T&E COMMITTEE #3
March 9, 2015

Discussion

MEMORANDUM

March 5, 2015

TO: Transportation, Infrastructure, Energy and Environment (T&E) Committee

FROM: KL Keith Levchenko, Senior Legislative Analyst

SUBJECT: **Discussion:** MS4 Permit and Green Infrastructure

Attachments:

- Montgomery County Department of Environmental Protection (DEP): Permit in Review Fiscal Year 2014 (©1-13)
- Philadelphia Water Department Federal and State Mandates, Green Stormwater Infrastructure Summary, and Programs (©14-18)
- Montgomery County Stormwater Partners Network Proposal Paper (©19-21)
- Environmental Protection Agency Green Infrastructure Information (©22-24)
- Green Infrastructure Benefits and Practices Chart (©25)
- Excerpt: "Comparison of Maintenance Cost, Labor Demands, and System Performance for LID and Conventional Stormwater Management" (©26)
- Proposed Metrics for Montgomery County's Stormwater (MS-4) Program (©27-28)
- Prince George's County Clean Water Program Flyer, FAQs, and Presentation (©29-43)

Meeting Participants:

Montgomery County Department of Environmental Protection (DEP)

- Lisa Feldt, Director
- Kathleen Boucher, Deputy Director
- Steven Shofar, Chief of Watershed Management

Other Participants

- Adam Ortiz, Director, Prince George's Department of the Environment
- Jim Smullen, CDM Smith/Philadelphia Water
- Rebecca Hammer, The Montgomery County Stormwater Partners Network

T&E Committee Chair Berliner asked DEP to provide an update on the County's National Pollution Discharge Elimination System Municipal Separate Storm Sewer System Discharge (NPDES-MS4) Permit.[1]

DEP has been asked to discuss its accomplishments and lessons learned over the past five years under the current permit, some approaches it is pursuing with regard to the next permit, and the status of the next permit and DEP's negotiations with Maryland Department of the Environment (MDE). DEP's presentation slides were not available as of the time of this memorandum but will be provided at the Committee meeting. DEP has provided a "Permit in Review Fiscal Year 2014" which is attached beginning on ©1.

Mr. Berliner invited several participants from outside Montgomery County as well.

Director Adam Ortiz of Prince George's County will provide an overview of Prince George's County's MS4 program and in particular its all-green implementation of its MS4 permit retrofit requirement. His presentation slides are attached on ©29-43.

Jim Smullen of Philadelphia Water will be discussing some of the economic and technical reasons why Philadelphia chose to adopt an all-green stormwater retrofit program. Philadelphia Water, like DCWater, faces a number of challenges related to its water/sewer infrastructure including: very old infrastructure and combined sewers (About 60% of Philadelphia's sewer system collects both sewage and stormwater). Some information on Philadelphia Water's green stormwater infrastructure programs is attached on ©14-18.

Finally, Rebecca Hammer, representing the Montgomery County Stormwater Partners Network, will outline her group's proposals (see ©19-21) to work with DEP to go "beyond compliance" with a greener and more accountable stormwater program.

NPDES-MS4 Permit Background

DEP is the lead department coordinating a multi-department/agency effort to meet the requirements of the five-year MS4 permit issued to the County by MDE on February 16, 2010. The current permit expired in February, although it remains in effect pending implementation of a new permit by MDE.

Some background information on the MS4 Permit and its funding is provided below.

NPDES-MS4 Permit Requirements

The County's Coordinated Implementation Strategy (CCIS) (dated January 2012) provides the planning basis for the County to meet the following goals, as required in the County's NPDES-MS4 Permit:

1. Meet Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) approved by EPA.

[1]DEP's most recent NPDES-MS4 Annual Report (for FY13 dated March 2014) is available on the DEP website at: https://www.montgomerycountymd.gov/DEP/Resources/Files/downloads/water-reports/npdes/AnnualReport-FY13-3-31-14-Final.pdf. DEP is in the process of preparing a final report for MDE covering the entire permit period through February 2015.

2. Provide additional stormwater runoff management on impervious acres equal to 20 percent of the impervious area for which runoff is not currently managed, to the maximum extent practicable (MEP). ***This requirement continues to be the primary driver of CIP expenditure increases which the Committee discussed last year during its review of the Stormwater Management FY15-20 CIP and is the focus of much of the March 9 discussion.***

3. Meet commitments in the Trash Free Potomac Watershed Initiative 2006 Action Agreement, which include support for regional strategies and collaborations aimed at reducing trash, increasing recycling, and increasing education and awareness of trash issues throughout the Potomac Watershed.

4. Educate and involve residents, businesses, and stakeholder groups in achieving measurable water quality improvements.

5. Establish a reporting framework that will be used for annual reporting, as required in the County's NPDES-MS4 Permit.

6. Identify necessary organizational infrastructure changes needed to implement the Strategy.

While DEP has made substantial progress over the past five years, DEP has not achieved the 20 percent impervious area control goal (#2 above).

Cost Implications

As discussed most recently during DEP's Operating Budget and CIP review last year, the cost implications for implementation of the MS4 permit are substantial. Last year, DEP estimated the permit costs to be about $305 million through 2015 and nearly $1.9 billion through 2030.

Water Quality Protection Fund and Charge

DEP's MS4 work (both operating and capital) is budgeted within the County's Water Quality Protection Fund. This self-supporting fund draws its revenue primarily from the Water Quality Protection Charge (WQPC) (about $28 million in FY15) as well as revenue from the County's bag tax (about $2.1 million in FY15).

The Fund and charge were created in 2001, when the Council approved Bill 28-00.

Two years ago, the Council enacted Bill 34-12 and approved Executive Regulations 17-12AM and 10-13. The bill and regulations included a number of changes to the charge, such as: broadening the charge to include all non-residential properties, establishing a 7 tier rate structure for residential properties, establishing credits for on-site stormwater management practices, and establishing a hardship exemption for residential properties and non-profit organizations. A three-year phase-in period for those properties which experienced an increase in assessments as a result of the legislation was also included.

The Council is currently considering some minor changes to the law and regulations (through Bill 2-15 and Executive Regulation 16-14).

At the state level, the Governor is supporting the repeal of provisions of law enacted in 2012 which require the nine largest counties and Baltimore City to establish stormwater fees. The bill would still allow jurisdictions to establish stormwater fees (or keep fees they already have) at their own discretion.

Attachment
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DEPARTMENT OF
ENVIRONMENTAL
PROTECTION

Permit in Review Fiscal Year 2014

This 2014 Permit in Review document is a snapshot of significant progress that Montgomery County has made in meeting the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit requirements.

Achievements shown are those from February 2010 to June 30, 2014 - the beginning of the Permit cycle through the County's fiscal year 2014 (FY14). This Permit covers stormwater discharges to and from storm drain systems owned and operated by Montgomery County.

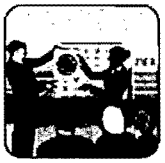
Legal Authority

The County has strengthened legal authority in accordance with NPDES regulations 40 CFR Part 122 by updating the County's Stormwater Management Code and Regulations.

Pollutant Identification

The County has continued to identify its storm drain and stormwater management system elements and sources of discharges.

Management Programs



To control stormwater discharge and reduce pollution, the County maintains a diverse group of programs that target Trash and Litter reduction, Stormwater Facility Maintenance and Inspections, Illicit Discharge Detection and Elimination, and Public Education.

Watershed Health

The County has completed its first round of watershed assessments and restoration project inventories. The County is implementing and assessing projects to reduce pollutants to meet Total Maximum Daily Loads. The County has prepared a Countywide Coordinated Implementation Strategy to achieve all Wasteload Allocations by 2035 except those for bacteria.

Program Funding

The County has committed to meet stormwater initiatives through a ten-fold increase in capital improvement project funding and an increase in operating budget funding over the Permit term.

Legal Authority

The County has strengthened legal authority in accordance with the Clean Water Act National Pollutant Discharge Elimination System (NPDES) regulations 40 CFR Part 122 by updating the County's Stormwater Management Code and Regulations. This section addresses § III.B. Legal Authority.

§ III.B. Throughout the Permit period, the County implemented measures to strengthen legal authority, including:

- **Montgomery County Code Chapter 19 establishes the County's legal authority to:**
  - **Article I Erosion and Sediment Control (ESC):** Administer an ESC program to control erosion and sediment during and post construction.
  - **Article II Stormwater Management (SWM):** Administer an SWM program to build and maintain stormwater facilities to slow and absorb runoff as well as to remove pollutants.
  - **Article IV Water Quality Ordinance:** Regulate pollutant discharges to County streams and establish inspection and enforcement procedures and penalties for non-compliance.
  - **Article V Special Protection Areas (SPAs):** Regulate developers in SPAs which are defined as having high-quality or unusually sensitive water resources that are threatened by landuse changes unless extraordinary protective measures are taken. During this Permit cycle, the following areas in the County were defined as SPAs: Clarksburg, Piney Branch, Ten Mile Creek, Upper Paint Branch, and Upper Rock Creek.
- **During the Permit Cycle, the County enacted legislation to amend and update Chapter 19 including:**
  - **Stormwater Management:** Bills 40-10 and 7-11 amended the County's SWM law to require management of stormwater runoff through nonstructural Best Management Practices (i.e. environmental site design) use to the maximum extent practical for new development and redevelopment projects.
  - **Water Quality Protection Charge (WQPC):** Bill 34-12 modified the structure of the County's WQPC to comply with the 2012 Maryland House Bill 987.
  - **Erosion and Sediment Control:** Bill 1-13 brought local ESC requirements into compliance with the Maryland SWM Act of 2007 and the 2011 Maryland Standards and Specifications for Soil ESC.
- **Coal Tar Sealants:** Bill 21-12, Coal Tar Pavement Products Law, banned the use of coal tar products.
- **Carryout Bag Law:** Bill 11-8, the County's Carryout Bag Law, was enacted to increase awareness about disposable bag litter and to reduce carryout bag use by taxing 5 cents per bag.

Co-Permittees

As defined in §I.B. of the NPDES Municipal Separate Storm Sewer System Permit, there are seven co-permittees in addition to the County. These include six small localities: Chevy Chase, Kensington, Poolesville, and Chevy Chase Village, and the Village of Friendship Heights. Montgomery County Public Schools was added as a co-permittee for this Permit cycle.

Pollutant Identification

The County has continued to identify its storm drain and stormwater management system elements and sources of discharges. This section addresses §§ III.C. Source Identification and III.D. Discharge Characterization.

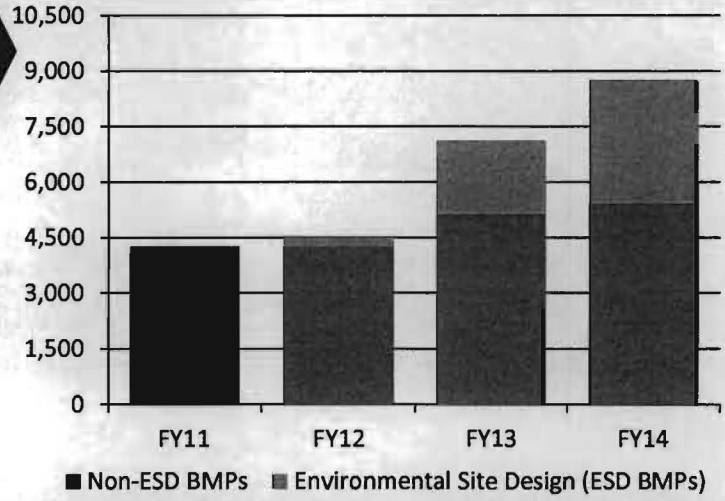
§ III.C. Source Identification

Stormwater Management (SWM) Facility Mapping. The County is mapping locations and types of both Environmental Site Design (ESD) and non-ESD SWM Facilities. These facilities are known collectively as Best Management Practices (BMPs).

Key Terms:

- **Environmental Site Design (ESD):** is a design strategy for maintaining predevelopment runoff characteristics and protecting natural resources. ESD stormwater facilities integrate site design, natural hydrology and smaller controls to capture and treat runoff.
- **BMPs:** a structural or non-structural device designed to temporarily store or treat runoff in order to mitigate flooding, reduce pollution and provide other amenities.

Total Number of Mapped Best Management Practices (BMPs) Systemwide by Fiscal Year



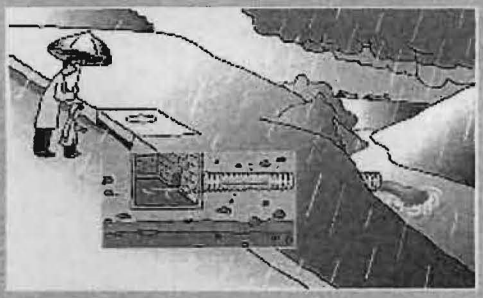
The implementation of ESD BMPs has increased from 3% to 38% over the permit period.

Storm Drain Mapping. The County continues to improve its storm drain mapping to facilitate the identification of pollution sources from the MS4.

Impervious Area Mapping. The County is digitizing and updating a layer of County impervious area, BMP drainage areas, and an analysis of controlled versus uncontrolled impervious areas.

§ III.D. Discharge Characterization

The County conducts stormwater monitoring to assess the effectiveness of its stormwater management programs, watershed restoration projects and to document progress towards meeting Wasteload Allocations included in approved Total Maximum Daily Loads.



Water chemistry, biological and physical monitoring are conducted at the Breewood Tributary within the Anacostia Watershed to assess the effects of multiple watershed restoration projects within a small watershed.

Physical monitoring is conducted in the Clarksburg Town Center within the Seneca Watershed to assess the effectiveness of stormwater management practices for stream channel protection. During the Permit cycle, the County documented conditions prior to and during construction. Post construction monitoring will occur in the next Permit cycle.

Management Programs

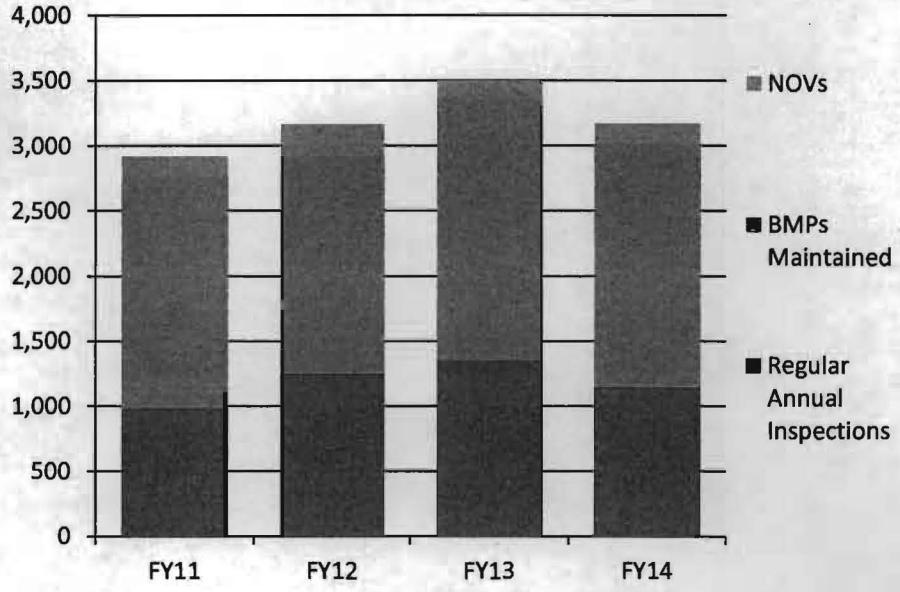
To control stormwater discharge and reduce pollution, the County maintains a diverse group of programs that target Trash and Litter reduction, Stormwater Facility Maintenance and Inspections, Illicit Discharge Detection and Elimination, and Public Education. This section addresses § III.E Management Programs.

§ III.E.1.a. Stormwater Management Facility Maintenance and Inspection

The DEP Stormwater Management (SWM) Facility Maintenance and Inspection Program oversees the triennial inspections and maintenance of all SWM facilities under the County's jurisdiction. DEP also issues notices of violations (NOVs) as appropriate.

To increase program efficiency, DEP has begun prioritizing maintenance of privately owned facilities by urgency of maintenance need.

Stormwater Management Maintenance Program Overview by Fiscal Year



§ III.E.1.c. Maryland Department of the Environment's Triennial Stormwater Program Review

In 2013, Maryland Department of the Environment reviewed the County's stormwater management program and found it to be acceptable under State law and in compliance with Part III.E.I of the Permit.

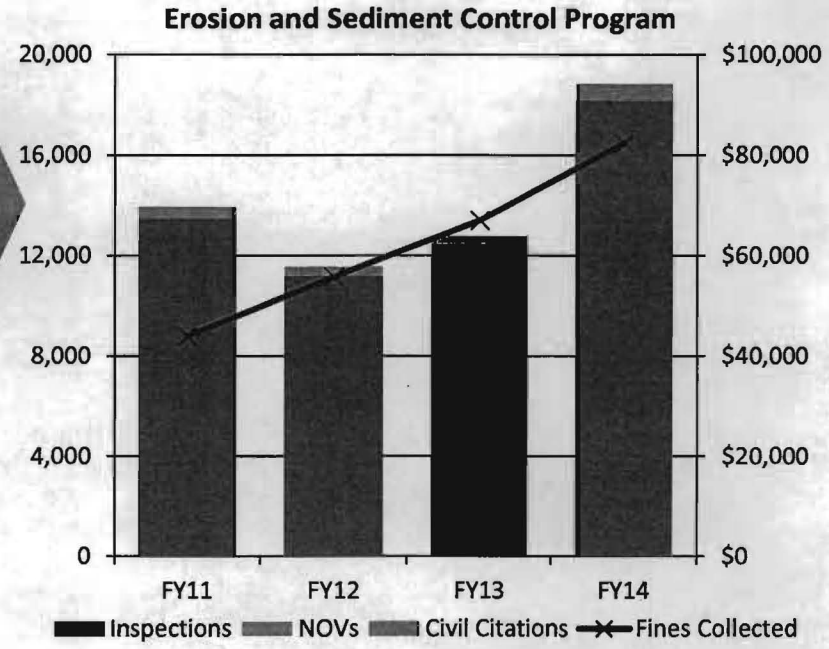
§ III.E.1.b. Implementing Maryland's Stormwater Management Act of 2007

In 2010 the County released a report detailing how the County's codes, regulations, programs, and policies may need to be updated to allow the use of ESD and low impact development. Based on this report and further study, many changes have been made, the most significant being the revision of the Zoning Code adopted in 2014 by County Council.

§ III.E.2. Erosion and Sediment Control

The County is responsible for the Erosion and Sediment Control (ESC) program which includes conducting inspections of ESC practices, issuing Notice of Violations (NOVs) and Civil Citations, and collecting fines.

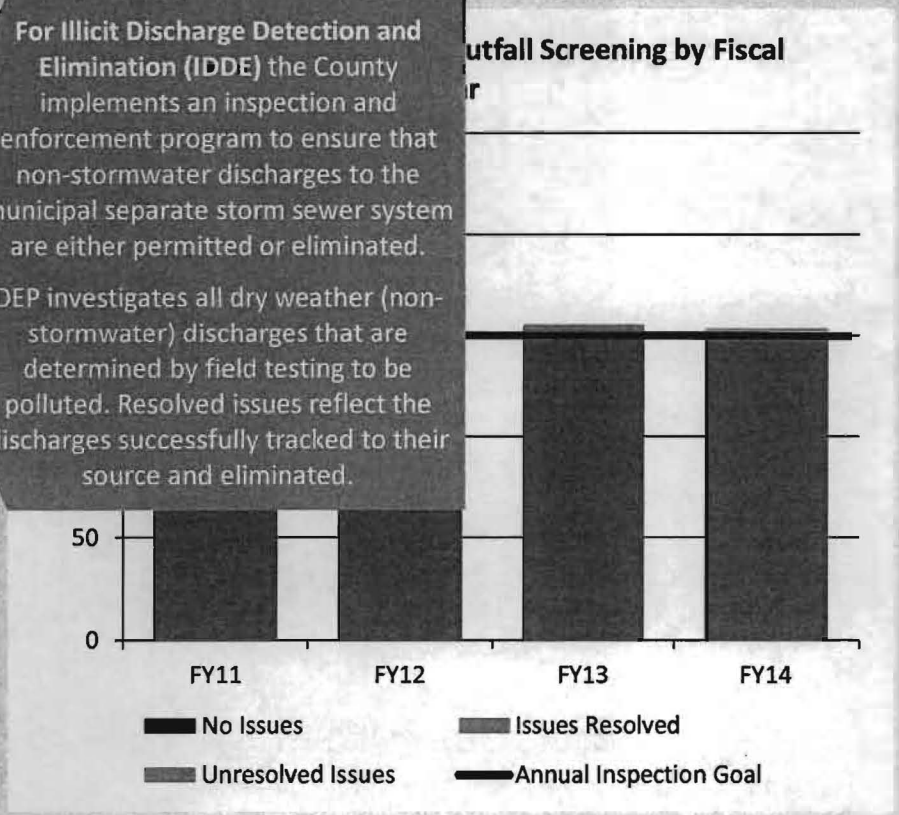
ESC Program Compliance. In 2013 MDE evaluated the County's ESC program and found it to be in compliance with Part III.E.2 of the Permit.



§ III.E.3. Illicit Discharge Detection and Elimination

For Illicit Discharge Detection and Elimination (IDDE) the County implements an inspection and enforcement program to ensure that non-stormwater discharges to the municipal separate storm sewer system are either permitted or eliminated.

DEP investigates all dry weather (non-stormwater) discharges that are determined by field testing to be polluted. Resolved issues reflect the discharges successfully tracked to their source and eliminated.



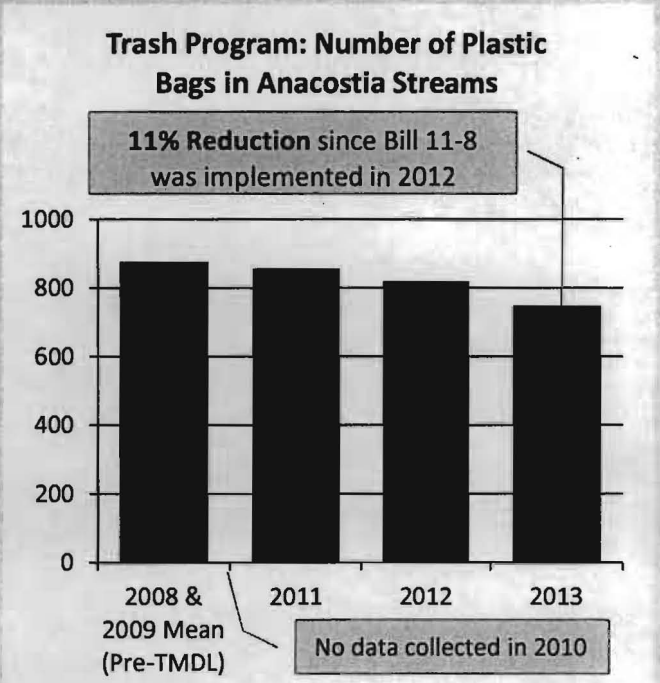
Throughout the Permit cycle, DEP has greatly improved IDDE inspections by focusing on smaller watersheds, conducting more thorough inspections, using Closed Circuit Television where appropriate, and testing for water quality parameters that are more informative.

DEP and the Center for Watershed Protection initiated a partnership in FY11 to focus IDDE efforts in the Sligo Creek subwatershed. Through this partnership, DEP has tracked illicit discharges and focused on quantifying pollution from anti-microbial agents used in rooftop Heating, Ventilation, and Air Conditioning systems.

§ III.E.4. Trash and Litter

The County has many programs and partnerships designed to reduce trash to meet the Potomac Trash Free Treaty goals and the 2010 Anacostia Trash Total Maximum Daily Load (TMDL).

The County's Carryout Bag Law (Bill 11-8) requires a 5 cents tax per carryout bag in order to reduce disposable bag litter.



§ III.E.5. Property Management

All of the County agencies which operate maintenance facilities, including Department of Transportation, Department of General Services, Department of Environmental Protection, as well as Montgomery County Public Schools, are complying with their General Permits (GP) for Stormwater Discharges. These agencies have:

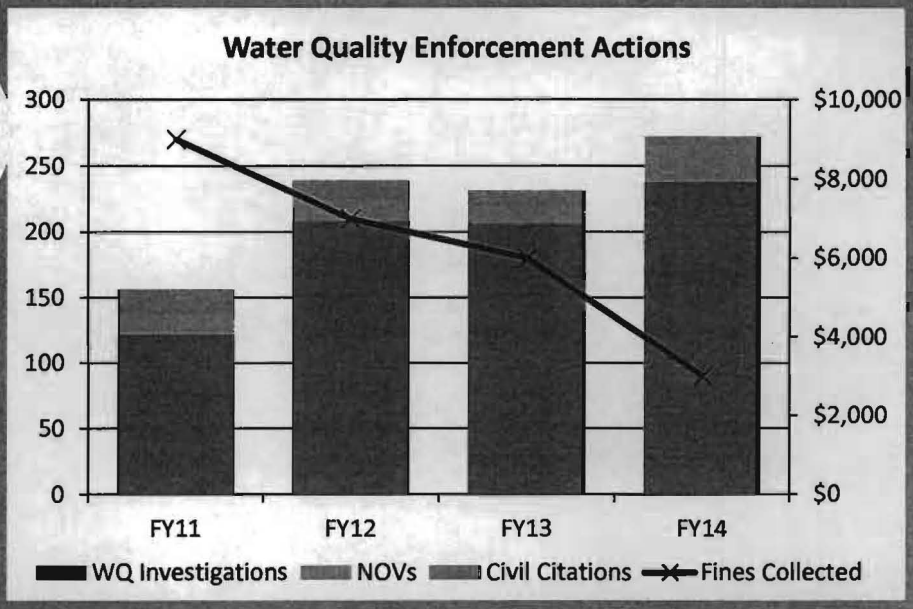
- Developed and submitted new Notices of Intent (NOIs) to comply with the GP
- Updated Stormwater Pollution Prevention Plans (SWPPPs)
- Conducted Annual SWPPP inspections
- Conducted training for onsite staff
- Increased funding for capital projects to improve stormwater pollution prevention

In addition to the measures above the Department of General Services has constructed two new maintenance depots with many pollution prevention and stormwater management upgrades. One of the depots, the Equipment Maintenance and Transit Operations Center, won a National Association of Counties award in FY14 for innovative green building designs elements including a green roof, stream buffer protection, and forest conservation.

Enforcement Actions

The DEP's Division of Environmental Policy and Compliance investigates and issues enforcement actions for water quality problems including complaints and sanitary sewer overflows.

Over the Permit cycle, the number of water quality cases have risen due partly to increased public outreach on stormwater pollution and more accessible communication protocols. The County now provides a 311 call service center and website where citizens can report incidents involving environmental problems.



§ III.E.6. Road Maintenance

Street Sweeping and Storm Drain Cleaning. Each year, tons of pollutants are prevented from entering the County's streams by the County's street sweeping program and Department of Transportation's cleaning of storm drain pipes and inlets. In FY14, these programs included:

- 229 miles of arterial street sweeping, which:
  - Removed 406 tons of material
  - Represents 162.6 impervious acres controlled
  - Removed 1,421 pounds of Total Nitrogen
  - Removed 568 pounds of Total Phosphorus
  - Removed 85 tons of Total Suspended Solids
- Cleaning 648 storm drain inlets and over 20,000 linear feet of storm drain, which:
  - Removed 406 tons of material
  - Represents 86 impervious acres controlled

Application of Sand and Salt. The DOT is minimizing the use of winter materials to the maximum extent practical, including pretreating roadways with salt brine, a practice that achieves deicing while using less salt.

§ III.E.7. Public Outreach and Education

The County continues to expand education and outreach programs to meet Permit requirements as outlined in the Public Outreach and Stewardship workplan (part of the Countywide Coordinated Implementation Strategy). DEP intends to eventually quantify pollutant reductions associated with behavior changes from these programs.

12,000+
Attendees

During this Permit cycle, DEP reached more than 12,000 people through outreach events. This translates to a 745% increase in DEP's watershed outreach presence in the community since the program's rejuvenation. Major activities included:

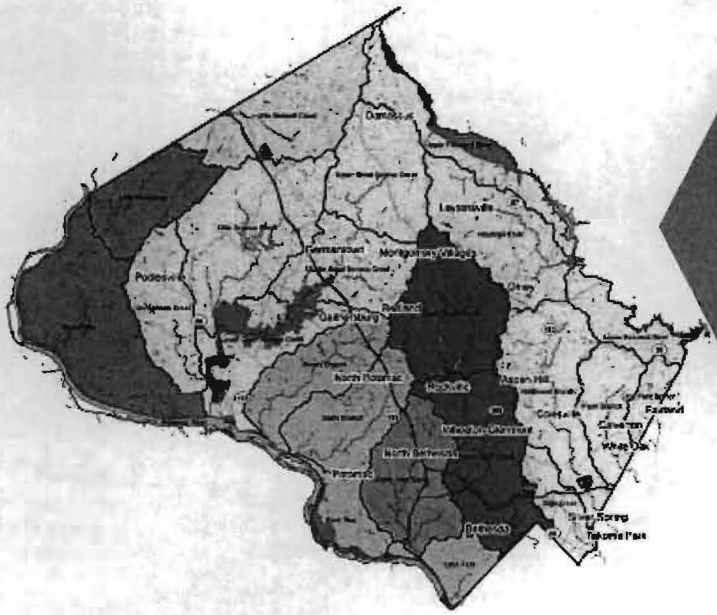
- **Anti-Litter Campaign:** The White Oak Community Anti-Litter Pilot in the Anacostia Watershed includes outreach and monitoring to show that changing people's behavior can reduce litter in local streams.
- **Watershed Group Capacity Building:** Local watershed groups receive training and guidance to educate residents about water quality awareness and to provide hands-on assistance.
- **Pet Waste Station Pilot:** 7 pet waste stations were installed in the Rock Creek watershed. Over 1,800 pounds of pet waste were collected in a year, preventing 105 pounds of nitrogen and

	14 pounds of phosphorus from entering the County's streams.

Watershed Health

The County has completed its first round of watershed assessments and restoration project inventories. The County is implementing and assessing projects to reduce pollutants to meet Total Maximum Daily Loads. The County has prepared a Countywide Coordinated Implementation Strategy to achieve all Wasteload Allocations by 2035 except those for bacteria. This section addresses § § III.F Watershed Assessment, III.G. Watershed Restoration, III.H. Assessment of Controls, and III.J. Total Maximum Daily Loads.

§ III.F. Watershed Assessment

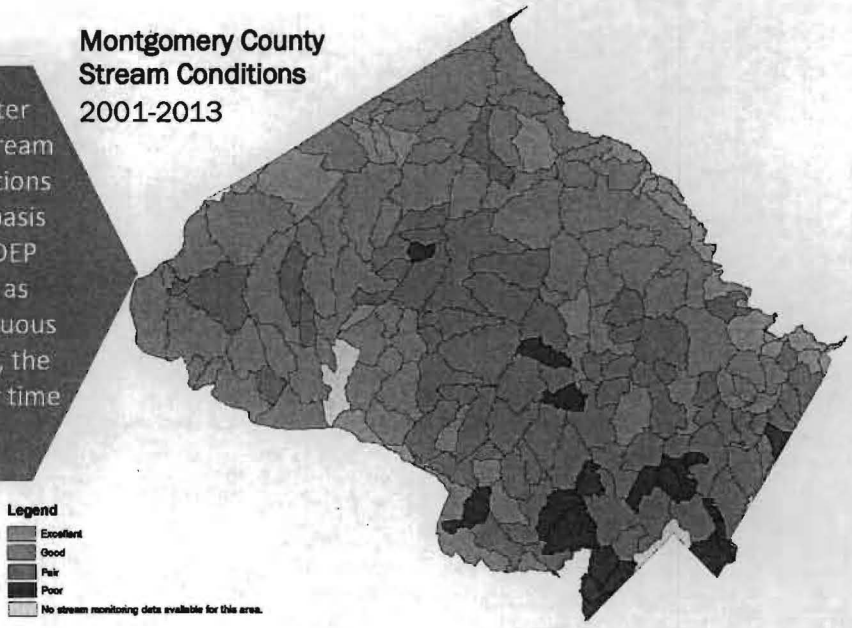


DEP has assessed all major watersheds in Montgomery County to identify opportunities for stormwater management and stream restoration.

Based on these assessments, watershed implementation plans to meet Permit goals have been developed for all County watersheds.

Stream Monitoring. DEP monitors water chemistry, biological community, and stream habitat conditions at representative stations in all County watersheds on a rotating basis over a five year cycle. Using this data, DEP labels biological conditions in streams as *excellent, good, fair* or *poor*. With continuous implementation of a robust MS4 permit, the County expects to see improvments over time in stream conditions.

Montgomery County Stream Conditions
2001-2013



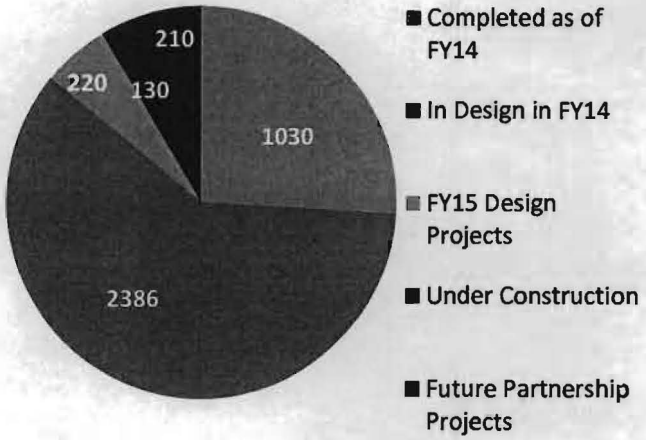
§ III.G. Watershed Restoration

Progress in Achieving the Municipal Separate Storm Sewer System (MS4) Permit Watershed Restoration Goal: DEP is currently reviewing current progress achieved towards meeting the goal of 20% impervious area control. DEP will provide an update when this review is complete.

To meet the current goals of the Permit to restore the County's watersheds to the maximum extent practicable, the County is implementing a variety of watershed restoration projects. These projects are in various stages of completion. Approximately 1,030 acres of impervious area are being controlled through projects that have already been completed. Projects to control another 2,386 acres were in the design phase in FY14. The County's watershed restoration projects including the following types:

Stream restoration: Reconstructing the stream channel to reduce erosion and improve habitat
Neighborhood Green Streets: Vegetated best management practices (BMPs) to reduce stormwater from streets and roads.
Stormwater Retrofits: Ponds and parking lot BMPs that capture and treat stormwater runoff
Government Facilities: Building BMPs at government facilities to capture runoff
Residential projects: Rainscapes program
Reforestation and impervious removal: return to a more natural environment so stormwater is captured
Management projects: Street sweeping and catch basin cleaning
Redevelopment projects: BMPs are required to be installed as impervious areas are redeveloped
Partnership projects: Partner with other County and external agencies to add stormwater control

Impervious Area Controlled (Acres)* through Watershed Restoration Projects



§ III.H. Assessment of Controls

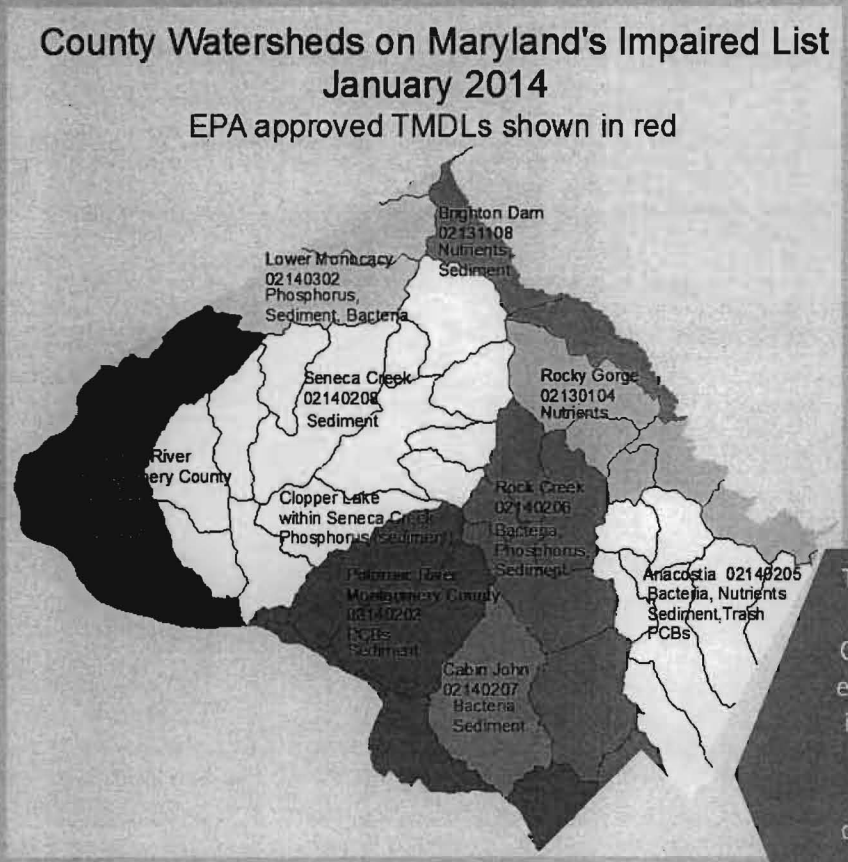
Watershed Restoration Assessment. The Permit requires DEP monitor watershed restoration success using a study design approved by the Maryland Department of the Environment. DEP is monitoring the Breewood Tributary in the Anacostia Watershed before, during, and after restoration activities are implemented. These projects include stream restoration and adding upland stormwater management to improve water quality, stream health, and ecological function.

Stormwater Management Assessment. DEP has met and enhanced the requirements of the Permit to evaluate the effectiveness of stormwater management practices required through the Maryland Design Manual. Biological, physical, and hydrology monitoring is being conducted for a comprehensive evaluation of the impacts from development in the Clarksburg Town Center of the Clarksburg Special Protection Area. Post-construction monitoring will be completed in the next Permit cycle.

§ III.J. Total Maximum Daily Loads

What is a Total Maximum Daily Load (TMDL)?

A TMDL is regulatory term that describes the maximum amount of a pollutant a waterbody can receive while still meeting water quality standards.



A TMDL is calculated as follows:

TMDL = WLA + LA + MOS where

WLA = Waste Load Allocation: the amount of pollutant allowed from point sources such as a wastewater treatment plant discharge pipe

LA = Load Allocation: the amount of pollutant allowed from non-point sources such as agriculture

MOS = the Margin of Safety: Accounts for uncertainty in predicting how well pollutant reductions will result in meeting water quality standards

The Permit requires the County to develop a plan to achieve progress towards the County's WLAs associated with TMDLs that existed as of 2009 and that have since been issued. The 2012 Countywide Coordinated Implementation Strategy and recent Watershed Implementation Plans demonstrate the County will achieve these WLAs by 2035 except for bacteria. There are very few management practices that specifically reduce bacteria in stormwater runoff.

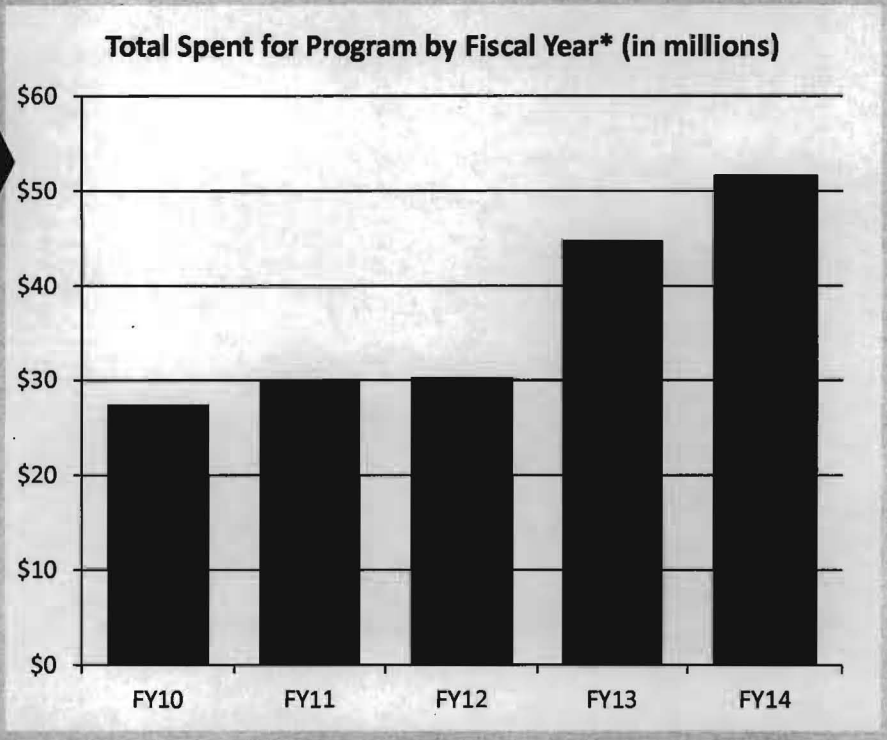
Chesapeake Bay TMDL. The County and its many partners continue working together to meet the nutrient and sediment reductions required for the Chesapeake Bay TMDL. Progress on local TMDLs supports progress towards the Bay TMDL.

Program Funding

The County has committed to meet stormwater initiatives through a ten-fold increase in capital improvement project funding and an increase in operating budget funding over the Permit term. This section addresses § III.I. Program Funding.

§ III.H. Program Funding

Total funding spent for all programmatic measures including personnel and capital improvement costs have substantially increased over the past five fiscal years.



**Starting in FY13 expenditures comprise additional costs including personnel, administrative and debt service that are not reflected in previous years.*

Funding Sources

The County currently has an approved capital budget of $363.7 million for the FY15-FY20 period. The increase in watershed restoration and stormwater facility maintenance and inspection will be financed primarily through water quality protection bonds. The debt service for these bonds will be supported by the County's Water Quality Protection Fund (WQPF). The CIP budget assumes $60 million in State aid over the six year CIP cycle based on grants awarded.

Lessons Learned

- The time required to build an effective restoration program exceeds by far the five year Municipal Separate Storm Sewer System Permit cycle.
- Many Permit programs require an adaptive management approach where progress is evaluated and programs are adjusted to maximize efficiency and cost effectiveness.
- There is much more to be understood regarding the effectiveness of practices to improve water quality and how to make watershed restoration programs more cost- effective.
- There are opportunities to improve efficiencies in Permit related programs (e.g., in particular for implementation and tracking success in watershed restoration).
- The County would like the flexibility to design a program that will better evaluate the effectiveness of the State's stormwater design manual requirements. Documenting the success of the Environmental Site Design approach in reducing water quantity and quality impacts requires more than the current focus on stream channel morphology.
- Watershed Assessments, Implementation Plans and Workplans have been completed. Effectively implementing the actions in these plans is the County's primary focus.

Mandates

Numerous federal and state regulations and programs are aimed at improving urban streams. These regulatory guidelines influence our watershed planning objectives.

The Clean Water Act of 1972 (CWA) (http://www.epa.gov/oecaagct/lcwa.html)

The passage of the Clean Water Act (CWA) created a framework for regulating discharges into the waters in the United States and establishing water quality standards for surface waters. Under the CWA, industries, municipalities, and other facilities were forced to implement pollution control programs.

The objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters by preventing point and nonpoint pollution sources, providing assistance to publicly owned treatment works for the improvement of wastewater treatment, and maintaining the integrity of wetlands.

Regulating discharges that go directly into surface waters (point sources) became critical to improving surface water quality and the surrounding environment. The CWA enacted a permit program, the National Pollutant Discharge Elimination System (NPDES), to manage and control these discharges.

Combined Sewer Overflow (CSO) Control Policy (http://cfpub2.epa.gov/npdes/cso/cpolicy.cfm)

This policy published in April 19, 1994 establishes a national approach for control of CSOs through the NPDES permit program. This policy provides guidance on coordinating the planning, selection, and implementation of CSO controls to meet the requirements of the Clean Water Act as flexibly and cost-effectively as possible and to allow for public involvement during the decision-making process.

One of the first requirements of CSO permittees was the implementation of nine minimum technology-based controls no later than January 1, 1997. The Nine Minimum Controls (mandates/nine_minimum_controls) are measures that can reduce the prevalence and impacts of CSOs and are not expected to require significant engineering studies or major construction.

Communities with combined sewer systems are also expected to develop long-term CSO control plans (/what_were_doing/documents_and_data/cso_long_term_control_plan) that will ultimately provide for full compliance with the Clean Water Act, including attainment of water quality standards. The long-term CSO control plans should consider the site-specific nature of CSOs and evaluate the cost effectiveness of a range of control options/strategies.

The Clean Water Act, Section 303 Total Maximum Daily Load (TMDL) Process (http://www.epa.gov/owow/tmdl/)

Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop TMDLs for these waters. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards.

TMDL regulations seek to improve water quality on impaired streams and water bodies. This involves collecting data on point and nonpoint source pollution loads and using the data to set maximum allowable loads from each source. The goal of the program is to strengthen each state's ability to meet clean water goals, to provide a list of all polluted waters, and to encourage cost-effective clean-up by guaranteeing that all sources of pollution are taken into account in the clean-up plans.

NPDES Municipal Separate Storm Sewer Systems (MS4) Stormwater Regulations (http://cfpub.epa.gov/npdes/home.cfm?program_id=6)

This regulation seeks to prevent harmful pollutants from being washed or dumped into a MS4 and therefore discharged directly into surface waters without treatment. This regulation required operators of MS4s to obtain a NPDES permit and develop a stormwater management program (SWMP). The SWMP must include measurable goals and implement stormwater management control (BMPs). Due to the large number of operating MS4s, this regulation was passed in two phases:

- The first phase (Phase I) was issued in 1990 and required municipalities with populations of 100,000 or more to obtain NPDES coverage for their stormwater discharges. An extensive description of the requirements for the SWMP is detailed in the code of federal regulations, 40 CFR 122.26 Stormwater Discharges (http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=d08ef1a272f112d03772d1558d8579bd&rgn=div8&view=text&node=40:21.0.1.1.12.2.6.6&idno=40), in addition to any state regulations. Philadelphia's MS4 was included in this regulation and submitted its SWMP in April of 1994.
- The second phase (Phase II) was issued in 1999 and required small MS4s in and outside of urbanized areas to obtain NPDES coverage for their stormwater discharges. For Phase II communities, the EPA developed a set of six minimum control measures that should be implemented to result in a significant reduction in pollutants discharged

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into receiving waters. (http://cfpub.epa.gov/npdes/stormwater/swfinal.cfm)

PA Act 167 Stormwater Management Planning (http://cfpub.epa.gov/npdes/home.cfm?program_id=6)

Act 167, the Stormwater Management Act of 1978, requires each county in Pennsylvania to prepare and adopt a stormwater management plan for each designated watershed in the county. A Stormwater Management Plan provides a mechanism for municipalities within the watershed to plan for and manage increased runoff associated with possible future development and land use change. It is not the intent of this plan to solve existing flooding or runoff problems (although this is becoming more of an expectation through Act 167 products such as detention discharge rates related to basin location), but to identify them for future correction and assure that problems do not get worse.

The Safe Drinking Water Act of 1974 (http://www.epa.gov/OGWDW/sdwa/)

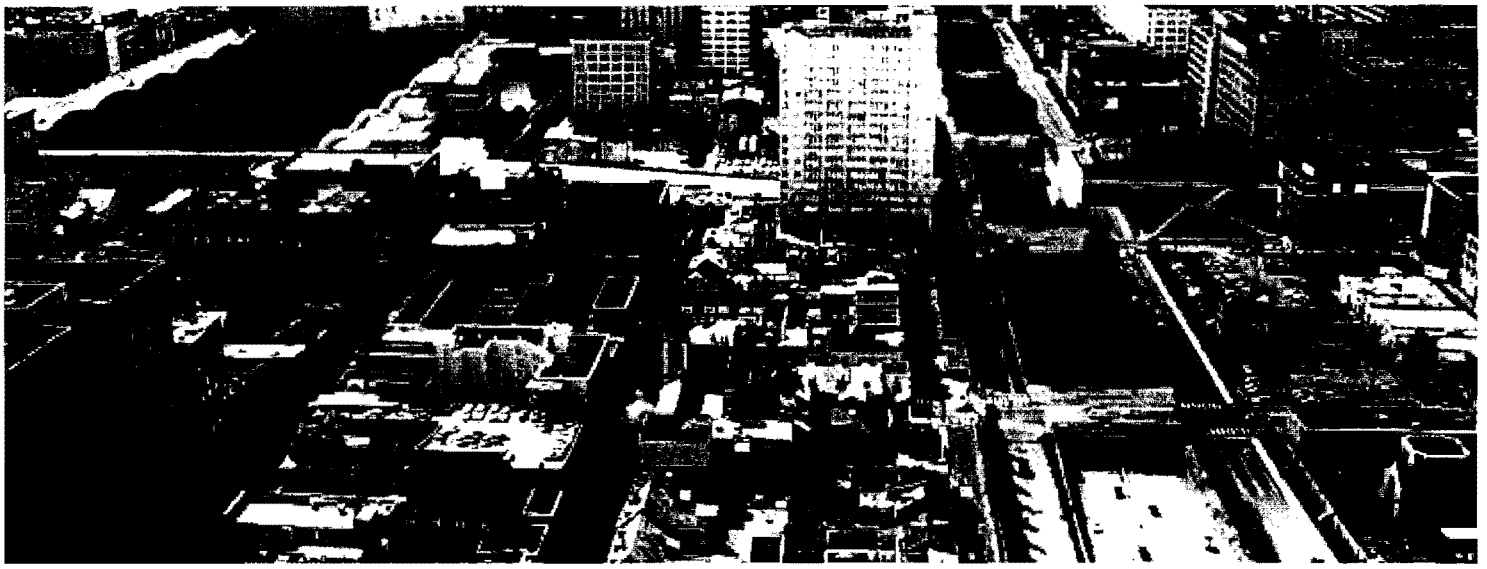
This is the principal law created to ensure safe drinking water for the public by establishing standards for water quality. State laws, like the Clean Streams Law, expand on the federal laws by addressing regional issues.

Long Term 2 Enhanced Surface Water Treatment Rule (LT2 Rule) (http://www.epa.gov/safewater/disinfection/lt2/index.html)

The Environmental Protection Agency has developed LT2 to improve your drinking water quality and provide additional protection from disease-causing microorganisms and contaminants that can form during drinking water treatment.

Green Stormwater Infrastructure

Green stormwater infrastructure includes a range of soil-water-plant systems that intercept stormwater, infiltrate a portion of it into the ground, evaporate a portion of it into the air, and in some cases release a portion of it slowly back into the sewer system.



Vision

Impervious surfaces, such as roadways and buildings, are characteristic of urbanized landscapes. As land development increases, it leads to replacement of pervious areas with impervious surfaces, causing an increase in stormwater runoff volume and combined sewer overflow (CSO) episodes. In turn, this affects Philadelphia's watersheds by impairing water quality and degrading stream habitats. Our vision is to protect and enhance our watersheds by managing stormwater runoff with innovative green stormwater infrastructure throughout our City, maximizing economic, social, and environmental benefits for Philadelphia.

Tools (green_infrastructure/tools)

Integrating green stormwater infrastructure into a highly developed area such as Philadelphia requires a decentralized and creative approach to planning and design. Various tools can be implemented to accomplish this, including stormwater planters, rain gardens and green roofs. All of these tools help to reduce runoff volume and filter pollutants by intercepting stormwater runoff before it enters the City's combined sewer system.

Programs (green_infrastructure/programs)

We're continuously exploring innovative ways to implement green infrastructure tools. Through our eight Land-Based Green programs, we will achieve our goals of reducing localized flooding, reducing combined sewer overflows, and improving water quality while also improving the quality of life of residents.

Projects (green_infrastructure/projects)

Issues Addressed

Mandates (/watershed_issues/mandates)
Stormwater Management (/watershed_issues/stormwater_management)
Safety (/watershed_issues/safety)

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Infrastructure Management (/watershed_issues/infrastructure_management)

Degraded Waterways (/watershed_issues/degraded_waterways)

Trash & Vandalism (/watershed_issues/trash_and_vandalism)

Regional & Global Trends (/watershed_issues/regional_and_global_trends)

To Learn More

Homeowner's Guide to Stormwater Management

A Homeowner's Guide to Stormwater Management (1.74MB PDF)
(http://www.phillywatersheds.org/doc/Homeowners_Guide_Stormwater_Management.pdf)

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Green Stormwater Infrastructure Programs

Green Streets (programs/green_streets)

Green Streets emphasize the capture of stormwater runoff from public right-of-ways, such as streets. Various green stormwater infrastructure practices can be employed, such as stormwater tree trenches, planters, and bump-outs, or pervious pavement.

Green Schools (programs/greenschools)

Schools are important neighborhood anchors and therefore offer excellent opportunities to educate the local community about green stormwater infrastructure. An array of green stormwater infrastructure practices can be implemented on school properties, such as rain gardens, green roofs, pervious pavement, tree trenches, and rain barrels.

Green Public Facilities

The value in retrofitting public facilities with green stormwater infrastructure allows public facilities to lead by example. The full array of green stormwater infrastructure practices can be implemented at public facilities, including rain gardens, green roofs, pervious pavement, stormwater tree trenches, rain barrels, and cisterns.

Green Parking

Retrofit and redesign of existing parking lots presents an opportunity to reduce stormwater runoff while also improving the visual appearance within communities. A number of green stormwater infrastructure practices can be used to manage stormwater in parking lots, including vegetated strips and swales, rain gardens, infiltration beds and trenches and pervious pavements.

Green Parks (programs/green-parks)

Draining the nearby highly impervious areas to the open spaces enhances the visual appearance and the amenities at parks, in addition to managing stormwater runoff. Parks and recreation centers provide excellent opportunities to implement highly visible demonstration projects.

Green Industry, Business, Commerce, and Institutions

The City's new stormwater management regulations for development and redevelopment and the parcel-based billing for stormwater management services provide incentives for private entities to install green stormwater infrastructure.

Green Alleys, Driveways, and Walkways

Philadelphia has many smaller alleys, driveways and walkways that are currently impervious. These often underutilized areas present an opportunity to retrofit, to allow infiltration, or to redesign. Such projects include diverted rooftop runoff to green stormwater infrastructure at the end of an alley and within the public right-of-way.

Green Homes

Residential roofs make up a significant amount of impervious cover in the City. PWD wants to work with homeowners to help them undertake projects to mitigate the impact of roof runoff. The Green Homes program envisions a number of small-scale solutions that homeowners can carry out themselves. These potential projects include installing rain barrels and/or connecting rain leaders to rain gardens or flow-through planters. More ambitious actions could include reducing the amount of impervious pavement, planting trees or building green roofs.

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THE MONTGOMERY COUNTY STORMWATER PARTNERS NETWORK
Audubon Naturalist Society * Natural Resources Defense Council * Potomac Conservancy

March 4, 2015

Proposal to Improve Stormwater Policies in Support of MS4 Permit Implementation

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The upcoming renewal of Montgomery County's stormwater permit is an opportunity for the County to once more lead the way in Maryland clean water policy. To demonstrate this leadership, we propose that the County government, led by the Department of Environmental Protection, commit to go beyond permit compliance in three specific areas. The Montgomery County Stormwater Partners Network has worked with DEP and the Council over the past ten years on initiatives that have improved our stormwater program. We are now seeking to help bring this program to the next level of effectiveness and accountability.

DEP is the lead agency implementing Montgomery's stormwater program. Through the Water Quality Protection Charge (WQPC) established in 2002, the current 6-year CIP budget for this program is $~315 million. The County Council's role regarding the stormwater program is threefold: enactment and revision of stormwater and water quality laws and codes; review and approval of County agency and program budgets; and oversight of program implementation. This proposal does not request legislation at this time. Rather, while the Stormwater Partners explore opportunities for collaboration with DEP, we seek the Council's concurrence with, and support for, this initiative.

Montgomery's stormwater program is driven by the mandates in the Municipal Separate Storm Sewer System (MS4) permit issued by MDE. The County's current permit expired last month, and MDE will soon issue Montgomery a next-generation permit containing new requirements. However, the standard terms that MDE includes in these permits are insufficient to ensure that the County will remain accountable for achieving water quality goals or including the public in important program decisions. Moreover, the permit's overly lax requirements would allow the County to invest in less-effective stormwater practices that are not the best use of government funds. Committing to higher implementation standards than those contained in the permit will boost investment in the most effective and beneficial controls, keep the County on track for achieving clean water mandates, and enhance public participation and buy-in.

Therefore, we request that DEP commit to adopting three policies that will improve upon the baseline requirements of its forthcoming permit renewal: (1) make green stormwater infrastructure the basis of the County's stormwater retrofit program; (2) establish more specific milestones in the County's pollution reduction plans; and (3) provide for greater public participation in these programs.

(1) Make Green Stormwater Infrastructure the Basis for the MS4 Retrofits Program.

The new MS4 permit will require the County to capture and treat the runoff from at least 20% of the County's impervious surfaces, or over 4000 paved acres. (This is in addition to the 30% that the County was required to retrofit during the previous two permit terms.) To date, DEP has implemented this requirement mainly by increasing the treatment capacity of existing stormwater ponds. Yet pond retrofits are less effective at reducing pollution and flooding than green stormwater infrastructure.

Green infrastructure practices (also known in Maryland as Environmental Site Design or ESD), which reduce runoff through infiltration, evapotranspiration, and reuse, are proven techniques that achieve better environmental results than ponds and offer a wide range of benefits to the community, including higher property values, green maintenance jobs, energy savings, wildlife habitat, and reductions in air pollution.

Thus far, the County's use of green infrastructure has been limited to a relatively small role in the watershed restoration program under the MS4 permit. We believe the County is now poised to adopt an all-green stormwater retrofit program under its forthcoming next-generation permit.

Over the past decade, DEP has introduced successful green infrastructure programs, including RainScapes and Green Streets – the latter with MC-DOT. Using the lessons learned from these programs, the County is now ready to create a much bigger role for green infrastructure in restoring its watersheds. Our neighbors, Prince George's County and the District of Columbia, have stormwater retrofit programs that are 100% green; the same is possible for Montgomery County. An important component of this effort will be for DEP to expand its green toolbox, including through use of available technologies such as: soil amendment with compost; Regenerative Stormwater Conveyances; and certain tree-based practices that have not yet been widely implemented here.

In order to accelerate Montgomery County's use of green stormwater infrastructure, we propose action on the following recommendations:

a) Green infrastructure (ESD) should be the default approach to meeting the MS4 permit's impervious acre restoration requirement. DEP and other agencies should use green infrastructure when implementing the restoration requirement unless technically infeasible;
b) DEP should prepare a report examining the feasibility, including long-term costs and benefits (including economic and health benefits), of a wide range of green (ESD) practices not currently in widespread use as default MS4 program retrofit methods, including: tree planting practices, including those used in the County's 100,000 Trees Initiative; compost-amended soils; use of green retrofit practices for all of DOT's drainage assistance projects; green roofs; and non-erosive conveyances; and
c) All County agencies, including the Departments of Transportation, Permitting Services, and Planning, should coordinate to achieve maximum ESD implementation and maintenance at public and private projects, including retrofits, new development and redevelopment projects. The agencies should provide the necessary staff training to support ongoing green stormwater infrastructure adoption and evolution and full collaboration with citizen, environmental, and watershed groups.

(2) Establish Greater Accountability in the County's Watershed Restoration Plans.

The County's new MS4 permit will require it to develop a "restoration" plan for meeting stream-specific pollution reduction targets, also known as wasteload allocations ("WLAs"). However, MDE's permit terms are deficient in that they lack requirements for establishing interim milestones, which are necessary to ensure that the County is making progress toward achieving its ultimate reduction targets. We ask that the County's restoration plans include:

a) Final deadlines for WLA attainment that are consistent with the deadlines of the Chesapeake Bay TMDL and that will achieve compliance as soon as possible, along with a demonstration that these deadlines represent the soonest possible attainment date; and

b) Interim pollution reduction milestones spaced no more than one year apart.

(For County water bodies for which there already exists a WLA plan, that plan should be revised so that it includes these required elements.)

(3) Enhance Public Participation in Watershed Restoration Plans and Related Programs.

Given past experience, it is unlikely that the renewed MS4 permit will have adequate requirements for public participation in the County's stormwater programs. Therefore, we ask that DEP provide more frequent, inclusive, and responsive opportunities for public engagement. These should include:

a) The establishment of a stakeholder group, (possibly through the auspices of the Water Quality Advisory Group), including representatives from nonprofit advocacy organizations, the private sector, and interested members of the general public, with which DEP will meet on a regular (e.g., bimonthly) basis to discuss the development of restoration plans and the implementation of other MS4 permit requirements. The group will submit a written annual report that includes any recommendations for program, policy and code improvements;
b) The development of standard procedures on the part of DEP, DOT, and other agencies, for engaging and collaborating with the public, including local watershed/civic groups in affected neighborhoods, in planning and implementing all RainScapes, Green Streets, and other retrofit and restoration projects;
c) The opportunity for the public to request a hearing on the County's draft restoration plans;
d) The annual publication of a detailed response to formal and informal public input on the County's stormwater plans and programs, either in the MS4 annual report or as a standalone publication.

INTRODUCTION

Green infrastructure uses natural processes to improve water quality and manage water quantity by restoring the hydrologic function of the urban landscape, managing stormwater at its source, and reducing the need for additional gray infrastructure in many instances. These practices are designed to restore the hydrologic function of the urban landscape, managing stormwater at its source and reducing or eliminating the need for gray infrastructure. An important objective of green infrastructure is to reduce stormwater volume, which improves water quality by reducing pollutant loads, stream bank erosion, and sedimentation. When green infrastructure is employed as part of a larger-scale stormwater management system, it reduces the volume of stormwater that requires conveyance and treatment through conventional means, such as detention ponds.

Green infrastructure practices can be integrated into existing features of the built environment, including streets, parking lots, and landscaped areas. Green infrastructure practices can be a viable option for managing stormwater in highly urbanized and infill situations where development density is desired and offsite mitigation is not a preferred alternative.

This document provides approaches local government officials and municipal program managers (Figure 1) in small to midsize communities can use to incorporate green infrastructure components into work they are doing in public spaces. The guide demonstrates ways in which projects can be modified relatively easily and at a low cost recognizing that municipal resources can be limited.

Implementing projects in public spaces can showcase the aesthetic appeal of green infrastructure practices and provide a visual demonstration of how they can function. This real-life context will also allow residents, businesses, and local governments to experience additional benefits and values of many green infrastructure practices—more walkable streets, traffic calming, green public spaces, shade, and enhanced foot traffic in retail areas. Municipal managers can then use the experience gained from the design, installation and maintenance green infrastructure projects to help tailor regulations and incentive programs and make green infrastructure easier to implement in the future.

These highlighted examples and case studies show how integrating green infrastructure methods can enhance retrofits and maintenance projects and also provide multiple community benefits. Local governments are in a unique leadership position to further green infrastructure within their communities. The U.S. Environmental Protection Agency (EPA) hopes that by using this guide localities can begin to institutionalize the use of green infrastructure in their municipal operations.

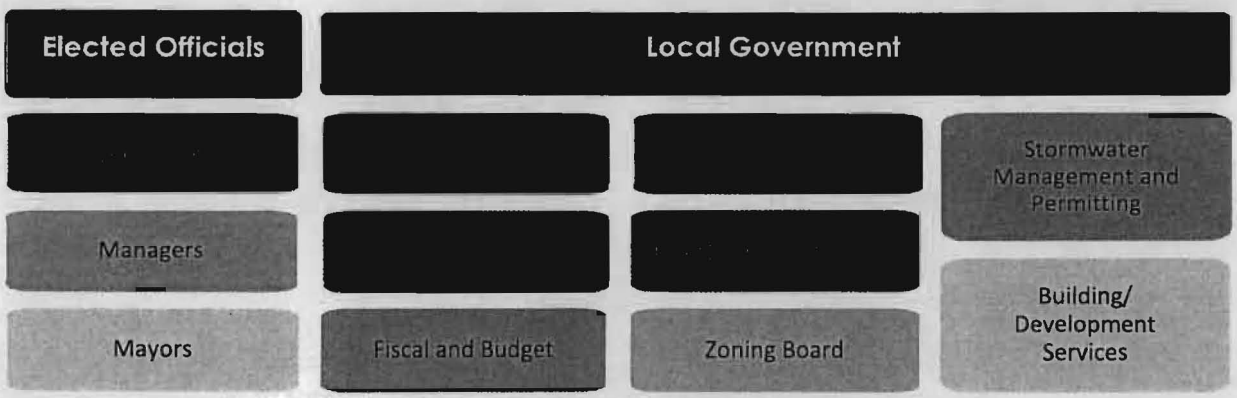

Figure 1. Intended audience

From: EPA.gov site

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GREEN INFRASTRUCTURE COSTS AND BENEFITS

Local agencies are often tasked with retrofitting a property or installing or replacing stormwater and drainage infrastructure. Overall, green infrastructure has been shown to be more cost-effective when compared with traditional gray infrastructure approaches, and green infrastructure offers numerous ancillary benefits (Figure 2). The visible, above-ground and accessible qualities of green infrastructure, as opposed to gray infrastructure, provide other benefits, including, improving air and water quality, improving quality of life, and offering public education opportunities, as described in Figure 3.

Though green infrastructure can potentially have higher installation costs in redevelopment and retrofit settings, this is not always the case due to the site-specific opportunities and constraints on many infrastructure projects. Since gray infrastructure retrofits can also be costly, green infrastructure can be integrated into already planned infrastructure improvement projects to help mitigate demolition and disposal costs.

From a life cycle perspective, it is important to compare the long-term maintenance and replacement costs associated with green and gray infrastructure. The vegetation characteristic of many green infrastructure practices becomes enhanced as it grows over time, whereas gray infrastructure's engineered materials only deteriorate over the long term. The maintenance required for green infrastructure practices typically does not require heavy equipment, whereas maintaining gray infrastructure's pipes, forebays, basins, and embankments can be more costly.

Green infrastructure can be a cost-effective strategy to help local governments meet regional water quality objectives. Besides green infrastructure's ability to improve water quality and reduce stormwater pollution, green infrastructure reduces the cost of total maximum daily load (TMDL) implementation by reducing pollutant loads associated with stormwater. Green infrastructure can reduce the cost to implement a stormwater management program because the amount of stormwater to be conveyed and treated is reduced.

Green Infrastructure Economics

Several recent publications evaluated the economic benefits associated with green infrastructure:

- **Banking on Green: A Look at How Green Infrastructure Can Save Municipalities Money and Provide Economic Benefits Community-wide:** http://www.americanrivers.org/assets/pdfs/reports-and-publications/banking-on-green-report.pdf
- **Case Studies Analyzing the Economic Benefits of Low Impact Development and Green Infrastructure Programs:** http://water.epa.gov/polwaste/green/upload/lid-gi-programs_report_8-6-13_combined.pdf
- **Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices:** http://water.epa.gov/polwaste/green/costs07_index.cfm
- **The Value of Green Infrastructure: A Guide to Recognizing its Economic, Environmental, and Social Benefits:** http://www.americanrivers.org/wp-content/uploads/2013/09/Value-of-Green-Infrastructure.pdf?c8031c.

Green Roofs

- Have a longer lifespan than traditional roofs
- Reduce energy costs
- Buildings with green roofs can command rental premiums
- Vegetation provides habitat for wildlife

Trees

- Intercept and absorb rainfall
- Reduce urban heat island
- Improve habitat and aesthetic value
- Provide shade in summer and block wind in winter, reducing heating and cooling costs
- Reduce greenhouse gases by absorbing CO_2
- Capture urban air pollutants (dust, O_3, CO)

Rain Barrels and Cisterns

- Reduce water consumption and associated costs
- Reduce demand for potable water
- Increase available water supply for other uses
- Can significantly reduce stormwater discharges from roofs

Bioswales and Rain Gardens

- Improve property and neighborhood aesthetics
- Reduce localized flooding
- Promote infiltration and groundwater recharge
- Enhance pedestrian safety when used in traffic calming applications

Permeable Pavements

- Reduce stormwater runoff and standing water
- Promote infiltration and groundwater recharge
- Improve the longevity of infrastructure
- May be easier to maintain than standard pavement

Green Space

- Increase soil porosity
- Reduces stormwater runoff volume
- Reduces peak stormwater flows
- Helps reduce the risk of flooding

Figure 2. Benefits of green infrastructure practices

Green Infrastructure Benefits and Practices

This section, while not providing a comprehensive list of green infrastructure practices, describes the five GI practices that are the focus of this guide and examines the breadth of benefits this type of infrastructure can offer. The following matrix is an illustrative summary of how these practices can produce different combinations of benefits. Please note that these benefits accrue at varying scales according to local factors such as climate and population.

Benefit	Reduces Stormwater Runoff											Improves Community Livability							
Practice	Reduces Water Treatment Needs	Improves Water Quality	Reduces Grey Infrastructure Needs	Reduces Flooding	Increases Available Water Supply	Increases Groundwater Recharge	Reduces Salt Use	Reduces Energy Use	Improves Air Quality	Reduces Atmospheric CO_2	Reduces Urban Heat Island	Improves Aesthetics	Increases Recreational Opportunity	Reduces Noise Pollution	Improves Community Cohesion	Urban Agriculture	Improves Habitat	Cultivates Public Education Opportunities
Green Roofs	●	●	●	●	○	○	○	●	●	●	●	●	◒	●	◒	◒	●	●
Tree Planting	●	●	●	●	○	◒	○	●	●	●	●	●	●	●	●	◒	●	●
Bioretention & Infiltration	●	●	●	●	◒	◒	○	○	●	●	●	●	●	◒	◒	○	●	●
Permeable Pavement	●	●	●	●	○	◒	●	◒	●	●	●	○	○	●	○	○	○	●
Water Harvesting	●	●	●	●	●	◒	○	◒	◒	◒	○	○	○	○	○	○	○	●

● Yes ◒ Maybe ○ No

Excerpt

Comparison of Maintenance Cost, Labor Demands, and System Performance for LID and Conventional Stormwater Management

James J. Houle[1]; Robert M. Roseen, Ph.D., P.E., D.WRE, M.ASCE[2]; Thomas P. Ballestero, Ph.D., P.E., M.ASCE[3]; Timothy A. Puls[4]; and James Sherrard Jr.[5]

Abstract: The perception of the maintenance demands of low impact development (LID) systems represents a significant barrier to the acceptance of LID technologies. Despite the increasing use of LID over the past two decades, stormwater managers still have minimal documentation in regard to the frequency, intensity, and costs associated with LID operations and maintenance. Due to increasing requirements for more effective treatment of runoff and the proliferation of total maximum daily load (TMDL) requirements, there is a greater need for more documented maintenance information for planning and implementation of stormwater control measures (SCMs). This study examined seven different types of SCMs for the first 2–4 years of operations and studied maintenance demands in the context of personnel hours, costs, and system pollutant removal. The systems were located at a field facility designed to distribute stormwater in parallel in order to normalize watershed characteristics including pollutant loading, sizing, and rainfall. System maintenance demand was tracked for each system and included materials, labor, activities, maintenance type, and complexity. Annualized maintenance costs ranged from \$2,280/ha/year for a vegetated swale to \$7,830/ha/year for a wet pond. In terms of mass pollutant load reductions, marginal maintenance costs ranged from \$4–\$8/kg/year TSS removed for porous asphalt, a vegetated swale, bioretention, and a subsurface gravel wetland, to \$11–\$21/kg/year TSS removed for a wet pond, a dry pond, and a sand filter system. When nutrients such as nitrogen and phosphorus were considered, maintenance costs per gper year removed ranged from reasonable to cost-prohibitive, especially for systems with minimal to no nutrient removal. As such, SCMs designed for targeting these pollutants should be selected carefully. The results of this study indicate that generally, LID systems, as compared to conventional systems, have lower marginal maintenance burdens (as measured by cost and personnel hours) and higher water quality treatment capabilities as a function of pollutant removal performance. Cumulative amortized system maintenance expenditures equal the SCM capital construction costs (in constant dollars) in 5.2 years for wet ponds and in 24.6 years for the porous asphalt system. In general, SCMs with higher percentages of periodic and predictive or proactive maintenance activities have lower maintenance burdens than SCMs with incidences of reactive maintenance. **DOI: 10.1061/(ASCE)EE.1943-7870.0000698.**

CE Database subject headings: Best Management Practice; Maintenance; Costs; Stormwater management; Water quality.

Author keywords: BMP; Maintenance; Cost; LID; Operation; Stormwater; Labor; Water quality; Expenses.

Introduction

The misunderstanding of inspection and maintenance expectations for low impact development (LID) systems has been one of the significant barriers to the acceptance of LID technologies. Most entities in charge of stormwater management systems over the past four decades generally have adopted maintenance plans or guidelines for conventional systems (curb, gutter, swale, and pond), yet there is little documentation in terms of the frequency, intensity, and costs associated with LID maintenance operations required to meet system design objectives. With increasing requirements for more efficient stormwater management designs and the proliferation of total maximum daily load (TMDL) requirements, a greater amount of documented maintenance information is necessary to facilitate the implementation of more effective stormwater management strategies. Increased attention to pollutant loads, numeric goals, and nondegradation requirements have also created the need for more emphasis on stormwater control measure (SCM) maintenance in order to meet permitting and reporting requirements (Erickson et al. 2010). Furthermore, as municipalities move to implement LID, managers need better information, resources, and methods to estimate an LID techniques' total costs, including maintenance. With more long-term LID maintenance costs available, cost estimations of this alternative will become easier to accomplish and more precise (Powell et al. 2005).

Traditionally, there has been significant resistance toward the acceptance and adoption of LID designs due to the perception that these systems have substantial maintenance requirements,

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Note. This manuscript was submitted on May 23, 2012; approved on January 25, 2013; published online on January 29, 2013. Discussion period open until December 1, 2013; separate discussions must be submitted for individual papers. This paper is part of the ***Journal of Environmental Engineering***, Vol. 139, No. 7, July 1, 2013. © ASCE, ISSN 0733-9372/2013/7-932-938/\$25.00.

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From: Montgomery County Stormwater Partners

Metrics for Montgomery County's Stormwater (MS-4) Program

Background: Why do we care about metrics for the stormwater program? For almost 20 years – since 1996 – Montgomery County has been implementing a stormwater program under the federal Clean Water Act. Issued by the Maryland Department of the Environment, Montgomery's countywide stormwater permit is aimed at achieving the protection and restoration of, our streams, lakes and rivers. Montgomery County residents rely on local waters for everything from drinking water supply to recreation; residents are also the funders whose payments to the Water Quality Protection Charge underwrite the stormwater program. County residents need to be able to see the metrics used in evaluating the county's overall stormwater pollution reduction program. This program features a six-year, roughly $300 million capital investment in stormwater retrofits- devices that collect and treat the runoff from parking lots, roofs, and roads.

Metrics that Montgomery County now uses to evaluate its stormwater programs include: biological integrity; nutrient reductions; paved acres that are served with retrofits; and number of stormwater facilities adequately maintained. The chart below is from Montgomery County's budget web site.

Program Performance Measures

County Watershed Stream Quality Index of Biological Integrity (IBI) Score

Percent of the phosphorous pollution reduction goal met

Percent of the nitrogen pollution reduction goal met

Percent of the impervious acreage control goal met

Stormwater Facility Maintenance Compliance Rate

Additional Metrics Needed:

In order to have a more complete picture of Montgomery's stormwater program, additional metrics are needed:

- Percent of the sediment reduction goal met
- Percent reduction of other pollutants (beside N, P, and S) for which the county is responsible for attaining wasteload allocations
- Percent reduction of stormwater volume discharged, countywide.
- Percent reduction of stormwater volume discharged, by watershed.
- Percent of streams in each major category (Excellent,Good, Fair, Poor) in Montgomery's Index of Biotic Integrity (IBI); trends in these ratings over time.
- Climate change pollution (CO_2) reductions achieved through the use of trees and other vegetation-based stormwater retrofit approaches
- Building energy efficiency changes attributable to tree plantings, green roofs and other stormwater practices
- Cost-effectiveness of the program (pollution reductions, including stormwater volume reductions, per dollar spent)

- Example: **$/Acre-inch reduced** – refers to the cost per acre-inch of runoff that is captured and reduced by stormwater retrofits. An acre-inch is one inch of runoff from one paved acre, such as a one-acre parking lot or a one-acre set of warehouse roofs.

- Jobs and businesses created through the stormwater program investments, broken out by category of stormwater retrofit/ restoration practice.
- Total and unit cost of stormwater facilities maintenance - every 3 to 5 year cycle
- Anticipated impact on property value of stormwater retrofit practices
- Quality of life, public health, and community benefits added (see chart below, from the Center for Neighborhood Technology, as a guide.)

Source of the chart:

http://www.cnt.org/resources/the-value-of-green-infrastructure-a-guide-to-recognizing-its-economic-environmental-and-social-benefits/

Green Infrastructure Benefits and Practices

This section, while not providing a comprehensive list of green infrastructure practices, describes the five GI practices that are the focus of this guide and examines the breadth of benefits this type of infrastructure can offer. The following matrix is an illustrative summary of how these practices can produce different combinations of benefits. Please note that these benefits accrue at varying scales according to local factors such as climate and population.

	Reduces Stormwater Runoff										Improves Community Livability						
Benefit	Reduces Water Treatment Needs	Improves Water Quality	Reduces Grey Infrastructure Needs	Reduces Flooding	Increases Available Water Supply	Increases Groundwater Recharge	Reduces Salt Use	Reduces Energy Use	Improves Air Quality	Reduces Atmospheric CO_2	Reduces Urban Heat Island	Improves Aesthetics	Increases Recreational Opportunity	Reduces Noise Pollution	Improves Community Cohesion	Urban Agriculture	Improves Habitat	Cultivates Public Education Opportunities
Practice										CO_2								
Green Roofs	●	●	●	●	○	○	○	●	●	●	●	●	◒	●	◒	◒	●	●
Tree Planting	●	●	●	●	○	◒	○	●	●	●	●	●	●	●	●	◒	●	●
Bioretention & Infiltration	●	●	●	●	◒	◒	○	○	●	●	●	●	●	◒	◒	○	●	●
Permeable Pavement	●	●	●	●	○	◒	●	◒	●	●	●	○	○	●	○	○	○	●
Water Harvesting	●	●	●	●	●	◒	○	◒	◒	◒	○	○	○	○	○	○	○	●

● Yes ◒ Maybe ○ No

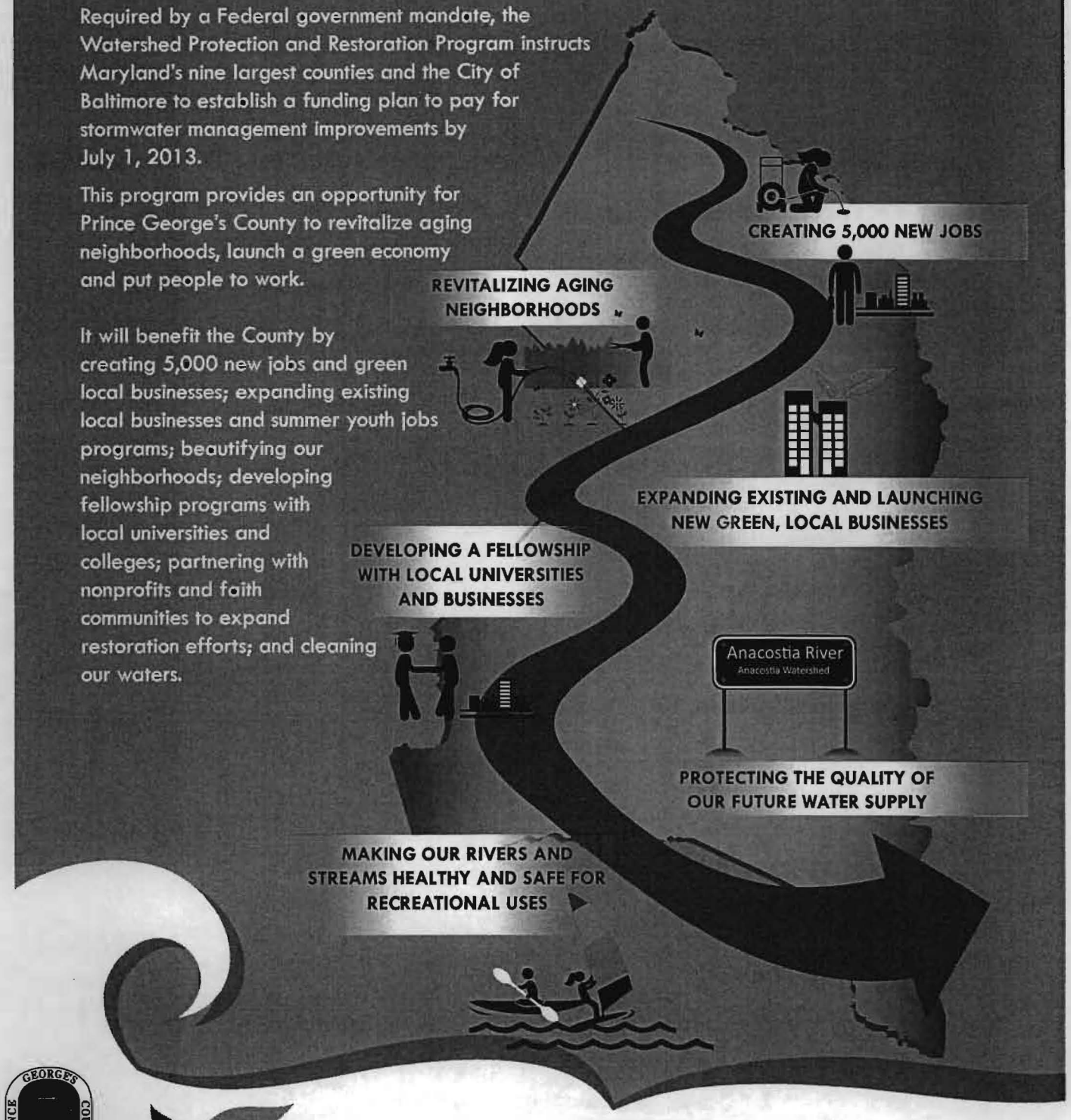
PRINCE GEORGE'S COUNTY

Clean Water Program

Required by a Federal government mandate, the Watershed Protection and Restoration Program instructs Maryland's nine largest counties and the City of Baltimore to establish a funding plan to pay for stormwater management improvements by July 1, 2013.

This program provides an opportunity for Prince George's County to revitalize aging neighborhoods, launch a green economy and put people to work.

It will benefit the County by creating 5,000 new jobs and green local businesses; expanding existing local businesses and summer youth jobs programs; beautifying our neighborhoods; developing fellowship programs with local universities and colleges; partnering with nonprofits and faith communities to expand restoration efforts; and cleaning our waters.



PRINCE GEORGE'S COUNTY MARYLAND

Rushern L. Baker, III
County Executive

DEPARTMENT OF THE ENVIRONMENT
Adam Ortiz | Director

For more information on the program, please see the frequently asked questions on the back.

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PRINCE GEORGE'S COUNTY

Clean Water Program

FAQs

WHAT IS THE WATERSHED PROTECTION AND RESTORATION PROGRAM?

In 2010 the Federal government required states to meet new standards under the Clean Water Act to address stormwater runoff pollution from impervious areas (that don't absorb water) such as parking lots, roads and roofs. To meet this mandate, Governor Martin O'Malley last year signed into law House Bill 987 (The Watershed Protection and Restoration Program) that requires nine Maryland Counties and the City of Baltimore to collect a fee from property owners to implement a program to address this issue, the Clean Water Act Fee.

WHAT IS STORMWATER RUNOFF POLLUTION?

Every day, trash, oil, sediment, chemicals and other pollutants collect on our roofs, roads, parking lots and driveways. When it rains, the pollutants travel over these surfaces, flow into the storm drains and in great volume end up in our creeks, rivers, lakes and streams.

WILL THIS FUND CREATE JOBS AND OPPORTUNITY FOR PRINCE GEORGE'S COUNTY?

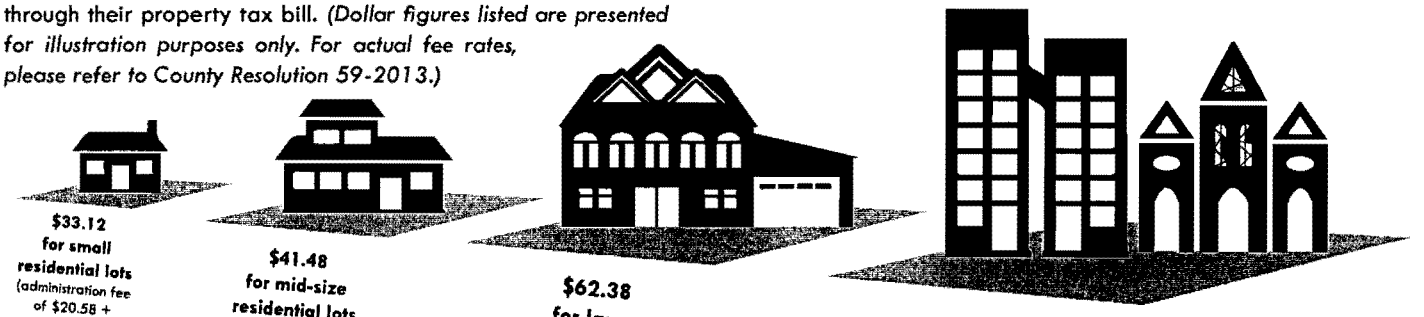
This fund provides an opportunity for Prince George's County to revitalize aging neighborhoods, launch a green economy and put people to work. It will benefit our County by creating 5,000 new jobs and new green local businesses; expanding existing local businesses and summer youth jobs programs; developing fellowship programs with local universities and colleges; and improving our waterways.

HOW WILL THESE FUNDS BE SPENT?

To meet the Federal mandate, the County has to treat 8,000 acres of uncontrolled impervious surfaces at a cost of approximately $1.2 billion and complete the program by 2025. The funds will be used solely to retrofit parking lots, roads and roofs with treatment devices that will filter out pollutants from stormwater.

HOW IS THE FEE CALCULATED?

Prince George's County established a fee structure based on the impervious surface to be paid annually by property owners through their property tax bill. *(Dollar figures listed are presented for illustration purposes only. For actual fee rates, please refer to County Resolution 59-2013.)*



$33.12 for small residential lots (administration fee of $20.58 + impact fee of $12.54)

$41.48 for mid-size residential lots (administration fee of $20.58 + impact fee of $20.90)

$62.38 for large residential lots (administration fee of $20.58 + impact fee of $41.80)

$370 for each impervious acre for industrial, commercial or institutional properties. (administration fee of $20.58)

ARE THE FEES FAIR AND EQUITABLE?

Prince George's County is dedicated to meeting our Federal requirements while keeping the fees as low as possible. Our fee structure is equitable, based on the amount of impervious surface, and lower than most Maryland Counties.

CAN THE FEE BE MODIFIED OR REDUCED?

Property owners that retrofit their property with approved runoff treatment practices can receive up to a 100 percent reduction in the impact fee. The County will provide a limited amount of rebate funds each year to property owners to retrofit their properties. A fee can also be appealed to the Department of the Environment (DoE) if there is an error in the way the County calculated the fee.

WILL THERE BE A PROGRAM FOR FINANCIAL HARDSHIP?

The County's Office of Finance will identify whether the property owner received a Maryland Homeowners Tax Credit. If the Homeowners Tax Credit has been received, the tax bill will be credited for the full amount of the fee. No application is required.

DO AGRICULTURAL PROPERTIES PAY THE FEE?

Yes, but the fee is based only on the impervious surfaces of the principal residential property and not the land in agriculture.

DON'T I ALREADY PAY FOR A STORMWATER PROGRAM?

Yes, but that program is designated for flood control, not clean water.

WHERE CAN I GET MORE INFORMATION?

Please visit DoE's website at www.princegeorgescountymd.gov/sites/StormwaterManagement/CleanWaterActFees/Watershed/Pages/default.aspx or call 3-1-1 for more information.

Prince George's County

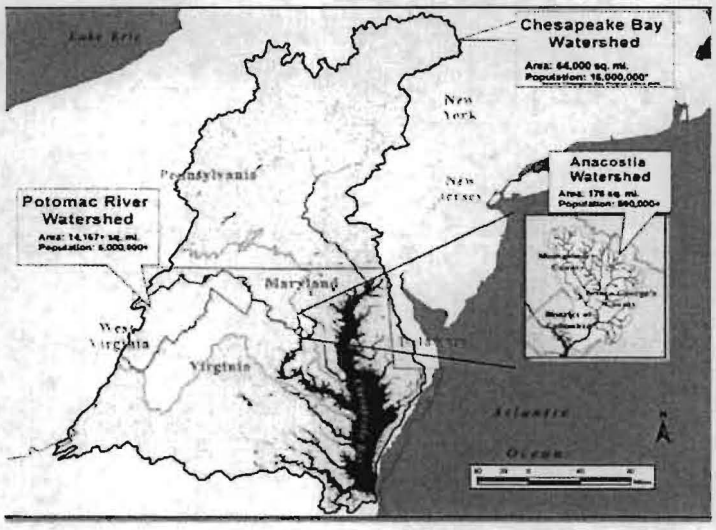
Clean Water Program

Department of the Environment

STORMWATER MANAGEMENT DIVISION

CHESEAPEAKE BAY WATERSHED

"YOU ARE HERE"



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CHESAPEAKE BAY WATERSHED

PRINCE GEORGE'S COUNTY, MARYLAND

- Population: 900,000
- 500 square miles
- Urban, Suburban, Rural
- Three major rivers
- Birthplace of Low Impact Development (LID)

STORMWATER MANAGEMENT DIVISION

NEIGHBORHOOD POLLUTION INCREASING

MUST ADDRESS POLLUTED RUNOFF

STORMWATER MANAGEMENT DIVISION

NEIGHBORHOOD POLLUTION INCREASING

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STORMWATER MANAGEMENT DIVISION

NEW CLEAN WATER ACT MANDATES

MUST ADDRESS POLLUTED RUNOFF

STORMWATER MANAGEMENT DIVISION

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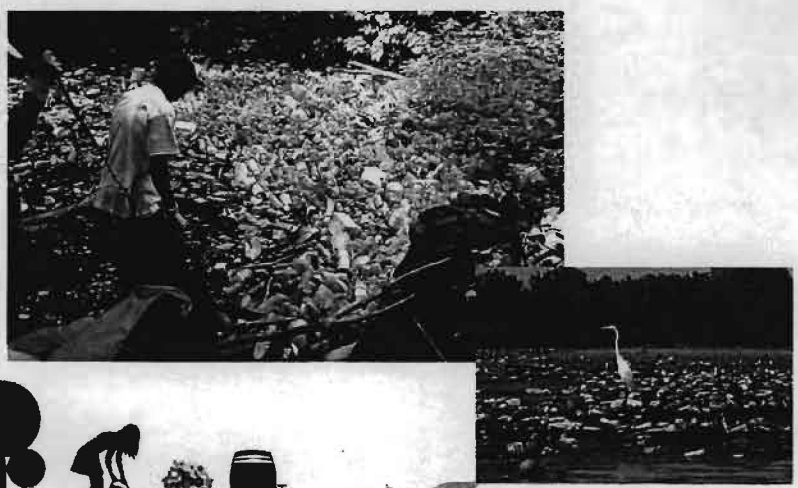
STORMWATER MANAGEMENT DIVISION

NEW CLEAN WATER ACT MANDATES

MUST ADDRESS POLLUTED RUNOFF



STORMWATER MANAGEMENT DIVISION

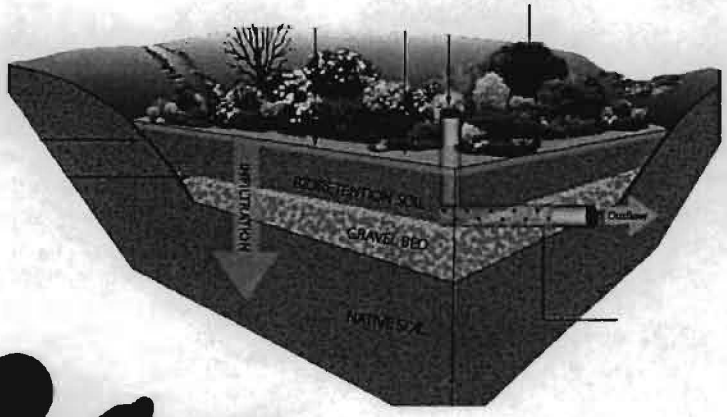
NEW CLEAN WATER ACT MANDATES

MUST ADDRESS POLLUTED RUNOFF

STORMWATER MANAGEMENT DIVISION

CLEAN WATER THROUGH RETROFITS

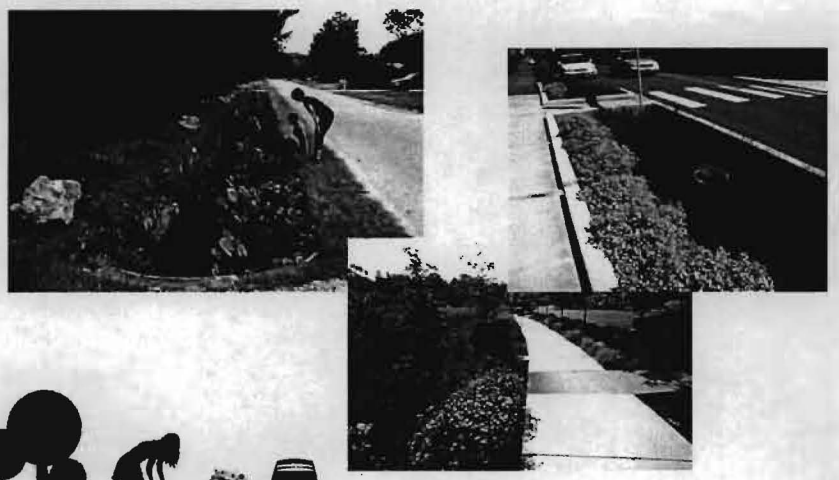
PERMEABLE PAVEMENT



STORMWATER MANAGEMENT DIVISION

CLEAN WATER THROUGH RETROFITS

BIOSWALES



STORMWATER MANAGEMENT DIVISION

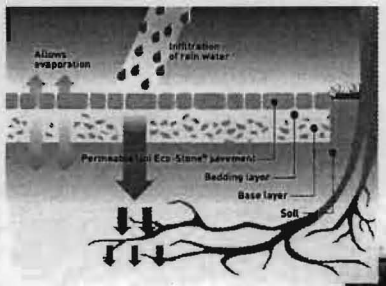
CLEAN WATER THROUGH RETROFITS

PERMEABLE PAVEMENT

STORMWATER MANAGEMENT DIVISION

CLEAN WATER THROUGH RETROFITS

PERMEABLE PAVERS



STORMWATER MANAGEMENT DIVISION

CLEAN WATER THROUGH RETROFITS

TREEBOX RAINGARDENS

STORMWATER MANAGEMENT DIVISION

NEW CLEAN WATER ACT MANDATES

EPA SETS AMBITIOUS GOALS

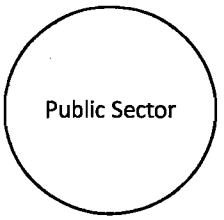
Mandate for Prince George's County

- Retrofit 15,000 impervious acres by 2025

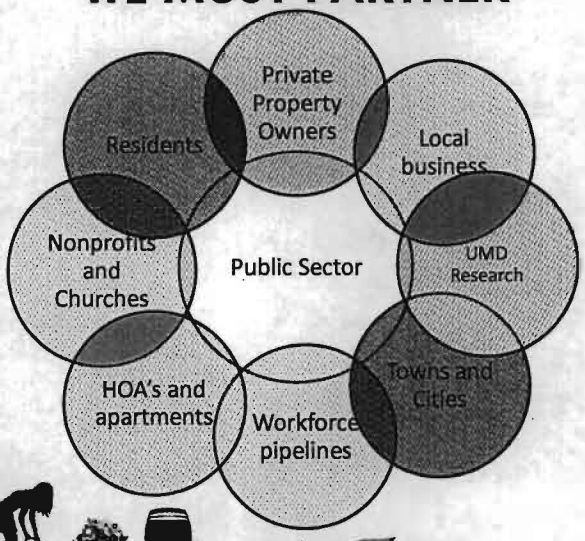
The Prince George's Model:

- Clean and healthy neighborhoods = clean and healthy waters
- Revitalize older communities
- Lead with innovation
- Grow local economy
- Partner as much as possible

WE ARE NOT ENOUGH



WE MUST PARTNER



STORMWATER MANAGEMENT DIVISION

KEY PARTNERS: PRIVATE PROPERTY OWNERS

Our **Rain Check** Program provides up to **$3 Million** in cash Rebates, Grants and technical assistance available for private property owners to install stormwater management practices on their property to reduce stormwater runoff pollution.

rain check

STORMWATER MANAGEMENT DIVISION

KEY PARTNERS: CHURCHES AND NONPROFITS

Alternative Compliance Program - Up to 100% Reduction of Impact Portion of Clean Water Act Fee

1. **Easements:** Up to 50% reduction
2. **Green Teams and Green Ministries:** Up to 25% reduction
3. **Green Housekeeping:** Up to 25% reduction

STORMWATER MANAGEMENT DIVISION

KEY PARTNER: PRIVATE SECTOR

"BETTER, GREENER, FASTER"

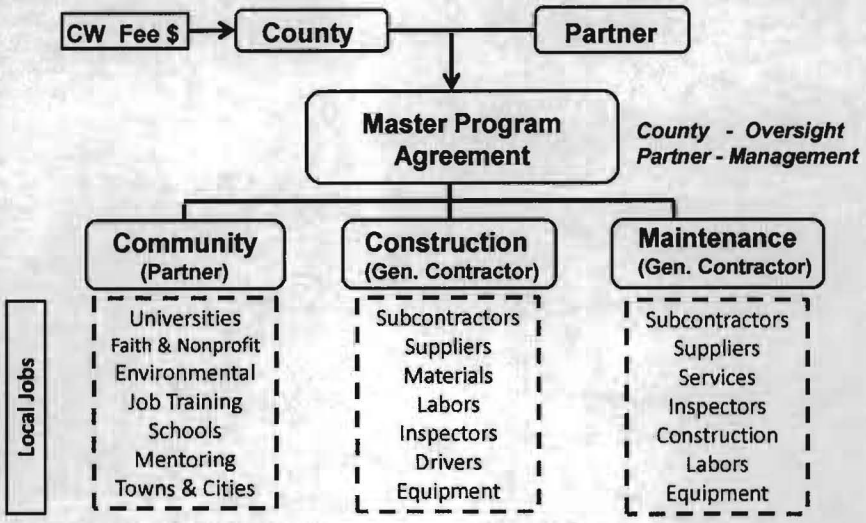
Launching Public Private Partnership (P3) Model for Efficiency to build our clean water infrastructure and industry center

- Enhance strengths and mitigate weaknesses
- Efficiencies in procurement, permitting, design, construction, maintenance, and operations.
- Business development requirements
  - Expand capacity of local businesses
  - Attract and develop new businesses to County

STORMWATER MANAGEMENT DIVISION

CLEAN WATER PARTNERHIP

LOCAL INVESTMENT, JOBS, BUSINESS, DEVELOPMENT, COMMUNITY WEALTH



CLEAN WATER PARTNERSHIP

LOCAL INVESTMENT, JOBS, BUSINESS, DEVELOPMENT, COMMUNITY WEALTH

- Partner: Corvias Solutions
- Construction: 3 years to retrofit 2,000 acres
- Maintenance: 30 years to maintain 2,000 acres
- Manage $100M in contracting
  - Paid up to 10% fee if performance goals are met:
    - Time, budget, procurement targets, business development
    - Ramps up to 40% County-based spending
- *Will "race" to 2000 acres vs DoE Capital Projects team*

MAJOR ECONOMIC DRIVER

$1.2B PROJECTED SPENDING BY 2025

15,000 Retrofitted acres =

- 46,000 stormwater devices
- 5,000 jobs:
  - Design, engineering, project management, construction, landscaping, maintenance
  - Supply chain & support
  - Research

STORMWATER MANAGEMENT DIVISION

MAJOR ECONOMIC DRIVER

$1.2B PROJECTED SPENDING BY 2025

Local Business Incentives

- Jobs First Legislation: 40% Target for certified County Based Businesses
- Business Development Reserve Program assist local small and minority business enterprises
- Major spending on Prince George's businesses

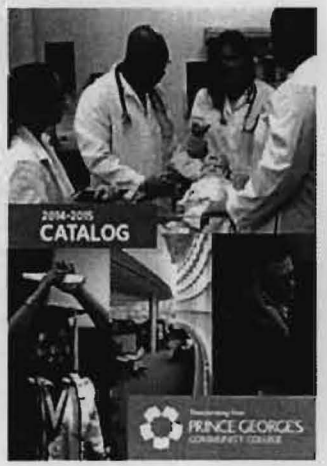
STORMWATER MANAGEMENT DIVISION

MAJOR ECONOMIC DRIVER

$1.2B PROJECTED SPENDING BY 2025

Workforce Pipelines

- PGCC Contractor Courses on Stormwater BMPs
- One Stop Workforce Center/ Re-entry programs
- Worker-Owned Co-op/CFE
- Labor
- Private Sector
- Universities



STORMWATER MANAGEMENT DIVISION

Thank you.

STORMWATER MANAGEMENT DIVISION