 billion per year at present to $2,740 billion by 2020.

Source: Green Jobs -- Towards Decent Work in a Sustainable, Low-Carbon World, UNEP/ILO/IOE/ITUC, September 2008
WHY GO GREEN!? 

The GAP WIDENS - between impaired waters and restored waters!

EPA Region III Rivers and Streams Trend Analysis

<table>
<thead>
<tr>
<th>Year</th>
<th>Assessed</th>
<th>303(d) impaired waters</th>
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<tbody>
<tr>
<td>1998</td>
<td>43,243</td>
<td>0</td>
</tr>
<tr>
<td>2000</td>
<td>66,166</td>
<td>1,423</td>
</tr>
<tr>
<td>2002</td>
<td>94,212</td>
<td>2,960</td>
</tr>
<tr>
<td>2004</td>
<td>105,225</td>
<td>4,478</td>
</tr>
<tr>
<td>2006</td>
<td>123,672</td>
<td>6,000</td>
</tr>
</tbody>
</table>
National Research Council 2008
Stormwater Study Findings

• SCMs that harvest, infiltrate, and evapotranspirate stormwater are critical to reducing the volume and pollutant loading of small storms.

• “It should be noted that there are important, although indirect, water quality benefits of all runoff-volume-reduction SCMs—

  (1) the reduction in runoff will reduce streambank erosion downstream and the concomitant increases in sediment load, and

  (2) volume reductions lead to pollutant load reductions, even if pollutant concentrations in stormwater are not decreased.
70% increase in peak flow.
170% increase in runoff volume.
Former instantaneous peak flow now lasts ~4 hours.
Paradigm Shift:
Get away from the curb and gutter, big basin approach

• Shift from the concept of moving stormwater as far away as quickly as possible in large, buried collection and conveyance systems.

• Shift towards the concept of managing stormwater the way mother nature would do it: where it falls; plants & soils.
Paradigm Shift: Rain is a Resource, Not a Waste

– Drinking water
– Ground water recharge
– Stream baseflow
– Trees & other plants
– Aesthetic qualities
Paradigm Shift:
Trifocal Approach to Stormwater Management

Region or Watershed

Neighborhood

Site
Why Watershed Protection?

- Managing water resource programs on a watershed basis is beneficial:
  - Environmentally
  - Financially
  - Socially
A Watershed Driven Approach:

• Considers a watershed as a functioning **system**, not as a series of discrete and isolated points
• A collaborative effort that…
  – Is geographically focused
  – Involves all stakeholders
• Breaks down the programmatic barriers
• Green Highways Partnership (GHP)
  – Purpose
  – Background
  – Highlights

• Green Highways Watershed Approach to Stormwater Management
  – Linear projects at the state and local DOT level
  – Principles & Regulatory Connections
GHP

• Formed in 2005
• **Voluntary – Not** Regulatory
• **Collaborative**
• Public-Private Partnership

• **Goals**
  – Promote *innovation, stewardship, streamlining, and green solutions* for linear environment
  – Provide *greater incentives for streamlining & environmental stewardship* in transportation
  – Promote green technologies for sustainable results – including healthy, economically viable communities.
What makes a highway or street green?

Street Tree Space (Soil Volume = 1,000 cf)
Compost Amended Soils
Permeable Pavement In Parking Lane
Permeable Pavement Under Bike Rack
Permeable Sidewalks
Bioretention
Permeable Pavement In Transitway
Bike Rack
Bioretention
Bike Lane

© The Low Impact Development Center, Inc.
Green Highways & Green Streets enable:

– Development of integrated watershed planning approaches

– Leveraging of resources (technology, funding, outreach)

– Integration of green elements into infrastructure

– Creation of partnerships and develop cross-cutting programs

– Creation of Context Sensitive Solutions
EXAMPLES OF GREEN HIGHWAY PRACTICES:

1. Bioretention
2. Porous Asphalt/Pervious Concrete
3. Environmentally Friendly “Green” Pavements
4. Forest Buffers
5. Restored and Storm water Wetlands
6. Stream Restoration
7. Wildlife Crossings & Corridors
8. Soil Amendments
GHP Framework: 3 Major Environmental “Theme” Teams

- Conservation & Ecosystem Protection
- Recyclables & Reuse
- Watershed-Driven Stormwater Management
Theme Teams

- **Conservation & Ecosystem Protection**
  - Establish regional ecosystem frameworks and an ecosystem approach to transportation programs and projects.

- **Recyclables and Reuse**
  - Promote environmentally sound use of industrial and commercial materials
  - Promote practices that conserve non-renewable resources, reduce impacts to landfills, reduce greenhouse gas emissions, and save energy.

- **Watershed-Driven Stormwater Management**
  - Implement watershed-driven approach to address stormwater impacts through integrated, innovative, cost-effective practices that eliminate flow and loads by 90-100%
Conservation & Ecosystem Protection

- Uses natural infrastructure approaches to link transportation and environmental planning.
  - Identifies critical habitats and other areas of ecological importance
  - Facilitates the placement, design, and scope of future transportation projects
- **Urban Ecosystem Analysis can accurately measure** “environmental savings* of using a “natural infrastructure approach”.

*Potential savings that can be calculated are:
  - Stormwater impacts
  - Carbon sequestration and storage
Assessing Natural Infrastructure

• Urban Ecosystem Analysis
  – Means of calculating existing & potential value of a communities’ natural infrastructure and land use

Page from report showing City of Bellevue, Washington Landcover Classification from 2007
High Resolution Imagery
Source: American Forests

http://www.americanforests.org/resources/rea/
NCHRP Project 25-09
Evaluation Methodology

Main components of C&R material evaluation:

• Material Screening
• Detailed Laboratory Evaluation
• Fate and Transport Modeling
• Evaluation of Data and Characterization Potential Impacts
• Report with Tools/Methodology for Evaluating materials is available

**NCHRP Project 25-09**

**Waste and By-product Materials Evaluated**

<table>
<thead>
<tr>
<th>Coal Combustion Products</th>
<th>MSW Incinerator Ash</th>
<th>Sludge Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blast Furnace Slag</td>
<td>Steel Slag</td>
<td>Non-Ferrous Slag</td>
</tr>
<tr>
<td>Scrap Tires</td>
<td>Mining Waste</td>
<td>Baghouse Fines</td>
</tr>
<tr>
<td>Foundry Sand</td>
<td>Reclaimed Asphalt Pavement</td>
<td>Reclaimed Concrete Pavement</td>
</tr>
<tr>
<td>Waste Polymers</td>
<td>Waste Glass/Ceramic</td>
<td>Kiln Dust</td>
</tr>
<tr>
<td>Quarry Fines</td>
<td>Silica Fumes</td>
<td>Sulfate Waste</td>
</tr>
<tr>
<td>Shingle Waste</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Recycling and Reuse (R/R)
Benefits of Industrial Materials Use

• **Environmental**
  – Avoided impacts from processing virgin materials (e.g. GHG emissions)

• **Economic**
  – Reduced disposal costs

• **Performance**
  – Perform as well as or better than traditional materials
    - Increased strength, improved workability, resistance to chemical attack, longer life
Recycling and Reuse (R/R) Examples

• State DOT pilot projects that optimize beneficial use of byproducts
  – Virginia, West Virginia, Maryland, and Pennsylvania
• Efforts currently include:
  – Virginia GHP demonstration projects and Green Rating System
  – Mid-Atlantic Specification Harmonization Task
  – Information exchanges (NRC, other regions), outreach tools
Watershed-Driven Stormwater Management

- Promotes coordination of public and private stakeholder interests toward watershed protection
- Supports & integrates R&D – *leveraged to address data needs and gaps*
- Uses collaborative partnerships to produce tangible results
- Provides an opportunity for infrastructure agencies to plan, deliver the most cost-effective protection that includes added benefits to watersheds
- Promotes DOT protective measures both inside & outside the ROW
Watershed-Driven Stormwater Management

Principles of Watershed Approach

• Regulatory compliance is the minimum
• Requires a stormwater management plan considering watershed-wide needs – Target results per year
• Focuses on achieving positive environmental results for the watershed
• Integrates stormwater plans into transportation project development and project features
How do we integrate these green techniques with conservation and green infrastructure planning?
GHP – Promoting Green Infrastructure Approaches

Infiltration - Evapotranspiration - Capture & Use

- Protecting areas with natural ecological functions
- Amended soils
- Impervious cover removal
- Bioretention
- Permeable pavements
- Green roofs
- Cisterns & rain barrels
- Trees & expanded tree boxes
- Reforestation & restoration
- Infill & Redevelopment
- Alternative parking & street designs

Water Conservation
Bioinfiltration
Open Swales
Parking Lot Island Infiltration Areas
Planters
Green Roofs
Vegetated Buffers & Landscaping
Permeable and Porous Pavements
Importance of Design

• Design is crucial with respect to whether or not performance standards can be met.
• Not all ‘green’ is created equal: some practices look green, but do not necessarily function green.
• Maximizing retention is important, so think about design details for each application.
• Simple designs often mean simple construction and maintenance.
Designs to Maximize Retention
Green Streets
by the Green Highways Partnership

What could be...

Bioretention on family-friendly street edge
Source: Portland Bureau of Environmental Services

Traffic calming and signature green space at street entry
Source: Portland Bureau of Environmental Services

Rain gardens for viewing; pedestrian-friendly permeable concrete walks
Source: LID Center

Permeable interlocking concrete pavement (PICP) in parking lanes
Source: Portland Bureau of Environmental Services

Streets constructed of pervious concrete pavement or other permeable surfaces
Source: City of Bellingham, WA

Curb bump outs/extensions provide bioretention areas; traffic calming measures improve safety
Source: LID Center

Planning for environmentally sustainable growth in the Anacostia Watershed

Greening Tools...

Solar trash compactor; Program information on trash can
Source: LID Center

ADA-compliant PICP
Source: ICPI

Energy-efficient light fixtures; Banner standards on light poles
Source: Cannell Graphics

Bioretention next to pervious concrete with recycled materials for edges
Source: LID Center

Bench for local recycling and art opportunities
Source: LID Center

Recreational alternative transportation support
Source: Damien Newton, Streetsblog.org

Educational sign explaining greening initiatives
Source: Damien Newton, Streetsblog.org

Bench for local recycling and art opportunities
Source: LID Center

Planning for environmentally sustainable growth in the Anacostia Watershed
# Cost Savings

Table 2. Summary of Cost Comparisons Between Conventional and LID Approaches*  

<table>
<thead>
<tr>
<th>Project</th>
<th>Conventional Development Cost</th>
<th>LID Cost</th>
<th>Cost Difference</th>
<th>Percent Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd Avenue SEA Street</td>
<td>$868,803</td>
<td>$631,548</td>
<td>$217,255</td>
<td>25%</td>
</tr>
<tr>
<td>Auburn Hills</td>
<td>$2,360,385</td>
<td>$1,598,989</td>
<td>$761,396</td>
<td>32%</td>
</tr>
<tr>
<td>Bellingham City Hall</td>
<td>$27,600</td>
<td>$5,600</td>
<td>$22,000</td>
<td>80%</td>
</tr>
<tr>
<td>Bellingham Bloedel Donovan Park</td>
<td>$52,800</td>
<td>$12,800</td>
<td>$40,000</td>
<td>76%</td>
</tr>
<tr>
<td>Gap Creek</td>
<td>$4,620,600</td>
<td>$3,942,100</td>
<td>$678,500</td>
<td>15%</td>
</tr>
<tr>
<td>Garden Valley</td>
<td>$324,400</td>
<td>$260,700</td>
<td>$63,700</td>
<td>20%</td>
</tr>
<tr>
<td>Kensington Estates</td>
<td>$765,700</td>
<td>$1,502,900</td>
<td>-$737,200</td>
<td>-96%</td>
</tr>
<tr>
<td>Laurel Springs</td>
<td>$1,654,021</td>
<td>$1,149,552</td>
<td>$504,469</td>
<td>30%</td>
</tr>
<tr>
<td>Mill Creekc</td>
<td>$12,510</td>
<td>$9,099</td>
<td>$3,411</td>
<td>27%</td>
</tr>
<tr>
<td>Prairie Glen</td>
<td>$1,004,848</td>
<td>$399,536</td>
<td>$605,312</td>
<td>40%</td>
</tr>
<tr>
<td>Somerset</td>
<td>$2,456,843</td>
<td>$1,671,461</td>
<td>$785,382</td>
<td>32%</td>
</tr>
<tr>
<td>Tellabs Corporate Campus</td>
<td>$3,162,160</td>
<td>$2,700,650</td>
<td>$461,510</td>
<td>15%</td>
</tr>
</tbody>
</table>

* The Central Park Commercial Redesigns, Crown Street, Poplar Street Apartments, Prairie Crossing, Portland Downspout Disconnection, and Toronto Green Roofs study results do not lend themselves to display in the format of this table.

** Negative values denote increased cost for the LID design over conventional development costs.

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How does Green Infrastructure Save Money?

• Primarily through costs avoided/reduced:
  – Eliminate or reduce stormwater ponds
  – Eliminate or reduce pipes
  – Reduce stormwater or CSO Storage
  – Reduce other hard infrastructure:
    • Narrower streets
    • Less sidewalk
    • Reduce stormwater treatment devices
    • Avoid land purchase for ponds, etc.
    • Use saved land to build more lots
Municipal Case Studies
Chicago, Illinois

• More than 80 green roofs totaling over 1 million square feet.
• A 2003 study found green roof runoff volume was less than half that of conventional roofs.
• Temperatures above the Chicago City Hall green roof average 10° to 15°F lower than a nearby black tar roof. August temperature difference can be as much as 50°F. Estimated annual energy savings of $3,600.
Chicago Green Alleys

- 13,000 alleys – more than 1,900 miles.
- 3,500 acres of impervious surface.
- 20% unimproved; 20% need repair.
- Alleys not connected to storm sewers, cause of flooding.
Chicago Green Alleys

• Pilot projects address stormwater, urban heat island, recycled materials, energy efficiency and light pollution.
• Early pilot alley retains the volume of a 3-inch, 1-hour event.
• Created a market for permeable concrete - $145/yd to $45/yd one year later (regular concrete $50/yd).
Milwaukee, Wisconsin

- Green roofs, bioretention and rain barrels used to reduce combined sewer inflow.
- Green infrastructure expected to reduce CSO volume by 14-38%.
Portland, Oregon

- City code requires on-site stormwater management for new and re-development.
- Subsidized downspout disconnection program.
  - 45,000 participating households.
  - Infiltrates 1 billion gallons of rainwater annually.
Portland, Oregon

Permeable Paver Blocks

- Used in a similar manner to curb extensions to manage street runoff.
- Allow hardscape function to be retained.
- Have virtually eliminated runoff from the street.
Portland, Oregon

- Brooklyn Creek Basin
- $63 million cost savings in going from grey to green infrastructure wet weather control
Seattle, Washington

Natural Drainage Systems

- Stormwater source control.
- Monitoring has demonstrated 99% reduction in stormwater runoff.
- No measured runoff since December 2002.
Seattle, Washington

Table 7. Citywide Management Unit (MU) Data*

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Citywide</th>
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<tbody>
<tr>
<td></td>
<td>Current</td>
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<tr>
<td>Acres in MU</td>
<td>54,324</td>
</tr>
<tr>
<td>MU as % of city land base</td>
<td>100%</td>
</tr>
<tr>
<td>Canopy coverage</td>
<td>18%</td>
</tr>
<tr>
<td>Number of trees</td>
<td>1,377,500</td>
</tr>
<tr>
<td><strong>Plantings needed</strong></td>
<td></td>
</tr>
<tr>
<td><strong>One-time cost of plantings</strong></td>
<td></td>
</tr>
<tr>
<td>Maintenance Costs (yr)</td>
<td>$14,054,300</td>
</tr>
<tr>
<td>Benefits (yr)</td>
<td></td>
</tr>
<tr>
<td><strong>Stormwater Mitigation Value (yr)</strong></td>
<td>$20,643,000</td>
</tr>
<tr>
<td><strong>Air Cleaning Value (yr)</strong></td>
<td>$4,854,000</td>
</tr>
<tr>
<td><strong>Carbon Sequestration (Tons CO2)</strong></td>
<td>$5,400</td>
</tr>
<tr>
<td><strong>Carbon Sequestration (Value $)</strong></td>
<td>$1,584,000</td>
</tr>
<tr>
<td><strong>Other Benefits (Energy, Aesthetics, &amp; etc)</strong></td>
<td>$17,237,300</td>
</tr>
<tr>
<td><strong>Net Benefit (All Benefits - All Costs) (yr)</strong></td>
<td>$29,304,000</td>
</tr>
</tbody>
</table>

*All values are based on estimates and currently accepted models (McPherson et al. 2002).

12 % more Canopy:
Stormwater + Air Quality + Carbon + Other
Benefits = $15 million annual net benefit

(Seattle Urban Forest Management Plan 2007)
Combined Sewer Overflow (CSO) LTCPs with Green Infrastructure Elements to Date

- Cincinnati OH
- Kansas City MO
- Lansing MI
- Louisville KY
- Sanitation District #1 KY
- Philadelphia PA
How is EPA supporting these types of approaches?
Municipal Handbook

The Municipal Handbook is a series of guidance documents to help local officials implement green infrastructure in their communities. Modules will be released as completed, including:

– Rainwater Harvesting Policies
– Green Streets
– Funding Options
– Retrofit Policies
– Municipal Incentives
Use of Green Infrastructure in NPDES Permits and Enforcement

- Memo issued August 16, 2007
- Jointly issued by WPD and WED
- Clarifies that green infrastructure controls can be implemented within current regulatory framework
Green Infrastructure Permitting & Enforcement Guide

• For NPDES permit writers and enforcement staff.
• Information on how to include and/or review green infrastructure components in permits and enforcement documents for stormwater, SSOs, CSOs.
• Is in final draft, and will be released soon.
US EPA Stormwater BMP Fact Sheet

National Pollutant Discharge Elimination System (NPDES)

Subcategory: Infiltration

Pervious Concrete Pavement

Pervious concrete, also known as porous, gap-graded, or enhanced porosity concrete, is concrete with reduced sand or fines and allows water to drain through it. Pervious concrete over an aggregate storage bed will reduce stormwater runoff volume, rate, and pollutants. ..

The void space allows stormwater to flow through the concrete as shown in Figure 1, and enter a crushed stone aggregate bedding layer and base that supports the concrete while providing storage and runoff treatment. When properly constructed, pervious concrete is durable, low maintenance, and has a low life cycle cost. Figure 2 shows a pervious concrete walkway installed at the EPA Headquarters in Washington, D.C.
How is EPA supporting these types of approaches? GHP continues to promote GI practices and technologies in the roadway environment.
### Location
- Either side of a closed-section roadway (median or shoulder)

### Fixed-Object Hazard?
- No

### Effectiveness
- Water quality: **Medium**
- Volume: **N/A**
- Peak discharge: **Low**

### Storage Capacity
- None

### Targeted Pollutants
- Total Suspended Solids
- Fecal coliform
- Oxygen depleting substances

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Low Impact Development Highway Manual (National Cooperative Highway Research Program, NCHRP)
Porous/Pervious Pavements

Product and Technology-Based Solutions & Best Management Practices

- Porous/Pervious Pavements serve as an “at source” solution
- Multiple product sources and technologies
  - Porous Aggregates
  - Porous Asphalt
  - Pervious Concrete
  - Open Jointed Blocks

Source: Bruce Ferguson

Source: KPFF Engineers

Source: Bruce Ferguson

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Porous/Pervious Pavements

Product and Technology-Based Solutions & Best Management Practices

Two terms currently being used:
- **Porous**: having pores (voids)
- **Pervious**: allowing fluid to pass through

Successful porous/pervious pavements require correct:
- Pavement selection
- Design
- Installation
- Maintenance

Source: Portland Cement Association & National Ready Mixed Concrete Association
Porous/Pervious Pavements

Sustainable Characteristics and Benefits:
- Americans with Disabilities Act (ADA) Compliant
  - Shoes, wheel chairs, crutches
- Noise Reduction
- Stormwater Mitigation/Management
- Cooler Surface
- Supports Tree Growth

Source: Interlocking Concrete Pavement Institute (ICPI)
Pervious Concrete
Park & Ride Parking Lot (4 acres)
Site of 2008 Super Bowl – Glendale, Arizona

Source: National Ready Mixed Concrete Association (NRMCA)
Alternative Materials

Source: Interlocking Concrete Pavement Institute (ICPI)

Source: RMC Research & Education Foundation
Large R-O-W’s for suburban/rural arterials

Source: Prince George’s County Department of Environmental Resources, Maryland
Pretreatment Grass Swale

Source: A.P. Davis, University of Maryland College Park
Innovative & Adaptive BMP Conditions

Source: Low Impact Development Center, Inc.
Bioretention in a Box

Source: Filterra
Constructability

Mt. Rainier, Maryland LID Demonstration Project

LID Center designed this project for the University of Maryland, College Park and the Hydrology and Hydraulics Division of the Maryland State Highway Administration (SHA).
Irving Street Cloverleaf Retrofit (Washington DC)

Source: Greeley and Hansen, LLC
Erosion & Sediment Control & Site Restoration

Irving Street
Cloverleaf Retrofit
(Washington DC)
EPA / FHWA Grant

Nannie Helen Burroughs Avenue Great Street
LID Toolbox
Stormwater solutions which support sustainable urban design

Bioslope
- Add green infrastructure
- Keeps the water away
- Promotes wetland function
- Mitigates potential flooding & runoff from impervious surfaces
- Grass, shrubs, and trees

Bioswale
- Stormwater treatment strategy
- Bioretention basin
- Bioretention basin
- Water retention
- Vegetation

Biofiltration Cell
- Plant and landscape design
- Water retention
- Vegetation

Permeable Pavers
- Prevents soil erosion
- Reduces stormwater runoff
- Reduces stormwater runoff
- Softer touch for drivers

Vegetated Filter Strip
- Stormwater management
- Vegetation
- Vegetation

Street Trees
- Plant vegetation
- Vegetation

Source: Low Impact Development Center, Inc.
Retrofit Strategies for BMPs

NCHRP 25-31
– Guidelines for Evaluating & Selecting Modifications to Existing Roadway Drainage Infrastructure to Improve Water Quality in Ultra-Urban Areas

Project Status: In Progress
Design Manuals

Source: Anacostia Waterfront Transportation Architecture Design Standards
System integration, consistency & sustainability

Source: District Department of Transportation
Future Directions - Integration with Community & Economic Development Planning & Site Design

Edmonston, Maryland: *Greening Communities by Greening Streets*

Community revitalization through the use of low impact development, attraction of green businesses, and attention to health by encouraging biking and walking.

Source: Low Impact Development Center, Inc.
American Recovery and Reinvestment Act
From Main Streets to Green Streets!: Collaboration for Prosperity and Sustainability

A Model for Sustainable, Green Land Use Planning for Low Income Communities located in the Anacostia River Watershed of the Chesapeake Bay

What is…

Green Streets
by the Green Highways Partnership

What could be…

“From Main Streets to Green Streets!”

Using Green Highways and Green Infrastructure to revitalize our communities: Green Stimulus Plan for the Town of Edmonston, Maryland

What makes this a “Green Street?”

• A Top (tree canopy) to bottom (water quality) plan
• Native tree canopy
• Street lighting with clean energy
• Walking, running, and biking
• Recycled materials
• Stormwater bioretention and filtration
• Open process and public engagement
• Education and replication

Anticipated Project Benefits:

Social Benefits:
• Reduction in urban heat island effect
• Provides “Green Job” opportunities
• Educational through street kiosks
• Crime reduction benefit
• Health benefit

Economic Benefits:
• Energy cost reduction and water conservation
• “Green Enterprise” business opportunities

Environmental Benefits:
• Carbon sequestration
• Improved water quality through 90% capture of stormwater
• Carbon footprint reduction
• Recycling and beneficial reuse

Source: LID Center

Planning for environmentally sustainable growth in the Anacostia Watershed

2010 Concrete Sustainability Conference 78 © National Ready Mixed Concrete Association
Clean Water State Revolving Fund

• Fact sheet released explaining the use of CWSRF for green infrastructure projects
• Stimulus: CWSRF $4B
• 20% ‘green’
• **Target intersections**
  – Prone to nuisance flooding
  – With specific CSO problems
• **Funding and planning**
  – 80 new Green Streets every year for the next decade
  – Small plantings in right of way one of PlaNYC’s most successful retrofit programs

Source: *Draft PlaNYC Sustainable Stormwater Management Plan 2008*
URL:
City of Baltimore, MD
Green Streets Master Plans

Figure 2: A) Bioretention on one street. B) Bioretention on both streets.

GHP CENTER for TRAINING and DEVELOPMENT

City of Baltimore, MD
Green Streets Master Plans

Figure 2: A) Bioretention on one street. B) Bioretention on both streets.

GHP CENTER for TRAINING and DEVELOPMENT
"What we see now as a key development is green infrastructure solutions going Main Street, no longer reserved to demonstration sites but the mainstay of a new community development and redevelopment model. **Green Streets yield multiple benefits** for communities well beyond the stormwater management outcomes they deliver. It’s time to train a new generation on how this is done."

**Jon Capacasa**  
EPA Region 3  
Director, Water Protection Division

“The Recovery Act provided the Clean Water SRF with $4 billion to help states finance high priority infrastructure projects needed to ensure clean water. We can build infrastructure that minimizes the environmental footprint we leave for future generations and leverage these investments to maximize environmental progress. One of the most exciting aspects of the **Recovery Act** is the requirement that the states allocate 20 percent of their SRF dollars to promote the implementation of green infrastructure projects. These green infrastructure projects are an effective response to environmental challenges that is cost effective, sustainable, and provides multiple environmental benefits.”

**Craig Hooks**  
EPA  
Assistant Administrator  
July 31, 2009 Testimony before the Transportation & Infrastructure Committee  
United States House of Representatives
Green Streets Conceptual Guide

- Describes green approaches for:
  - Residential Streets
  - Commercial Streets
  - Arterial Streets
  - Alleys

- Includes concept designs

- Discusses functions and applications
Last, but not least... Outreach, Training, Communication – Vital to Progress!

Webinars, Forums, Workshops, Conferences, Meetings, Training, We Need Your Continued Support!
Newsletters, Websites!!!

GHP DIGEST

- Weekly Information Resource Guide for Green Highway Practitioners

Revised GHP Web Site – WWW.GREENHIGHWAYSPARTNERSHIP.ORG
THANK YOU!

lueckenhoff.dominique@epa.gov