

ESD Retrofits in Montgomery County: A Maryland MS-4 Case Study



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Restoration Partnership
Financing-Demonstration of
Approaches joint committee
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Background and Current Plans

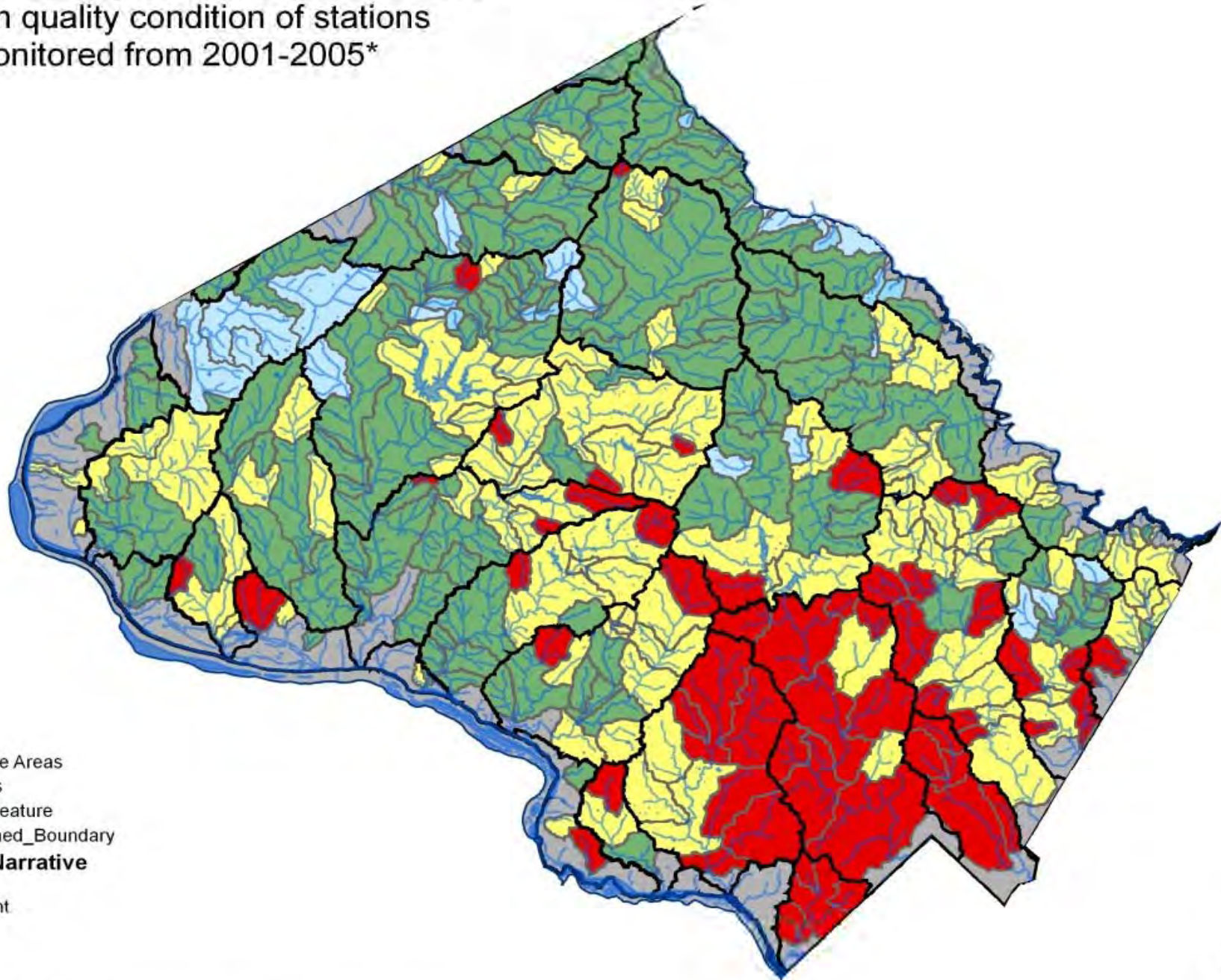
- Loss of stream biological health in past 20 years
 - Mix of green, gray stormwater infrastructure
 - Public demand for improved stream protection and restoration
-
- 2010-2015 MS-4 permit – aggressive restoration
 - 20% of impervious area to be restored = 4302 Acres
 - Countywide – 18% w/ESD = 774 IAs (Impervious Acres)
 - Subset: Anacostia - 26% w/ESD = 373 IAs.
 - ESD will account for 53% of the \$300 million budget
 - Average ESD suite cost of \$205,000/ IA.

MS-4 Restoration Objectives: Mandates and Commitments

- Anacostia Restoration Plan:
~1000 green SW retrofits
- Local, State, Federal Clean Water
and Stormwater Laws
- MS-4 Permit Mandates:
Watershed Restoration; TMDLs
(13 approved TMDLs, 8 waters
listed for biological impairment);
ESD regs & code revisions; Trash
elimination
- Restore & Protect Local Streams

Stream Quality Conditions 2001-2005

Stream quality condition of stations
monitored from 2001-2005*



Legend

- Drainage Areas
- Streams
- Water Feature
- Watershed_Boundary

Average Narrative

- Excellent
- Good
- Fair
- Poor
- Not Monitored

*Horsepen Branch was monitored in 2000

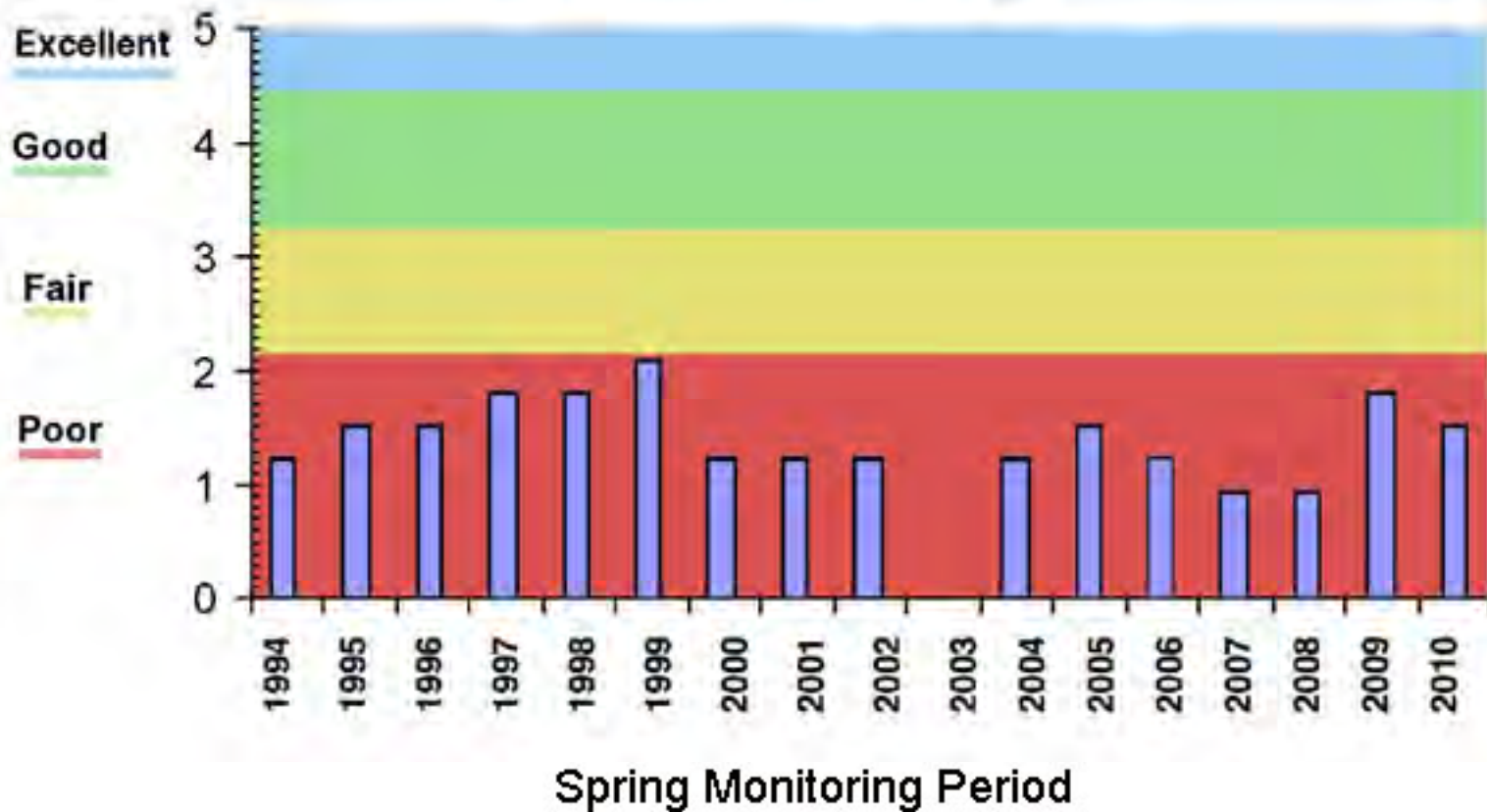
Audubon Naturalist Society – 17-Year Collection of WQ Data

Countryside Tributary of Paint Branch

[map of all sites](#)

Stream Health Data Chart

(No data available for years with no rating.)

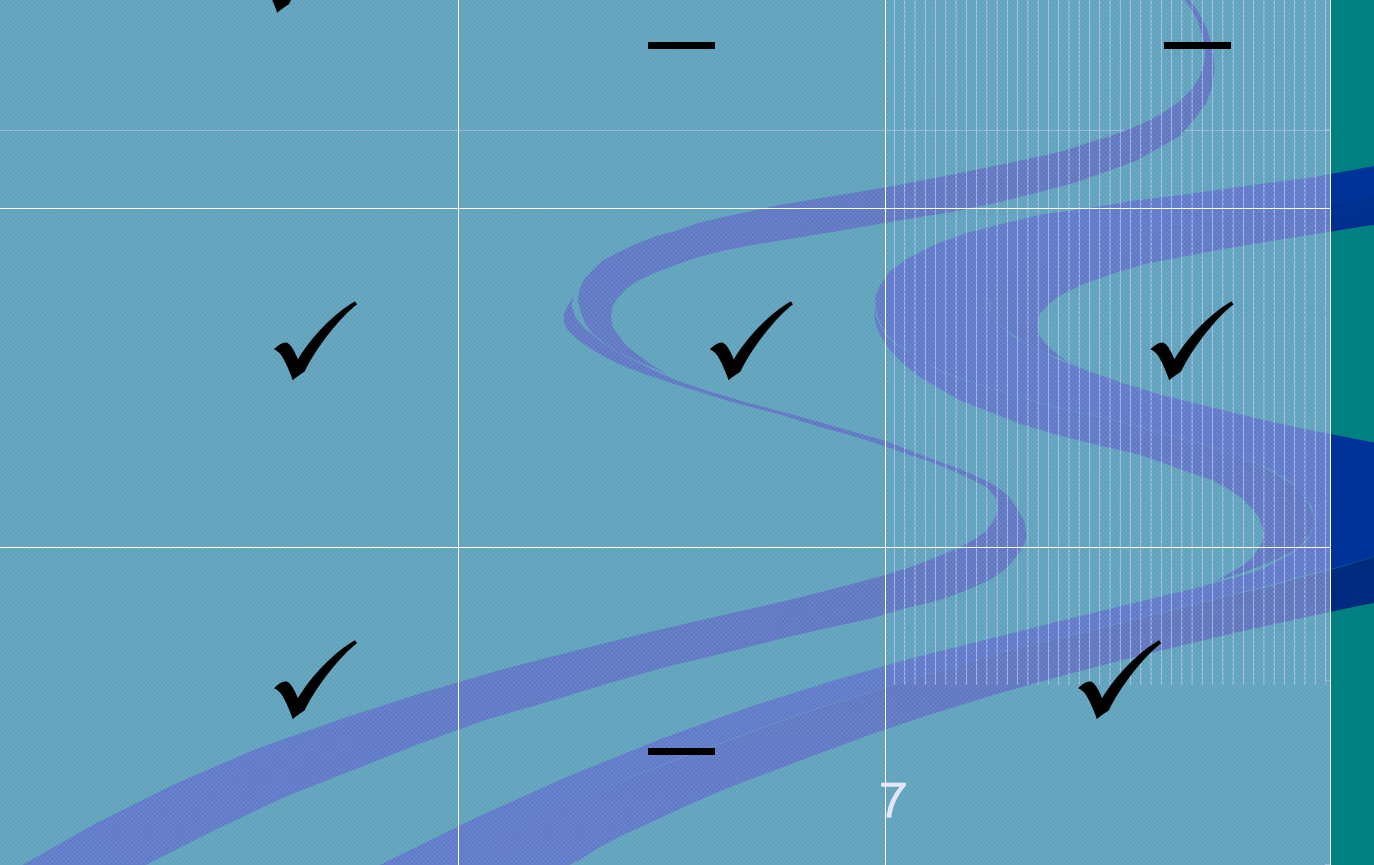


Benthic Health

- Temperature of the water
- Biodiversity of the Riparian Zone
- Steady Flow of clean water

3 Restoration Methods

<i>Method</i>	<i>Objective</i> Reduce Loadings	Reduce Runoff	Restore Biology
Pond Retrofit	✓	—	—
ESD	✓	✓	✓
Stream Channel Restoration	✓	—	✓



BOTE Analysis

Caveats

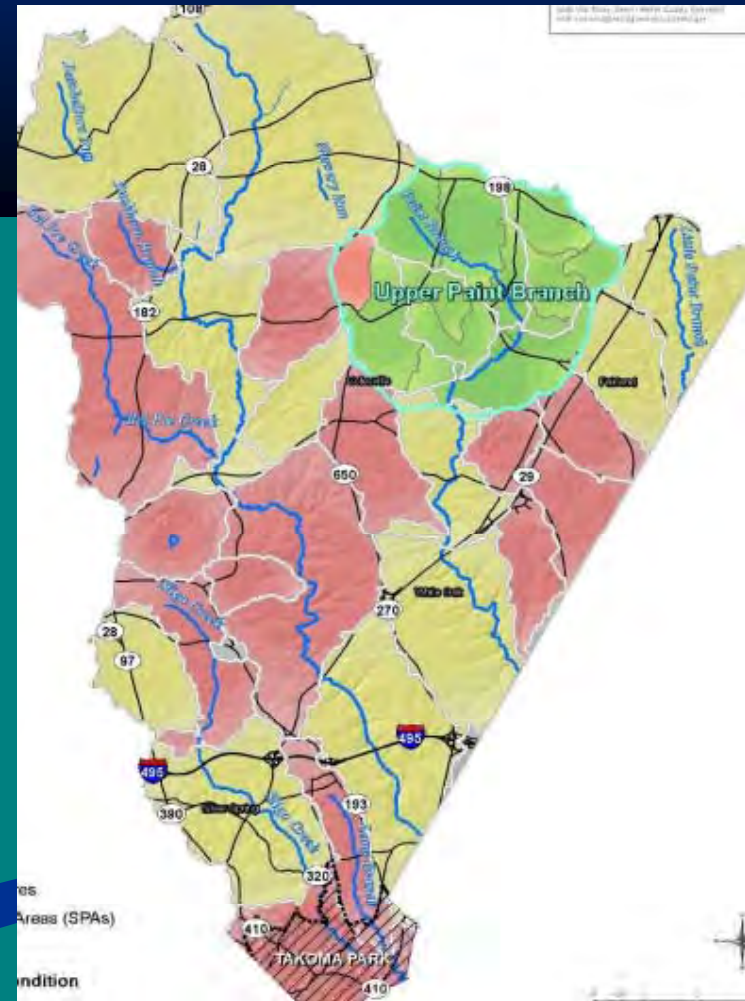
- **Cost Data is based on small data sets or single data points; more research needed.**
- **We are not modelers.**
- **Current analysis is for first costs, does not include life-cycle costs.**

Objectives of the Analysis

- Support DEP's work to increase the role of ESD
- Collect ESD cost data, apply to Anacostia Watershed.
- Expand the ESD toolbox
- Apply ESD sets to selected IA subcategories
- Mostly low and medium-cost technologies

Retrofit Analysis: Anacostia in Mont.Co.

- Residential Target Neighborhoods
- Low-density roads
- Other County roads
- Public parking lots
- Public roofs
- Public Schools
- Private non-Res.
- Pond Retrofits
- 12 ESD practices; 10 w/ unit costs
- Low to mid-range in cost.



BOTE Analysis

(Back-of-the-Envelope)

If we can:

- 1) Widen scope of ESD-LID Retrofit Toolbox;
- 2) Focus on lower- cost ESD practices;
- 3) Apply them in well-tailored suites to each LU category/subcat., then,
- 4) Can we increase the role of ESD while staying w/in the budget?

Proposed Expanded ESD Toolbox for Retrofits

Currently-planned Mix:

- Bioretention
- Rain Gardens
- Permeable Pavement
- Cisterns
- Green Roofs

Additional Recommended ESD Practices:

- Trees in Dry Ponds
- Trees in Right of Way/
Single-Family Home lots
- Regenerative SW
Conveyance
- Conservation Landscaping
- Reforestation and D.M.
- Bioswales w/o curbs
- Trees – Suspended Pymt.

Proposed Expanded ESD Toolbox

- Trees in Dry Ponds



Image source: <http://www.forestsforwatersheds.org/> Center for Watershed Protection and U.S. Forest Service, 2008.

Dennis Ave. Detention Ponds – Trees in a Dry Cell



Proposed Expanded ESD Toolbox

Regenerative Stormwater Conveyance

- RSC cost factor based on one site's design proposal



Proposed Expanded ESD Toolbox

■ Conservation Landscaping at Rockville H.S.



Cost Data Applied – Analysis Results

Anacostia Watershed - Montgomery County

- 8 LU Subcats. & 10 ESD Practices
- ~25 people queried for cost data; 1/3 responded.
- Conservation Landscaping, BR, tree planting core practices.
- High-end techniques used sparingly, highly visible.

Example: Public Roofs
Portion of 54 Imp. Acres
assigned to each ESD
retrofit practice:

BR	0.4
CL	0.25
Trees	0.125
GR	0.1
<u>BS</u>	<u>0.125</u>
Total:	1.0

ESD Retrofit Practice	Cost – \$ per Imp. Acre	# Sources ~ Data Pts.
Tree Planting – Res.	8400	>1
Tree Plntg. - Dry Ponds	14381	>1
Riparian Reforestation	13074	>1
Cons. Landscaping	54722	1
Regenerative SW Conveyance	35000	1
Bioswales	137000	1
Curb-contained BR	172000	1
Rain Gardens	200000	1
Trees - Suspended Pvmt.	253000	1
Green Roofs	501000	1

ESD Retrofit Cost Analysis – Alternative Scenario for the Anacostia Watershed in Montgomery Co.

Results and Findings

- Average cost of ESD practices: \$71,000 per IA
- Few managers, developers collect or report cost data; data set collected thus far is very small.
- Green Roofs used for about 1/10th of IA of 3 cat's: public roofs; public schools; and private non-residential.
- Total IA addressed with ESD in Anacostia portion: 1841
- Total estimated cost: \$130,000,000

Conclusions and Recommendations

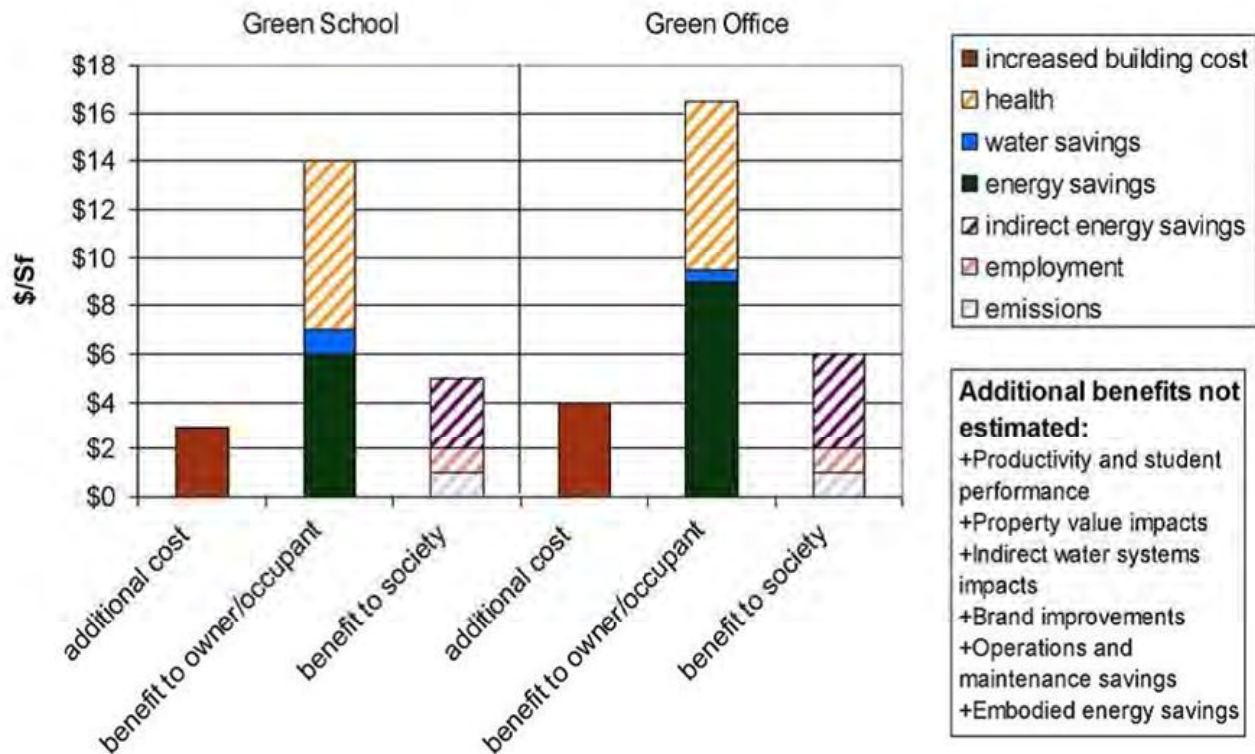
1. **Runoff Reduction is a Core Objective.**
2. **More cost, benefit data collection & documentation needed; revise this analysis with new data.**
3. **Expand ESD toolbox to include lower-cost green practices.**
4. **Alternative ESD suite (\$71,024/IA) is 1/3 the cost of planned ESD suite (\$200,000/IA).**
5. **Alternative ESD suite close to target avg. cost of MS-4 Restoration: \$69,735 (= total restoration budget of \$300m/4302 Imp. Acres)**
6. **Montgomery can apply ESD to all 4302 Impervious Acres for the MS-4 permit -- and stay within budget.**
7. **Market tailored benefits of ESD to each sector.**

Green Schools and Offices: Numerous Benefits from Going Green.



U.S. General Services Administration

Achieving High-Performance Federal Facilities: Strategies and Approaches for Transformational Change: A Workshop Report



<http://www.nap.edu/catalog/13140.html>

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Organizations listed for identification purposes only; views expressed are solely those of the authors.