T&E COMMITTEE #2
October 10, 2011

Update

MEMORANDUM

October 6, 2011

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

FROM: Keith Levchenko, Senior Legislative Analyst

SUBJECT: **Update:** National Pollution Discharge Elimination System Municipal Separate Storm Sewer System Discharge (NPDES-MS4) Permit

During the FY12 budget process earlier this year, the T&E Committee asked the Department of Environmental Protection (DEP) to provide an update on the County's NPDES-MS4 permit. DEP officials and staff participating in the update:

- Robert Hoyt, Director, DEP
- Steven Shofar, Chief of Watershed Management, DEP
- Craig Carson, Acting Manager for Capital Improvements Projects, Watershed Management, DEP
- Pam Parker, Senior Planning Specialist, Watershed Management, DEP

Mike Riley, Deputy Director of Montgomery County Parks, will also provide a brief update on Parks' efforts to meet its permit requirements.

Background

NPDES-MS4 Permit

DEP is the lead department coordinating a multi-department/agency response to meet the requirements of the stormwater permit issued to the County by the Maryland Department of the Environment on February 16, 2010. The major requirements of the County's NPDES-MS4 Permit are:

1. Complete restoration efforts for an additional 20 percent of the County's impervious, urban surfaces not currently restored to the maximum extent practicable.

2. Support regional strategies to reduce trash and increase recycling, as set forth in the Trash Free Potomac Watershed Initiative 2006 Action Agreement, to eliminate trash in the Anacostia and Potomac Rivers.

3. Implement TMDL limits to restore impaired waterways in the County by developing and implementing plans to reduce nonpoint source pollutant loads (e.g., from stormwater). Ensure anti-degradation measures for high quality waters (Tier II waters) within the County, including appropriate reviews prior to approval of capital projects, water/sewer plan amendments, and any development with the potential to affect water quality and downstream water quality.

4. Establish long-term schedules for identifying sources of pollution and water quality improvement opportunities for all watersheds in the County.

5. Use environmental-site design/low-impact development as a method to capture stormwater, by improving the County's stormwater management ordinances/regulations and modifying the County's planning and zoning codes as needed. Environmental Site Design (ESD), as outlined in Chapter 5 of the Maryland Stormwater Management Act, is required to be implemented to the maximum extent practicable.

6. All new construction in the County must follow the State stormwater controls as defined in the Stormwater Management Act of 2007. Chapter 5 of the Stormwater Management Act on Environmental Site Design requires developers to maintain after development, as nearly as possible, the predevelopment runoff characteristics to the maximum extent practicable.

7. Detect and eliminate illegal, non-stormwater discharges into the storm drain.

8. Involve and engage the public in the process of stormwater control.

The County submitted its draft implementation plan to the Maryland Department of the Environment (MDE) on February 16, 2011 (the report plus Appendix C attached beginning on ©A). Work with MDE is ongoing to finalize the Draft Plan. However, the County has been ramping up expenditures in the Water Quality Protection Fund (Operating Budget and CIP) for the past couple of years, based on the previous draft and final permit requirements.

Overall, as noted in the draft implementation plan on ©27, DEP estimates costs at about $305 million through 2015 and nearly $1.9 billion in costs through 2030.

Water Quality Protection Fund

The Water Quality Protection Fund and charge were created in 2001 via Council legislation (Bill 28-00). For the past 10 years, the Water Quality Protection Fund has covered the costs for the County's inspection, maintenance, and rehab of thousands of stormwater management facilities. DEP is gearing up its implementation of the new NPDES permit approved last year, and the Water Quality Protection Fund will be the primary source of funding (for both current revenue and bond financing) for this work as well.

DEP is considering a number of changes to Chapter 19-35 of the County Code to modify the Water Quality Protection Charge. This is not surprising, given the major cost commitment of the NPDES-MS4 permit, the fact that the County now has the benefit of 10 years of experience with the Water Quality Protection Charge, and the availability of improved technologies to implement the charge. The intent of these changes will be to make the charge more equitable and broader based and ensure that there are sufficient resources to meet the NPDES-MS4 permit requirements.

FY12 Budget Actions

As part of the FY12 budget, the Council approved a number of significant actions related to the Water Quality Protection Charge, which is the primary funding source for the County's compliance with the NPDES-MS4 permit. These actions included:

- **Shifting Department of Transportation (DOT) costs for storm drain maintenance to the Water Quality Protection Fund.** The movement of storm drain maintenance costs (first recommended by the County Executive) to the Water Quality Protection Fund was the single biggest increase to the Fund for FY12 ($2,050,070 and 30 workyears). This transfer recognizes that inlet cleaning is a specific MS4 permit requirement, as is the mapping of the storm drain system in the County.

- **Use of Water Quality Protection Fund for M-NCPPC Costs**. A total of nearly $1.9 million of FY12 expenses in the Parks budget and Planning Board staff budget is now charged to the Water Quality Protection Fund. This action was first recommended by the Council's Planning, Housing, and Economic Development (PHED) Committee and later endorsed by the T&E Committee and approved by the Council.

- **To accommodate the above impacts on the Fund, the MS4 permit requirements noted earlier, and other increases such as additional stormwater management facilities being added to the maintenance program, the annual Water Quality Protection Charge rate per equivalent residential unit (ERU)[1] was increased from $49 for FY11 to $70.50 for FY12. Substantial increases in the charge are expected over the next several years, under the current charge structure, to meet the permit requirements. (Note: as mentioned earlier, DEP is considering a number of changes in the Water Quality Protection Fund law, including modifications to the charge.)**

Attachment
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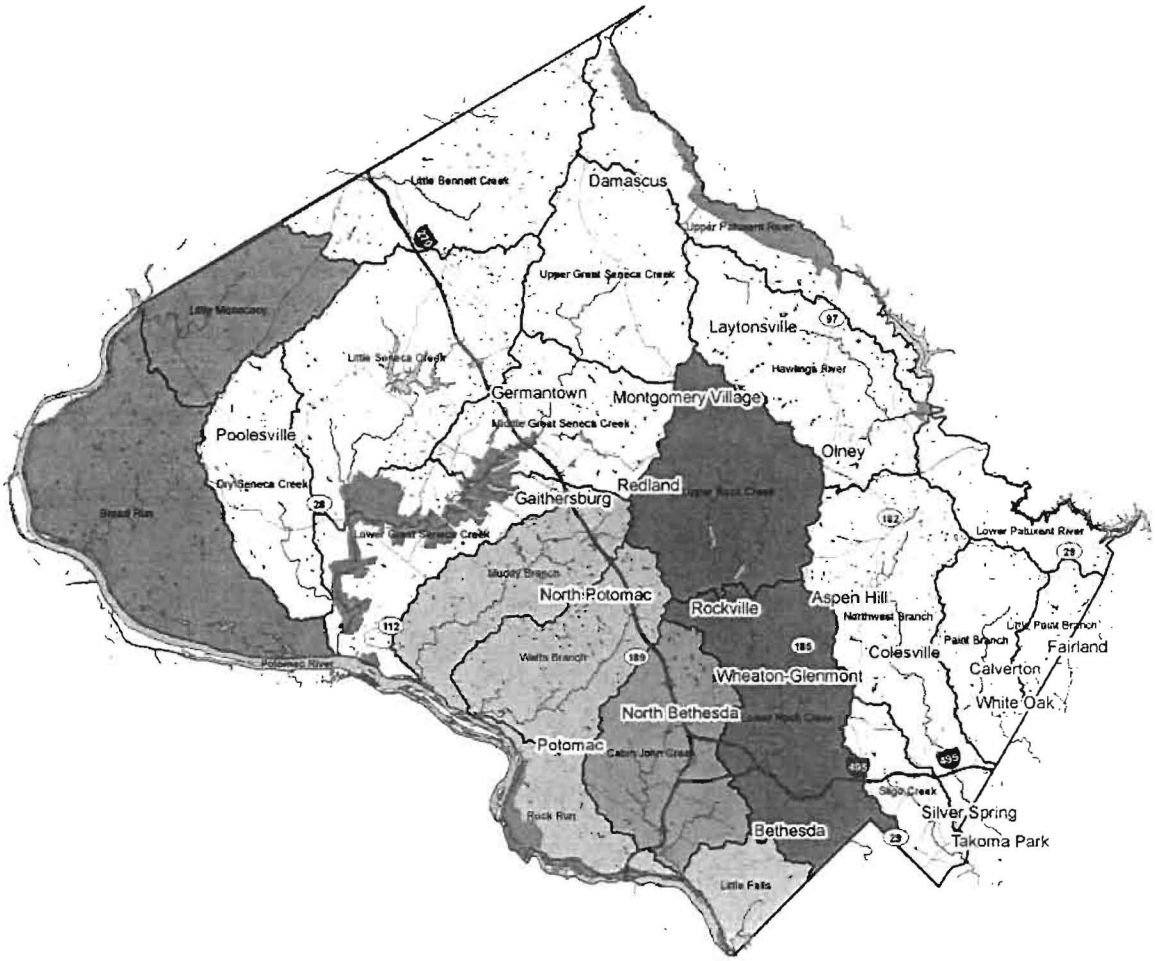
[1] The Council is required to set the rate per ERU for this charge each year by resolution. The ERU is the amount each property owner of a single-family detached home pays per year for each property owned. Townhouse owners pay 1/3 of an ERU. Condominiums & apartments are accessed based on actual imperviousness, which is then converted to an ERU number. Associated non-residential properties (i.e., properties that drain into facilities that also serve residential properties) are also charged in a similar manner to condominiums and apartments. Federal, State, and municipal facilities do not currently pay the County charge. Commercial properties that DO NOT drain into residential facilities also do not currently pay the charge.

Properties in the City of Rockville and Takoma Park are not subject to the charge, since those jurisdictions have their own charge. The charge is paid by Gaithersburg residents, but the revenue received is passed back (minus an administrative fee) to the City of Gaithersburg, which spends the revenue on stormwater management-related projects in the City.

MONTGOMERY COUNTY COORDINATED IMPLEMENTATION STRATEGY



PREPARED FOR:

MONTGOMERY COUNTY

DEPARTMENT OF ENVIRONMENTAL PROTECTION

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DRAFT February 16, 2011

(A)

Montgomery County
Countywide Coordinated Implementation Strategy
DRAFT

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ACRONYMS

BMPs – best management practices

DA – drainage area

DEP – Department of Environmental Protection

DF – discount factor

DU – dwelling unit

EPA – Environmental Protection Agency

ESD – environmental site design

GIS – geographic information systems

HOA – homeowners association

IA – impervious area

IC – impervious cover

LDR – low density residential

LID – low impact development

MDE – Maryland Department of the Environment

MEP – maximum extent practicable

MDP – Maryland Department of Planning

MNCPPC – Maryland National Capital Parks and Planning Commission

MPN – most probable number

MPR – maximum practicable reductions

MS4 – municipal separate storm sewer system

NPDES – National Pollutant Discharge Elimination System

RR – runoff reduction

SPA – Special Protection Area

TFPI – Trash Free Potomac Watershed Initiative

TMDLs – total maximum daily loads

TN – total nitrogen

TP – total phosphorus

TSS – total suspended sediment

USACE – Army Corps of Engineers

WLAs – waste load allocations

WQPC – water quality protection charge

WRAP – watershed restoration action plan

WTM – watershed treatment model

1. PURPOSE

Project Overview

Montgomery County's Department of Environmental Protection (DEP) watershed restoration programs are restoring stream valleys, improving water quality and addressing historical damage caused by urban stormwater pollution. Watershed restoration is a regulatory requirement of the County's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit.

This Countywide Coordinated Implementation Strategy (the Strategy) document presents the restoration strategies that are needed to meet the watershed-specific restoration goals and water quality standards as specified in the current MS4 permit. Specifically, the Strategy will provide the planning basis for the County to:

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

2. Provide additional stormwater runoff management on impervious acres equal to 20% of the impervious area for which runoff is not currently managed to the maximum extent practicable (MEP).

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.

Chesapeake Bay Total Maximum Daily Load (TMDL)

The Chesapeake Bay Total Maximum Daily Load (TMDL), established by the US Environmental Protection Agency (EPA), sets pollution limits for nitrogen, phosphorus, and sediment in the Chesapeake Bay Watershed. This TMDL, required under the Clean Water Act, is in response to

the slow progress by states within the watershed to limit their pollutants to levels which meet water quality standards in the Bay and its tidal tributaries. Total limits set in the Bay TMDL for the states of Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia, and the District of Columbia are "185.9 million pounds of nitrogen, 12.5 million pounds of phosphorus and 6.45 billion pounds of sediment per year – a 25 percent reduction in nitrogen, 24 percent reduction in phosphorus and 20 percent reduction in sediment" (USEPA December 2010). The TMDL also sets "rigorous accountability measures" for state compliance. Although an implementation plan for the bay TMDL has not been completed, the goals for Urban MS4s (18% nitrogen, 34% phosphorus, and 37% sediment) are compared to the reductions provided by implementation of the Strategy.

Montgomery County TMDLs

The County has a number of watersheds where EPA-approved TMDLs have established pollutant loading limits for waterbodies. These loading limits represent the maximum amount of a pollutant that the waterbody can receive and still meet water quality standards, and an allocation of that load among the various sources of that pollutant (e.g., point sources or nonpoint sources). MS4 permit jurisdictions like Montgomery County are considered point sources and are given a waste load allocation (WLA).

Pollutant loads from point and nonpoint sources must be reduced by implementing a variety of measures. One condition of the County's MS4 Permit is to make progress toward implementation of TMDL load reduction allocations in the County's watersheds . In addition to TMDLs, all of the watersheds in the County also have listed impairments. Table 1.1 below lists TMDLs and Impairments per watershed.

Table 1.1: Summary of TMDLs

Watershed Grouping	Approved TMDLs (Approval Date)	Draft TMDLs	Impairments (First Listed)
Anacostia	Bacteria (2007) Sediment (2007) Nutrients (2008) Trash (2010)	PCBs (2010)	Heptaclor Epoxide (2002) Biological (2006)
Rock Creek	Bacteria (2007)	Sediment (2010)	Phosphorus (1996) TSS (1996) Biological (2002)
Cabin John Creek	Bacteria (2007)	Sediment (2010)	Biological (2006)
Seneca Creek (Mainstem)		Sediment (2010)	Biological (2006)
Seneca Creek (Clopper Lake)	Phosphorus and Sediment (2002)		
Lower Monocacy	Fecal Bacteria (2009)* Sediment (2009)	Nutrients (2010)	Phosphorus (1996) Biological (2002)
Upper Potomac Direct			Phosphorus (1996) TSS (1996) Biological (2006) PCBs in Fish Tissue (2008)
Lower Potomac Direct			Phosphorus (1996) TSS (1996) Biological (2006) PCBs in Fish Tissue (2008)
Patuxent (Tridelphia)	Phosphorus and Sediment (2008)		Biological (2004)
Patuxent (Rocky Gorge)	Phosphorus (2008)		

Sources:
http://www.mde.state.md.us/programs/Water/TMDL/CurrentStatus/Pages/Programs/WaterPrograms/TMDL/Sumittals/index.aspx
http://www.mde.maryland.gov/programs/Water/QualityFinancing/SaterQualityFinanceHome/Pages/Water/hb1141/map_wq_montgomeryco.aspx
MDE 2008 Integrated Report (combined 303(d) List and 305b Report)

* TMDL was approved after Task Order #7 was issued and is therefore not included in the detailed pollutant load modeling associated with the Strategy

Montgomery County MS4 Permit Background

On February 16, 2010, Maryland Department of the Environment (MDE) issued Montgomery County a new MS4 permit. This 5-year permit complies with the Environmental Protection Agency's NPDES regulations that require large urban jurisdictions to control pollution from stormwater runoff to the maximum extent practicable. The EPA's latest estimates are that 10 percent of Maryland's nitrogen load comes from urban and suburban stormwater runoff (USEPA, May 2010). The County MS4 Permit requires development of implementation plans to meet WLAs through watershed restoration and other programmatic measures.

Major new provisions of the permit include:

- Requiring restoration of an additional 20 percent of impervious surfaces not currently receiving adequate treatment
- Developing and implementing measurable strategies to reduce trash as part of the County's commitment to a trash-free Potomac River
- Reducing pollutant loadings to comply with pollution limits necessary to meet water quality standards for impaired waters (TMDLs)

The plans and strategies outlined in this document, establish the steps Montgomery County is taking to fulfill the requirements associated with this MS4 Permit.

Implementation Plans and Pre-assessments

There are two major watersheds located within Montgomery County: the Potomac River watershed which covers approximately 88% of the County, and the Patuxent River watershed which covers approximately 12% of the County. In terms of the County's MS4 Permit area, the area proportion is 96% in the Potomac and 4% in the Patuxent River watersheds. The County is further divided into eight subwatersheds based on the eight digit United States Geologic Survey (USGS) Hydrologic Unit Code (HUC) as shown in Figure 1.1. Seven of the eight subwatersheds have restoration implementation plans that have been developed for this project effort. The eighth watershed, Upper Potomac Direct, does not have an implementation plan because a watershed assessment has not yet been completed for the watershed as noted below.

For more information about a specific watershed and the associated plans see the DEP website (www.montgomerycountymd.gov/stormwaterpermit). The seven watersheds that have implementation plans are:

- Anacostia

- Cabin John Creek
- Lower Monocacy
- Lower Potomac Direct (Muddy Branch and Watts Branch)
- Patuxent
- Rock Creek
- Seneca Creek (Great Seneca, including Clopper Lake)

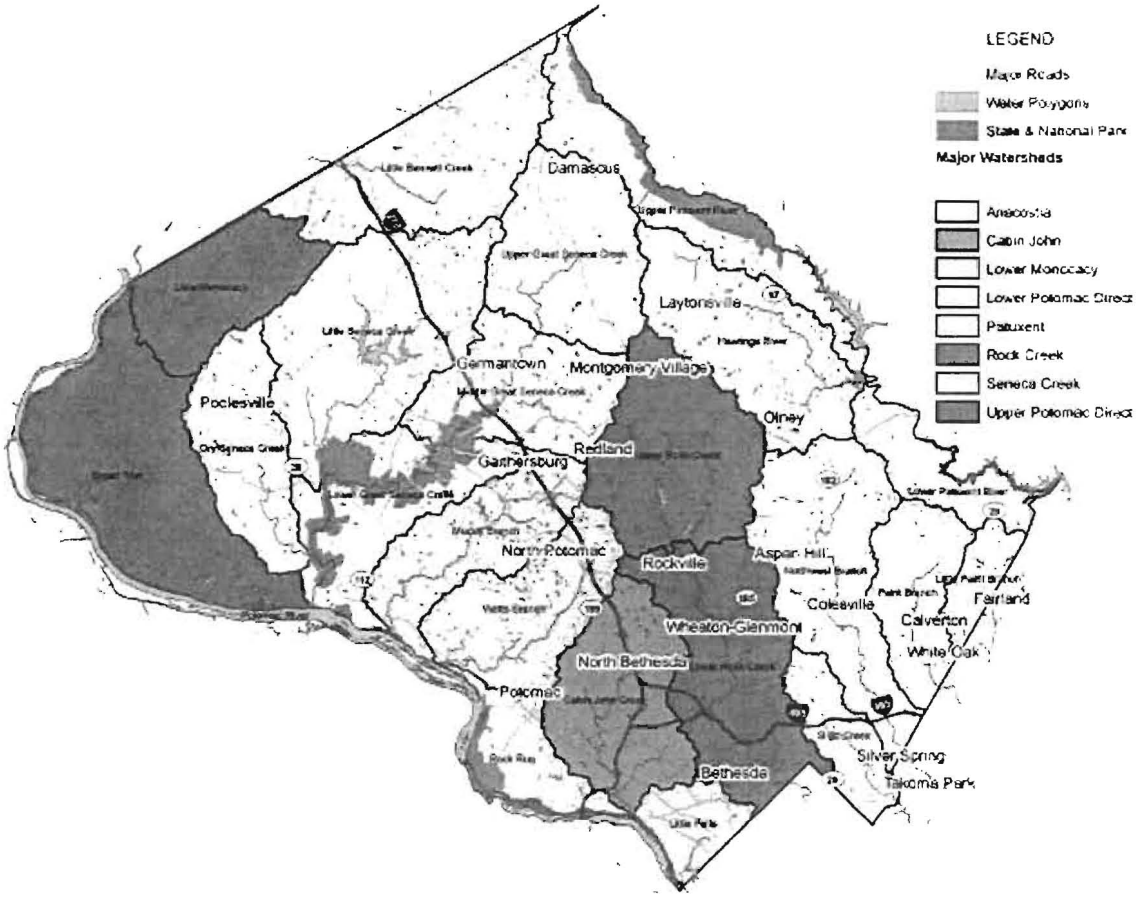


Figure 1.1: Map of Watersheds

The goals of the implementation plans are to:

- Identify feasible best management practices (BMPs)
- Quantify the area they treat and the amount of pollutants they can remove from stormwater runoff before entering into the County's streams, rivers, and lakes

- Determine the restoration potential for each watershed or subwatershed and evaluate the ability to meet applicable TMDLs.
- Provide a schedule and cost estimate for meeting the WLAs set by the TMDL

In addition to the seven implementation plans, there are three watershed pre-assessments that have been completed for watersheds that have not been previously assessed. The pre-assessments will be used by the County to develop watershed assessments and associated implementation plans which will be completed this permit cycle. They include:

- Seneca Creek: Little Seneca and Dry Seneca
- Lower Potomac Direct, including Rock Run and Little Falls but excluding Muddy Branch and Watts Branch
- Upper Potomac Direct, including Little Monocacy & Broad Run

The seven implementation plans (Table 1.2) provided the input data for the development of this Strategy.

Table 1.2 Watershed Groupings and Plans

Watershed grouping	Implementation Plan	Pre-Assessment
Anacostia	X	
Rock Creek	X	
Cabin John Creek	X	
Seneca Creek		
Great Seneca (including Clopper Lake)	X	
Dry Seneca and Little Seneca		X
Lower Monocacy	X	
Upper Potomac Direct (West of Seneca Creek, not described in any other grouping)		X
Lower Potomac Direct (East of Seneca Creek, not described in any other grouping)		
Muddy Branch and Watts Branch	X	
All other subwatersheds		X
Patuxent (Triadelphia/Brighton Dam and Rocky Gorge)	X	

Trash Free Potomac

The Alice Ferguson Foundation founded the Trash Free Potomac Watershed Initiative (TFPWI) in 2005 to reduce trash and increase awareness of trash issues in the watershed. TFPWI actions

include the Potomac River Watershed Trash Treaty, Annual Potomac River Watershed Trash Summit, Annual Potomac River Watershed Cleanup, market-based approaches such as the Trash Free Potomac Facility Program, and a Regional Anti-Litter Campaign (Alice Ferguson Foundation, 2011). The MS4 permit requires Montgomery County to meet the commitments of Potomac River Watershed Treaty. The permit specifically requires that Montgomery County:

1. Support and implement regional strategies to reduce trash
2. Develop a work plan to implement a public outreach and education campaign
3. Establish baseline conditions of trash being discharged and develop a reduction strategy and work plan for the Montgomery County portion of the Anacostia Watershed
4. Implement approved control measures in accordance with the trash reduction work plan
5. Conduct public participation in development of trash reduction strategy
6. Submit progress annually

Public Outreach and Stewardship

The County's MS4 Permit requires significant opportunities for public participation in achieving TMDLs, watershed restoration, and trash management. The permit specifically requires the County to prepare a work plan to implement a public outreach and education campaign. The County recognizes that a successful strategy will require a significant increase in effective and coordinated public outreach and public stewardship. The implementation plans and this Strategy describe how DEP plans to implement public outreach and education campaigns with specific performance goals and deadlines.

2. EXISTING CONDITIONS

Watershed health is variable throughout the County and typically well correlated with intensity and age of urbanization. More specifically, watershed health typically declines with increasing density and older age of development. Many of Montgomery County's older urban and suburban areas were developed in an era when runoff from paved surfaces (roads, parking lots, driveways) was directed to storm drains which conveyed untreated runoff directly to streams. This large volume of water caused massive erosion of the stream banks and destroyed habitat. Stormwater treatment using stormwater ponds to receive, detain, and filter runoff before it flowed into streams was either inadequate or non-existent. The Anacostia, Rock Creek, and Cabin John Creek watersheds are examples where these conditions are common. Modern stormwater techniques, known as environmental site design or ESD, encourage the reduction of runoff by infiltrating the water into the ground near its source.

Watershed health improves in more rural areas of the County, but even in these areas, stream degradation can occur, stemming from large lot development and poor agricultural management practices.

The County has conducted comprehensive water quality and biological sampling for more than a decade, which provides a representative snapshot of existing watershed health as well as the ability to track watershed health over time. Figure 2.1 shows countywide watershed resource conditions based on monitoring that was conducted from 2000-2008. The area inside the beltway in the more urban core has lower water quality (fair to poor) while the area outside the beltway tends to have better water quality (fair to good to excellent).

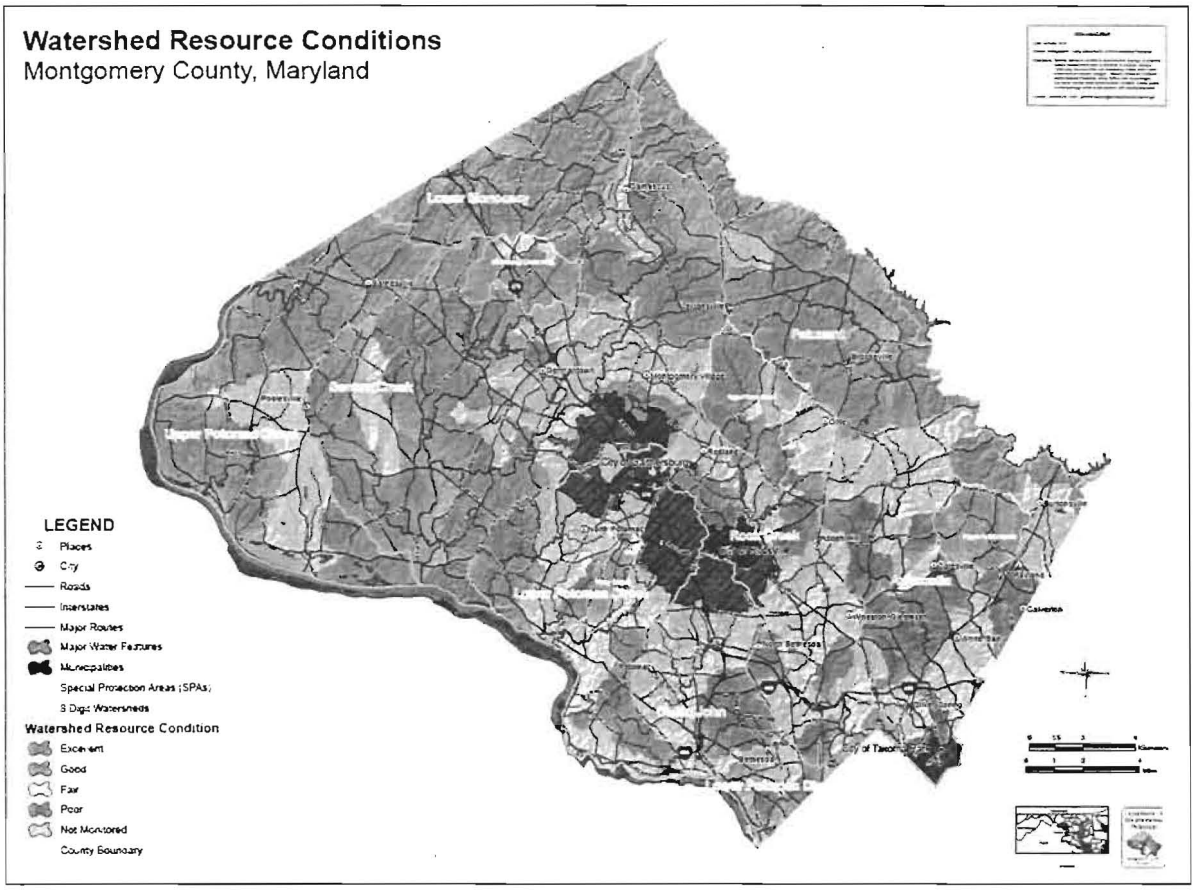


Figure 2.1: County Watershed Resource Conditions

County Statistics

The Strategy will benefit from the fact that the majority of county residents own the property they reside on (nearly 70%) and thus have control over that property. Also, nearly 70% of the residences are single unit homes. Moreover, the average household income is roughly $90,000 making the likelihood of financial capability to install BMPs an appropriate assumption. Both of these statistics make advocacy of BMPs on residential properties an imperative for the Strategy.

Montgomery County's robust business economy was also considered in the Strategy development. Despite the current economic volatility, Montgomery County's business community is still profitable and still maintaining and improving existing facilities. Moreover, the construction of the inter-county-connector (ICC) through much of Montgomery County will provide opportunities to install demonstration BMPs on newly developing properties for replication throughout stakeholder groups. Also, the presence of communication industry leaders (i.e., Discovery Channel) in the County creates unique stewardship education partnership possibilities with businesses. The Strategy will include these stakeholders'

involvement opportunities to best harness the power of Montgomery County's healthy business economy.

The county includes a fairly even split of males and females. The majority of residents, nearly 50%, fall between the ages of 25 and 55. Only 15% of the population is aged 60 and above. In addition, the majority of Montgomery County residents indicate their preferred language as English; however, Spanish translations of stakeholder involvement opportunities will be required in select watersheds to accommodate the 13% of county residents that indicate their preferred language as Spanish. Other potential target groups for translation for stakeholder involvement include the Asian community, as 11% of the county's population is Asian (mostly Korean and Vietnamese). Because of this, the Strategy and implementation plans will take multilingual requirements into consideration for signage and other educational tools as well.

MS4 Permit Coverage

The County's most recent NPDES MS4 stormwater permit only covers runoff from developments within the County area. The following areas are excluded from the County's MS4 permit area, shown in Figure 2.2:

- Cities of Gaithersburg, Rockville, and Takoma Park
- Maryland National Capital Park and Planning Commission (MNCPPC) lands
- Washington Sanitary Sewer Commission (WSSC) land
- Federal and State government owned land and facilities
- Rural zoning

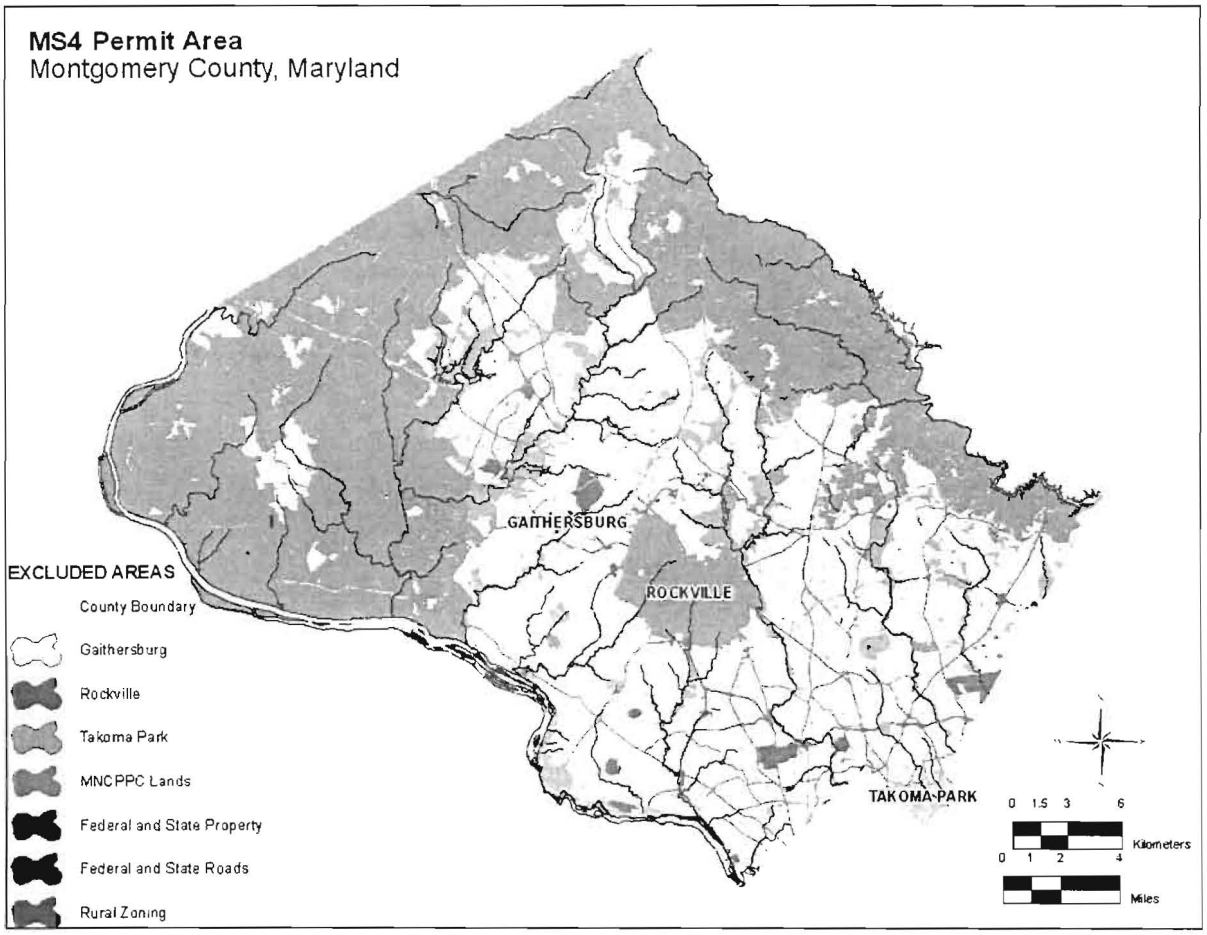


Figure 2.2: Areas outside the Montgomery County MS4 Permit Area

Impervious Surfaces

As previously mentioned, the County's MS4 Permit requires treatment of an additional 20% of impervious cover not currently receiving treatment to the MEP. Table 2.1 presents a summary of the countywide impervious cover totals along with breakdowns by major land cover type. These land covers will be the focus of much of the County's targeted effort to treat the 20% target.

Table 2.1 Impervious Surface Summary

Description	Area in Acres	% of Total Area
Total County Area	324,552	100%
Total Area of Impervious Surface	35,965	11%
County Area Subject to Stormwater Permit (1)	138,649	43%
Impervious Cover Subject to Stormwater Permit (2)	25,119	18%
Areas of Impervious Surface (3)		
Road	13,607	38%
Building	13,073	36%
Parking	7,870	22%
Sidewalk	1,069	3%
Recreation (4)	347	1%

1. Exclusions include: Certain zoning codes, parklands, forests, municipalities with own stormwater management programs, state and federal properties, and state and federal maintained roads
2. Percent of County Jurisdictional Area subject to the Stormwater Permit
3. Impervious area within each category within the total County area.
4. Recreation imperviousness excludes swimming pools

Implementation Plan Guidance Document

The Implementation Plan Guidance Document (revised October 25, 2010) provides a road map for how the implementation plans were created. The primary sections of the Guidance Document and a short description of each are provided in Appendix A

The Guidance Document divides BMPs into five classes or codes shown below. The Guidance Document also provides a list of BMPs and which code they fall under, which is provided in Appendix B.

Code 0: Pretreatment Practices
Code 1: Non-performing BMPs: No runoff reduction and no long term pollutant removal
Code 2: Under-performing BMPs: Limited runoff reduction and low pollutant removal
Code 3: Effective BMPs: No runoff reduction but moderate to high pollutant removal
Code 4: ESD BMPs: High runoff reduction and moderate to high pollutant removal

Impervious Cover Accounting and Tracking

Montgomery County has GIS data layers that contain all the stormwater BMPs in the County and their drainage areas. In order to determine the 20% target for impervious cover treatment

to the MEP, the County analyzed their existing impervious cover and their existing BMP database to determine how much impervious cover is currently being treated to the MEP. Several methods were considered based on a determination of the MEP standard compared to existing treatment methods. According to MDE guidance, to be considered MEP, a BMP must capture at least the Water Quality Volume (WQv) (the first inch of rainfall) or the CPv volume (2.6 inches of rainfall). The final method used for determining which BMPs are MEP and the amount of impervious surface not treated to the MEP was as follows:

1. All BMPs that were installed after 2002 or are classified as Code 4 were considered MEP.
2. An analysis of typical Code 3 stormwater ponds installed after 1986 was performed to determine if this class of BMPs met the definition of MEP. Based on that analysis, Code 3 BMPs constructed after 1986 are considered MEP.
3. All other classes of BMPs not specified above are not considered MEP and are eligible for retrofit.

Table 2.2 below shows the breakdown of the impervious acres treated by BMP codes and era (shaded areas are BMP codes treated to the MEP).

Table 2.2 Acres of Impervious Cover Treated by BMP Code and Design Era

Design Era		Post2002	1986-2002	Pre1986	Blank	*Total*
BMP Code	0	28	711	24	132	***895***
	1	33	555	1,391	367	***2,346***
	2	41	299	12	23	***375***
	3	75	2,482	1,437	267	***4,261***
	4	20	459	482	40	***1,001***
Totals*		***198***	***4,506***	***3,345***	***828***	***8,877***

IC Credit	100%	Code 3& 4	Code 4		*Total*
Acres treated to MEP	198	2,942	482	40	***3,661***

Assuming a total countywide impervious acreage of 25,119 acres and an impervious acreage treated to the MEP of 3,661 as shown in Table 2.2, there are currently 21,458 acres of untreated impervious area. Twenty percent of 21,458 equates to 4,292 acres of impervious area that must be restored over the current permit cycle.

Pollutant Load Tracking

In addition to tracking impervious cover, it is necessary to compute existing pollutant loads and projected reductions in loads as a result of applying stormwater controls and BMPs. The Center for Watershed Protection's (CWP) Watershed Treatment Model (WTM) version 2.0 (CWP, 2001) was the tool selected to conduct this analysis and track load reductions across a range of implementation strategies.

The WTM uses a spreadsheet model to calculate annual pollutant loads and runoff volumes. The model also accounts for the benefits contributed by a full suite of stormwater treatment practices and programs. The first step in the model calculates existing pollutant loads by adding primary and secondary source loads, then subtracting reductions according to existing management practices. The second step applies future management practices by subtracting these calculated reductions from the existing loads. Appendix B of the Guidance Document provides a detailed explanation of the assumptions and steps in the modeling process.

For each watershed, the WTM was run under existing conditions with existing BMPs to determine a baseline pollutant load for targeted pollutants. The baseline period for non-TMDL parameters was based on 2002 Maryland Department of Planning land use/land cover data coupled with the County's existing urban BMP database. Pollutants targeted included: bacteria, Total Phosphorus (TP), Total Nitrogen (TN), Total Suspended Solids (TSS), and Trash. Next, a series of model runs was developed for analyzing the pollutant load reduction effect that various restoration strategies would have based on assumed levels of implementation for the various strategies. Individual restoration strategies that were sequentially modeled included the following:

- Completed and High Priority Projects – these include projects already completed or high priority structural BMPs scheduled for retrofit in the FY11-FY16 Capital Improvements Program (CIP)
- Low Priority Projects – these includes FY11-FY16 CIP projects that for various reasons are considered a lower priority.
- Other Potential Projects – these include other projects in existing inventories that were not listed in the previous two categories. For the Anacostia, they include projects in Anacostia Restoration Plan (ARP) prepared by the Army Corp of Engineers.
- Public ESD Retrofits – These include small scale ESD practices applied to County-owned buildings, streets and parking lots and rights of way. Examples include rainwater harvesting, green roofs, upland reforestation, soil compost amendments, rooftop disconnection "green street" retrofits and converting drainage ditches to dry swales.

These are Code 4 structures. This category also includes other structural BMP upgrades to existing County BMPs which were designated as under-performing or non-performing.

- Private ESD Retrofits - These projects include ESD on commercial property and residential property and include green roofs, rain gardens, and permeable pavement.
- Riparian Reforestation - Focuses primarily on tree planting for riparian buffer restoration.
- Stream Restoration - Includes the use of natural materials such as rocks, logs, and native vegetation to reduce pressure on eroded banks, prevent down-cutting of the streambed, and restore the natural meander patterns and slope profiles found in stable reference streams.
- Programmatic Practices – This category deals with potential pollutant reduction that can be attributed and quantified through MS4 stormwater pollution prevention improvements and better housekeeping on County land and facilities. Also includes any pollutant reductions due to product substitution (e.g., nitrogen and phosphorus limits in fertilizer), operational programs (e.g., recycling) and enforcement. This category also deals with reduced pollutants that can be attributed and quantified through MS4 stormwater education (e.g., lawn care) and outreach aimed at pollution prevention, better housekeeping, and increased stewardship.

The naming convention applied for the model runs was WTM 1.0 (i.e., baseline), WTM 2.0 (i.e., completed and high priority, low priority and other potential projects), WTM 3.0 (i.e., public and private ESD), WTM 4.0 (i.e., riparian reforestation and stream restoration), and WTM 5.0 (i.e., programmatic). Model runs were developed sequentially to yield incremental increases in load reduction by strategy. In practice, however, strategies can be applied in combination and out of sequence to achieve targeted outcomes and the most cost-effective solutions. A summary of the scenarios is provided in Table 2.3 below.

Table 2.3 Summary of Watershed Treatment Model (WTM) Scenarios

Implementation Phase	*Description*
WTM Baseline Conditions	The WTM was run under existing conditions approach with the MDP year 2002 land use/land cover data and existing BMPs.
WTM 2.0 Completed as of 2009; High Priority; Low Priority and Other Potential Projects	The WTM was run with a series of future management practices, which were proposed projects from the County inventory of restoration sites. These practices cover new ponds, retrofits of existing BMPs, and some ESD practices from the proposed projects list.
WTM 3.0 ESD Strategies and Other Structural BMPs	The County's inventory for other project types that include public properties (e.g., libraries and parking lots), public schools, and open section roads available for ESD retrofits was reviewed, as were areas for private property ESD retrofits.
WTM 4.0 Habitat Restoration	This category includes any pollutant reduction or volume reduction that can be attributed to specific stream rehabilitation, wetland restoration and or riparian reforestation projects planned for construction in the watershed for the permit cycle
WTM 5.0 MS4 Programmatic Practices	See description above.

TMDL Calibration and Tracking

Where TMDLs existed for individual watersheds, the WTM was run under existing conditions with existing BMPs based on the year in which the data was collected for TMDL development. The baseline pollutant load was then compared and normalized to the MDE-determined baseline MS4 load for the TMDL pollutant. Any BMPs with "approved" dates after the year in which the data was collected for TMDL development were not included in the baseline calculation, but rather were counted towards meeting the TMDL reduction target.

Once the normalized model was established, reductions achieved through programs and practices were tracked using the WTM scenarios based on the percent load reduction from baseline toward meeting the TMDL required WLA. The normalized baseline and WLA target are determined and specified in the relevant TMDL documents developed by MDE.

3. WATERSHED IMPLEMENTATION PLANS AND RESTORATION POTENTIAL

The watershed implementation plans and pre-assessments developed in conjunction with the Strategy are driven by regulatory requirements facing each watershed. Table 3.1 summarizes the drivers by watershed.

Table 3.1 Restoration Objectives

Watershed/Subwatershed	Pollutants	Impervious Cover	Trash
Patuxent	TMDL	20% Countywide Goal	
Anacostia			TMDL
Rock Creek			Trash-Free Potomac
Great Seneca			
Cabin John Creek			
Lower Monocacy			
Watts Branch/Muddy Branch			
Dry and Little Seneca			
Lower Potomac Direct			
Upper Potomac Direct			

Table 3.2 presents the more detailed and quantitative aspects of the TMDL requirements for the MS4 portion within each watershed. The Strategy has been developed to meet the MS4 permit area WLA compliance targets presented in Tables 3.2.

In addition to the individual watershed requirements, there is a Countywide requirement to comply with the wasteload allocations associated with urban areas under the Chesapeake Bay TMDL which applies to nutrients and sediment. There is an interim target established for 2017, where reductions from baseline conditions of 9%, 12%, and 20% respectively for TN, TP, and TSS are to occur. Then by 2020, full compliance is required, which correspond to reductions from baseline conditions of 18%, 34%, and 37%, respectively for TN, TP, and TSS.

Table 3.2 TMDL Summary by Impairment

TMDL	Watershed	Date	Pollutant	TMDL % Reduction	County MS4 Baseline Load	Annual Allocation	Units	WLA_{SW} Percent Reduction
Bacteria	Cabin John Creek	2007	*E. coli*	52.0%	44,257	30,670	Billion MPN/yr	30.7%
	Rock Creek	2007	Enterococci	97.0%	453,669	18,195	Billion MPN/yr	96.0%
	Anacostia River	2007	Enterococci	86.0%	247,809	29,978	Billion MPN/yr	87.9%
Nutrients	Anacostia River	2008	TN	78.8%	206,312	38,959	lbs/yr	81.8%
	Anacostia River	2008	TP	79.7%	20,953	3,947	lbs/yr	81.2%
	Triadelphia Reservoir	2008	TP	58.0%	438	373	lbs/yr	15.0%
	Rocky Gorge Reservoir	2008	TP	48.0%	4,268	3,628	lbs/yr	15.0%
	Clopper Lake	2002	TP	39.3%	101	55	lbs/yr	45.4%
Sediments	Anacostia River	2007	TSS	85.0%	7,682	1,101	tons/yr	87.5%
	Triadelphia Reservoir	2008	TSS	29.0%	29	29	tons/yr	0.0%
	Clopper Lake	2002	TSS	0.0%	13	13	tons/yr	0.0%
	Lower Monocacy River	2009	TSS	38.0%	172	68	tons/yr	60.8%
Trash	Anacostia River	2010	Trash	100.0%	228,683	-	lbs/yr removed	100.0%

Adapted from "2010 Status of Approved Stormwater Wasteload Allocations for NPDES Regulated Stormwater Entities in Montgomery County," April 27, 2010 by Jeff White, MDE

Potential to Reduce Stormwater Pollutant Loads

Within each of the implementation plans, an analysis was developed that explored the restoration potential for that watershed. Cost was not a limiting factor for the analysis, but rather assumptions were made based on feasibility of implementation rates and consideration of conflicts with typical site conditions with respect to site use, utilities, land ownership, etc. For example, it was assumed that 40% of large County-owned parking lots would be available for stormwater retrofitting. These assumptions are necessary for planning purposes where detailed site investigations have not occurred. However, some level of implementation is

reasonable to assume. In addition, all identified high priority and low priority County projects that have the potential to be constructed were assumed to be implemented.

Implementation cost and effectiveness (in terms of pollutant load reduced) was also tracked through the process of determining watershed restoration potential, which enables the cost/benefit evaluation of various strategies for a target parameter (e.g., tons of sediment per dollar spent or billion MPN of bacteria per dollar, etc.). For example, by tracking cost and effectiveness it is possible to evaluate the relative cost/benefit of a strategy like ESD versus a non-structural programmatic practice. Moreover, the comparison of these two strategies is going to be different depending on what parameter is being considered (e.g., ESD may be more cost effective for nutrient reduction but less cost effective for bacterial load reduction).

The tables in Appendix C help to illustrate this point. Specifically, a series of summary charts and tables have been developed that illustrate the cost effectiveness of the range of strategies considered by watershed with respect to pollutant load reduction. The summaries reflect the full restoration potential developed for each watershed.

It is also useful to compare strategy effectiveness and range of opportunity across watersheds. To facilitate this, a series of tables were compiled that groups all watersheds together and considers watershed restoration potential by strategy. These summary tables are presented in Tables 3.3 through 3.10.

For this analysis, stream restoration was treated as a special modeling case (Table 3.9), because it was not tracked as a strategy that receives credit for impervious cover treatment and because it requires a different pollutant load reduction tracking method based on linear feet of implementation and the existing stream resource condition (good, fair, or poor IBI scores received different pollutant removal credit). Further details on stream restoration modeling are presented in the individual implementation plans and the Guidance Document.

Not all WTM scenarios were modeled for all watersheds. For example, if there were no previously identified completed, high priority, low priority, or other potential projects within a watershed, they would appear as zeros for that individual watershed in Tables 3.3 through 3.6. Also, for non-TMDL watersheds such as Great Seneca and Muddy Branch and Watts Branch subwatersheds, the public and private property ESD, riparian reforestation, and MS4 programmatic practices scenarios were not modeled due to the lack of regulatory drivers that define pollutant removal targets.

Table 3.3. Cost and benefit summary for completed projects (WTM 2.0)

Watershed	Total			ESD Projects		Incremental reduction from baseline (%)				
	Cost (million $)	Number of projects **	Impervious control added (ac)	Cost (% total)	Impervious (% total)	TN	TP	TSS	Bacteria	Trash
Anacostia	9.5	25	167	7%	3%	4%	4%	1%	4%	4%
Cabin John	0.0	0	0	0%	0%	0.2%	0.2%	0.3%	0.3%	1%
Rock Creek	4.4	6	212	13%	1%	2%	2%	3%	3%	2%
Triadelphia	0.0	0	0	0%	0%	0%	0%	0%	0%	0%
Rocky Gorge	0.0	0	0	0%	0%	0%	0.1%	0%	0%	0%
Lower Monocacy	0.0	0	0	0%	0%	0%	0%	0%	0%	0%
Clopper Lake	0.0	0	0	0%	0%	0%	0%	0%	0%	0%
Great Seneca *	0.6	2	11	0%	0%	1%	1%	1%	0%	2%
Muddy/Watts	0.0	0	0	0%	0%	0%	0%	0%	0%	0%

* Includes Clopper Lake ** Project count does not include stream restoration

Pollutants with a TMDL are highlighted

Table 3.4. Cost and benefit summary for high priority projects (WTM 2.0)

Watershed	Total			ESD Projects		Incremental reduction from baseline (%)				
	Cost (million $)	Number of projects **	Impervious control added (ac)	Cost (% total)	Impervious (% total)	TN	TP	TSS	Bacteria	Trash
Anacostia	6.4	33	148	65%	16%	2%	2%	0.6%	2%	2%
Cabin John	1.6	6	88	19%	2%	3%	3%	3%	3%	1%
Rock Creek	8.9	14	373	13%	1%	2%	3%	3%	3%	4%
Triadelphia	0.0	0	0	0%	0%	0%	0%	0%	0%	0%
Rocky Gorge	0.4	2	5	77%	27%	0.6%	0.6%	0.7%	0.6%	1%
Lower Monocacy	0.0	0	0	0%	0%	0%	0%	0%	0%	0%
Clopper Lake	0.0	0	0	0%	0%	0%	0%	0%	0%	0%
Great Seneca *	18.3	24	789	6%	0.8%	19%	19%	20%	0%	24%
Muddy/Watts	4.4	16	211	8%	1%	6%	6%	6%	0%	6%

* Includes Clopper Lake ** Project count does not include stream restoration

Pollutants with a TMDL are highlighted

Table 3.5. Cost and benefit summary for low priority projects (WTM 2.0)

Watershed	Total			ESD Projects		Incremental reduction from baseline (%)				
	Cost (million $)	Number of projects **	Impervious control added (ac)	Cost (% total)	Impervious (% total)	TN	TP	TSS	Bacteria	Trash
Anacostia	5.1	16	188	61%	8%	2%	2%	0.7%	2%	3%
Cabin John	1.6	8	10	98%	78%	0.2%	0.2%	0.2%	0.2%	0.3%
Rock Creek	8.8	24	657	7%	1%	4%	4%	6%	5%	7%
Triadelphia	0.40	1	2.0	100%	100%	0.5%	0.5%	0.6%	0.5%	1%
Rocky Gorge	0.9	2	4.58	100%	100%	8.4%	8.2%	8.3%	8.2%	11.6%
Lower Monocacy	0	0	0	0%	0%	0%	0%	0%	0%	0%
Clopper Lake	0	0	0	0%	0%	0%	0%	0%	0%	0%
Great Seneca *	6.6	16	87	41%	15%	4%	4%	4%	0%	4%
Muddy/Watts	2.0	6	26	84%	33%	0%	0%	1%	0%	0%

* Includes Clopper Lake ** Project count does not include stream restoration

Pollutants with a TMDL are highlighted

Table 3.6. Cost and benefit summary for other potential projects (WTM 2.0)

Watershed	Total			ESD Projects		Incremental reduction from baseline (%)				
	Cost (million $)	Number of projects **	Impervious control added (ac)	Cost (% total)	Impervious (% total)	TN	TP	TSS	Bacteria	Trash
Anacostia	249.2	497	2222	73%	62%	23%	24%	8%	26%	30%
Cabin John	0.0840	1	5	0%	0%	0.1%	0.1%	0.1%	0.1%	0.1%
Rock Creek	2.0	4	201	0%	0%	1.2%	1.2%	1.9%	1.5%	2.1%
Triadelphia	0.0	0	0	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rocky Gorge	2.0	2	0	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%
Lower Monocacy	0.0	0	0	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%
Clopper Lake	0.0	0	0	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%
Great Seneca *	0.2	5	53	0%	0%	2.3%	2.3%	2.7%	0.0%	2.7%
Muddy/Watts	0.0	0	0	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%

* Includes Clopper Lake ** Project count does not include stream restoration

Pollutants with a TMDL are highlighted

Table 3.7. Cost and benefit summary for ESD projects (WTM 3.0)

Watershed	Cost (million $)		Impervious control added (ac)	Incremental reduction from baseline (%)				
	ESD for public property	ESD for private property		TN	TP	TSS	Bacteria	Trash
Anacostia	237.8	212.96	1,813	20%	21%	7%	22%	27%
Cabin John	87.8	103.07	876	22%	23%	25%	24%	28%
Rock Creek	247.1	341	2,427	30%	30%	33%	32%	35%
Triadelphia	4.1	4.7	36	10%	10%	11%	11%	20%
Rocky Gorge	31.2	19	285	26%	27%	32%	30%	46%
Lower Monocacy	8.6	2.9	53	14%	15%	15%	15%	0%
Clopper Lake	0.8	0.51	21	14%	14%	15%	0%	14%
Great Seneca *	0.0	0	0	0%	0%	0%	0%	0%
Muddy/Watts	0.0	0	0	0%	0%	0%	0%	0%

* Includes Clopper Lake

Pollutonts with a TMDL are highlighted

Table 3.8. Cost and benefit summary for riparian reforestation (WTM 4.0)

Watershed	Cost (million $)	Impervious control added (ac)	Incremental reduction from baseline (%)				
	Habitat restoration		TN	TP	TSS	Bacteria	Trash
Anacostia	1	6	0%	0%	0%	0.1%	0.2%
Cabin John	7.77	39	1%	2%	1%	3%	3%
Rock Creek	24	119	2%	2%	2%	4%	5%
Triadelphia	0.10	1	0.1%	0.2%	0.1%	0.4%	0.3%
Rocky Gorge	2.5	12	1%	2%	2%	3%	8%
Lower Monocacy	1.1	5	3%	3%	3%	4%	0%
Clopper Lake	0.23	2	4%	4%	2%	0%	4%
Great Seneca *	0	0	0%	0%	0%	0%	0%
Muddy/Watts	0	0	0%	0%	0%	0%	0%

* Includes Clopper Lake

Pollutants with a TMDL are highlighted

Table 5.7. Cost and benefit summary for stream restoration (WTM 4.0)

Watershed	Stream Restoration		Impervious control added (ac)	Incremental reduction from baseline (%)				
	Cost (million $)	Number of projects		TN	TP	TSS	Bacteria	Trash
Anacostia	93.7	200	0	42%	56%	326%	0%	0%
Cabin John	16.2	15	0	17%	9%	80%	0%	0%
Rock Creek	20.1	30	0	9%	7%	100%	0%	0%
Triadelphia	0.0	0	0	0%	0%	0%	0%	0%
Rocky Gorge	19.1	18	0	10%	7%	36%	0%	0%
Lower Monocacy	7.3	n/a	0	7%	10%	32%	0%	0%
Clopper Lake	0.0	0	0	0%	0%	0%	0%	0%
Great Seneca *	25.9	33	0	19%	8%	16%	0%	0%
Muddy/Watts	24.2	45	0	16%	7%	13%	0%	0%

* Includes Clopper Lake

Pollutants with a TMDL are highlighted

Table 5.8. Cost and benefit summary for MS4 programmatic practices (WTM 5.0)

Watershed	Cost (million $)	Impervious control added (ac)	Incremental reduction from baseline (%)				
	Programmatic practices - MS4		TN	TP	TSS	Bacteria	Trash
Anacostia	3.6	0	9%	9%	10%	8%	82%
Cabin John	0.47	0	15%	14%	0%	10%	0%
Rock Creek	1.2	0	11%	11%	0%	7%	0%
Triadelphia	0.0056	0	23%	3%	0%	0%	0%
Rocky Gorge	0.09	0	38%	8%	0.3%	5%	2%
Lower Monocacy	0.07	0	0%	0%	19%	0%	0%
Clopper Lake	0.01	0	61%	30%	0%	0%	0%
Great Seneca *	0	0	0%	0%	0%	0%	0%
Muddy/Watts	0	0	0%	0%	0%	0%	0%

* Includes Clopper Lake

Pollutants with a TMDL are highlighted

4. COORDINATED IMPLEMENTATION STRATEGY

The Strategy has multiple objectives to accomplish, whereby a challenging balance between strategies and timeframe is required. There isn't necessarily a correct answer in the process but rather an optimized result that addresses an agreed upon suite of priorities. The Strategy presented here was primarily driven by known and established regulatory timeframes and compliance endpoints. Meeting these endpoints using the more cost effective approaches was also given priority. After this, consideration was given to other known and important approaches that stakeholders and the County have an interest in pursuing. Specifically, the following compliance dates and objectives were considered in developing the Strategy over the long-term (Table 4.1):

Table 4.1 Compliance Targets for Countywide Coordinated Implementation Strategy

Target Date	Compliance Target	Metric
2015	Meeting 20% impervious cover treatment requirement within the MS4 Permit cycle	~4,300 acres of Impervious Cover
2017	Meet the interim dates and targets for the Chesapeake Bay TMDL, which include specific regulated urban area reductions by 2017 for nutrients and sediment (based on Maryland Department of the Environment's Watershed Implementation Plan)	9%, 12%, and 20% respectively for TN, TP, and TSS reductions from baseline conditions
2020	Meet the full compliance and targets for the Chesapeake Bay TMDL, which include specific regulated urban area reduction by 2020 for nutrients and sediment (based on Maryland Department of the Environment's Watershed Implementation Plan)	18%, 34%, and 37% respectively for TN, TP, and TSS reductions from baseline conditions
	Meet additional impervious cover treatment targets associated with next MS4 Permit cycle (assumes another 20% target)	~3,400 acres of Impervious Cover (20% of impervious remaining after 2015)
2025	Meet additional impervious cover treatment targets associated with next MS4 Permit cycle (assumes another 20% target)	~2,750 acres of Impervious Cover (20% of impervious remaining after 2020)
2030	Out year compliance with other watershed TMDLs	100% compliance with MS4 Permit Area WLAs

To meet the compliance targets outlined in Table 4.1, the following priorities were generally followed:

- 100% implementation of completed, high, and low priority County projects in first five years (by 2015).
- Greater ESD focus in urban (as opposed to suburban and rural) watersheds initially. Goal for ESD in these watersheds on public property in first five years is 10% and on private property is 10%. The level of implementation was largely driven by the 20% Countywide impervious goal.
- 100% of Public Outreach Potential for all TMDL watersheds in first five years. This was pursued to address trash, nutrient and bacteria loading which rely strongly on effective outreach programs to modify behaviors.
- Generally limited strategies to the top four most cost effective per watershed.
- Habitat restoration (stream restoration and buffer reforestation) not pursued as priority until after first five year period. These programs emphasize greater pollutant reduction efficiency rather than impervious cover treatment, which is the primary focus for the first permit cycle.

The Strategy was informed by the individual watershed implementation plans for seven watersheds, which included the Clopper Lake and Patuxent subwatersheds. Therefore, in order to develop countywide estimates for pollutant load reduction (as is required by the Chesapeake Bay TMDL), watershed area weighting was applied. The process for developing the Countywide strategy and individual watershed implementation plans was woven together. Once the restoration potential was determined from the individual plans, the strategy and schedule was compiled using the restoration potentials and the drivers listed above. The final restoration cost and schedule was then placed in the implementation plans.

It is also worth noting that the high and low priority projects along with the other potential projects strategies represent a static or fixed number of projects that have been identified by the County. For this analysis, this list of practices is not replenished and therefore, once all opportunities have been implemented, other strategies are pursued. In reality, the County will continue to develop and update its list of specific project opportunities and have these available for implementation in future years.

The output from this effort is presented in a series of tables ordered by target date in Appendix D. In addition, Table 4.2 provides an overall summary of pollutant load reduction tracking versus time. Through inspection of Table 4.2 it can be seen that the Strategy meets the

impervious cover treatment targets under the current MS4 permit (as well as projected targets for 2020 and 2025 assuming a continued 20% treatment requirement), interim and final Chesapeake Bay nutrient and sediment reduction targets by 2017 and 2020 respectively, and out year MS4 permit area WLA compliance for the majority of pollutants. Exceptions include meeting the bacteria WLA load reductions required for the Anacostia and Rock Creek.

Table 4.2 Projection by Phase for Watersheds and Pollutants

							Permit/TMDL Targets	
Watershed	Fiscal Year	2015	2017	2020	2025	2030	2017	2020
Anacostia	Impervious Treated (acres)	1,421	2,393	3,364	4,272	4,544		
	ESD (% Impervious)	26%	44%	61%	69%	71%		
	Cost (Million $)	160	307	486	732	820		
	ESD (% Cost)	45%	62%	71%	78%	78%		
	Nitrogen	25%	39%	68%	89%	100%	81.8%	82%
	Phosphorus	27%	42%	77%	100%	100%	81.2%	81%
	Sediment	47%	72%	100%	100%	100%	87.5%	88%
	Bacteria	21%	33%	46%	59%	64%	87.9%	88%
	Trash	41%	65%	89%	100%	100%		
Rock Creek	Impervious Treated (acres)	1,541	1,961	2,381	3,625	3,989		
	ESD (% Impervious)	17%	28%	36%	57%	61%		
	Cost (Million $)	87	172	262	566	658		
	ESD (% Cost)	70%	79%	79%	89%	90%		
	Nitrogen	24%	30%	38%	55%	61%		
	Phosphorus	25%	30%	38%	54%	60%		
	Sediment	38%	50%	92%	100%	100%		
	Bacteria	21%	27%	33%	50%	55%	96.0%	96%
	Trash	17%	24%	31%	50%	55%		
Cabin John	Impervious Treated (acres)	187	380	570	1,018	1,018		
	ESD (% Impervious)	52%	72%	78%	87%	87%		
	Cost (Million $)	23	65	114	215	219		
	ESD (% Cost)	92%	91%	86%	90%	88%		
	Nitrogen	21%	27%	39%	55%	58%		
	Phosphorus	20%	26%	35%	49%	51%		
	Sediment	6%	17%	60%	91%	100%		
	Bacteria	16%	22%	27%	40%	40%	31%	31%
	Trash	6%	12%	19%	34%	34%		
Muddy Watts	Impervious Treated (acres)	237	237	237	237	237		
	ESD (% Impervious)	4%	4%	4%	4%	4%		
	Cost (Million $)	6	8	19	25	31		
	ESD (% Cost)	32%	27%	11%	8%	7%		
	Nitrogen	6%	7%	15%	18%	22%		
	Phosphorus	6%	7%	10%	12%	13%		
	Sediment	7%	8%	14%	17%	20%		
	Bacteria	0%	0%	0%	0%	0%		
	Trash	6%	6%	6%	6%	6%		
Great Seneca	Impervious Treated (acres)	901	921	941	941	941		
	ESD (% Impervious)	2%	2%	2%	2%	2%		
	Cost (Million $)	26	48	50	51	52		
	ESD (% Cost)	15%	8%	8%	8%	8%		
	Nitrogen	24%	41%	43%	44%	45%		
	Phosphorus	24%	32%	34%	34%	34%		
	Sediment	26%	41%	43%	44%	44%		
	Bacteria	0%	0%	0%	0%	0%		
	Trash	31%	32%	33%	33%	33%		

							Permit/TMDL Targets	
Watershed	Fiscal Year	2015	2017	2020	2025	2030	2017	2020
Clopper	Impervious Treated (acres)	0	6	12	22	22		
	ESD (% Impervious)	0%	86%	86%	92%	92%		
	Cost (Million $)	0	0	1	2	2		
	ESD (% Cost)	0%	72%	73%	84%	84%		
	Nitrogen	61%	67%	72%	79%	79%		
	Phosphorus	30%	36%	41%	48%	48%	45%	45%
	Sediment	0%	5%	10%	17%	17%		
	Bacteria	0%	0%	0%	0%	0%		
	Trash	0%	6%	11%	18%	18%		
Lower Monocacy	Impervious Treated (acres)	1	16	32	58	58		
	ESD (% Impervious)	100%	85%	84%	91%	91%		
	Cost (Million $)	0	4	11	18	20		
	ESD (% Cost)	100%	85%	54%	63%	58%		
	Nitrogen	0%	5%	14%	22%	24%		
	Phosphorus	0%	5%	16%	26%	28%		
	Sediment	0%	5%	46%	61%	69%	60.8%	61%
	Bacteria	0%	6%	12%	19%	19%		
	Trash	0%	0%	0%	0%	0%		
Rocky Gorge	Impervious Treated (acres)	11	88	165	307	307		
	ESD (% Impervious)	64%	89%	90%	95%	95%		
	Cost (Million $)	3	17	40	70	75		
	ESD (% Cost)	55%	82%	64%	73%	68%		
	Nitrogen	47%	55%	67%	82%	85%		
	Phosphorus	17%	25%	36%	52%	53%	15%	15%
	Sediment	10%	19%	45%	70%	79%		
	Bacteria	14%	23%	32%	47%	47%		
	Trash	15%	30%	46%	68%	68%		
Triadelphia	Impervious Treated (acres)	3	12	20	38	38		
	ESD (% Impervious)	100%	98%	97%	99%	99%		
	Cost (Million $)	1	3	5	9	9		
	ESD (% Cost)	99%	98%	98%	99%	99%		
	Nitrogen	24%	27%	29%	34%	34%		
	Phosphorus	4%	7%	9%	14%	14%	15%	15%
	Sediment	1%	4%	6%	12%	12%		
	Bacteria	1%	4%	6%	12%	12%		
	Trash	2%	6%	11%	21%	21%		
Countywide	Impervious Treated (acres)	4,302	6,014	7,722	10,518	11,154	6,008	7,723
	ESD (% Impervious)	18%	34%	47%	60%	63%		
	Cost (Million $)	305	622	987	1,687	1,884		
	ESD (% Cost)	53%	66%	70%	80%	80%		
	Nitrogen	18%	25%	36%	46%	51%	9%	20%
	Phosphorus	17%	23%	34%	44%	46%	12%	34%
	Sediment	23%	34%	54%	60%	62%	20%	37%
	Bacteria	11%	15%	20%	28%	30%		
	Trash	18%	26%	33%	41%	42%		

Assumptions:

1. Does not include repeated Outreach and Education costs beyond FY2015
2. Does not include an inflation multiplier

Summary of Individual Implementation Plans

A summary of the general considerations and prioritization for each watershed implementation plan is provided below.

Anacostia – For the first permit cycle (through 2015), a priority was placed on full implementation of completed, high, and low priority projects. Next, implementation of a third of the other potential projects was targeted, as a large number of these were identified in conjunction with the USACE's Anacostia Watershed Restoration Plan efforts. ESD was emphasized on both public (10%) and private property (10%). Finally, outreach (25%) and stream restoration (12%) are targeted for pollutant load reduction but are not credited towards impervious cover credit. In future permit cycles, the remainder of the other potential projects are targeted along with ESD and a limited amount of riparian reforestation for impervious cover and pollutant load reduction. Outreach and stream restoration are significant strategies pursued for load reduction benefits. Nutrient and sediment MS4 permit area WLAs are met by 2030, but bacteria load reduction does not meet MS4 permit area WLA compliance. The remaining bacteria reduction is believed to be associated with urban wildlife sources. Unless intense urban wildlife management practices are implemented, this remaining load reduction will not be possible.

Rock Creek – For the first permit cycle (through 2015), a priority was placed on full implementation of complete, high and low priority projects. Next, 25% implementation of other potential projects was targeted. ESD was emphasized on both public (10%) and private property (10%), with private property implementation being linked to Rainscapes Program success. Finally, outreach (100%) and stream restoration (22%) are targeted for pollutant load reduction but are not credited towards impervious cover credit. In future permit cycles, the remainder of the other potential projects are targeted along with ESD and riparian reforestation for impervious cover and pollutant load reduction. Stream restoration is a significant strategy pursued for load reduction benefits. The bacterial load reduction does not meet MS4 permit area WLA compliance. However, the remaining bacterial load is believed to be associated with urban wildlife sources. Unless intense urban wildlife management practices are implemented, this remaining load reduction will not be possible.

Cabin John Creek – Similar to the other two more urban watersheds in the County, during the first permit cycle (through 2015), a priority was placed on full implementation of complete, high and low priority projects. Fewer opportunities exist overall compared to the Anacostia and Rock Creek. Next, 25% implementation of other potential projects was targeted. ESD was emphasized on both public (10%) and private property (10%). Finally, outreach (100%) was

targeted for pollutant load reduction but not credited towards impervious cover credit. No riparian reforestation or stream restoration was targeted due to limited or no opportunities. In future permit cycles, the remainder of the other potential projects are targeted along with ESD and some riparian reforestation for impervious cover and pollutant load reduction. The bacteria load reduction meets MS4 permit area WLA compliance by 2025.

Muddy Branch/Watts Branch – During the first permit cycle (through 2015), a priority was placed on full implementation of complete, high and low priority projects. Fewer opportunities exist overall compared to the Anacostia and Rock Creek Watersheds. No other strategies were pursued as there are no existing TMDLs in the Muddy Branch/Watts Branch subwatersheds. In future permit cycles, previously identified stream restoration projects are implemented for pollutant load reduction.

Great Seneca Creek – This watershed implementation plan is unique in that it includes the small Clopper Lake subwatershed which has a TMDL for phosphorus. Even with the TMDL, there are limited identified opportunities to pursue in the Clopper Lake subwatershed, in part due to the limited area of the subwatershed within the County MS4 permit area. During the first permit cycle (through 2015), a priority was placed on full implementation of complete, high and low priority projects within Great Seneca Creek subwatershed. No opportunities exist for these strategies in Clopper Lake. However, full outreach was applied in Clopper Lake in the first permit cycle. In future years, other potential projects, ESD on public and private property and a small amount of riparian reforestation (in Clopper Lake) is pursued. The Clopper Lake WLA for phosphorus within the MS4 permit area is met.

Patuxent – During the first permit cycle (through 2015), a priority was placed on full implementation of complete, high and low priority projects. Far fewer opportunities exist overall compared to the Anacostia and Rock Creek. A limited amount of ESD on private land and stream restoration was pursued. Finally, outreach (100%) was targeted for pollutant load reduction (primarily nutrients) but not credited towards impervious cover credit. No riparian reforestation was targeted within the MS4 Permit area due to cost effectiveness in the Rocky Gorge subwatershed and limited opportunities in the Triadelphia subwatershed. In future permit cycles, ESD on private and public land is pursued more substantially as is stream restoration. A limited amount of riparian reforestation achieves some impervious cover and pollutant load reduction. The Rocky Gorge phosphorus WLA within the MS4 permit area is met easily and the Tridelphia phosphorus WLA is also met, but with a longer timeframe needed for compliance.

Lower Monocacy Creek – Lower Monocacy Creek is the most rural watershed in the County and has the least amount of area subject to the County MS4 permit. In addition, there are no pre-identified restoration projects within the watershed. Therefore, during the first permit cycle (through 2015), only a very small amount (5%) of private property ESD is pursued. It is not until the second permit cycle that more focus is placed on private and public ESD as well as stream restoration and programmatic strategies such as street sweeping to target sediment loads associated with the TMDL. In future permit cycles, stream restoration is pursued for pollutant load reduction. The sediment WLA within the MS4 permit area is projected to be met around 2025.

Countywide – The Countywide effort was driven by impervious cover treatment targets and Chesapeake Bay TMDL 2017 and 2020 reduction targets associated with sediment and nutrients for urban MS4s. For impervious cover, it was assumed that a 20% target would be required for each five-year permit cycle. The Bay TMDL targets for urban MS4 areas were easily met for all pollutants in 2017 and easily met for nitrogen and sediment but more difficult to meet for phosphorus in 2020.

Public Outreach and Stewardship

The County recognizes and is committed to the increasingly important role that public outreach and stewardship will play if improved water quality conditions are going to be achieved countywide. While the County currently has a very active and layered outreach program, the model requires changes that will result in broader stakeholder groups serving as the leaders and primary champions for clean water in their communities. This includes greater participation from minority and faith-based groups, business consortiums, schools, neighborhood associations, and civic groups. Additionally, the new model requires revisiting current initiatives carried out by the various County agencies to look for better and more efficient ways to communicate messages, cross-train, and create synergies that result in greater engagement, greater awareness, and sustained changes in behavior.

Within each implementation plan, specific suggestions for outreach and education opportunities are identified. In addition, Appendix E of this Strategy contains "practice sheets" which highlight targeted restoration activities for the County to develop and refine. A total of eight practices have been identified that can be adopted countywide or in more targeted watershed areas where there are specific water quality issues to address. Many of the practices build upon existing County programs but require a much broader reach to new partner groups. Program start up costs are suggested and were used to for cost estimates associated with Countywide strategy. The highlighted practices include:

- Pet Waste Pickup Education and Outreach Campaign
- Lawn Stewardship Education and Outreach Campaign
- Anti-Littering Education and Outreach Campaign
- Innovative Stormwater Management Awareness Campaign
- Stream Stewards Education and Outreach Campaign
- Riparian Reforestation Education and Outreach Campaign
- Roof Runoff Reduction Education and Outreach Campaign
- Parking Lot Recharge Value Education and Outreach Campaign

Start up costs by practice, along with an overall five year cost estimate, are provided in Table 4.3. Start up timeframes are assumed to be up to 18 months.

Table 4.3 Outreach Start Up and 5-Year Cost Projections

Practice	Practice Start Up Cost
Pet Waste Pickup	$240,500
Lawn Stewardship	$30,600
Anti-Littering	$175,050
Stormwater Management Improvements Awareness	$50,450
Stream Stewards	$74,825
Riparian Reforestation	$30,575
Roof Runoff Reduction	$101,400
Parking Lot Recharge Value	$41,500
Estimated Start Up Total	**$744,900**
5-Year Outreach Budget Projection	**$2,650,000**

These eight practice sheets provide specific costs and timelines for implementation. They also provide suggestions for measuring program success. These practice sheets along with the specific recommendations in the implementation plans make up the Public Outreach and Education Campaign.

Trash Reduction

Most of the implementation plans have to address trash loadings to meet requirements of the Potomac Trash Treaty that is referenced in the County's MS4 Permit. In addition, the Anacostia Trash TMDL has recently been accepted by MDE and the EPA. According to the Anacostia

TMDL, there is reasonable assurance that the goals of the Treaty and TMDL can be met with proper watershed planning, implementing pollution-reduction BMPs, and using strong political and financial mechanisms.

Currently, the County has a number of activities which target trash reduction. They include the following:

- Adopt-a-Road Program through DOT, which focuses on public awareness and involvement in trash management. There are 205 participants who adopted road segments and agreed to six major road cleanups per year;
- Storm Drain Marking through DOT
- Support for illegal dumping enforcement, outreach, and research and monitoring.
- Partnership with DOT to conduct street sweeping covering about 2,500 curb miles and occurring once a year;
- Partnership with the Park Police to monitor illegal dumping, which combined enforces 300-400 actions a year.
- Non-residential and residential recycling programs through Solid Waste Services (SWS).
- Transit stop trash management program at 600 bus stops countywide supported by DOT Transit Services.

In addition to continuing these efforts, a number of trash good-housekeeping efforts have been proposed as part of this Strategy. A detailed description of the quantitative methods and strategies applied can be found in Appendix E of the Guidance Document. In general, the following six trash-reduction strategies are recommended:

1. Significantly increase funding for trash reduction programs
2. Create and enhance regional partnerships and coordination among businesses, environmental groups, individual citizens, and government at all levels and in all jurisdictions
3. Improve people's awareness, knowledge, and behavior relating to littering and illegal dumping
4. Promote the greater introduction and use of effective trash-reduction technologies and approaches
5. Improve enactment and enforcement of laws to reduce trash
6. Increase trash monitoring-related data collection, generation, and dissemination efforts

The Anacostia watershed implementation plan provides an outline of the actions that will be taken through the first permit cycle to reduce trash. The range of programs and practices specially aimed at reducing trash inputs to roads and streams that will be targeted include: reduce, reuse and recycle campaigns; littering and illegal dumping enforcement; stream cleanups; and street sweeping. These measures are in addition to any trash trapped and

removed by structural practices which are computed using the WTM. The plan shows that the trash TMDL can be met by 2025 at a cost of 732 million dollars.

Adaptive Management, Monitoring, and Reporting

Sound implementation strategies require assessment and effective adaptation to respond to new information, changing conditions, new technologies, and lessons learned. This will be the basis of the plan that will be used when benchmarks are not met and the projected funding is inadequate.

Adaptive management requires monitoring of a variety of measures that can be used to determine whether progress is being made towards meeting the Countywide water quality objectives. Ultimately, it is the instream water quality and the loading limits with respect to the TMDLs that determine the success of implementation; however, there are many interim measures that can also be correlated to success, which are worthwhile pursuing.

Surface water monitoring can be an expensive and time consuming undertaking. Montgomery County is fortunate to have an extensive Countywide stream monitoring network that can serve as a foundation for providing spatial and temporal data to indicate stream health. The County's MS4 Permit also outlines the required assessment of controls, which includes chemical, biological, and physical monitoring. Specifically, the permit calls for the County to continue their watershed restoration monitoring of the Lower Paint Branch subwatershed and physical monitoring of the Clarksburg Special Protection area. In addition to the existing monitoring network, the County will continue tracking and data reporting associated with levels of implementation (e.g., acres of impervious cover treated, areas of buffer planted, miles of stream restored, miles of streets swept). For measuring effectiveness of outreach and stewardship efforts, other types of monitoring and reporting are planned that include before and after attitude surveys, frequency of website visits and information requests.

For many restoration strategies it may be difficult to tease out their individual effectiveness in terms of pollutant load reductions, but collectively, the monitoring that occurs should provide adequate insight into the overall effectiveness of a layered implementation strategy.

In addition to the monitoring and assessment, the County will be reporting results on an annual basis as part of their NPDES MS4 Permit annual report. The MS4 Permit requires annual reporting of the following:

- The status of implementing the components of the stormwater management program that are established as permit conditions
- A narrative summary describing the results and analyses of data, including monitoring data that is accumulated throughout the reporting year;
- Expenditures for the reporting period and the proposed budget for the upcoming year;
- A summary describing the number and nature of enforcement actions, inspections, and public education programs;
- The identification of water quality improvements and documentation of progress toward meeting applicable WLAs developed under EPA approved TMDLs; and
- The identification of any proposed changes to the County's program when WLAs are not being met.

The County will build upon annual reporting that has historically occurred to meet permit requirements and will supplement this reporting with tracking table summaries that quantify implementation activities for the range of strategies pursued during that year and the associated treatment (e.g., impervious cover treated, pollutant load reduced, education and outreach partners established, etc.). Cost will also be tracked in association with rates of implementation. This level of performance will then be compared with countywide strategy targets (e.g., progress towards meeting WLAs) associated with key performance dates such as those presented in Table 4.1. The level of progress achieved by the County will then feed into the adaptive management approach described above.

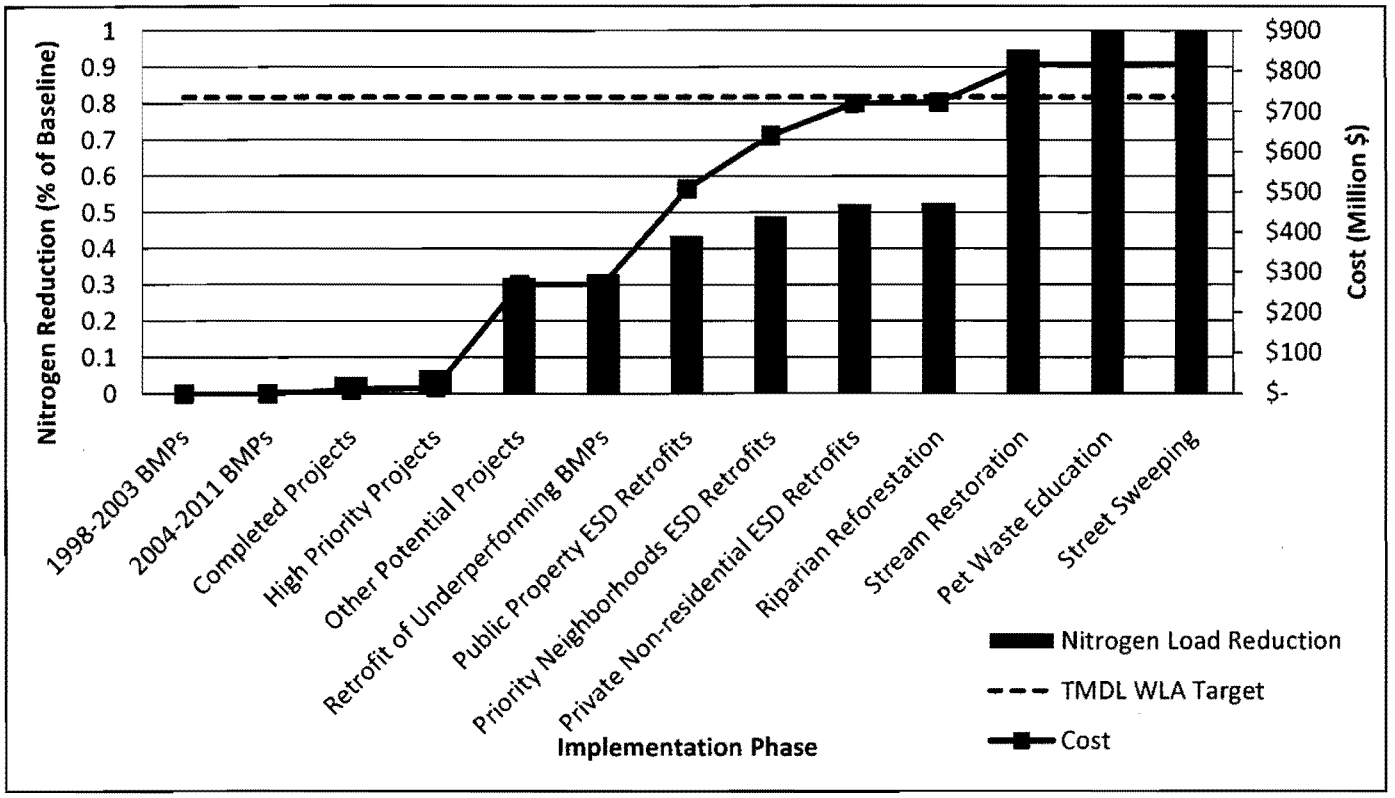
Organization Needs to Implement Strategy

Montgomery County DEP staff possesses substantial expertise and institutional knowledge that yields many positive outcomes and efficient processes under the current pace of restoration and permit compliance activities. Under this strategy, however, the pace of implementation is required to significantly increase. Based on an increase in the level of implementation it is reasonable to assume that additional capacity may be needed to provide sufficient oversight and management of all the projects.

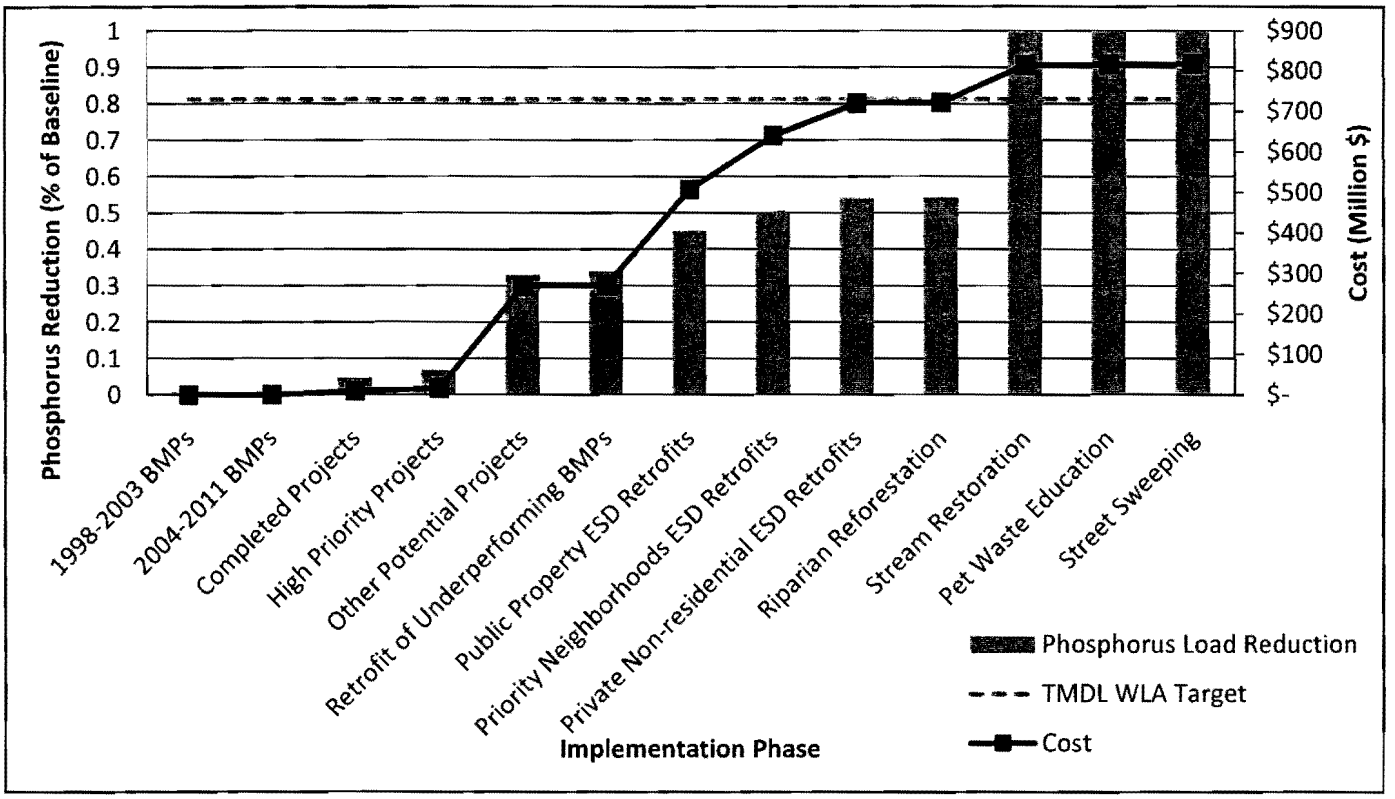
Another critical element of this strategy is the recognition and commitment to pursuing outreach initiatives that build community capacity by targeting new partner groups that provide the necessary leadership, oversight, and sustained effort to change behaviors and foster stewardship. The County currently carries out many well established and managed outreach programs, but it may require additional focus across County agencies and departments for these partnerships to become established and thrive.

Through the implementation process, and the monitoring and reporting that is required, large amounts of data will be generated. Technological advances happen so rapidly in this day and age, it will be important for the County to stay current with technology and methods so that more efficient and cost-effective data management and reporting will be possible. The County currently relies on a detailed and sophisticated GIS to spatially locate projects, and manage tables of data related to projects. The growth and development of this spatial database will be a critical component of the reporting and tracking capability of the County. These databases generate the input data that are used to measure progress towards baseline loading targets. Regular review and upkeep of the data as well as routine summarization of progress (annually at a minimum) will likely require additional dedication of staff. This is especially the case during periods where the implementation rate of structural practices in the ground is accelerated.

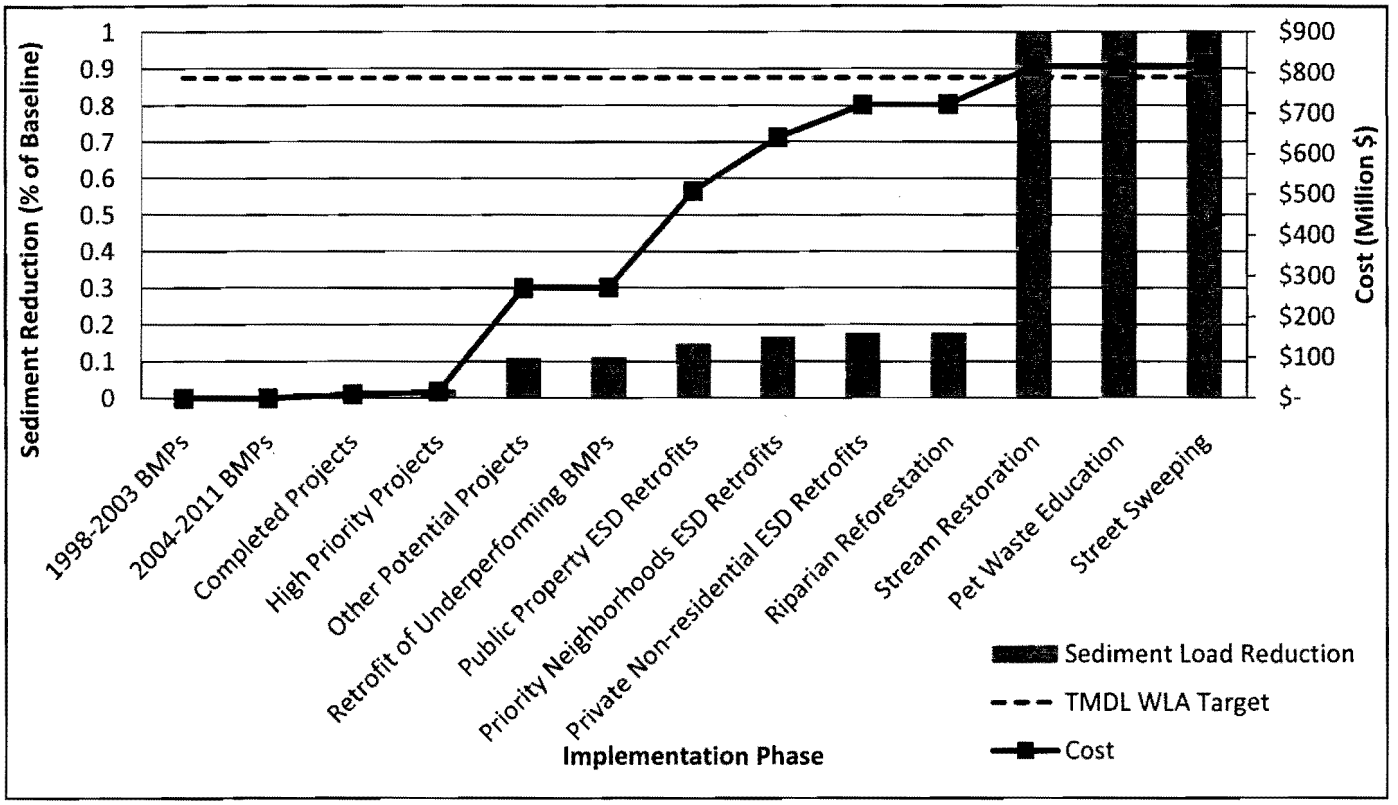
Appendix C – Restoration Potential by Watershed



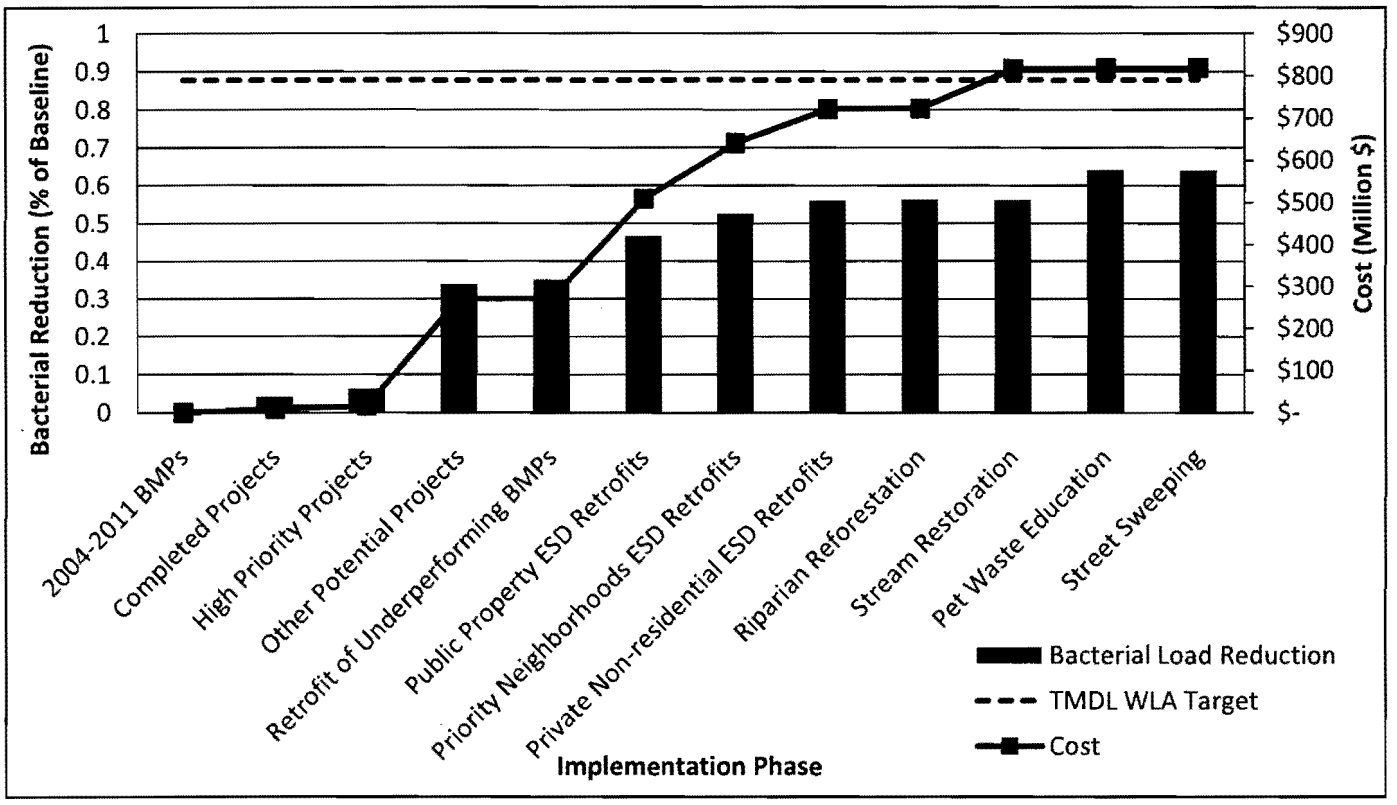
Rank	Restoration Strategy	TN reduction	Incremental Cost	Unit Cost
		lbs/yr	Million $	lbs/Million $
1	Pet Waste Education	15,169	0.88	17,193
2	Retrofit of Underperforming BMPs	1,769	1.20	1,475
3	Stream Restoration	72,423	93.04	778
4	Completed Projects	6,643	9.48	701
5	High Priority Projects	3,260	6.35	513
6	Other Potential Projects	43,276	254.30	170
7	Habitat Restoration	224	1.41	158
8	Public Property ESD Retrofits	18,270	236.55	77
9	Priority Neighborhoods ESD Retrofits	9,271	132.78	70
10	Private Non-residential ESD Retrofits	5,594	80.18	70
11	Street Sweeping	-	1.24	-



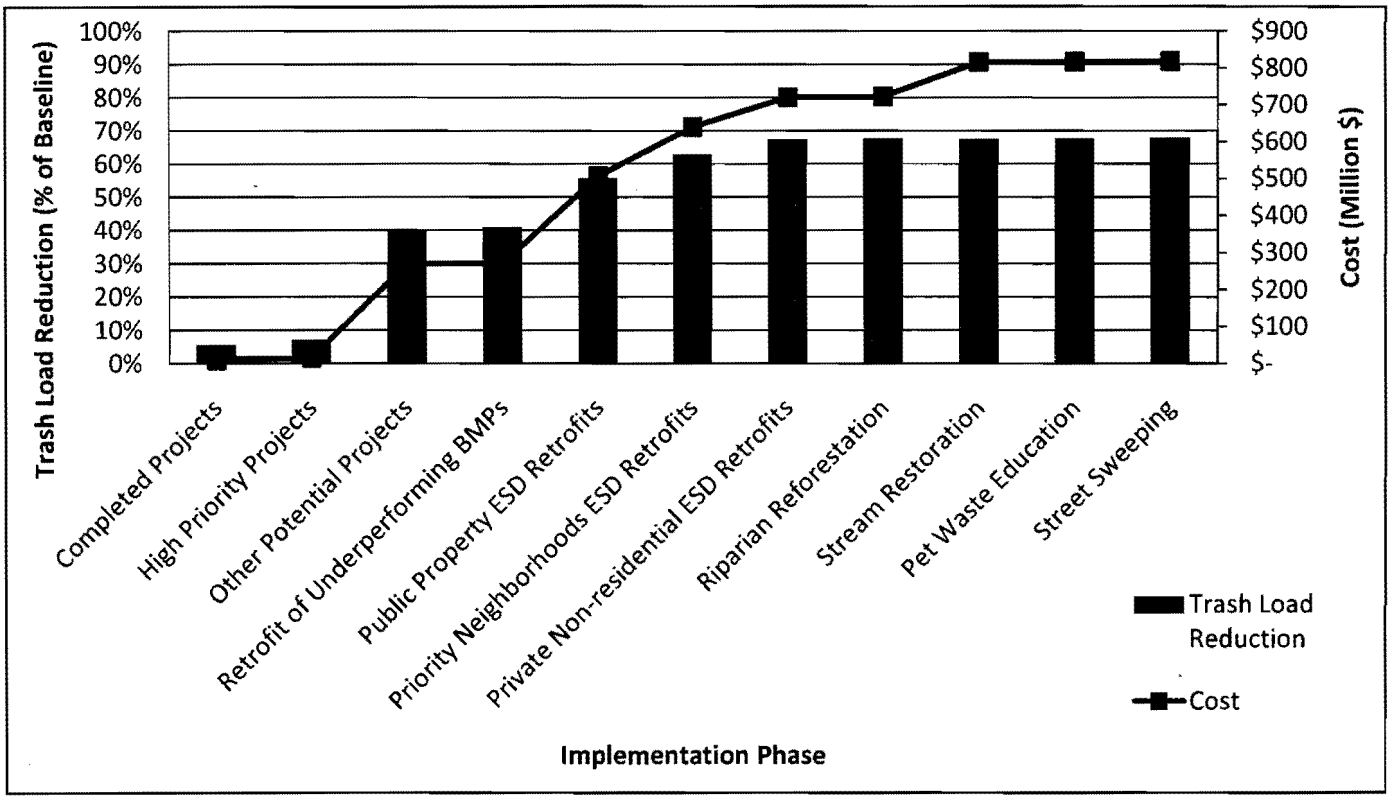
Rank	*Restoration Strategy*	*TP reduction*	*Incremental Cost*	*Unit Cost*
		lbs/yr	Million $	lbs/Million $
1	Pet Waste Education	1,979	0.88	2,243
2	Retrofit of Underperforming BMPs	247	1.20	206
3	Stream Restoration	13,097	93.04	141
4	Completed Projects	915	9.48	96
5	High Priority Projects	451	6.35	71
6	Habitat Restoration	37	1.41	26
7	Other Potential Projects	6,067	254.30	24
8	Public Property ESD Retrofits	2,546	236.55	11
9	Priority Neighborhoods ESD Retrofits	1,294	132.78	10
10	Private Non-residential ESD Retrofits	781	80.18	10
11	Street Sweeping	-	1.24	-



Rank	Restoration Strategy	Sediment reduction	Incremental Cost	Unit Cost
		tons/yr	Million $	tons/Million $
1	Street Sweeping	800	1.24	645
2	Stream Restoration	25,057	93.04	269
3	Retrofit of Underperforming BMPs	25	1.20	21
4	Completed Projects	97	9.48	10
5	High Priority Projects	47	6.35	7
6	Other Potential Projects	660	254.30	3
7	Public Property ESD Retrofits	272	236.55	1
8	Priority Neighborhoods ESD Retrofits	139	132.78	1
9	Private Non-residential ESD Retrofits	84	80.18	1
10	Habitat Restoration	2	1.41	1
11	Pet Waste Education	-	0.88	-

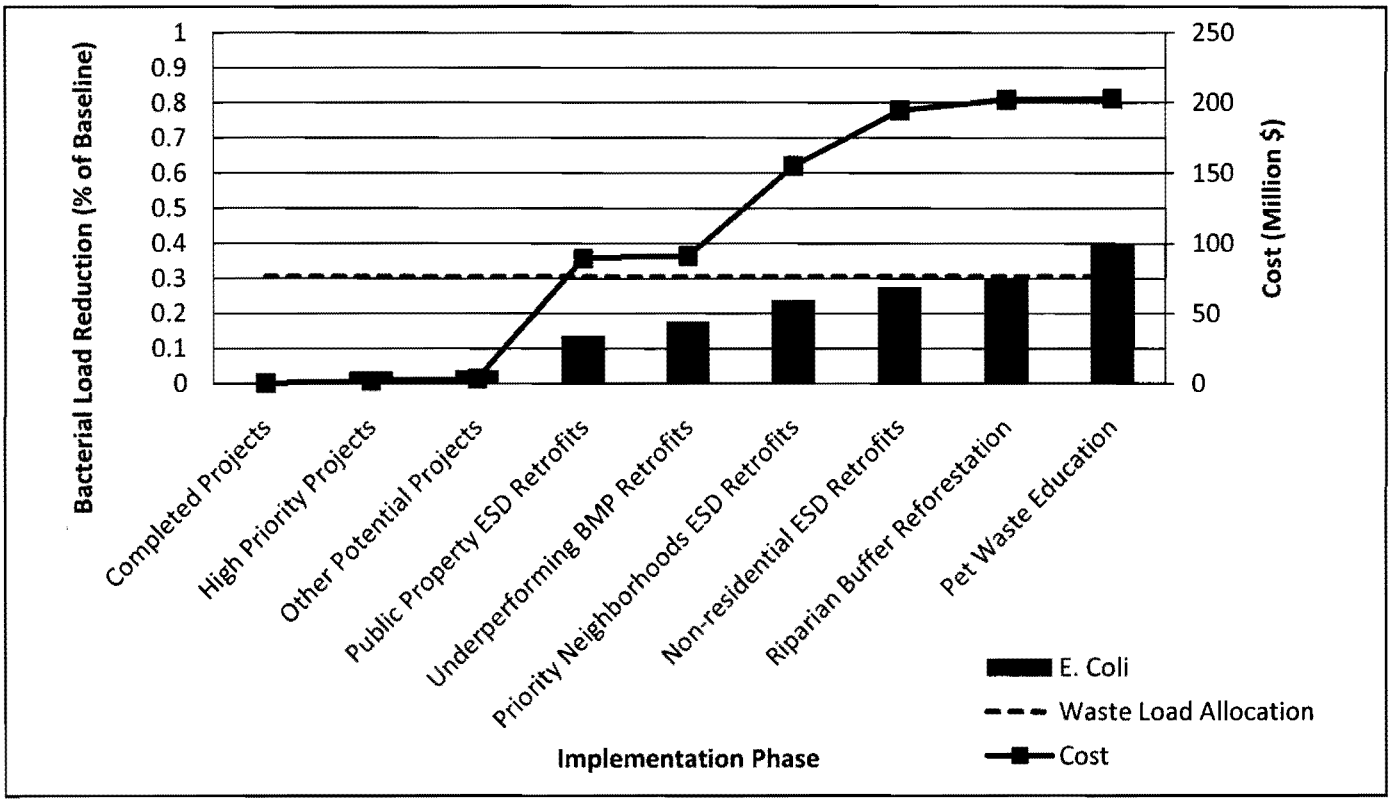


Rank	*Restoration Strategy*	*Enterrococci reduction*	*Incremental Cost*	*Unit Cost*
		Billion MPN/yr	Million $	Billion MPN /Million $
1	Pet Waste Education	19,643	0.88	22,263
2	Retrofit of Underperforming BMPs	2,781	1.20	2,318
3	Completed Projects	10,441	9.48	1,101
4	High Priority Projects	5,120	6.35	806
5	Other Potential Projects	69,895	254.30	275
6	Riparian Reforestation	310	1.41	219
7	Public Property ESD Retrofits	29,025	236.55	123
8	Priority Neighborhoods ESD Retrofits	14,777	132.78	111
9	Private Non-residential ESD Retrofits	8,917	80.18	111
10	Stream Restoration	-	93.04	-
11	Street Sweeping	-	1.24	-



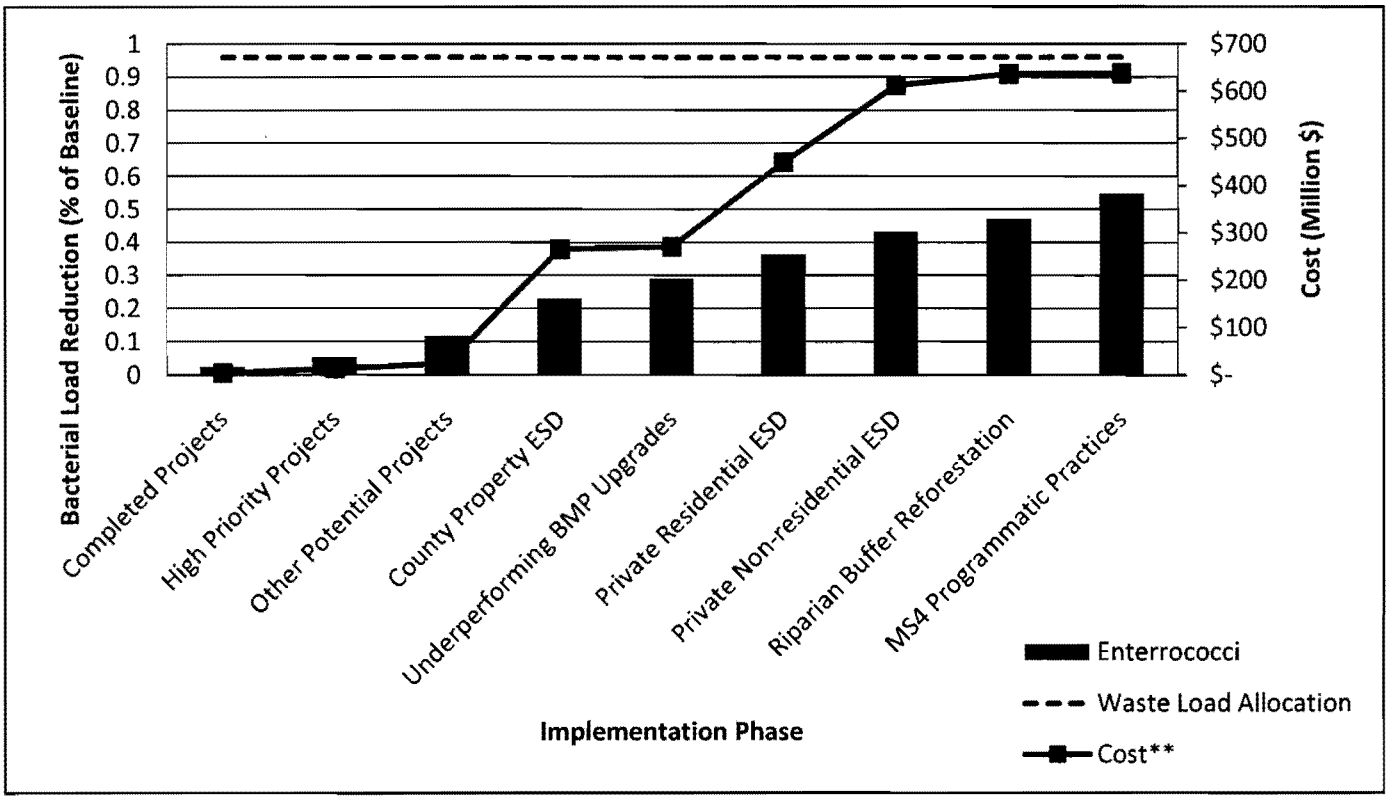
Rank	*Restoration Strategy*	*Potential Trash Reduction*	*Incremental Cost*	*Unit Cost*
		lbs/year	Million $	lbs/Million $
1	Recycling Education and Investigations	51,654	0.2	238,837
2	Plastic Bag Ban, and Misc. Enforcement	63,546	1.3	48,882
3	Anti-litter Campaign, Education	23,761	0.9	26,930
4	Retrofit of Underperforming BMPs	1,144	1.2	954
5	Completed Projects	6,598	9.5	696
6	High Priority Projects	2,786	6.4	439
7	Other Potential Projects	56,341	254.3	222
8	Habitat Restoration	266	1.4	188
9	Street Sweeping	204	1.2	164
10	Public Property ESD Retrofits	25,348	236.6	107
11	Priority Neighborhoods ESD Retrofits	12,529	132.8	94
12	Private Non-residential ESD Retrofits	7,547	80.2	94
13	Stream Restoration	-	93.0	-
14	Pet Waste Education	-	0.9	-

CABIN JOHN



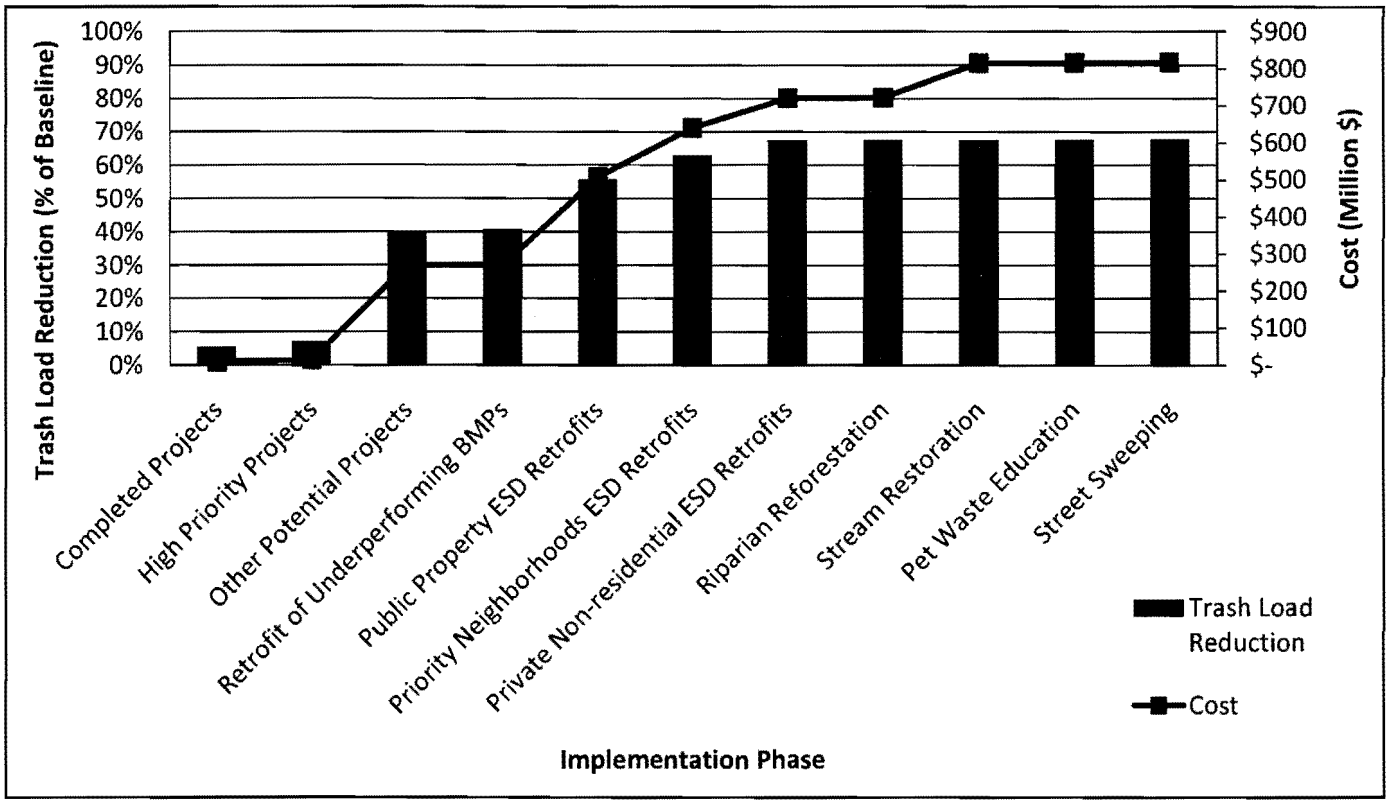
Rank	*Restoration Strategy*	*E. coli reduction*	*Incremental Cost*	*Unit Cost*
		Billion MPN/yr	Million $	Billion MPN /Million $
1	Pet Waste Education	4,388	$0.5	9,436
2	Underperforming BMP Retrofits	1,892	$1.9	1,022
3	High Priority Projects	1,289	$1.6	800
4	Riparian Reforestation	1,133	$7.8	146
5	Other Potential Projects	148	$1.7	86
6	Public Property ESD Retrofits	4,400	$86.0	51
7	Private Non-residential ESD Retrofits	1,618	$39.2	41
8	Priority Neighborhoods ESD Retrofits	2,633	$63.8	41
9	Completed Projects	112	$0.0	0

ROCK CREEK



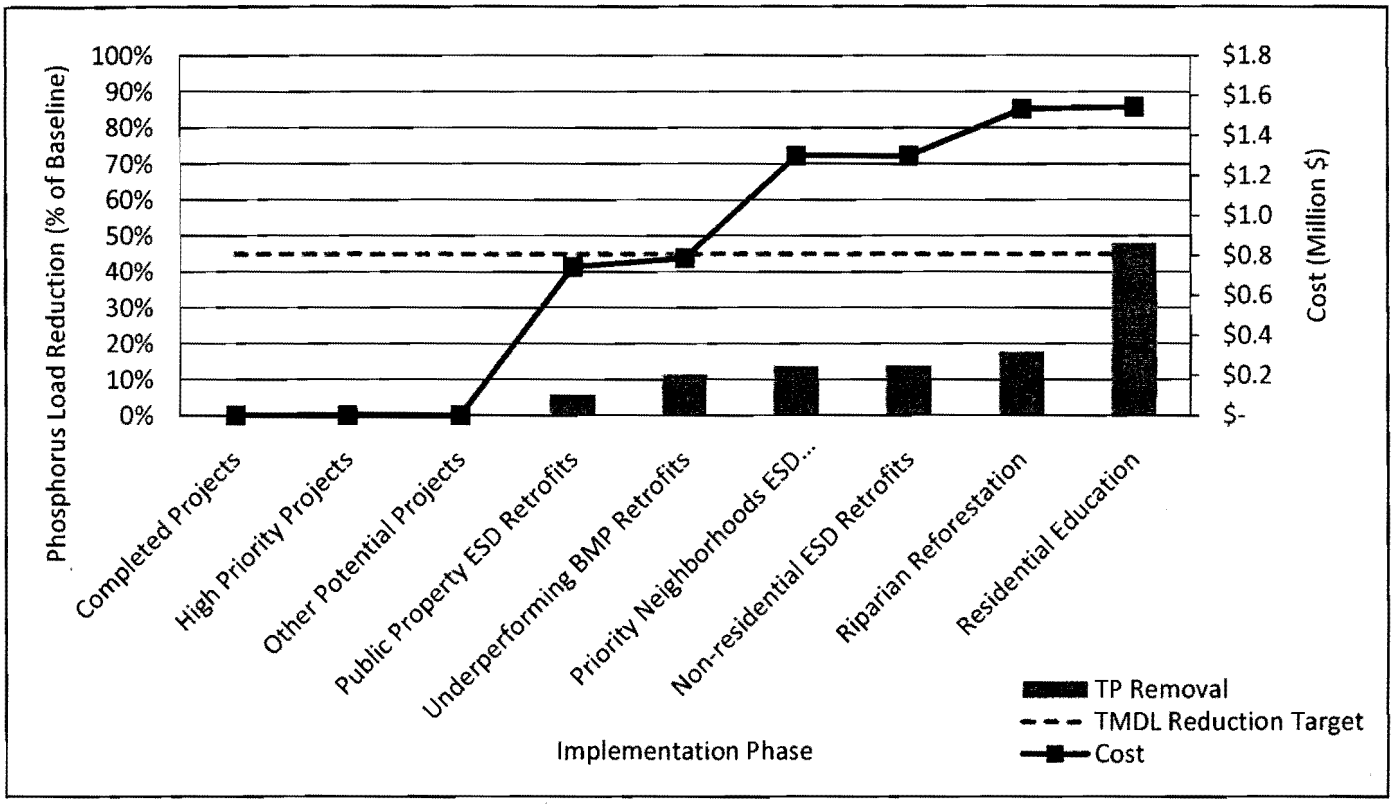
Rank	*Restoration Strategy*	*Enterrococci reduction*	*Incremental Cost*	*Unit Cost*
		Billion MPN/yr	Million $	Billion MPN /Million $
1	Pet Waste Management	35,734	1.18	30,190
2	Underperforming BMP Upgrades	28,800	5.77	4,995
3	Other Potential Projects	30,239	10.83	2,792
4	Completed Projects	12,131	4.44	2,734
5	High Priority Projects	14,239	8.90	1,600
6	Riparian Reforestation	18,999	23.84	797
7	County Property ESD Retrofits	54,519	241.36	226
8	Private Residential ESD Retrofits	35,230	177.37	199
9	Private Non-residential ESD Retrofits	32,486	163.80	198

ROCK CREEK



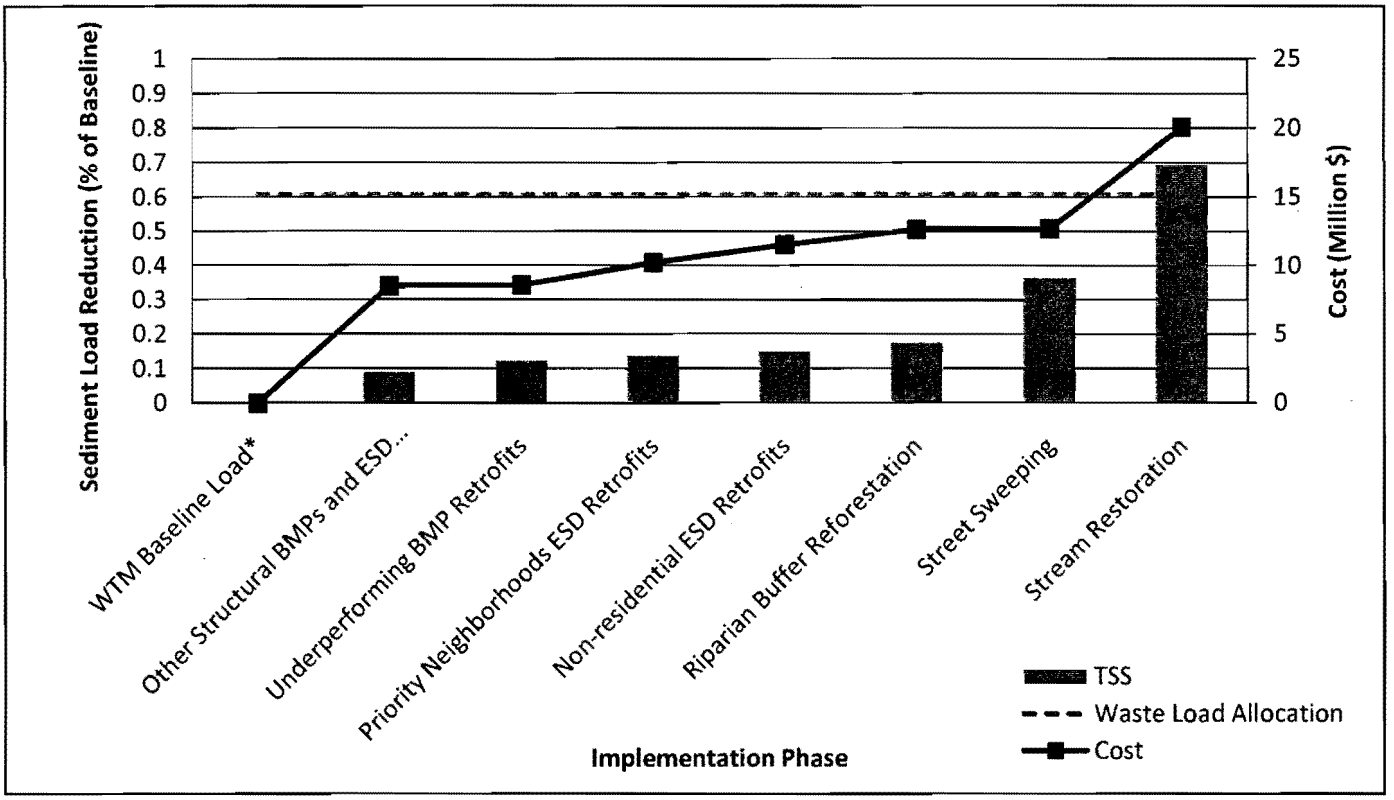
Rank	*Restoration Strategy*	*Trash Reduction*	*Incremental Cost*	*Unit Cost*
		lbs/year	Million $	lbs/Million $
1	Other Potential Projects	16,038	10.85	1,478
2	Underperforming BMP Upgrades	6,756	5.77	1,172
3	Completed Projects	4,217	4.44	950
4	High Priority Projects	6,366	8.90	715
5	Riparian Reforestation	9,237	23.84	387
6	Public Property ESD Retrofits	24,587	241.36	102
7	Priority Neighborhoods ESD Retrofits	16,155	177.37	91
8	Private Non-residential ESD Retrofits	14,793	163.80	90
9	Pet Waste Education	-	1.18	-

SENECA - CLOPPER LAKE



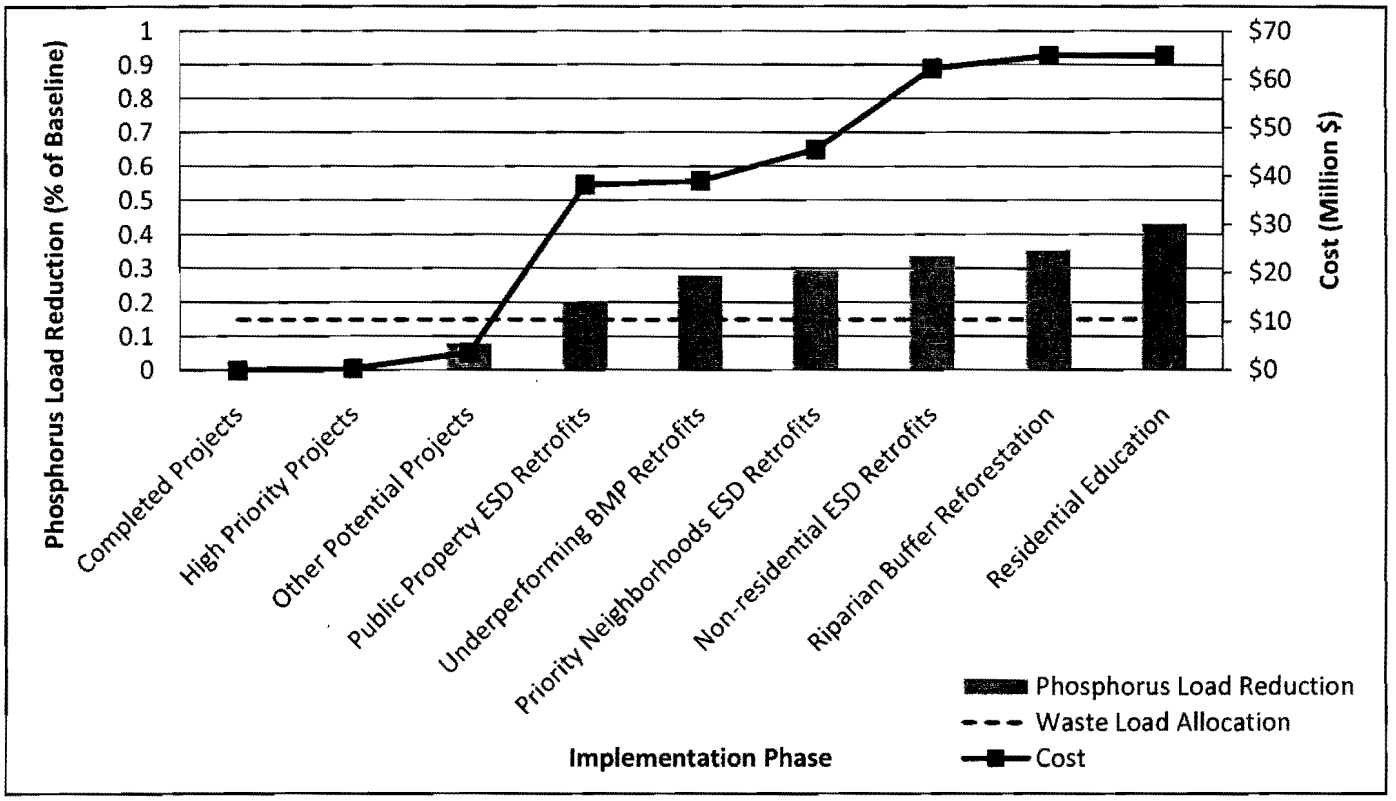
Rank	*Restoration Strategy*	*TP Reduction* (lbs/yr)	*Incremental Cost* (Million $)	*Unit Cost* (lbs/yr/Million $)
1	Residential Education	33	0.01	6,246
2	Underperforming BMP Retrofits	13	0.04	341
3	Riparian Buffer Reforestation	19	0.23	99
4	Priority Neighborhood ESD Retrofits	15	0.51	35
5	Public Property ESD Retrofits	7	0.75	9.9

LOWER MONOCACY



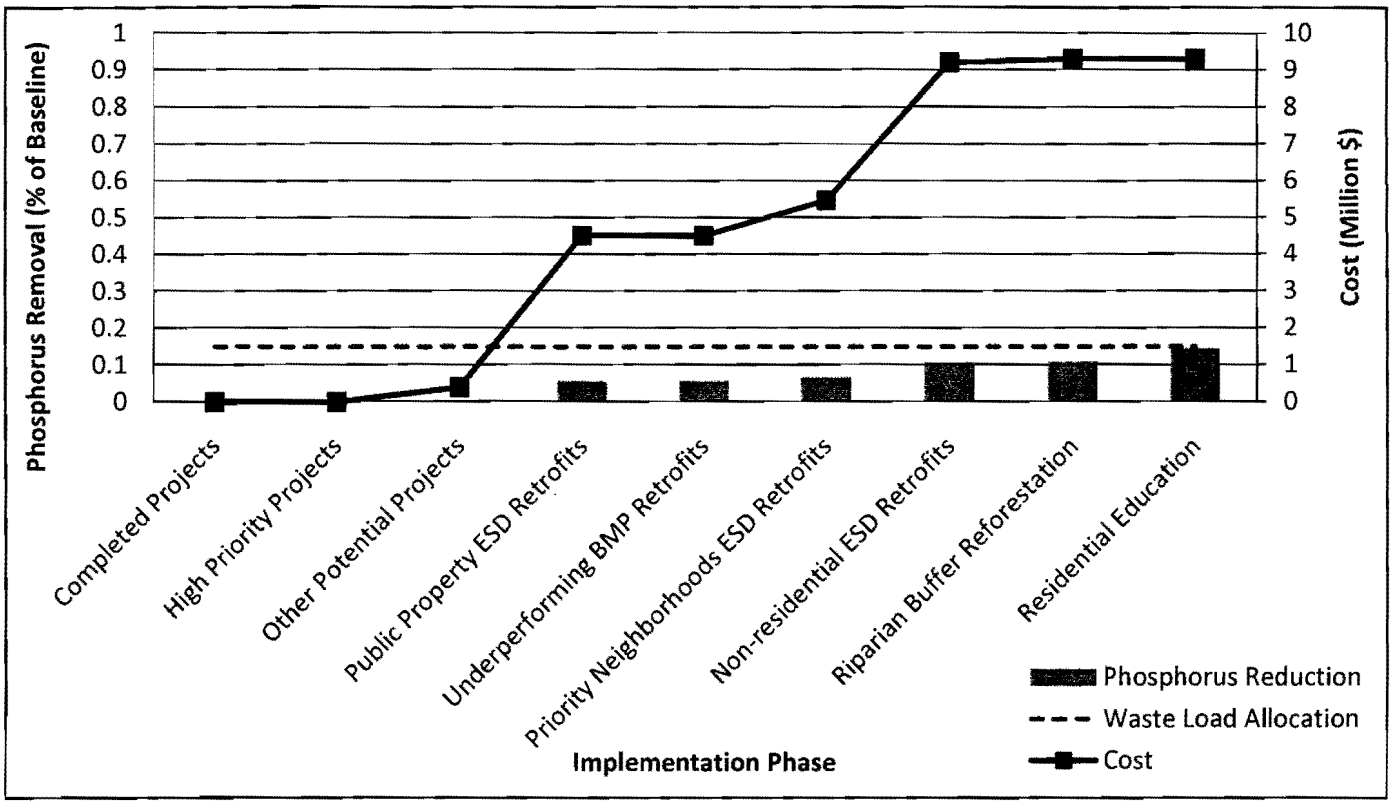
Rank	*Restoration Strategy*	*Sediment reduction*	*Incremental Cost*	*Unit Cost*
		tons/year	Million $	ton/Million $
1	Street Sweeping	22	$0.07	312.1
2	Underperforming BMP Retrofits	4	$0.10	38.9
3	Stream Restoration	37	$7.34	5.1
4	Riparian Buffer Reforestation	3	$1.09	2.5
5	Other Structural BMPs and ESD Strategies	10	$8.51	1.2
6	Priority Neighborhoods ESD Retrofits	2	$1.60	1.0
7	Non-residential ESD Retrofits	1	$1.32	1.0

PATUXENT - ROCKY GORGE RESERVOIR



Rank	Restoration Strategy	TP lbs/yr	Incremental Cost Million $	Unit Cost lbs/ Million $
1	Lawn Care Education	367.0	0.1	3,739.4
2	Underperforming BMP Retrofits	349.9	0.8	433.8
3	Other Potential Projects	352.4	3.3	107.6
4	High Priority Projects	25.2	0.4	68.5
5	Riparian Reforestation	76.2	2.6	29.8
6	Public Property Retrofits	585.4	34.5	16.9
7	Priority Neighborhoods ESD Retrofits	79.6	6.5	12.3
8	Private Non-residential ESD Retrofits	194.1	16.8	11.6
9	Completed Projects	5.3	0.0	0.0

PATUXENT - TRIADELPHIA RESERVOIR



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8	Private Non-residential ESD Retrofits	194.1	16.8	11.6
9	Completed Projects	5.3	0.0	0.0