DRAFT - SUBJECT TO HRPDC APPROVAL

Reducing Nutrients on Private Property:

Evaluation of Programs, Practices, and Incentives

June 2012

WETLANDS WATCH
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PLANNING DISTRICT COMMISSION

Virginia Coastal Zone
MANAGEMENT PROGRAM

PEP 12-05

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HAMPTON ROADS REGION

REDUCING NUTRIENTS ON PRIVATE PROPERTY: EVALUATION OF PROGRAMS, PRACTICES, AND INCENTIVES

Prepared for the

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ABSTRACT:

Non-governmental organizations (NGO) are engaged in efforts to change private landowner behavior using practices that could be credited toward a local government's progress in achieving their Chesapeake Bay Total Maximum Daily Load (TMDL), Phase II Watershed Implementation Plan (WIP) strategies. Examples of local government and NGO collaborations are examined in this report, and recommendations are presented to expand these efforts in the Hampton Roads region.

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Work to support the development of Virginia's Phase II WIP is included in the Hampton Roads Planning District Commission Unified Planning Work Program for Fiscal Year 2012, approved by the HRPDC at its Executive Committee meeting of June 16, 2011. This specific project is included in the HRPDC 2011 CZM competitive grant proposal package. HRPDC authorized the submittal of the grant proposal and subsequent acceptance of grant offer at its Executive Committee meeting of September 15, 2011. This report was prepared for the Hampton Roads Planning District Commission by Wetlands Watch, Inc. and leveraged ongoing efforts by Wetlands Watch, using funding from The Campbell Foundation for the Environment.

PREFACE

This report was for the Hampton Roads Planning District Commission (HRPDC) as a subcontractor to CH2M Hill and funded through a grant to the HRPDC from the Virginia Coastal Zone Management Program.

The goal of this project is to support local Hampton Roads government efforts to develop Phase II Watershed Implementation Plan (WIP) strategies with a preliminary investigation into the feasibility, opportunities, and constraints of utilizing best management practices (BMPs) for nutrient reduction on existing urban/suburban residential and light commercial private property. The purpose of this report is to summarize the findings of this three-month preliminary investigation of:

- **Model Programs** of successful voluntary and mandated private property stormwater management programs and practices, including financial incentive programs and utility credits that Hampton Roads localities can use in their efforts to comply with the Virginia WIP strategies.
- **Efforts of non-profit organizations, citizens groups, and trained stewardship programs** (non-governmental organizations "NGO") to increase environmental stewardship and install BMPs in the Hampton Roads Region.
- **Appropriate best management practices (BMPs)** suitable for existing private urban and suburban residential and small commercial properties and factors that impact the feasibility and effectiveness of these retrofit-type BMPs to achieve nutrient and/or sediment reductions on private property.
- **Advantages, disadvantages, obstacles, and unresolved issues** that impact the feasibility of achieving nutrient reductions on private property.
- **Availability, quality, and usefulness of existing bmp data** associated with these NGO programs and projects in order to determine if the existing BMP data can be used by localities to estimate nutrient and sediment load reductions on private property.

The investigation was designed to expand on work originally initiated by Wetlands Watch in Late Spring 2011: 1) to identify existing watershed steward activities and programs in Hampton Roads and Chesapeake Bay Region; 2) to select a model program to emulate that would increase environmental stewardship actions including BMPs and habitat protection/restoration in Hampton Roads, 3) identify programmatic changes and resources needed to develop new or refine existing environmental steward programs, and 4) conduct a Strategic Summit to bring interested stakeholders together in a collaborative effort to develop a Watershed Stewards Academy (WSA) or refine existing environmental steward programs in Hampton Roads.

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EXECUTIVE SUMMARY

In 2010, the U.S. Environmental Protection Agency (EPA) established the Chesapeake Bay Total Maximum Daily Load (TMDL) for nitrogen, phosphorous, and sediment. The TMDL pollution reduction allocation was subdivided by state jurisdiction and watershed basin. Virginia further subdivided the state allocation to the local-government level. Each state developed Watershed Implementation Plans (WIPs) that explained how and when states would meet pollution reduction allocations.

In the Phase I and II WIPs, Virginia identified a number of strategies to meet the Chesapeake Bay TMDL (Bay TMDL). Ultimately, these state strategies will require localities to develop, implement and maintain regulatory and/or voluntary programs to achieve the Bay TMDL and comply with Municipal Separate Storm Sewer System (MS4) permits as well as other state and federal regulatory programs. In largely urban and suburban localities, like most in Hampton Roads, the Virginia WIP strategies for the urban sector pose a significant challenge. Population densities, older/pre-Clean Water Act developments, prevalence of impervious surfaces, lack of available land for large-scale best management practices (BMPs), and many other factors increase the difficulty of achieving nutrient and sediment reductions in stormwater runoff in Hampton Roads.

One strategy to meet the TMDL reduction goals is to encourage homeowners and businesses to voluntarily install BMPs on their property. Local governments are concerned about the increased staff and funding needed to motivate private property owners to install and maintain these practices, and to inspect, monitor and report nutrient and sediment reductions from these retrofit BMPs for the Chesapeake Bay TMDL.

In the spring of 2011, using unrestricted funding from The Campbell Foundation for the Environment, Wetlands Watch began a review of efforts by nonprofit watershed groups, environmental steward groups, local, state, and federal government, and the private sector to increase the use of conservation landscaping practices as BMPs on private property. This work evolved into a partnership with the Hampton Roads Planning District Commission (HRPDC), through a subcontract with CH2M Hill and funded through a grant from the Virginia Coastal Zone Management Program. In support of Hampton Roads local government efforts to develop Phase II WIP strategies, Wetlands Watch, Inc., conducted an investigation into the feasibility, opportunities, and constraints of utilizing BMPs for nutrient and sediment reduction on existing urban/suburban residential and light commercial private property.

This investigation relied on an on-line literature and records search, a survey of private property owners and trained environmental stewards, and extensive stakeholder interviews and communications with non-governmental organizations (NGOs), foundations, local and state government staff, Virginia Soil and Water Conservation District (SWCD) personnel, Virginia Cooperative Extension agents, and US EPA and Chesapeake Bay Program staff to examine:

- **Model Programs** of successful voluntary and mandated private property stormwater management programs and practices, including financial incentive programs and utility credits that Hampton Roads localities could use in their efforts to comply with the Virginia WIP strategies.

- **Efforts of non-profit organizations, citizens groups, and trained stewardship programs** (NGOs) to increase environmental stewardship and install BMPs in the Hampton Roads Region.
- **Best management practices (BMPs)** suitable for urban and suburban residential and small commercial properties in Hampton Roads and factors that impact the feasibility and effectiveness of these retrofit-type BMPs to achieve nutrient and/or sediment reductions on private property.
- **Advantages, disadvantages, obstacles, and unresolved issues** that impact the feasibility of achieving nutrient reductions on private property.
- **Availability, quality, and usefulness of existing BMP data** associated with NGO programs and projects in order to determine if the existing BMP data can be used by localities to estimate nutrient and sediment load reductions on private property.

This report highlights a number of model programs that localities can emulate or modify based on their own needs in order to increase the number of BMPs on residential, small commercial or small institutional properties. Most of the programs were originally designed to comply with stakeholder outreach, education, and engagement associated with MS4 permits or local TMDLs; however, if properly planned, implemented, tracked, and subsequently monitored, BMPs installed through these programs can be used to achieve sediment and nutrient reduction to meet the Chesapeake Bay TMDL. Seven of the programs highlighted are located in Virginia, with three of the programs in Hampton Roads. Most of the programs highlighted, whether initiated by local government, nonprofit watershed groups, or Soil and Water Conservation Districts (SWCDs) include several key characteristics that localities in Hampton Roads should consider when designing their own program.

This investigation identified significant, often untapped and unrecognized organizational, marketing, and financial resources in Virginia's Chesapeake Bay watersheds that could be utilized to achieve nutrient and sediment pollution reduction goals. Nonprofit watershed groups, SWCDs, environmental steward groups like the Master Naturalists and Advanced Master Gardeners, and private sector entities acting alone and in partnership with local governments have been working with private property owners (residential, commercial, institutional, and industrial) to change their behavior and adopt watershed conservation and restoration practices. At the same time, some local governments have begun reaching out to the NGOs for assistance in meeting environmental goals for MS4 programs or broader sustainability benefits.

From a residential and small commercial property perspective, the practices promoted are described as bayscaping, rainscaping, sustainable landscaping, water-friendly actions, or conservation landscaping. Much of the existing outreach, education, and engagement efforts have been funded by non-governmental sources, primarily foundations, which leverage significant in-kind volunteer and donated services. Often, NGOs will partner with the private sector (stormwater consultants, wetlands specialists, landscape architects/designers), research institutions, or local/state/federal government to provide technical expertise. NGOs work with local citizen volunteers, trained environmental stewards, and landscape contractors to install and maintain demonstration projects. Some NGOs and government programs have worked with the private sector to market and increase the availability of goods and services for these conservation landscaping BMPs. Pollution reductions from conservation landscaping BMPs could make a significant contribution toward meeting locality WIP goals in urban and suburban Virginia localities if practices were expanded, standardized for different applications,

consistently implemented, and appropriately documented and maintained to support nutrient removal efficiencies.

Based on data provided by the National Fish and Wildlife Foundation (NFWF), Wetlands Watch, Inc. estimates that NFWF alone has provided approximately $2.5 million within the Hampton Roads area, to NGOs, SWCDs, and localities to conduct outreach, education, and deliver incentive-based programs that increase environmental stewardship and installation of BMPs on existing private property. With matching funds from private sources and other grant programs like the Virginia DCR Water Quality Implementation Funds (WQIF), the total economic value associated with the NFWF funded grant projects is at least $5 million. Wetlands Watch, Inc. has estimated that NFWF provided almost $20 million in funding for a combination of Small and Targeted Watershed Grants in Virginia from 2006 to present. Other sources of funding for localities include US EPA grants, NOAA grants, either directly or through the Virginia Coastal Zone Management Program, Virginia WQIF, Chesapeake Bay Trust grants, general funds, bonds, stormwater utility fees, and stormwater mitigation funds.

This report also attempts to identify BMPs suitable for use in the Coastal Plain that meet existing EPA and Virginia standards. The report defines these BMPs and discusses how they are credited in Chesapeake Bay Models and the Virginia Stormwater Regulations.

In conclusion, Wetlands Watch found:

- Many BMP retrofits have been implemented on private property in Hampton Roads that could count towards WIP and MS4 required goals. However, additional work is needed to locate, track and standardize data documenting these activities.
- There is not a current process to ensure consistency, reliability, ongoing maintenance, and adequate reporting of existing and future BMPs on private property to enable localities to count these BMPs towards compliance with the Chesapeake Bay TMDL and MS4 permits.
- Stewardship or private property retrofit programs need to have strategies based on a well-defined, unifying, and publicly-available plan that acknowledges and responds to local issues, transition to long-term efforts with reliable funding sources, and involve partnerships between local governments, local NGOs (including trained environmental stewards), and private sector interests (landscaping and nursery businesses).
- There are model programs, in adjacent states and within Virginia that could be used to lay out "best practices" to expand BMP installation on urban/suburban residential and light commercial private property – including ways to provide incentives and remove barriers to adoption of these BMPs.
- Stakeholders would benefit from regional cooperation and coordination among and between NGOs, local, state, and federal government agencies, environmental steward programs, and the private sector (stormwater and landscape-related businesses).
- A strategic summit in eastern Virginia would provide stakeholders with opportunities to identify local programmatic needs and barriers to success, exchange ideas, share success stories, and formulate plans for cooperative partnerships.

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GLOSSARY

ACB	Alliance for the Chesapeake Bay
ACE	Arlingtonians for a Clean Environment
AOSS	Alternative On-site Septic Systems
ASLA	American Society of Landscape Architects
AWS	Anacostia Watershed Society
BMP	Best Management Practices
BSD	Better Site Design
CBF	Chesapeake Bay Foundation
CBNERRS	Chesapeake Bay National Estuarine Research Reserve System
CBP	Chesapeake Bay Program
CBSM	Community-Based Social Marketing
CBWM	Chesapeake Bay Watershed Model
CCLC	Chesapeake Conservation Landscaping Council
CSN	Chesapeake Stormwater Network
CSO	Combined Sewer Overflows
CWP	Center Watershed Protection
CZM	Virginia Coastal Zone Management Program
DC	District of Columbia
DCR	Department of Conservation and Recreation
DDOE	Washington DC Department of the Environment
DDOT	Washington DC Department of Transportation
DDPR	Washington DC Department of Parks and Recreation
DEE	Virginia DEQ Department of Environmental Education
DEP	Montgomery County, MD Department of Environmental Protection
DEQ	Virginia Department of Environmental Quality
DGIF	Virginia Department of Game and Inland Fisheries
DPW	Anne Arundel County, MD Department of Public Works
E&S	Erosion and Sediment Control
EARNN	Environmental Awards for Recycling in Neighborhoods (Norfolk, VA)

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(continued)

EPA	US Environmental Protection Agency
ERP	Elizabeth River Project
HOA	Home Owners Associations
GIS	Geographic Information Systems
HRPDC	Hampton Roads Planning District Commission
JCC	James City County, VA
JCC PRIDE	James City County Protecting Resources In Delicate Environments
JCSA	James City Service Authority
JRA	James River Association
LID	Low Impact Design (stormwater management)
LRN	Lynnhaven River NOW
MAST	Maryland Assessment Scenario Tool
MD	Maryland
MDE	Maryland Department of the Environment
MS4(s)	Municipal Separate Storm Sewer System(s)
NCCCAP	North Carolina Community Conservation Assistance Program
NCR WSA	National Capital Region Watershed Stewards Academy
NEC	Norfolk Environmental Commission
NEIEN	National Environmental Information Exchange Network
NEMO	Chesapeake Network for Education of Municipal Officials
NFWF	National Fish and Wildlife Foundation
NGO(s)	Non-governmental organization(s)
NOAA	National Oceanic and Atmospheric Administration
NPDES	EPA National Pollutant Discharge Elimination System
NPS	National Pollutant System
ODU	Old Dominion University
Plant ES Natives	Plant Eastern Shore Natives Campaign
RPA	Chesapeake Bay Resource Protection Area
RFY	River Friendly Yards (City of Fredericksburg, VA)

GLOSSARY
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SAV	Submerged Aquatic Vegetation
SITES	Sustainable Sites Initiative (ASLA)
SSC	Special Stormwater Criteria (James City County, VA)
STAG	EPA State and Tribal Assistance Grant
SWCD(s)	Soil and Water Conservation District(s)
TMDL	Total Maximum Daily Load
VAST	Virginia Assessment Scenario Tool
VCE	Virginia Cooperative Extension
VDOF	Virginia Department of Forestry
VDOT	Virginia Department of Transportation
VIMS	Virginia Institute of Marine Science
VMRC	Virginia Marine Resources Commission
VoiCes	Volunteers as Chesapeake Stewards
WIP(s)	Watershed Implementation Plan(s)
WQGIT	Chesapeake Bay Program Water Quality Goal Implementation Team
WQIF	VA DCR Water Quality Implementation Fund
WQPC	Water Quality Protection Charge (stormwater utility fee Montgomery County, MD)
WQSTM	Chesapeake Bay Water Quality and Sediment Transport Model
WSA	Watershed Stewards Academy

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1 Background

In 2010, the US Environmental Protection Agency (EPA) established the Chesapeake Bay Total Maximum Daily Load (TMDL) for nitrogen, phosphorous, and sediment. The TMDL allocation was subdivided by state jurisdiction and watershed basin. Virginia further subdivided allocations into local government targets. Each state within the Chesapeake Bay Watershed developed Watershed Implementation Plans (WIPs) to identify strategies to meet the TMDL.

As part of the Urban Stormwater Strategy described in the Commonwealth's Phase II WIP, Virginia identified the following key management practices that the State and localities should implement in order to meet TMDL load allocations for existing urban areas (p. 7):

- Revise Virginia's Stormwater Management Regulations to prevent load increases from new development.
- Additional BMPs on existing pervious and impervious lands through future permits and wider adoption of stormwater utility fees or other funding mechanisms.
- Restrictions for application of non-agricultural fertilizers and voluntary reporting from "for-hire" applicators.
- Municipal/county owned non-agricultural lands receiving nutrients to develop, implement and maintain nutrient management plans.
- Golf courses implement nutrient management plans.
- Controls on certain do-it-yourself non-agricultural lawn and turf fertilizers.
- Incorporate requirements within Virginia's Stormwater Management Regulations (under revision) that redevelopment meets reductions in nutrient and sediment loads.

In addition to the WIP requirements, urbanized localities are already subject to state permits for Municipal Separate Storm Sewer Systems (MS4s) to control stormwater runoff and reduce pollutants. The Phase II WIP states that the MS4-permitted localities will be required to develop, implement, and maintain Chesapeake Bay Watershed Action Plans that are consistent with the WIP and identifies the following requirements (p. 24-5):

- The Commonwealth will utilize MS4 permits to ensure BMP implementation on existing developed lands achieves nutrient and sediment reductions equivalent to Level 2 (L2) scoping run reductions by 2025.
- Level 2 implementation equates to an average reduction of 9 percent (%) of nitrogen loads, 16% of phosphorus loads, and 20% of sediment loads from impervious regulated acres and 6% of nitrogen loads, 7.25% of phosphorus loads, and 8.75% of sediment loads beyond 2009 progress loads for pervious regulated acreage.
- Level 2 reductions are beyond urban nutrient management reductions for pervious regulated acreage.
- MS4 operators will be given three full permits cycles (15 years) to implement the necessary reductions to meet the L2 implementation levels.

Ultimately, these requirements will necessitate that localities develop, or expand regulatory and/or voluntary programs to achieve the Bay TMDL and comply with MS4 permits. Virginia's revised stormwater regulations were crafted to allow new development without increasing the

urban nutrient and sediment loads. However, most localities need to reduce existing nutrient and sediment loads to meet the WIP targets. Localities will need to implement projects on existing developed public or private property. Stormwater Best Management Practices (BMPs) that are installed after a property has been developed are called retrofits. The installation of BMPs retrofits is a challenging and potentially expensive strategy to meet the Bay TMDL requirements.

In support of Hampton Roads local government efforts to develop Phase II Watershed Implementation Plan (WIP) strategies, Wetlands Watch, Inc. conducted an investigation into the feasibility, opportunities, and constraints of utilizing BMPs for nutrient reduction on existing urban/suburban residential and light commercial private property (private property). The work was performed for the Hampton Roads Planning District Commission (HRPDC) as a subcontractor to CH2M Hill and partially funded through a grant to the HRPDC from the Virginia Coastal Zone Management Program. Within a three month period, through a series of informational interviews, meetings with stakeholders, literature searches, and an online survey, Wetlands Watch identified and assessed:

- **Model Programs** of successful voluntary and mandated private property stormwater management programs and practices, including financial incentive programs and utility credits that Hampton Roads localities can use in their efforts to comply with the Virginia WIP strategies.
- **Efforts of non-profit organizations, citizens groups, and trained stewardship programs** (non-governmental organizations (NGOs)) to increase environmental stewardship and install BMPs in the Hampton Roads Region.
- **Types of BMPs** most suitable for implementation on urban and suburban residential and small commercial properties and factors that impact the feasibility and effectiveness of these retrofit-type BMPs.
- **Advantages, disadvantages, obstacles, and unresolved issues** that impact the feasibility of achieving nutrient reductions on private property.
- **Availability, quality, and usefulness of BMP data** associated with existing NGO programs and projects in order to determine if the BMP data can be used by localities to estimate nutrient and sediment load reductions on private property.

Informational interviews, meetings, workshops, and webcasts that Wetlands Watch participated in and/or conducted are summarized in Appendix A. The model programs identified during this investigation have relied on strategic government/NGOs/private sector partnerships and utilized coordinated and collaborative strategies to:

- Reduce costs of management actions;
- Increase efficiency of management programs;
- Address multiple and overlapping issues;
- Promote environmental stewardship; and
- Facilitate, incentivize, track, and/or report BMPs on private and public property in urbanized areas within the Chesapeake Bay Watershed.

The investigation was designed to expand on work originally initiated by Wetlands Watch in Late Spring 2011 to:

1. Identify existing watershed steward activities and programs in Hampton Roads and the Chesapeake Bay Region;
2. Select a model program to emulate that would increase environmental stewardship actions including BMPs and habitat protection/restoration in Hampton Roads;
3. Identify programmatic changes and resources needed to develop new or refine existing Watershed Steward Programs; and
4. Conduct a Strategic Summit to bring interested stakeholders together in a collaborative effort to refine existing environmental steward programs and network existing programs and efforts in Hampton Roads.

Preliminary findings were presented at a Hampton Roads Watershed Roundtable Workshop on January 25, 2012, at the Virginia Zoo in Norfolk, VA. Over 50 stakeholders including local and state government representatives, Virginia Cooperative Extension agents, NGOs, interested citizens, and environmental consultants and landscape professionals attended the workshop. In addition to the presentations, the workshop included a facilitated discussion with attendees and a tour (by Zoo staff) of stormwater retrofits, living shorelines, and wetlands restoration BMPs installed at the Zoo. Comments from attendees gathered during the discussion and via follow-up communications were incorporated into the findings of this report.

With the approval of the HRPDC and the Virginia Coastal Zone Management Program, the finding will be used by Wetlands Watch and the Virginia members of the Chesapeake Bay Program (CBP) Master Watershed Stewards Action Team (Action Team) to plan a regional, facilitated Strategic Summit.

The Action Team was established by the CBP Fostering Chesapeake Stewardship Goal Implementation Team in response to the Chesapeake Executive Order 13508 goal "to expand citizen stewardship by fostering a dramatic increase in the number of citizen stewards of every age who support and carry out local conservation and restoration." The primary mission of the Action Team is to determine how to expand existing watershed stewards programs to train citizens to organize and conduct restoration in a series of priority landscapes and watersheds. The Virginia members of the Action Team include: Carl Hershner (Virginia Institute of Marine Science Center for Coastal Resource Management), Michelle Prysby (Virginia Master Naturalists), and Shereen Hughes (Wetlands Watch). David Close, Coordinator of the Virginia Master Gardeners program, also has been included in the Action Team's discussions. Specifically, the Virginia Team is tasked with:

- Summarizing programs that are currently working to engage citizens and build local stewards;
- Identifying common goals among current programs;
- Identifying gaps and needs influencing goal attainment; and
- Outlining a strategy that would increase capacity of individual groups as well as assist in meeting collective goals.

VIMS and Wetlands Watch identified an additional goal of tracking stewardship actions as BMPs that can eventually be used by localities as a nutrient and sediment reduction WIP strategy.

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2 EXISTING MODEL PROGRAMS

2.1 Introduction

A major objective of this investigation was to complete a literature review of voluntary and mandated private property stormwater management programs and practices, including financial incentive programs and utility credits. Wetlands Watch conducted a literature review and identified programs and practices that encourage, promote, and/or mandate BMPs on private property in Maryland, Virginia, and North Carolina. These existing model programs are summarized below. Links to program resources are listed in section 2.7. Some programs are city or county-scale, some are regional and multi-jurisdictional, and others are conducted at the sub-watershed scale. Whether originally initiated by local government, state agencies, NGOs and/or Soil and Water Conservation Districts (SWCDs), all programs have implementation strategies that include collaboration with other stakeholders as a means to increase environmental stewardship and the number of BMPs on private property.

While all of the programs highlighted share some common features, the roles of different stakeholders and the degree of collaboration between local government staff, contractors, technical experts, watershed groups, watershed stewards, and citizens vary. Some programs are basic ones funded by foundations, run independently of local and state government and focused on a fairly narrow set of practices. Other programs are more sophisticated and involve government funding and include a wide range of BMPs.

2.2 City or County-Wide Programs

Several examples of city or county-wide programs within the Chesapeake Bay Watershed were identified. Programs of this scale are primarily controlled by local government agencies, typically initiated by environmental divisions, and developed as planning tools to comply with MS4 permits, local TMDLs, and other regulatory requirements. By focusing on "the environment" rather than just stormwater management, localities can take a big-picture, strategic approach to address the inter-relationship of land-use decisions, environmental regulations, and watershed management. Programs in the following localities provide examples of city and county-wide approaches that can serve as model programs for the Hampton Roads: Anne Arundel County, MD; Washington, DC; Montgomery County, MD; Arlington County, VA; James City County, VA; and the City of Fredericksburg, VA(see section 2.7 for web links to program resources).

2.2.1 Anne Arundel County, Maryland

Anne Arundel County, MD, has developed a program around a series of subwatershed management and restoration plans with implementation strategies that rely on collaboration between diverse groups of stakeholders. Information regarding the Anne Arundel County program was obtained through a series of communications with Suzanne Etgen, director of the Watershed Steward Academy (WSA), and on-line sources provided in the Reference section of this document under Anne Arundel County. The three program priorities are:

1. Provide the Department of Public Works (DPW) Watershed Restoration Ecosystem and Restoration Services with implementation strategies for subwatershed management and restoration plans that address impaired waterways and MS4 permit conditions;

2. Respond to and direct local watershed groups and concerned citizens that want to take an active role in watershed restoration projects; and
3. Achieve stakeholder outreach, education, and involvement associated with the MS4 permit conditions.

The Ann Arundel County Watershed Stewards Academy 2011 Annual Report notes that DPW and the Arlington Echo Outdoor Education Center (associated with Anne Arundel County Public Schools) formed a partnership to develop WSA to "build capacity within each neighborhood" to reduce pollutants entering the local waterways. DPW provides technical support, oversight, and guidance to WSA and Watershed Stewards. The County developed and maintains an on-line reporting form and GIS system to track and map Watershed Steward activities and BMPs installed on private property. This on-line GIS reporting and tracking system can be used by any stakeholder that has installed BMPs on private property. WSA is run through the Arlington Echo Outdoor Education Center by three staff members. WSA recruits and trains community leaders as Watershed Stewards who plan, fund, and implement BMPs in their community. WSA staff:

- Manage and coordinate training programs, the Watershed Stewards and their projects, and the volunteer technical support network;
- Obtain funding;
- Maintain and provide a resource list and toolbox; and
- Ensure that projects and training are coordinated with regulatory efforts.

Watershed Stewards attend a 15-session, hands-on training program to learn how to:

- Assess watersheds,
- Develop site-specific plans,
- Educate and engage neighbors,
- Reduce pollutants and stormwater runoff,
- Coordinate and report actions,
- Fund raise, and
- Advocate and build advocacy.

The private sector is involved and engaged through:

- **The Technical Consortium**, a support network of government and private sector professionals that provide technical advice or expertise at the request of Watershed Stewards.
- **A Landscape Professionals Training Program** (through the local community college) and a resource list of recommended certified landscaping professionals, environmental consultants and suppliers (nurseries and garden centers).

DPW and Arlington Echo, a group of technical experts including the Center for Watershed Protection (CWP), and other stakeholders spent 3 years designing the program including curriculum (S. Etgen, personal communication, 2011). WSA packaged the program to share with others interested in developing a similar program; as a result, several other WSAs have formed. Most notable is the National Capital Region WSA, a collaborative partnership of several different

watershed groups that works in Washington, DC, Montgomery County, MD, and Prince Georges County, MD.

Another program that collaborates and supports the DPW/WSA effort is *Rainscaping.org*. The *Rainscaping Campaign* website is a valuable on-line resource for do-it-yourselfers as well as Watershed Stewards. The site promotes rainscaping, a term used to describe conservation landscaping and on-site, low-impact development (LID) retrofits (e.g. rain gardens, downspout disconnections, pervious pavement, etc.).

2.2.1.1 Funding and Incentives

WSA is a non-profit organization funded by a combination of Watershed Stewards certification fees, National Fish and Wildlife Foundation (NFWF) and Chesapeake Bay Trust grants, private sources, and in-kind donations. According to the 2011 annual report, administrative costs are less than 5% of the total budget and the 2012 projected funding sources include $125,000 from grants, $50,000 from private sources, and $200,000 from in-kind donations. According to NFWF files, WSA received a $500,000 NFWF grant in 2011.

The County currently does not have a stormwater utility fee. The County does offer a stormwater management tax credit to property owners that install a select group of BMPs on their property; however, conversations with Suzanne Etgen of WSA indicate that most people are unaware of the tax credit and the amount of money is not significant enough to motivate people to install BMPs and apply for a credit. A link to the County BMP tax credit form is provided in section 2.7 and in the Reference section of this document under Anne Arundel County. WSA projects are partially funded by grants; however, Watershed Stewards have to raise half the funds for their projects and recruit community members to install and maintain BMPs.

2.2.1.2 Tracking and Effectiveness

BMPs installed are tracked by the County GIS/database system and the total area of impervious surface managed by BMPs is summarized by Stormwater BMP type. According to the County's 2011 report "Anne Arundel County Storm Water National Pollutant Discharge Elimination System," the annual estimated cost to maintain and manage the BMP/MS4 database and GIS system for the next five years varies from $200,000 to $380,000.

Through WSA, DPW has found a way to increase the number of BMPs installed on private property using approved methods that can be used to comply with the Bay TMDL and MS4 permits. These BMP projects have the additional benefits of increasing citizen interest and enthusiasm to practice environmental stewardship, focusing the actions of watershed groups and Stewards in priority neighborhoods (including low income areas), and minimizing costs through the use of volunteers and trained Stewards. Between 2009 and 2011, the "Anne Arundel County Watershed Stewards Academy Annual Report 2011" notes the following successes:

- Certified 70 Watershed Stewards;
- Identified 25 new Watershed Steward candidates;
- Engaged over 700 volunteers;
- Donated over 6,500 volunteer hours;

- Planted over 6,500 native plants and trees;
- Installed over7,700 square feet of bio-retention;
- Installed over 9,200 square feet of conservation landscaping;
- Installed over 409 rain barrels; and
- Staged 338 presentations to reach 11,840 county citizens.

The Anne Arundel County WSA program was identified by the CBP Master Watershed Stewards Action Team[1] as a model program to emulate in response to the Chesapeake Executive Order 13508 goal "to expand citizen stewardship by fostering a dramatic increase in the number of citizen stewards of every age who support and carry out local conservation and restoration." More information on CPB's Fostering Chesapeake Stewardship Goal Implementation Team (GIT 5) may be found on CBP's website: www.chesapeakebay.net/groups/group/fostering_stewardship_goal_implementation_team.

Anne Arundel County provides one model approach for Hampton Roads localities to consider as a strategy to increase environmental stewardship and installation of BMPs. Several key elements of this successful collaborative program are identified below:

- The program is *organized around a watershed management and restoration plan* at the subwatershed level. This structure promotes solutions that focus on local priorities and areas of concern by neighborhood.
- *Collaboration, Partnerships, and Protocol were established* to reduce costs, increase efficiency, identify and respond to overlapping goals, ensure that BMPs are designed, installed and maintained to specifications, and track BMPs installed. In addition, Anne Arundel County has refined their method of outreach and communication and synchronized their regional messages and efforts with local community-level efforts.
- By recruiting and organizing community leaders as Watershed Stewards to work within their own communities, the program applies *community-based social marketing techniques* that rely on trusted advisors, peer pressure, and social diffusion to increase the likelihood of people to adopt new environmentally-friendly behaviors and install and maintain BMPs on private property.
- *Provide incentives and assistance* to promote the identification of site-specific areas of concern, recommend appropriate BMPs, and ensure that BMPS are dependably installed and maintained.
- *Promote state- and EPA-approved BMPs* that provide locality-specific solutions and have readily available standards and protocols for site analysis, design modifications, installation, reporting, and maintenance for urban stormwater retrofits.
- *Utilize a combination of funding mechanisms* including in-kind volunteer labor and partnerships with non-profit, grant-funded organizations.
- *Work with the private sector and support a growing market* for trained professionals and BMP supplies and suppliers.

[1] Although the Master Water Stewards Action Team became inactive during preparation of this report, Team co-chairs Julie Winters and Amy Handen intend to resume activities in mid-2012 (personal communication, 3/29/12).

- *Develop and sponsor hands-on workshops and comprehensive training programs* for local stormwater and landscape professionals, do-it-yourselfers, and Watershed Stewards.
- *Create a data management plan* to locate, track, analyze, and report select BMPs to demonstrate regulatory compliance, assess program impacts, and satisfy funding source reporting requirements.

Community-Based Social Marketing (CBSM)

This approach to behavior change grew out of a realization that simply providing information, training, and incentives on environmental issues was not sufficient to achieve broad behavior change. Canadian psychologist, Doug McKenzie-Mohr, has developed a new approach to behavior change that has gained wider acceptance in environmental outreach and education circles. "Community-based social marketing is based upon research in the social sciences that demonstrates that behavior change is most effectively achieved through initiatives delivered at the community level which focus on removing barriers to an activity while simultaneously enhancing the activities benefits," according to McKenzie-Mohr.

The CBSM approach begins by identifying specific behaviors you are seeking to change or encourage and then determining a specific set of barriers mitigating the behavior change and looking at incentives for the change you are seeking. Using this information, a specific strategy is developed to effect behavior change – a strategy that involves personal contact and reinforcement at the community level. "Personal contact is emphasized because social science research indicates that we are most likely to change our behavior in response to direct appeals from others," according to McKenzie-Mohr.

The general consensus among those working with citizens to adopt watershed-friendly behavior is that CBSM is a valuable and successful model that provides higher rates of "reasonable assurance" that water quality-enhancing behavior is taking place. Several of the programs reviewed in this report, including the Anne Arundel County Watershed Stewards Academy, *River Star Homes* by the Elizabeth River Project, *Pearl Homes* by Lynnhaven River NOW and the *Plant ES Natives Campaign* by the Virginia Coastal Zone Management Program, have been designed using CBSM principles outlined by McKenzie-Mohr.

2.2.2 Washington, DC

The Washington, DC Department of the Environment (DDOE) programs and initiatives are organized around a comprehensive sustainability plan, *Green Forward*. By including all of their sustainability efforts in one comprehensive planning effort, the District is able to identify strategies that provide multiple solutions to common problems in an ultra-urban environment. The implementation strategies for the watershed management and restoration program include the following stormwater rebate programs: *RiverSmart Homes*, *Green Roofs*, *RiverSmart Communities*, and *RiverSmart Washington*. These programs were initiated by the DDOE

Watershed Management Division to address combined sewer overflows (CSOs), impaired waters, and their MS4 permit. Program goals include:

- Reduce quantity and improve quality of stormwater runoff;
- Improve groundwater quality;
- Increase habitat diversity;
- Promote watershed stewardship; and
- Promote water conservation.

DDOE partners with certified and approved landscaping companies, local watershed and community groups, NCR WSA, stormwater consultants, DC Department of Transportation (DDOT), DC Public Schools, DC Department of Parks & Recreation (DDPR), DC Water, and *Green Up DC*. *Green Up DC* is a web-based campaign that allows property owners to track, record, and view "green" projects in the DC area. BMPs and impervious surface reduction are included in the list of "green" actions being tracked on the website.

2.2.2.1 Funding and Incentives

Funding for the DDOE programs includes a stormwater utility fee, funding from NFWF, EPA, and the American Recovery and Reinvestment Act, and the minimum 10% property owner match required for rebate funded projects. By requiring a financial commitment from the property owners, DDOE found that the owners were more invested in the maintenance and upkeep of the BMPs installed.

The *RiverSmart Homes* program is a residential incentive program which began in 2007. It was originally funded by EPA and the American Recovery and Reinvestment Act then transitioned to funding from a stormwater utility fee. The DDOE began the program with a series of demonstration home projects in each ward (area of the city), then expanded the project to a small subwatershed, Pope Branch. The pilot project targeted properties within a community with a high percentage retired, African-American homeowners. The DDOE conducted 125 audits which resulted in the installation of 100 landscape projects.

The program has since expanded, largely through word-of-mouth to other neighborhoods and includes a range of socio-economic participation. With *RiverSmart Homes*, the City will fund up to $1200 worth of landscaping services for shade trees, pervious pavers, rain barrels, rain gardens, and bayscaping (conservation landscaping with native plants). Through an online application process, homeowners request a site visit and stormwater audit. DDOE staff visit the site, conduct the stormwater site audit, and make a series of recommendations to the homeowner. The homeowner then selects actions from the DDOE recommendations to install. Homeowners agree to an inspection by DDOE after the landscaping work is completed and must pay for approximately 10% of the landscaping cost. DDOE has partnered with local contractors, local watershed groups, and some non-profit partners including DC Greenworks, NCR WSA, and the Alliance for the Chesapeake Bay to install landscaping BMPs.

Approved landscape contractors must attend a one-day training to become eligible to install the *RiverSmart* landscapes (bayscaping and rain gardens). Training is free, offered each fall and spring, and includes a classroom session and a hands-on component where participants assist with a rain garden installation at a *RiverSmart Homes* site. Curriculum includes the goals and purpose of *RiverSmart Homes*, design and placement of gardens, and administrative

requirements. *RiverSmart Communities* is a program similar to *RiverSmart Homes*, but is geared towards multi-family residential, small businesses, and houses of worship.

The *RiverSmart Washington* program is focused on green streets stormwater retrofit projects and supported by NFWF grant funds. It is a partnership between government agencies, NGOs, and the private sector led by DDOE, DDOT, DC Public Schools, DPR, Rock Creek Conservancy, Casey Trees, LimnoTech, Inc., and DC Water. This program is based on the "green build out model" developed by Casey Trees and LimnoTech. DDOE and Rock Creek Conservancy are recruiting homeowners and business owners in two specific sewersheds to install on-site LID retrofits. DDOE also is working with DC Public Schools and DPR to install on-site LID retrofits and green roofs on public properties and DDOT is addressing stormwater management, traffic calming measures, and community character by installing streetscaping and other green street retrofits. Homeowners and businesses who participate must use qualified contractors that are supervised by the Rock Creek Conservancy and can receive up to $5,000 in rebates for approved work. Storm sewer flows are monitored to collect data on flow reduction associated with green street retrofits. According to NFWF files, the City received a NFWF grant for $800,000 and provided $2,412,500 in matching funds.

The *Green Roof* rebate program is co-managed by Anacostia Watershed Society (AWS) and DDOE. Through this program, private property owners can receive $5 per square foot of "new vegetated green roof" installed. Applications are submitted to AWS, which coordinates the review and approval process. Upon approval of the project, property owners are given 10% of the rebate money. Once AWS verifies installation of the green roof and DDOE inspects the roof, property owners receive the remaining 90% of the rebate. The recipients agree to make the roof available for inspections and for public access as a demonstration project. Recipients of the rebates also sign an agreement to maintain the roof .The *Green Roof* rebate program is administered by the AWS with funds from the Anacostia River Cleanup and Protection Act of 2009 ("DC Bag Law") and the Stormwater Enterprise Fund.

2.2.2.2 Tracking and Effectiveness

DDOE tracks BMPs and controls the quality of BMP design, installation, and maintenance through involvement in site visits, audits, BMP recommendations and inspections, the use of preferred trained landscapers and Watershed Stewards, and requiring a signed maintenance agreement with property owners.

Through the web-based sustainability initiative *Green Up DC,* green energy and impervious surface reduction projects can be reported, tracked and viewed online. The site allows property owners in the District to plan projects, view existing projects, and access resources and information. The following program statistics were posted on this website on May 10, 2012:

Project Type	Number of Projects	Impervious Surface Treated (sq ft)
Green Roofs	2	204
Rain Barrels/Cisterns	1194	155,185
Bayscaping	210	2486
Permeable Pavement	44	1300
Rain Gardens	113	13,599
Tree Planting	919	155,185

For the *RiverSmart Homes* program, a 2010 summary of results noted 320 homeowners on the waiting list for rain gardens and bayscaping, demonstrating the success of program outreach and awareness efforts.

According to a 2010 video, *RiverStar Homes: Getting Smart About Runoff in Washington, DC*, the City has derived a number of benefits from the *RiverStar Homes* program:

- The site audits allow DDOE staff to interact with homeowners, educate and engage citizens about problems caused by stormwater, and empower citizens to be "green" through action on their own property.
- The program format makes it easy and cost-effective for property owners to install landscape-scale stormwater retrofits and circumvents design and installation problems encountered as a result of poorly informed citizenry.
- The program helps to build ownership of landscape-scale solutions and circumvents maintenance issues by requiring a 10% property owner contribution and inspection/maintenance agreements.
- The City may be able to avoid the cost of new stormwater infrastructure by increasing the number of landscape scale stormwater retrofits on private property.

Resources for the above information can be accessed through the links provided in section 2.7 and in the References section of this report under Washington, DC.

2.2.3 Montgomery County, Maryland

The Watershed Management Division of the Montgomery County Department of Environmental Protection (DEP) is responsible for developing, implementing, and measuring the effectiveness of a watershed management plan. The plan and monitoring strategies were primarily developed to comply with the County MS4 permit; but also addresses community priorities and goals. The *Rainscapes* program is one example of a County-implemented strategy that addresses community priorities and MS4 permit compliance. The Montgomery County program began in 2004 and is one of the longest running local government programs within the Chesapeake Bay watershed. It has served as a model for other programs like the DC *RiverSmart* program and has incorporated lessons learned since its inception. Montgomery County, MD has been an early adopter of many sustainable urban growth tools including adoption of ordinances and policies that encourage and sometimes require green building and better site design.

The *Rainscapes* program is run by the County DEP and began as a grant funded effort in 2004 to increase stakeholder involvement and provide outreach about landscaping BMPs and watershed-friendly behavior. The program promotes BMPs that reduce the volume of stormwater runoff and result in measurable water quality benefits. The *Rainscapes* program was developed through a collaborative effort to respond to community concerns and includes components called *Rainscapes Rewards* and *Rainscapes Neighborhoods*.

The *Rainscapes Rewards* program addresses on-site, residential BMPs. The *Rainscapes Neighborhoods* program works with well-organized neighborhoods in specific high priority areas of a subwatershed to encourage 30% of private property owners to install on-site LID retrofits and conservation landscaping.

2.2.3.1 Funding and Incentives

As a result of the lobbying efforts of local watershed groups, the County established an incentive program in 2006 involving rebates for approved BMPs. The program is funded, in part, by the Water Quality Protection Charge (WQPC) collected as part of property taxes. The charge is based on the amount of impervious surface of a property.

The qualifying protocol for a *Rainscapes* project rebate requires the property owner to:

- Submit an application for review and approval by DEP prior to construction;
- Allow project inspection upon completion;
- Submit all invoices and receipts to staff; and
- Sign a Property Owner Agreement form that acknowledges that the owner is responsible for ongoing maintenance and allows County access for inspection every five years.

BMPs that are eligible for rebates include urban tree canopy, permeable pavement, impervious surface removal, rain barrels, cisterns, rain gardens, conservation landscaping, green roofs, and dry wells. The total rebate available is $1,200 for residential and $5,000 for commercial/institutional/multi-family projects. In addition to rebates, the County offers technical assistance.

The County has professional landscapers training and certification program which they intend to expand through the community college system. According to Ann English of the *Rainscapes* program, the County has also recently started working with NCR WSA (personal communication, April 16, 2012).

2.2.3.2 Tracking and Effectiveness

The County is developing a web-based database and GIS system to track BMPs installed on private property, as well as the expansion of the landscaper certification and training program. The County is considering additional cost-share mechanisms to expand the list of acceptable BMPs to respond to a demand for driveway retrofit projects.

According to a report by ECONorthwest (2011) on green infrastructure, identifies the following successes of the *RainScapes* program:

- Planted 315 trees;
- Installed 180 rain barrels;
- Installed 42 rain gardens;
- Installed 50 conservation landscaping projects;
- Installed 11 permeable pavement projects;
- Installed 3 dry wells;
- Installed 10 cisterns; and
- Installed 2 green roofs.

ECONorthwest estimates that the above projects have resulted in stormwater runoff reductions of 1.9 to 3.5 million gallons per year.

In 2011, the DEP prepared a detailed summary of the *Rainscapes* program including difficulties encountered during the development and implementation of the program, how the program has evolved over time, and planned improvements to the program (see Appendix B). Resources for the above information are provided in section 2.7 and in the References section of this report under Montgomery County.

2.2.4 James City County, Virginia

As a result of the building boom, which began in the 1990s, that transformed approximately half of the land from rural to urban/suburban and the designation of the entire county as a Chesapeake Bay Protection Area, JCC developed land-use and environmental policies, ordinances, and plans to control and direct growth, protect the area's cultural and natural character, address stormwater management, and protect natural resources. The first comprehensive watershed plan completed in 2001, the Powhatan Creek Watershed Plan, identified a need for the County to increase environmental stewardship through outreach, education and engagement of citizens (CWP, 2001).

In 2002, the County established *Protecting Resources In Delicate Environments* (PRIDE). Now known as JCC PRIDE, the program began as a jointly-funded effort between the Department of Development Management's Environmental Division (now known as Engineering & Resource Protection) and the James City Service Authority (JCSA). Currently, the County's General Services Department, Stormwater Division is the lead and the Engineering and Resource Protection and Planning Divisions, together with JCSA, collaborate on mutually beneficial projects and programs. JCC PRIDE is now in transition as the County takes steps to move all environmental education efforts under the JCC PRIDE umbrella. The primary program focus continues to be watershed protection employing eight education tools that can be used by citizens and civic organizations:

1. Land use planning;
2. Land conservation;
3. Aquatic buffers;
4. Better site design;
5. Erosion and sediment control;
6. Stormwater treatment practices;
7. Non-stormwater discharges; and
8. Watershed stewardship programs.

JCC PRIDE helped the local Master Gardeners develop and run a Master Water Stewards program (wherein Master Gardeners receive additional training to be certified as Master Water Stewards) and continues to offer workshops for local citizens and landscape professionals.

2.2.4.1 Funding and Incentives

Through workshops, demonstration and grant projects, a mini-grant program, and media promotions, the JCC PRIDE program informs and engages citizens on critical watershed issues

and best management practices. JCC PRIDE has partnered with a number of non-profit local and regional watershed organizations in a number of demonstration projects on County property, on private residential property, and on local business and church properties throughout the county. Past partners include the following entities: Williamsburg Land Conservancy; Chesapeake Bay Foundation (CBF); James River Association; Friends of Powhatan Creek; Alliance for the Chesapeake Bay; CWP; Virginia Cooperative Extension (VCE); Master Gardeners; local youth groups; private property owners; private consultants and suppliers; Colonial SWCD; and others.

In 2006-07, JCC partnered with the Colonial SWCD and local neighborhood homeowners associations (HOAs) on a $200,000, DCR- and NFWF-funded grant project entitled "Community Conservation Partnership." The project targeted priority communities identified by county staff. The Colonial SWCD and JCC staff conducted audits and developed a series of recommended BMPs; community members and businesses were recruited to assist with BMP installations. Matching grant fund sources include JCC PRIDE mini-grants, volunteer labor, and in-kind donations. The types of projects included stormwater pond upgrades, stormwater retrofits in VDOT right-of-ways, buffer planting, tree planting, wetlands planting, and stream bank stabilization projects. HOAs signed required BMP maintenance agreements that included the following conditions:

- Maintain the project with 2" mulch;
- Plant material must be properly maintained; dead plants are to be replaced with consistently sized and specified plants;
- Maintain projects for 5 years;
- Keep stormwater inlets free of mulch and plant debris;
- No heavy equipment allowed in landscaped area;
- Additional plantings or expansion must be pre-approved by SWCD; and
- Soil amendments (lime or fertilizers) must be applied in accordance with state specifications.

Turf Love is a Virginia Cooperative Extension -run nutrient and turf/lawn management program that promotes environmentally responsible lawn care and techniques and turf varieties to reduce water use. Program participation is typically required as a condition of approval for new development. A nutrient management planner assesses the property, collects soil samples analyzed by Virginia Tech, develops a nutrient and turf management plan, and educates property owners on lawn care to reduce nutrients, maintain a healthy permeable lawn, and reduce water use. The program is promoted by JCC PRIDE and JCSA and is funded by the participants, JCSA, and the County. *Turf Love* employees are VCE-staff and are certified as nutrient management planners through the VA DCR program. Initial funding for the program was $40,000/year; however, in the past several years funding has declined despite the increase in demand for program services.

The Stormwater Division recently received a $75,000, 15-month NFWF grant to begin a *Garden Love* program which is an extension of the *Turf Love* program. *Garden Love*, a partnership between the County, VCE, and the local Master Gardeners, is an incentive and assistance program that promotes and funds the installation of rain gardens on private property. With the grant money and $63,000 in matching funds, the program hopes to install 60 rain gardens and increase the number of nutrient management plans to 300. JCC PRIDE expects this program to

continue beyond the NFWF grant period with County funding. Participants sign a maintenance agreement for a period of 5 years, with follow up inspections by County Stormwater Division staff. Rain garden locations will be tracked through the County's existing BMP tracking procedures.

JCSA runs the *Be Water Smart* rebate program that promotes reduced water use and offers rebates of $25 for rain barrels, up to $700 for cisterns, and $150 to $250 for professionally designed "water smart" landscaping.

Other activities and partnerships include are summarized below:

- The Williamsburg Land Conservancy recruited private property owners to place 900 acres of land into Conservancy-owned and managed conservation easements.
- A JCC Parks and Recreation Department implemented a living shoreline project funded by a $100,000 Chesapeake Bay Trust grant. The project was designed in house and permitting was secured by County staff. CBF staff and volunteers from the community assisted with the project installation. The restoration effort was identified in the 2009 Shaping Our Shores master plan developed for the County's property fronting the James River.

2.2.4.2 Tracking and Effectiveness

According to County files, the SWCD and JCC PRIDE Community Conservation Partnership resulted in the following:

- Installation of 5 filtration practices that treat stormwater runoff from 10 acres;
- Installation of 6 infiltration practices that treat stormwater runoff from 13 acres; and
- Installation of erosion & sediment control projects that manage 4 acres.

In addition, the project resulted in the education and engagement of citizens from several different neighborhoods throughout the County.

Turf Love staff report the number of nutrient management plans written on a quarterly basis to JCC and on an annual basis to DCR. *Turf Love* reports the following successes with nutrient and turf management on private property (2006-present):

- Completion of 150 to 250 nutrient management plans per year, primarily on residential properties, totaling 1594 plans to date;
- A total of 811 acres under nutrient management, including 8 golf courses and 44 acres of common land in 2 subdivisions; and
- Results of follow-up surveys with participants show high compliance rates with the nutrient management plans.

JCSA keeps detailed records about the rain barrels and cisterns installed on private property through the rebate program. Since the program started in 2008, citizens have received rebates for 991 rain barrels and 4 cisterns with a total capacity of 136,578 gallons. Although several citizens have applied for the *Be Water Smar*t landscaping rebate, no one has met the qualifications to receive a rebate. However, many citizens that received rain barrel rebates indicated an interest in installing other types of BMP retrofits on their properties. This

information provides JCC staff the opportunity to contact these homeowners to identify those who have already installed additional measures, as well as owners who may be interested in installing additional BMPs if given enough incentive or assistance.

JCC engineering staff reports that landscape consultants for private property projects involving RPA or wetlands disturbances have begun to design plans that are more environmentally sensitive and minimize disturbances. Staff feels that this can be attributed to JCC PRIDE activities as well as County ordinances and policies.

JCC information resources for this report include county files and on-line documents and interviews with staff of the JCC Engineering and Resource Protection and Stormwater Divisions, JCSA, Colonial SWCD, a local Cooperative Extension agent, Master Gardeners, and members of the Friends of Powhatan Creek (a local watershed group).[2] Information links are provided in the James City County Reference section of this document.

2.2.5 Arlington County, VA

Arlington County, VA, Department of Environmental Services and Arlingtonians for a Clean Environment (ACE) have many inter-related green-building and stormwater management policies, programs and strategies to incentivize and increase "green" practices and stormwater retrofits on public and private property. Over 60% of the County is covered by impervious surfaces and much of the County was developed without stormwater facilities to capture and treat stormwater.

ACE is a NGO that was founded by, and is primarily funded by the Department of Public Works as an outreach, education, and involvement organization. It also raises funds as a non-profit group. ACE serves as the gate keeper of County environmental stewardship programs. The organization manages and promotes environmental stewardship and sustainable living (green practices) initiatives including: a litter control program; tree planting program; wild-life habitat certification program; the *Livable Neighborhoods Water Stewardship Program*; and *StormwaterWise Landscapes* (a new incentive program).

Arlington also runs workshops for professional landscaping companies. The County is currently working with CWP to develop stormwater retrofits plans, including green streets retrofits, for all the subwatersheds in Arlington.

2.2.5.1 Funding and Incentives

The County funds stormwater and watershed management primarily through two funding mechanisms. In 2008, the County established the Arlington Sanitary District and began collecting the Arlington Sanitary District Tax, which taxes property owners 1.3 cents per $100 of the assessed value of a property. The tax dollars collected ($5 to $7 million dollars per year) are placed in a stormwater management fund that funds the stormwater management program. In addition, the County established a Watershed Management Fund that collects fees from developers in lieu of BMP implementation when implementation is not feasible.

[2] Shereen Hughes of Wetlands Watch, primary author of this report, has personal knowledge and experience gained as a JCC Planning Commissioner, and member of the 2010 Comprehensive Plan Update, Green Building and BSD Implementation Committees.

Approximately $2.98 million in EPA State and Tribal Assistance Grants (STAG) distributed by the Virginia Department of Environmental Quality from 2004 to 2011 provide another source of funds for Arlington. The STAG grants are being used by Arlington and the City of Alexandria to implement the Four Mile Run Restoration Master Plan (Arlington County Board Agenda Item for Meeting of June 11, 2011).

The County's incentive programs to increase stormwater retrofits and watershed restoration BMPs on private property include the following: tree planting program; environmental stewardship training program (*Livable Neighborhood Water Stewards*); and the *StormwaterWise Landscapes* Program. The tree planting program provides grants to community groups to plant trees and contracts local companies to plant the trees. The *Livable Neighborhoods Water Stewardship Program* is a national program developed by the Empowerment Institute as a community outreach, education, and involvement tool for localities with Phase II MS4 permits. The program uses community-based social marketing techniques to recruit and train community leaders to organize residents to conduct home audits. Audits identify opportunities to adopt watershed-friendly habits, implement BMPs, and reduce water use with simple lifestyle changes. The program, now called the Water Stewardship Team program, is a partnership between ACE, Fairfax County, the City of Falls Church, the City of Alexandria and the Northern Virginia SWCD.

StormwaterWise Landscapes is a new Department of Environmental Services/ACE partnership that will partially fund on-site LID retrofits on 40 private residential or business properties. County staff will perform stormwater audits and provide property owners with guidance on recommended practices maps showing existing site conditions and recommended BMPs, and a list of contractors. Once property owners have installed at least one recommended practice, they must arrange for an inspection to be performed by County staff. Once notified of project approval, property owners submit receipts to ACE for grant disbursements. Property owners must agree to maintain the practice installed and will be featured in a case study (McDonnell and Jolicoeur, 2012).

BMPs available for reimbursement of 50% of the project cost include: cisterns; conservation landscapes (conversion of lawn or non-native invasive plantings to native plantings); green roofs; infiltration trenches and dry wells; pervious pavers or concrete for driveway, walkway, and patio installations; removal of impervious pavement; and rain gardens. The size of the conservation landscape, green roof, or pervious pavement projects must be a minimum of 150 square feet. The total amount of reimbursement depends on the type of practice installed and ranges from $500 to $1000 per practice.

Christin Jolicoeur, a watershed planner with Arlington County, indicated that *StormwaterWise Landscapes* is an MS4-related education and outreach program that is funded through the Arlington County Watershed Management Fund (personal communication, March 15, 2012). The Watershed Management Fund receives fees that are paid in lieu of on-site stormwater management during development/redevelopment activities. Education and outreach, along with BMP implementation, are considered acceptable uses of Watershed Management Fund monies.

2.2.5.2 Tracking and Effectiveness

While the BMPs promoted through the *StormwaterWise Landscapes* program could be used to achieve credit for the Chesapeake Bay TMDL, Arlington is treating the program as an outreach, education, and engagement activity for the MS4 permit.

With respect to the *Livable Neighborhoods Water Stewardship Program*, the ACE website reports the following successes since the program began in 2003:

- Over 250 households and 41 neighborhood teams have taken over 1000 new actions to protect water quality and conserve water.
- Program participants reduced water usage by a total of more than 3.4 million gallons per year.
- Each participating household adopted an average of 8 new actions. The most popular actions include: reducing use of toxic cleaners, finding and repairing water leaks, reducing water use during teeth brushing and dishwashing, and installing rain barrels.

Several stakeholders interviewed noted that the County felt that the *Livable Neighborhoods* program has reached a market saturation point and additional programs were needed to achieve more on-site retrofits; the *StormwaterWise Landscapes* Program is a response to fill that need.

2.2.6 City of Fredericksburg

The City of Fredericksburg has recently initiated a lawn management program in coordination with the Rappahannock River Basin Commission. The program is being managed and coordinated by Conserv (an NGO) and other partners including the Friends of the Rappahannock, The National Wildlife Federation, George Washington University Landscape Design Department, and Bio Green (a private corporation).

Kevin Utt, site development manager for the City, describes the *River Friendly Yards* (RYF) program as "an environmental incentives program to stimulate conversion of existing conventional lawn to '*River Friendly Yards*'" (personal communication, April 21, 2012). RFY landscapes are composed of elements that reduce nutrient loads to nearby streams. Program benefits to residents include homeowner technical assistance, participant recognition, financial incentives, education and outreach. An interesting aspect of the RFY program is the effort to develop tools and training to involve the private sector in installation and tracking of landscaping BMPs on private property.

The program is a multiyear effort that will provide environmental, community, and economic benefits. Program activities include the development of criteria for lawn-to-RFY conversion, quantification of pollutant reductions from RFY conversion, creation of a program monitoring system, development of examples of conversion levels and associated costs, and economic impact analysis. Opportunities for job creation and new income associated with RFY conversions will also be identified. The program will also examine the feasibility of an RFY Virginia nutrient credit to meet emerging TMDL implementation. Additional information is available on the program website: www.riverfriendlyyard.com.

2.3 Non-Profit Model Programs

Non-profit NGOs spearhead numerous independent programs to increase environmental stewardship and increase the number of BMPs on private property. NGO programs represent an under-recognized and unreported suite of BMPs that could be used toward achieving MS4 permit and Chesapeake Bay TMDL compliance. This section describes non-profit model programs that are run by NGOs and are funded by foundation sources with in-kind contributions from members, landowners, businesses, and local governments (see section 2.7 for web links to program resources).

The Nature Conservancy, Center for Watershed Protection (CWP), Chesapeake Bay Foundation (CBF), and the Alliance for the Chesapeake Bay (ACB) are examples of large organizations that have partnered with local organizations and groups. These NGOs have numerous grant projects and/or government contracts and local offices in Virginia. The James River Association (JRA) is an example of a regional, river-specific NGO in Virginia that has initiated watershed restoration projects in Hampton Roads. The Elizabeth River Project (ERP) and Lynnhaven River NOW (LRN) are examples of local, river-specific watershed organizations. ERP and LRN use award-winning techniques and programs to improve water quality, reduce stormwater runoff, protect and restore habitat, and increase environmental stewardship in their watersheds. There are many grant-funded projects designed and implemented by local environmental and watershed groups. Examples of projects with the most comprehensive programs are described below.

2.3.1 Elizabeth River Project

The Elizabeth River Watershed includes four localities: Norfolk, Chesapeake, Portsmouth, and Virginia Beach. The Elizabeth River Project is headquartered in Portsmouth, VA and, according to the organization's website, has been working for almost 20 years "to restore the Elizabeth River to the highest practical level of environmental quality through government, business and community partnerships." The most recent watershed action plan, "A River of the Future," was developed through a 100-stakeholder collaborative process and identifies 7 priority actions and an implementation strategy to achieve those goals.

2.3.1.1 Funding and Incentives

ERP has used large government grants and funding from a variety of other sources to conduct studies, implement strategies, install and maintain BMP demonstration projects, and educate and engage a wide range of stakeholders. Some major ERP projects include: Money Point in Chesapeake, Paradise Creek and Paradise Creek Nature Park in Portsmouth, and the Lafayette River Restoration project in Norfolk.

For the Paradise Creek Nature Park, ERP initially raised $1.4 million to buy the property and has raised $12 million to date. Virginia DCR, the City of Portsmouth, Virginia Land Conservation Foundation, and the Virginia Port Authority have contributed $500,000 or more to the park project. CSX Corporation, EPA (Targeted Watershed Initiative Grant), NFWF, The Virginian-Pilot, TowneBank Foundation, and Virginia DCR (Virginia Recreation Trails Grant) have contributed $100,000 to $499,000 to the project. A number of other foundations, organizations, local businesses and private individuals also have contributed funds.

Another funding mechanism used by ERP is the *Living River Restoration Trust* mitigation program established in 2004 as a partnership between ERP and the U.S. Army Corps of

Engineers. The program receives mitigation funds from the U.S. Army Corp of Engineers and, according to the Trust website, www.livingrivertrust.org, program funds are expended as follows:

> *[F]unds are used to offset impacts that cannot be avoided by achieving as many benefits as possible to the Elizabeth River ecosystem. Currently, funds primarily are expended for projects that clean up contaminated river bottom. This compensates off-site for harm to healthy river bottom when permittees conduct new dredging or filling projects for which government agencies require mitigation…and this innovative funding mechanism is the first of its kind in the United States.*

Through the *River Star Businesses* program, ERP works with local businesses and industry, local government, federal facilities, and public and private institutions to identify areas of concern, develop restoration plans, and install and maintain BMPs. Since the program began in 1997, ERP has recruited almost 100 participant businesses to voluntarily restore tidal wetlands, install native plant buffers and living shorelines, and install pollution control measures. ERP staff partnered with local environmental consulting firms (Bay Environmental and Williamsburg Environmental Group) to develop and implement restoration projects. ERP has an annual award meeting that recognizes the contributions and actions of these local *River Star Businesses.*

The *River Star Homes* is an ERP residential program that recruits homeowners to commit to a minimum of "7 easy steps" that provide a solution to pollutants of concern within the watershed: Scoop the poop; reduce fertilizers on lawns; don't feed the geese; use boat pump out facilities; don't flush medicines or grease down the drains, and protect storm drains from grass clippings, leaves, and oil. Although available to the entire watershed, ERP has a NFWF grant for a *River Star Homes* pilot project in the Lafayette River subwatershed.

2.3.1.2 Tracking and Effectiveness

ERP maintains a cumulative annual summary of actions taken and pollution reduced by *River Star Businesses* and in 2011 reported the following:

- Conservation and/or restoration of 92.82 acres of habitat ("habitat" includes wetlands, buffer planting, rain gardens, forested areas, butterfly gardens, and pond buffers);
- Prevention of 11.89 million pounds of hazardous waste and sediment pollution;
- Prevention of 222 million pounds of trash and debris-type pollution; and
- Installation of 25,340 plants.

More information about ERP is available on the website: www.elizabethriver.org.

2.3.2 Lafayette River Restoration

The Lafayette River Restoration project is a model partnership between ERP and CBF that demonstrates coordinated strategies to increase environmental stewardship and increase BMPs on private property. In 2009, the two partners began to co-organize and co-direct the Lafayette River Steering Committee, which the ERP website describes as a "group of over 100 stakeholders representing science, government, business and citizen interests". The Committee goals and strategies were identified by consensus and are summarized in the Lafayette River Restoration Plan. The primary goal of the plan is to reduce bacteria and nutrient levels in the

River to allow safe swimming, limited harvesting of oysters by 2014, and open harvesting of oysters by 2020. Different organizations, institutions, private consultants, businesses, and citizens have assumed project responsibilities most suited to their abilities and missions. CBF and ERP coordinate project efforts, identify opportunities for collaboration, track overall progress, and recommend project improvements when needed. CBF's contributions have included:

- Oyster restoration projects using innovative techniques;
- Recruiting and training citizens to be environmental stewards and advocates through oyster gardening workshops, the VoiCeS stewardship program, and educational field trips; and
- Technical and managerial expertise of local and organization-wide staff.

ERP provides technical and managerial expertise for the project and a local motivational force that engages citizens, organizations, businesses, and government through projects and the *River Star* programs.

2.3.2.1 Funding and Incentives

Funding sources for the Lafayette River Restoration project include the *Living River Restoration Trust* mitigation program, grants from NFWF, Virginia DCR, and EPA, and donations from ERP members, the United Way, Lowes, and other sources. Part of the funding for the Lafayette River Restoration effort was a $135,000 NFWF grant obtained by CBF to reduce nutrient, sediment, and bacteria pollution. According to files provided by NFWF, ERP received a $300,000 NFWF grant in 2011 to work with a social marketing expert (Dr. Doug McKenzie-Mohr), the City of Norfolk, and the Hampton Roads Sanitation District to develop *River Star Homes* into an effective model for fostering citizen behaviors that reduce nutrients and sediments. Virginia DCR has also been a major contributor of matching funds and staff time. ERP and CBF have been able to leverage all of the funding sources with public investment in stormwater and wastewater treatment plant upgrades by the City of Norfolk and the Hampton Roads Sanitation District. ERP and CBF have also partnered with marinas, schools, *River Star Businesses*, the Hermitage Museum, Lafayette Wetlands Partnership, Old Dominion University, the Virginia Zoo, civic leagues, and many other organizations to implement the Lafayette River Restoration Plan and engage and educate stakeholders.

Incentive programs developed by ERP include: *River Star Homes, River Star Schools,* and *River Star Businesses.* The *River Star Businesses* program recognizes and promotes participating businesses at an awards ceremony and on the ERP website. *River Star Schools* that meet the program's Model Level are awarded a trophy, certificates, and a school banner for serving more than "one year in the program, implementing extraordinary projects and mentoring and/or taking projects out of the classroom and into the community," according to ERP's summary "2010-2011 Achievements, River Star Schools & Youth Organizations." The *River Star Homes* participants receive a front-yard flag that promotes the property as a program participant, helpful tips on how to do more, and invitations to outdoor events and workshops. Currently, ERP staff and an organic lawn specialist are visiting *River Star Homes* in the Lafayette Watershed to test soil and develop organic urban nutrient management plans to reduce fertilizer use by 50%. ERP staff are considering other incentives such as providing $50 rebates to homeowners who install 132 gallon rain barrels and holding rain garden block parties.

The City of Norfolk has a number of incentive programs that could be used to promote and partially fund BMPs on private property including *Celebrate Trees,* a tree planting program, $65 dollar rain barrel-making workshops, and *Keep Norfolk Beautiful*. *Keep Norfolk Beautiful* is a program of the Norfolk Environmental Commission (NEC), a non-profit organization and a branch of the City of Norfolk Department of Public Works that manages an environmental rewards program for civic leagues in the City of Norfolk. Through a rewards program called *Environmental Awards for Recycling in Neighborhoods* (EARNN), civic leagues can earn cash rewards for stormwater management efforts and distributing stewardship information. In 2011, 25 civic leagues were enrolled in the program. In addition, the City co-sponsors *Riverfest*, an annual festival that promotes environmental stewardship, restoration efforts, and progress in the Lafayette River watershed.

2.3.2.2 Tracking and Effectiveness

Reporting and tracking data for BMPs installed on private property in the Elizabeth River Watershed varies depending on the grant funder's requirements and the NGO. There is a need for standardizing the reporting format, reporting interval, and type of data tracked and reported on BMPs installed through voluntary programs. NFWF records, online ERP reports, and the Lafayette Wetlands Partnership were reviewed during the preparation of this report. ERP also has been the recipient of Virginia DCR Water Quality Implementation Fund (WQIF) grants. Data for BMPs installed using WQIF funds are tracked and reported to DCR using the "Attachment D – NPS Best Management Practices Pollution Reduction Tracking Data Form."

The NFWF report for CBF's grant lists the following successes:

- Planted 125 urban trees;
- Created habitat for 30,000 oysters;
- Installed 20 stormwater runoff filtration systems;
- Installed 2 floating wetlands;
- Installed 3 rain gardens; and
- Installed a 0.5-acre living shoreline.

According to discussions with ERP staff, BMPs were installed at the Virginia Zoo, on City of Norfolk and ODU property as demonstration projects, and within the river or on private waterfront property.

The Virginia Zoo in Norfolk and The Hermitage Museum are just two examples of collaborative projects within the *River Star Businesses* program. Bay Environmental, ERP, CBF, Lafayette Wetlands Partnership, the City of Norfolk, Master Gardeners, Zoo Staff, and many others collaborated on a series of grant-funded projects to install several demonstration projects including wetlands restorations, rain gardens, green roofs, rain barrels, and a floating wetland at the Virginia Zoo. ERP, CBF, NOAA, Hermitage staff and many volunteers installed a living shoreline, native buffer plantings, and native plant demonstration gardens throughout the Museum grounds.

At last count, ERP had 695 private property owners sign up to become *River Star Homes*. ERP then conducted a survey to identify homeowners interested in adopting other BMPs in addition to the "7 easy steps". ERP has contracted out the lawn assessment/plans to an independent

contractor who specializes in organic lawn care and nutrient management. One private property owner has agreed to cease mowing wetlands in their backyard and signed a letter of commitment to preserve the wetlands with the Norfolk Environmental Division. Project analyses performed and guidance provided by Dr. McKenzie-Mohr will provide valuable information relevant to Hampton Roads that other localities and NGOs can use when planning future programs.

The Lafayette Wetlands Partnership is another local NGO collaborator that restores tidal wetlands in the Lafayette watershed. The Partnership has restored 29,000 square feet of wetlands and buffers and installed 1 rain garden. For one wetlands restoration project, the group worked with the local jails and used the prisoner road crews for volunteer labor. According to a member of the Partnership, many prisoners left with a sense of pride in their work and sense of environmental stewardship.

The Lafayette River Restoration collaboration is a uniquely unified effort that has resulted in many different stakeholders working together and individually to improve water quality in a subwatershed of the Elizabeth River. The participation and feedback from various stakeholders in the restoration plan implementation process allows for the identification of successful strategies and opportunities for improvement. However, stakeholders have reported some difficulties with inter-agency and partnership communication, public relations, and the maintenance of BMPs. For example, the Lafayette Wetlands Partnership successfully collaborated with the Norfolk Environmental Division on project planning and permitting wetlands projects funded and restored by the Partnership. However, on one completed projected, another City department later ruined the restored wetlands during routine infrastructure maintenance and upgrades.

ERP noted that their organization needs to remind private property owners on a regular basis to continue water-friendly lawn care and rain garden maintenance. ERP staff also voiced a concern that rain gardens, while popular, may not be appropriate in all urban settings. The Zoo has noted that while the design and installation of bioremediation projects like rain gardens are popular volunteer demonstration projects with Master Gardeners and other local groups, rain garden maintenance projects are not popular. After recognizing that demonstration bioretention projects on public property were not being maintained by city crews, ERP hired a private landscaping company to provide BMP maintenance. In addition, the Zoo staff has experienced some challenges with the floating wetlands including attracting geese, unattractive appearance of wetlands in winter months, and rusting and failure of hardware that caused the wetland to break into smaller islands. With an understanding that the floating wetlands are experimental, staff is working to identify design modifications and other manufactured products that might correct the problems.

2.3.3 Lynnhaven River NOW and the City of Virginia Beach

According to the Lynnhaven River NOW (LRN) website, a group of concerned and influential citizens formed the organization in 2003 in order to "foster partnerships that would apply public and private resources to the challenge of reducing pollution in the Lynnhaven…That core group formed the nucleus of what has grown into an award winning river restoration project with over 3,000 members called Lynnhaven River NOW." The Lynnhaven River watershed restoration plan includes the following objectives:

- Identify and reduce sources of pollutants including nutrients, sediments, bacteria and other chemicals;

- Educate and engage the community and partner organizations in the river restoration and protection; and
- Restore habitats including oyster reefs, salt marshes, and other buffers.

Like ERP, LRN has dedicated in-house staff as well as several committees made up of community leaders and technical experts. LRN has the following committees: Clean Boating and Clean Marinas; Education; Executive Program; Landscape Practices; Oyster Restoration; PR and Marketing; Public Policy; Stewardship and Access; and Wetland. Each committee identifies critical issues and potential solutions, establishes guidelines, and recommends programmatic strategies and actions.

LRN has influenced and helped to transform City of Virginia Beach land-use planning and policy and environmental planning, policy, and enforcement. The City has taken a proactive approach by establishing an Environment and Sustainability Office, initiating a sustainability plan and forming: the Virginia Beach Green Ribbon Committee and Water Quality Task Force. Both groups, managed by the City, bring together inter-agency and NGO stakeholders to develop strategies for the City. The City is looking for ways to expand the LRN model to other subwatersheds in Virginia Beach. The LRN model has been so effective that the City has contracted the organization to provide outreach, education and engagement services for the City.

Using a NFWF grant, Lynnhaven River NOW initially worked with the Virginia Beach office of the Virginia Cooperative Extension to develop and co-sponsor water-friendly workshops that educate citizens and landscape professionals on water-friendly actions to reduce stormwater, protect and restore habitat, and improve water quality. LRN provides on-line guidance and resources for do-it-yourselfers on water-friendly practices and maintains a list of local landscape professionals, retail and wholesale suppliers, and lawn care companies who provide water-friendly services and supplies. In 2009, LRN, the City of Virginia Beach, the Virginia Cooperative Extension, and the Virginia Chapter of the American Association of Landscape Architects offered a two-day professional landscaping workshop; a link to the workshop agenda is provided in Appendix D.

Through experience, LRN found that the Virginia Tech soil analysis recommended excessive nutrient applications. LRN contracted with a Richmond-based soil analysis firm to provide members with a "low nutrient" analysis and recommendations. The organization has since shared this information with ERP, who is now using the services of the same firm.

2.3.3.1 Funding and Incentives

Lynnhaven River NOW and its programs are funded through a combination of sources. Approximately one-third of the funding comes from private individual donations and the proceeds from events like the annual oyster roast and "Paddle for the River;" another third comes from foundation and government grants, and another third comes from a contract with the City government. The organization also intends to set up a long-term endowment (Burke and Dunn (editors), 2010). LRN has been the recipient of grants from NFWF and the Chesapeake Bay Restoration Fund.

LRN's incentive programs include the *Pearl School* program, the *Pearl Homes* program, an annual photography contest, and an annual volunteer appreciation picnic and volunteer-of-the-year award. According to Burke and Dunn (2010), the *Pearl School* program was established to

recognize, encourage, and support the efforts of teachers and schools that are developing an ethic of environmental responsibility and stewardship among students. Burke and Dunn (2010) also note that LRN also has a wetland restoration project called Growing Wetlands in the Classroom, through which plants are grown by students and transplanted to restoration sites.

LRN recently launched the *Pearl Homes* program as a way to engage and recognize citizens for water-friendly behavior and practices (see Appendix C). At last count, 376 property owners have enrolled to become *Pearl Homes.* The program is similar to the ERP *River Star Homes* and also uses community-based social marketing techniques using the methodology of Dr. McKenzie-Mohr. If accepted into the program, property owners receive a *Pearl Home* garden flag to display in the front yard and advertise participation to neighbors.

2.3.3.2 Tracking and Effectiveness

LRN and the City of Virginia Beach are currently developing a GIS-based online BMP tracking and reporting system. Once this system is completed, the City and LRN will be able to track and report the BMPs installed on private property, and report nutrient and sediment load reductions to Virginia and EPA for credit toward the City's pollution reduction goals under the Chesapeake Bay TMDL.

Every year, LRN develops a report card for the river. In 2010, the following were reported:

- Transplant of 798,143 oysters and construction of 58 total acres of oyster habitat;
- No net loss of wetlands;
- Increase of 6.08-acres of submerged aquatic vegetation;
- Preservation of 2,996 acres of open space and opening of 4 public access sites;
- A no discharge zone in effect and 4 certified "Clean Marinas;"
- Provision of $3.9 million increase in funding from the City for water quality improvements; and
- Engagement of 4,758 members and 14,664 citizens by LRN programs.

In March 2012, LRN reported that approximately 300 private property owners committed to becoming *Pearl Homes* program participants.

A thorough case study of LRN is featured by The Conservation Fund in *Sustainable Chesapeake, Better Models for Conservation* (Burke and Dunn (editors), 2010). Additional information is provided in the Reference section under Lynnhaven River NOW – City of Virginia Beach.

2.3.4 Reedy Creek Watershed Project – Richmond, VA

The Reedy Creek Watershed Project is another promising NFWF-funded pilot program to increase environmental stewardship and the number of on-site LID retrofits on private property. The project is a collaborative effort between a local watershed group, the Reedy Creek Coalition, and the Alliance for the Chesapeake Bay (ACB).

2.3.4.1 Funding and Incentives

Partners and additional funding sources include the Reedy Creek Coalition, Virginia Commonwealth University (L. Douglas Wilder School of Government and Public Affairs), City of Richmond (Dept. of Public Utilities), Richmond City Councilman Doug Connor, Friends of Forest Hill Park, the Virginia Department of Environmental Quality (DEQ), Patrick Henry School of Science and Arts, Clean Virginia Waterways, and the Altria Group, Inc. The budget for this 3-year effort is approximately $830,000.

According to the NFWF grant, the project will:

> [D]evelop and implement a social engagement and urban conservation program to address stormwater pollution in the Reedy Creek watershed. Project will conduct community education initiatives, perform residential and commercial stormwater audits, and establish a cost-share program for urban conservation practices… Through the course of this program, we plan to conduct 150 audits (residential and businesses), train 40 volunteer auditors, and install 150 BMPs of various sizes and designs and…Our measurement of program success will come from a volunteer water monitoring program we have recently launched. Water samples are collected throughout the watershed and Richmond DPU analyzes these at the City's WWTP laboratory... We anticipate reducing 154.5 lbs. N, 16 lbs. P, and 27 tons of sediment annually.

2.3.4.2 Tracking and Effectiveness

Although all the audits have been completed for the project, BMP installation did not start until late 2011, so the results of this project were not available at the time of publication. Some of the BMPs are suitable for a stormwater utility credit from the City of Richmond. According to Chris French, ACB's former Virginia Director, once the BMPs are installed and citizens apply for a credit, the program will be able to evaluate the effectiveness of the Richmond stormwater utility credit incentive and the City will have a mechanism for tracking the BMPs installed through the credit program (personal communication, 2011).

2.3.5 Friends of the Rappahannock

Friends of the Rappahannock is another well-organized, long-lived watershed organization, similar to the Elizabeth River Project and Lynnhaven River NOW, that has been instrumental in testing innovative environmental stewardship development techniques and promoting watershed-friendly BMPs on private property. The City of Fredericksburg, Stafford County, and Spotsylvania County are located in the Rappahannock River watershed and were early adopters and promoters of LID stormwater management practices. Friends of the Rappahannock members have been key advocates supporting City and County efforts. Friends of the Rappahannock is a partner of the *River Friendly Yards* program in the City of Fredericksburg (see section 2.2.6 for a description of the *River Friendly Yards* program).

2.3.5.1 Funding and Incentives

According to NFWF files, in 2009, Friends of the Rappahannock received a $108,956 NFWF grant to "replicate innovative models for nutrient control in two rapidly suburbanizing municipalities in the Rappahannock River Basin. The [p]roject will implement best practices for stormwater

management and change landowner behavior via a "building block" method for changing development codes and a social marketing program that quantifies nutrient reductions."

Friends of the Rappahannock (like Arlington County) use the *Livable Neighborhood Water Stewards Program* to promote and increase water-friendly actions on private property neighborhood by neighborhood. The Virginia DEQ's Office of Environmental Education trained Friends of the Rappahannock as well as another NGO, the Three Rivers Environmental Educators.

2.3.5.2 Tracking and Effectiveness

Stafford County Department of Code Administration has a Stormwater BMP Master Database/GIS that could be used by other localities as a model for tracking BMP retrofits online.

Wetlands Watch did not conduct a detailed investigation into the effectiveness of the partnership activities between Friends of the Rappahannock and Spotsylvania and Stafford Counties; however, a conversation with Kevin Byrnes of the George Washington Regional Commission indicates that Spotsylvania County and Stafford County have well-coordinated MS4 programs as a result of promoting low impact design stormwater management and their collaboration with Friends of the Rappahannock. Additional details are available at their website; the link to the website is provided in section 2.7 and in the Reference section under Friends of the Rappahannock River.

2.4 Soil and Water Conservation Districts

Soil and Water Conservation Districts provide another means to organize and fund programs to increase environmental stewardship and BMPs on private property. SWCDs are semi-independent regional oversight agencies with the primary mission of protecting and conserving soil and water resources. SWCDs provide technical services, conservation information, and educational opportunities (see section 2.7 for web links to program resources). Each SWCD functions like an independent contractor with programs and in-house expertise adapted to the needs of local citizens. Although a portion of SWCD funding comes from the state, the majority of a SWCD budget comes from localities and other sources.

The primary role of SWCDs in rural areas has been to develop and manage the Virginia Agricultural Best Management Practices Cost-Share Program and to promote installation of agricultural BMPs. Some SWCDs, like the Colonial SWCD, are responding to the transition from rural to urban land use within their districts and have developed programs that apply their experiences with agricultural BMP programs to the promotion of urban stormwater retrofits (see section 2.2.4, James City County "Community Conservation Partnership" program). The Northern Virginia SWCD, whose entire jurisdiction is Fairfax County, VA, has developed expertise in urban stormwater retrofits and stream restoration as well as outreach, education, and involvement of urban stakeholders. Based on a conversation with Laura Grape of the Northern Virginia Regional Commission, Fairfax County determined that they could not use County funds to install rain gardens on private property because this would result in increased property values. To avoid the inequitable use of tax revenue, the County had the Northern Virginia SWCD deliver the program.

Another promising NFWF grant-funded SWCD pilot project, which is still in the early stages of implementation, involves collaboration between 3 SWCDs, 15 localities and the local Master

Gardeners. The pilot project will test the feasibility of using a well-established North Carolina SWCD program, *North Carolina Community Conservation Assistance Program* (NCCCAP). According to the NFWF grant proposal, the Culpeper, Hanover-Caroline, and Thomas Jefferson SWCDs will partner and collaborate with Master Gardeners, local government, Virginia Department of Forestry (VDOF), Chesapeake Network for Education of Municipal Officials (NEMO), and Rivanna Regional Stormwater Education Partnership. The budget for this one-year project is approximately $50,000. The project will adapt and test the NCCCAP program to include Virginia-approved BMPs, estimate efficiencies and nutrient load reductions for approved BMPs, identify necessary adjustments, and prepare a pilot manual. SWCD staff will attend the same professional certification courses required by NCCCAP and be certified to review designs and inspect BMPs. NCCCAP has an on-line database tracking and reporting system used for both agricultural BMPs in the cost-share program and urban BMPs installed through the NCCCAP program.

2.5 Plant Eastern Shore Natives Campaign

The Plant Eastern Shore Natives Campaign (Plant ES Natives) is a program developed by the Virginia DEQ Coastal Zone Management (CZM) Program in partnership with localities on the Eastern Shore of Virginia to promote the use of native plants on private properties (see section 2.7 for web links to program resources). CZM partnered with community members to design the program, identify barriers to success, develop attractive reference materials, develop an implementation strategy that used community based social marketing techniques, identify demonstration sites, and recruit local garden centers and nurseries to supply, market and sell native plants. Like the Anne Arundel County WSA, the Plant ES Natives campaign is recruiting and training community leaders to be native plant stewards. In addition, this program has created a supply and demand for native plants and is now being piloted in the Northern Virginia area by the Northern Virginia Regional Commission with a CZM grant. Within the coastal plain, native plants are the preferred plant material for many landscaping-type BMPs on private property (like rain gardens and riparian buffers); however, native plants are often not marked as natives or marketed by local nurseries and garden centers.

CZM also started a Native Plants Marketing Group that has brought together several state agencies and NGOs to coordinate efforts to increase the use of native plants in general and include native plantings as a BMP to achieve nutrient and sediment reduction credit toward meeting goals for the Chesapeake Bay TMDL.

2.6 Environmental Stewardship and Professional Training Programs

2.6.1 Environmental Stewards Programs

In Virginia, there are a number of programs that train and coordinate citizen leaders to be environmental stewards within their community. These leaders are technically trained to provide a predictable level of volunteer environmental and landscape-related services to their community. Often these programs receive support from regional, state- and federal-run stewardship outreach and education programs:

- Backyard and Corporate Habitats – Department of Game and Inland Fisheries (DGIF)
- Urban Forestry and Rain Gardens – Virginia Department of Forestry (DOF)
- Virginia Naturally – DEQ Department of Environmental Education (DEE)

- Bayscapes – Alliance for the Chesapeake Bay and US Fish and Wildlife Service
- Water Wise/Be Water Smart, askHRGreen.org - HRPDC
- Bayscaping and oyster gardening – CBF and LRN
- Stormwater Management/Nutrient Management – DCR
- Go Native – CZM
- The Virginia Horticultural Society

Environmental stewards from several training programs have provided watershed-related volunteer services including Master Gardeners and Master Naturalists, Livable Neighborhood Water Stewardship Program, CBF VoiCeS and Oyster Gardeners, the CBF/Wetlands Watch Land-Use Training Program, Virginia Save Our Streams Program, and the DCR Nutrient Management Certification Program. The types of program-provided training are summarized in Table 2-1. Although the services and the level of training may vary from one program to the next, all programs develop a network of motivated environmental advocates who are trained to educate and engage members of their community using social marketing techniques.

Through conversations and survey results, Wetlands Watch noted that many of these trained stewards are cross-trained in different programs. For instance, many Advanced Master Gardeners also are Master Naturalists and/or VoiCeS graduates. Typically, Virginia Cooperative Extension agents coordinate the Master Gardeners and Master Naturalists programs in a locality and the advanced training offered is a reflection of the needs identified by the local agent.

Virginia Tech runs an Advanced Master Water Stewards training program in Blacksburg, Virginia with a curriculum similar to the Anne Arundel County and National Capital Region WSAs. However, local chapters organize their own training courses and the curriculum and expertise of instructors varies from one locality to the next.

No one program in Virginia provides the level of service and predictable level of technical expertise comparable to the Anne Arundel County WSA. Trained environmental stewards, while already active and providing valuable services within the Hampton Roads area, have the potential to be more valuable partners in the effort to increase BMPs on private properties. A clearly identified management structure, a more predictable level of service and technical expertise, a technical consortium, a local and regional resource guide, and centralized, consistent tracking and reporting system would make these stewards more valuable partners.

The Virginia Members of the CBP Master Water Stewards Action Team have proposed a Regional Watershed Stewardship Academy Summit to bring stakeholders together to assess existing stewardship programs, identify opportunities for program refinement and improvements, identify locality specific services and level of service needs, and formulate a stronger collaborative network to support local efforts to increase stewardship and BMPs on private property.

Table 2-1: Existing Environmental Stewardship Programs in Virginia

Stewardship Programs	Train-the-Trainer**	Citizen Scientists	Site Assessments	Solutions Plan	BMP Design, Installation,	BMP maintenance	Environmental Advocates	Fund-raising	Tracking and Reporting
Master Gardeners	Gardening, Water Stewards, Tree Stewards		✓	✓	Sometimes, depends on local chapter interests, demonstration projects		✓	✓	Just beginning to report and track activities online
Master Naturalists	Environmental subjects	✓	✓	✓	✓	✓	✓	✓	
CBF VoiCeS	Chesapeake Bay and Land-Use			✓	Organize and oversee, depends on individual steward		✓	✓	
CBF Oyster Gardeners	✓	✓					✓		?
CBF/Wetlands Watch Land-Use Advocacy							✓		
Livable Neighborhoods Water Stewards	✓	✓	✓	✓	✓	✓	✓		

Table 2-1: Existing Environmental Stewardship Programs in Virginia (continued)

Stewardship Programs	Train-the-Trainer**	Citizen Scientists	Site Assessments	Solutions Plan	BMP Design, Installation,	BMP maintenance	Environmental Advocates	Fund-raising	Tracking and Reporting
Virginia Save Our Streams Program		Water Quality Monitoring					✓		✓
DCR Nutrient Management Certification	✓		✓	✓					✓
Reedy Creek Coalition			✓	✓	✓		✓		✓
Native Plant Society	Native Plant talks, walks, demos			✓	✓		✓		

** Train-the-Trainer programs focus on stakeholder outreach, education, and involvement.

2.6.2 Training for Landscape Professionals

Landscape professionals can be valuable partners in efforts to increase BMPs on private property because many of the appropriate BMPs are landscaping practices. Similarly, lawn care companies can promote water-friendly lawn care practices and, if properly trained and incentivized, minimal levels of fertilizers and nutrients.

Landscape architects/designers and landscaping companies, who often are trusted advisors to private property owners, have the ability to incorporate and promote stormwater management and habitat restoration within a landscape design. In addition, many of the BMPs need regular maintenance and landscape contractor involvement is critical for proper maintenance. Several stakeholders interviewed for this report noted that landscape maintenance crews often mow BMPs because they mistake native plant buffers and wetland plants for weeds.

A number of training and/or certification opportunities for landscape professionals are available in the Chesapeake Bay region through environmental stewardship programs. However, many of the training workshops are either not available within the Hampton Roads region or are not provided on a regular basis because of lack of funding.

Lynnhaven River NOW, the Virginia Beach VCE, the City of Virginia Beach, and the local chapter of the American Society of Landscape Architects ran a series of workshops in Virginia Beach and would like to host these popular workshops again, but do not have the funding (Appendix D). Landscape professionals who attended these Virginia Beach workshops are listed on the Lynnhaven River NOW website. The VIMS Chesapeake Bay National Estuarine Research Reserve (CBNERR) program is planning a series of workshops to train landscape professionals. Within the last few years, the American Society of Landscape Architects (ASLA) has developed a sustainable landscape program called SITES. Local VCE offices and garden centers have hosted classes on sustainable landscaping practices. The Chesapeake Conservation Landscaping Council promotes the use of eight conservation landscaping practices and is developing a certification program for landscape professionals in the Chesapeake Bay region; landscape professionals who agree to apply these 8 practices are promoted on the Plant More Plants (a DCR campaign) website.

Landscape professionals interviewed have noted an increase in the number of customers asking for conservation type landscaping, rain gardens, and permeable pavers. JCC Engineering and Natural Resources and the City of Virginia Beach Sustainability staff have noticed an increase in the number of professionally designed, environmentally sensitive landscape plans submitted as proposed compensation for RPA, beach dune, and wetlands disturbances.

While there are already examples where the private sector is a valuable partner in efforts to increase the number of BMPs on private property, Hampton Roads as a region would benefit from more landscape professionals with stormwater BMP training. The proposed WSA Strategic Summit agenda includes a review of existing programs and a delivery mechanism for certification and training of landscape professionals.

2.7 Resources

Below are links to information resources for the programs described in this section.

City- or County-Wide Programs

Anne Arundel County, MD:

- Anne Arundel County Department of Public Works: www.aacounty.org/DPW/index.cfm
- Rainscaping: www.rainscaping.org
- Stormwater management tax credit form: www.aacounty.org/Finance/Resources/StormWaterMgmtTaxCredit.pdf
- Watershed Steward Academy: www.aawsa.org
- Watershed Ecosystem and Restoration Services (WERS) Division Watershed Mapping Application: gis-world.aacounty.org/wers

Washington, DC

- Anacostia Watershed Society: www.anacostiaws.org
- District Department of the Environment: ddoe.dc.gov
- District Green Roof Rebate Program: www.anacostiaws.org/programs/stewardship/green-roofs
- Green Up DC: greenup.dc.gov
- National Capital Region Watershed Steward Academy: ncr-wsa.org
- RiverSmart Homes: ddoe.dc.gov/riversmarthomes
- RiverSmart Communities: ddoe.dc.gov/service/riversmart-communities
- RiverSmart Washington: www.rockcreekconservancy.org/index.php/about-the-program-riversmart
- Rock Creek Conservancy: www.rockcreekconservancy.org/

Montgomery County, VA

- Montgomery County Department of Environmental Protection (DEP): www.montgomerycountymd.gov/deatmpl.asp?url=/content/dep/dephome/index.asp
- Montgomery County DEP RainScapes Program: www.montgomerycountymd.gov/dectmpl.asp?url=/content/dep/water/rainscapes.asp
- Montgomery County DEP Water Quality Protection Charge (WQPC): www.montgomerycountymd.gov/dectmpl.asp?url=/content/dep/water/wqpc.asp
- National Capital Region Watershed Steward Academy: www.ncr-wsa.org

James City County, VA

- Friends of Powhatan Creek: fopc.wm.edu/FOPC.html
- James City County, Be Water Smart Program: www.jamescitycountyva.gov/bewatersmart/
- James City County General Services Department, Stormwater Division: www.jccegov.com/stormwater/index.html
- James City County, Protecting Resources In Delicate Environments (PRIDE): www.jamescitycountyva.gov/jccpride/

- James City County, Shaping Our Shores Master Plan: www.jccegov.com/sos
- James City/Williamsburg Master Gardeners, Turf Love/Garden Love Program: jccwmg.org/turflove.htm
- James River Association: www.jrava.org
- Virginia Cooperative Extension, Turf Love Program: offices.ext.vt.edu/james-city/programs/anr/Turf_Love.html
- Williamsburg Land Conservancy: www.williamsburglandconservancy.org/

Arlington County, VA

- Arlington County Department of Environmental Services: www.arlingtonva.us/Departments/EnvironmentalServices/EnvironmentalServicesMain.aspx
- Arlington County StormwaterWise Landscapes Program: www.arlingtonva.us/departments/EnvironmentalServices/sustainability/page83039.aspx
- Arlingtonians for a Clean Environment: www.arlingtonenvironment.org/
- Empowerment Institute, Livable Neighborhood Water Stewards/Water Stewardship Program: empowermentinstitute.net/files/WSP.html

City of Fredericksburg, VA

- City of Fredericksburg, River Friendly Yards Program: www.riverfriendlyyard.com
- Rappahannock River Basin Commission: www.rappriverbasin.org/

Non-Profit Model Programs

- The Nature Conservancy, Virginia: www.nature.org/ourinitiatives/regions/northamerica/unitedstates/virginia/index.htm
- Center for Watershed Protection: www.cwp.org
- Chesapeake Bay Foundation: www.cbf.org
- Alliance for the Chesapeake Bay: www.allianceforthebay.org
- James River Association: www.jrava.org
- Elizabeth River Project: www.elizabethriver.org
  - Money Point, Chesapeake: www.elizabethriver.org/Projects/Money_Point.aspx
  - Paradise Creek/Paradise Creek Nature Park, Portsmouth: www.elizabethriver.org/Projects/Paradise_Creek.aspx
  - Lafayette River Restoration, Norfolk: www.elizabethriver.org/Projects/Lafayette%20River%20Restoration.aspx
  - River Star Businesses Program: www.elizabethriver.org/RiverStars/RiverStarsIndustires.aspx
  - River Star Homes Program: www.elizabethriver.org/RiverStars/default.aspx
  - River Star Schools Program: www.elizabethriver.org/RiverStars/RiverStarsSchool.aspx
- The Living River Restoration Trust: www.livingrivertrust.org
- Lynnhaven River NOW: www.lynnhavenrivernow.org
  - Pearl Schools: www.lynnhavenrivernow.org/pearl-school.aspx
  - Oyster Gardening: www.lynnhavenrivernow.org/lynnhaven-oysters.aspx

- Keep Norfolk Beautiful: www.norfolkbeautiful.org
- Lafayette Wetlands Partnership: www.lrwpartners.org
- Virginia Beach Clean Waters Task Force: www.vbgov.com/government/offices/eso/boards-commissions/pages/clean-waters-task.aspx
- Virginia Beach Green Ribbon Committee Implementation Report: www.ourfuturevb.com/compplandocs/Documents/greenribbonreport070808.pdf
- Reedy Creek Coalition: www.reedycreekcoalition.org
- Friends of the Rappahannock: www.riverfriends.org

Soil and Water Conservation Districts

- Virginia Association of Soil and Water Conservation Districts: vaswcd.org/
  - Colonial SWCD: www.colonialswcd.net
  - Northern Virginia SWCD: www.fairfaxcounty.gov/nvswcd
  - Peanut SWCD: (ph)757-357-7004
  - Virginia Dare SWCD: www.vbgov.com/government/departments/agriculture/programs-and-services/pages/va-dare-soil-and-water-conservation-district.aspx
  - Chowan Basin SWCD: www.chowanbasinswcd.org
- North Carolina Community Conservation Assistance Program: www.enr.state.nc.us/dswc/pages/ccap_program.html

Plant Eastern Shore Natives Campaign

- Plant Eastern Shore Natives Campaign: www.deq.state.va.us/Programs/CoastalZoneManagement/CZMIssuesInitiatives/NativePlants.aspx
- Virginia DEQ Coastal Zone Management: www.deq.virginia.gov/Programs/CoastalZoneManagement.aspx
- Northern Virginia Regional Commission: www.novaregion.org

Environmental Stewardship and Professional Training Programs

Environmental Stewardship Programs

- Backyard and Corporate Habitats – Department of Game and Inland Fisheries: www.dgif.virginia.gov/habitat/
- Urban Forestry and Rain Gardens – Virginia Department of Forestry: www.dof.virginia.gov/mgt/rfb/rain-gardens.htm
- Virginia Naturally – DEQ Department of Environmental Education: www.deq.state.va.us/ConnectWithDEQ/EnvironmentalInformation/VirginiaNaturally.aspx
- Bayscapes – Alliance for the Chesapeake Bay and US Fish and Wildlife Service: www.fws.gov/chesapeakebay/bayscapes.htm
- askHRGreen.org – HRPDC: askhrgreen.org/
- Bayscaping - CBF: www.cbf.org/page.aspx?pid=525
- Oyster gardening – LRN: www.lynnhavenrivernow.org/need-oyster-growers.aspx
- VoiCes – CBF: www.cbf.org/Page.aspx?pid=545

- Stormwater Management/Nutrient Management – DCR: www.dcr.virginia.gov/stormwater_management/nutmgt.shtml
- Go Native – CZM: www.deq.state.va.us/Programs/CoastalZoneManagement/CZMIssuesInitiatives/NativePlants.aspx
- The Virginia Horticultural Foundation: www.vahort.org/about.shtml
- Virginia Native Plant Society: www.vnps.org
- Virginia Save Our Streams Program: www.vasos.org
- Virginia Master Naturalist: www.virginiamasternaturalist.org
- Virginia Master Gardeners Association: www.vmga.net

Training for Landscape Professionals:

- Watershed-Friendly Landscape Workshop Presentations - Lynnhaven River NOW; Virginia Beach VCE; City of Virginia Beach; American Society of Landscape Architects): www.vbgov.com/government/offices/eso/watershed-workshop/pages/default.aspx
  - Landscape professionals who attended workshops above: http://www.lynnhavenrivernow.org/pages/207/default.aspx
- Virginia Institute of Marine Science, Chesapeake Bay National Estuarine Research Reserve: www.vims.edu/cbnerr/
- American Society of Landscape Architects, Sustainable Sites Initiative: www.asla.org/sites.aspx
- Chesapeake Conservation Landscaping Council: www.chesapeakelandscape.org
- DCR Plant More Plants Campaign: www.plantmoreplants.com/resources.shtml

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3 Appropriate BMPs

3.1 Introduction

One of the objectives of this study was to identify BMPs appropriate for private properties, distinguish between those appropriate for different land uses and scales, and estimate the nutrient removal potential for each BMP type. Wetlands Watch relied heavily on work by the Center for Watershed Protection and Tom Schueler, Director of the Chesapeake Stormwater Network (CSN) and CBP Stormwater Coordinator. CWP prepared a series of subwatershed restoration guidance documents and tools called the *Urban Subwatershed Restoration Manuals* (see References section for links). In Manual 3*, Urban Stormwater Retrofit Practices (*Schueler et al., 2007*),* CWP provides extensive analysis, guidance, and summaries of all the factors to consider during the selection, design, installation, maintenance, inspection, and monitoring of stormwater retrofit BMPs. Additional summary tables and figures from Manual 3 are included in Appendix E of this report.

Tom Schueler has prepared and participated in the *MS4 Phase II Stormwater Manager Training webcasts* (links provided in the Reference section) and has authored two key technical bulletins (CSN Technical Bulletin Nos. 2 and 9) that:

- Identify appropriate BMPs for private property;
- Identify issues associated with BMP design, installation, maintenance, inspection, and monitoring;
- Identify factors that influence and limit the successful use of these BMPs; and
- Provide WIP strategies and methodology for estimating nutrient reduction rates for stormwater retrofits.

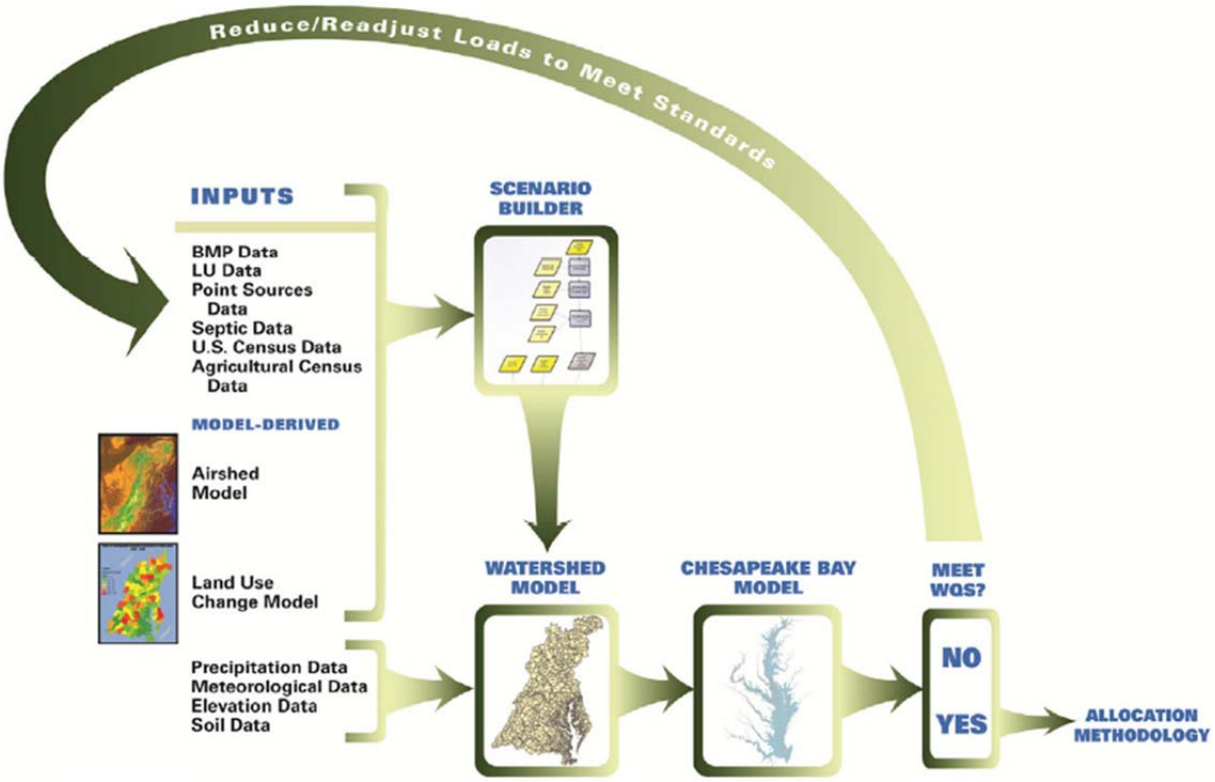
Both Schueler and CWP provided technical expertise and co-authored the guidance for the Runoff Reduction Method adopted by the Virginia Stormwater Management Program. Many of the BMP standards and specifications documents (available on the Virginia BMP Clearinghouse website) were developed by CSN and CWP.

This section incorporates review of the following resources: documentation for the Virginia Assessment Scenario Tool (VAST), Scenario Builder, and the EPA's suite of models for the Chesapeake Bay; the VA Stormwater Management website; and the BMP Clearinghouse. Links to these references are provided in the Reference section of this report under General References. Stakeholders were interviewed through a survey, in-person or phone interviews, through email correspondence, and/or during the HRPDC Watershed Roundtable Workshop on January 25, 2011 at the Virginia Zoo in Norfolk. A list of stakeholders interviewed and meetings attended is provided in Appendix A.

The Chesapeake Bay Model(s)

The Chesapeake Bay Watershed Model 5.3.2 is actually one of a suite of interactive models used to establish the Chesapeake Bay TMDL and model the effects of nitrogen, phosphorus, and sediment on the Chesapeake Bay. The BMPs that are modeled within the Watershed Model are Land-use related BMPs and the tidal waters and tidal shoreline of the Bay constitute the edge of the model domain. Model outputs include non-point source loads derived from land-use type and existing reported practices, and point source loads derived from Wastewater Discharge Loads obtained from reports provided by states and/or localities. According to the Watershed Model documentation, BMPs like vegetative non-structural tidal shoreline erosion control (which include tidal wetlands), structural erosion control, living shorelines, and headland controls are simulated as a load reduction along the shoreline. In addition, shoreline erosion and tidal wetlands are modeled as Bank Loads and Wetland Loads, respectively, in the Chesapeake Bay Water Quality and Sediment Transport Model (WQSTM). Submerged Aquatic Vegetation (SAV) and Oyster Reefs are included in the WQSTM; however, Wetlands Watch did not explore how these BMPs are accounted for in the model. See Figure 3-1.

Figure 3-1: Chesapeake Bay Model Relationships from Section 5 of the *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus, and Sediment* (US EPA, December 2010)



"BMP" is a broad term that describes a variety of practices and measures that can be applied as strategies to meet local watershed management goals. BMPs can include any of the following (Schueler, 2005):

- **Stormwater retrofits**: storage retrofits, on-site non-residential retrofits, and on-site residential retrofits.
- **Stream restoration**: stream cleanups, stream repair, comprehensive restoration practices.
- **Riparian management**: reforestation, park, greenway, or riparian buffer planting, riparian wetland restoration, and natural regeneration of vegetation.
- **Discharge prevention:** identify, fix, and/or prevent illicit sewage connections, commercial and industrial illicit connections, failing sewage lines, and industrial and transport spills.
- **Pervious area restoration**: land reclamation, upland re-vegetation/reforestation, and management of natural area remnants.
- **Pollution source control**: residential source control and hotspot source control.
- **Municipal practices and programs**: street sweeping and storm drain practices, green streets, best practices for development/redevelopment, stewardship of public land, municipal stewardship programs, watershed education and enforcement.

For MS4 permit holders, public education and public involvement activities are also considered BMPs (see EPA National Pollutant Discharge Elimination System (NPDES) website, http://cfpub.epa.gov/npdes/stormwater/menuofbmps/).

This investigation focuses on developing a discrete list of "appropriate" BMPs for Hampton Roads localities to promote in order to facilitate implementation of BMPs on existing private property. The "appropriateness" and feasibility of BMPs for use in urban settings in the coastal plain is dependent upon the following factors:

- Whether the BMP is an EPA approved practice that can be reported as a land use change, a nutrient and sediment reduction efficiency rate (urban stormwater BMPs), a load reduction, or a system change (Table 3-1).
- Whether Virginia's BMP standards and specifications indicate the BMP is a "Preferred" or "Acceptable" practice in the Coastal Plain or if there are recommended regional design adaptations for use in the Coastal Plain (Table 3-2).
- Locality-specific ordinances, policies, enforcement, technical expertise, culture, internal and external local government relationships with and attitudes towards stakeholders.
- Location-specific watershed management and restoration priorities, areas and pollutants of concern, and program implementation strategies.
- Availability of funding and personnel as well as the technical expertise of stakeholders.
- The degree of urbanization of the watershed (amount of impervious surface cover).
- Unique site-specific characteristics like location within the watershed and the coastal plain, existing hydrologic conditions (drainage, soils, depth to water table), property size and impervious surfaces, physical constraints (like property size, location of buildings, utilities, and paving).

- Property (and adjacent property) owner attitudes including negative and positive perceptions about BMPs, personal landscaping tastes and priorities, willingness and ability to commit time, energy, and/or resources, and willingness to cooperate with localities' need to inspect, monitor, and track the BMPs.

BMPs currently approved for and included in the Chesapeake Bay Watershed Model 5.3.2 represent a land use change, load reduction, a system change, or urban stormwater practices with approved nutrient and sediment reduction efficiency rates. The general land use categories are Agriculture (including Nurseries), Forest (which includes forested and emergent non-tidal wetlands), Developed Lands (including Low and High Intensity Pervious and Impervious MS4 permitted and Non-regulated, Extractive Active and Abandoned Mines, and Bare-Construction), and Open Waters (Non-Tidal). Urban BMPs approved for use in the EPA Watershed Model 5.3.2 are listed in Table 3-1.

The Virginia Stormwater Management BMPs are non-proprietary BMPs approved for use to comply with the new Virginia Stormwater Regulations. These new stormwater regulations are based on the runoff reduction method, which focuses on using a combination of the Impervious Urban Surface Reduction practices (described in Section 3.2.1) to reduce "the post-development stormwater runoff volume from a site, as well as meeting more stringent nutrient load reduction requirements." Virginia-approved BMPs are presented in Figure 3-2.

Maryland Department of the Environment (MDE) prepared a Chesapeake Bay TMDL/NPDES guidance document, *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (MDE 2011),* that has a thorough discussion of structural and alternative BMP credits and the recommended efficiencies associated with each BMP (see Figure 3-3). The University of Maryland Center for Environmental Science developed cost estimates for approved BMPs based on impervious surface reduction (see Figure 3-4) and provides multipliers for each county in Maryland, links to cost estimate spreadsheets, and guidance on linkage to the Maryland Assessement Scenario Tool (MAST) (King and Hagan, 2011).

The Chesapeake Bay Program recognizes that BMPs credited in the model need to be periodically reviewed and updated. The CBP Water Quality Goal Implementation Team (WQGIT) is tasked with approving the loading rates used in the Chesapeake Bay Watershed Model (CBWM). Existing loading and effectiveness rates are evaluated on a three year schedule. The process for evaluating whether new practices should be added to the model is defined in the WQGIT document, "Protocol for the Development, Review, and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model" (see Appendix F). The review process entails a request from a qualifying group, determination of the need for review, review by a panel of experts, and approval by the WQGIT. Through this process, it is possible that BMPs not mentioned in this report could be added to the Model or that efficiencies listed in this report may change in the future.

Table 3-1: BMPs Approved for Use in the Chesapeake Bay Watershed Model 5.3.2

Practices	Total Nitrogen	Total Phosphorus	Total Sediment
	Efficiency Rates %		
LAND USE CHANGE BMPs			
Urban Forest Conservation			
Urban Growth Reduction			
Impervious Urban Surface Reduction			
Urban Tree Planting			
Urban Forest Buffers	25	50	50
SYSTEMS CHANGE			
Septic Connections			
URBAN STORMWATER MANAGEMENT BMPs			
Dry Detention and Extended Detention Basins	5	10	10
Dry Detention and Hydrodynamic Structures	20	20	60
Urban Filtering Practices (sand filters)	40	60	80
Urban Infiltration Practices with Sand and/or Vegetation	85	85	95
Wetlands and Wet Ponds	20	45	60
Urban Infiltration Practices without sand and/or vegetation	80	85	95
Bioretention – C & D Soils with underdrain	25	45	55
Bioretention – A & B Soils with underdrain	70	75	80
Bioretention – A & B Soils without underdrain	80	85	90
Permeable Pavement w/o sand or vegetation C&D soils with underdrain	10	20	55
Permeable Pavement w/o sand or vegetation A&B soils with underdrain	45	50	70
Permeable Pavement w/o sand or vegetation A&B soils w/o underdrain	75	80	85

Table 3-1: BMPs Approved for Use in the Chesapeake Bay Watershed Model 5.3.2 (continued)

Practices	Total Nitrogen	Total Phosphorus	Total Sediment
	Efficiency Rates %		
URBAN STORMWATER MANAGEMENT BMPs (continued)			
Permeable Pavement – with sand or vegetation C&D soils with underdrain	20	20	55
Permeable Pavement – with sand or vegetation A&B soils with underdrain	50	50	70
Permeable Pavement – with sand or vegetation A&B soils w/o underdrain	80	80	85
Vegetated Open Channels (Grass Channels) C&D soils w/o underdrain	10	10	50
Vegetated Open Channels (Grass Channels) A&B soils w/o underdrain	45	45	70
Bioswale (Dry Swale)	70	75	80
Urban Nutrient Management	17	22	N/A
Street Sweeping (Bimonthly)	3	3	9
LOAD REDUCTION BMPs			
Urban Stream Restoration			
Non-structural shoreline erosion control - use of native vegetation to stabilize tidal shorelines	(75)*	(75)*	(75)*
Structural shoreline control – shoreline hardening with rigid, barrier-type structures	(75)*	(75)*	(75)*
Offshore Breakwater – Living Shorelines	(75)*	(75)*	(75)*
Headland Control	(50)*	(50)*	(50)*
OTHER PRACTICES			
Septic Pumping	50		
Septic Denitrification	50		

*Values in parenthesis are listed as possible values in Section 6.8 of *Best Management Practices for Nutrients and Sediments (2010).*

Table 3-2: Factors Influencing the Suitability of Virginia Approved BMPs (VA DCR and Water Resources Research Center, 2009)

Practice	Spec No.	Karst Terrain [1]	Coastal Plain [2]	Trout Waters [3]	Ultra-Urban [4]	Hotspots [5]
Rooftop Disconnection	1	Preferred	Preferred	Preferred	Restricted	Accepted
Sheetflow to Veg. Filter or Conserved Open Space	2	Preferred	Preferred	Preferred	Restricted	Restricted
Grass Channels	3	Accepted	Restricted	Accepted	Restricted	Restricted
Soil Compost Amendments	4	Accepted	Accepted	Preferred	Preferred	Restricted
Vegetated Roofs	5	Preferred	Accepted	Accepted	Preferred	Accepted
Rainwater Harvesting	6	Preferred	Preferred	Preferred	Preferred	Accepted
Permeable Pavement	7	Preferred	Preferred	Preferred	Preferred	Prohibited
Infiltration	8	SS: Acc. LS: Pro.	SS: Acc. LS: Rest.	Preferred	Restricted	Prohibited
Bioretention	9	SS: Acc LS: Rest.	Preferred	Preferred	Preferred	Accepted
Urban Bioretention	9A	Preferred	Accepted	Restricted	Preferred	Accepted
Dry Swales	10	Preferred	Preferred	Preferred	Restricted	Restricted
Wet Swales	11	Prohibited	Preferred	Accepted	Restricted	Restricted
Filtering Practices	12	Preferred	Accepted	Accepted	Preferred	Preferred
Constructed Wetlands	13	Accepted	Preferred	Accepted	Restricted	Restricted
Wet Ponds	14	Restricted	Accepted	Prohibited	Restricted	Accepted
Ext. Detention Ponds	15	Restricted	Restricted	Restricted	Restricted	Restricted
KEY		**Preferred Practice:** widely feasible and recommended				
		Accepted Practice: can work depending on site conditions				
		Restricted Practice: extremely limited feasibility				
		Prohibited Practice: do not use due to environmental risk				

NOTES: SS = small scale applications LS = large scale applications
[1] CSN Tech Bulletin No. 1 [2] CSN Tech Bulletin No. 2 [3] CSN Tech Bulletin No. 6
[4] CSN Tech Bulletin No. 5 [5] CWP (2004)

Figure 3-2: Runoff Reduction and Nutrient Removal Rates for Virginia Approved BMPs (VA DCR and Water Resources Research Center, 2009)

Practice	Design Level	Runoff Reduction	TN EMC Removal [3]	TN Load Removal	TP EMC Removal	TP Load Removal [6]
Rooftop Disconnect	1 [2]	25 to 50 [1]	0	25 to 50 [1]	0	25 to 50 [1]
	No Level 2 Design					
Sheet Flow to Veg. Filter or Conserv. Open Space	1	25 to 50 [1]	0	25 to 50 [1]	0	25 to 50 [1]
	2 [5]	50 to 75 [1]	0	50 to 75 [1]	0	50 to 75 [1]
Grass Channels	1	10 to 20 [1]	20		15	23
	No Level 2 Design					
Soil Compost Amendment	Can be used to Decrease Runoff Coefficient for Turf Cover at Site. See the design specs for Rooftop Disconnection, Sheet Flow to Vegetated Filter or Conserved Open Space, and Grass Channel					
Vegetated Roof	1	45	0	45	0	45
	2	60	0	60	0	60
Rainwater Harvesting	1	Up to 90 [3,5]	0	Up to 90 [3,5]	0	Up to 90 [3,5]
	No Level 2 Design					
Permeable Pavement	1	45	25	59	25	59
	2	75	25	81	25	81
Infiltration Practices	1	50	15	57	25	63
	2	90	15	92	25	93
Bioretention Practices	1	40	40	64	25	55
	2	80	60	90	50	90
Urban Bioretention	1	40	40	64	25	55
	No Level 2 Design					
Dry Swales	1	40	25	55	20	52
	2	60	35	74	40	76
Wet Swales	1	0	25	25	20	20
	2	0	35	35	40	40
Filtering Practices	1	0	30	30	60	60
	2	0	45	45	65	65
Constructed Wetlands	1	0	25	25	50	50
	2	0	55	55	75	75
Wet Ponds	1	0	30 (20) [4]	30 (20) [4]	50 (45) [4]	50 (45) [4]
	2	0	40 (30) [4]	40 (30) [4]	75 (65) [4]	75 (65) [4]
Ext. Det. Ponds	1	0	10	10	15	15
	2	15	10	24	15	31

Notes [1] Lower rate is for HSG soils C and D, Higher rate is for HSG soils A and B.

[2] The removal can be increased to 50% for C and D soils by adding soil compost amendments, and may be higher yet if combined with secondary runoff reduction practices.

[3] Credit up to 90% is possible if all water from storms of 1-inch or less is used through demand, and the tank is sized such that no overflow occurs. The total credit may not exceed 90%.

[4] Lower nutrient removal in parentheses apply to wet ponds in coastal plain terrain.

[5] See BMP design specification for an explanation of how additional pollutant removal can be achieved.

[6] Total mass load removed is the product of annual runoff reduction rate and change in nutrient EMC.

Figure 3-3: Maryland's list of Alternative Urban BMPs (MDE, 2011)

BMP Practice	Efficiency Per Acre			Impervious Acre Equivalent
	TN	TP	TSS	
Mechanical Street Sweeping	4%	4%	10%	0.07
Regenerative/Vacuum Street Sweeping	5%	6%	25%	0.13
Nutrient Management	17%	22%	0%	0.09
Grass/Meadow Buffers	30%	40%	55%	0.27
Forest Buffers	45%	40%	55%	0.34
Impervious Urban to Pervious (MDE)	13%	72%	84%	0.62
Impervious Urban to Forest (MDE)	71%	94%	93%	1.00
Planting Trees on Pervious Urban (MDE)	66%	77%	57%	0.38
Planting Trees on Impervious Urban (MDE)	71%	94%	93%	1.00
Reforestation on Pervious Urban (MDE)	66%	77%	57%	0.38
Reforestation on Impervious Urban (MDE)	71%	94%	93%	1.00
BMP Practice	**Pounds Reduced per Ton of Collected Dry Material**			**Impervious Acre Equivalent**
	TN	**TP**	**TSS**	
Catch Basin Cleaning	1.5	0.6	600	0.40
Storm Drain Vacuuming	1.5	0.6	600	0.40
Mechanical Street Sweeping	1.5	0.6	600	0.40
Regenerative/Vacuum Street Sweeping	1.5	0.6	600	0.40
BMP Practice	**Pounds Reduced per Linear Foot**			**Impervious Acre Equivalent**
	TN	**TP**	**TSS**	
Stream Restoration	0.02	0.035	2.55	0.01
Shoreline Stabilization (MDE)	0.16	0.11	451	0.04*
BMP Practice	**Pounds Reduced per Unit**			**Impervious Acre Equivalent**
	TN	**TP**	**TSS**	
Septic Pumping	0.6	0	0	0.03
Septic Denitrification	6.0	0	0	0.26
Septic Connections to WWTP (MDE)	9.0	0	0	0.39
Alternative BMPs for Consideration				
Education				
Sub-Soiling				
Trash Removal				
Pet Waste Management				
Outfall Stabilization				
Floodplain Restoration				
River Bank Stabilization				
Bio-Reactor Carbon Filter				
Disconnection of Illicit Discharges				
*Only nutrient values were used to derive impervious acre equivalent.				

Figure 3-4: University of Maryland BMP Cost Estimates (King and Hagan, 2011)

Stormwater Management Practice	Pre-Construction Costs[1]	Construction Costs[2]	Land Costs[3]	Total Initial Costs	Total Post-Construction Costs[4]	Total Costs over 20 Years	Average Annual Costs over 20 Years
Impervious Urban Surface Reduction	$ 8,750	$ 87,500	$ 50,000	$ 146,250	$ 885	$ 163,957	$ 8,198
Urban Forest Buffers	$ 3,000	$ 30,000	$ -	$ 33,000	$ 1,210	$ 57,207	$ 2,860
Urban Grass Buffers	$ 2,150	$ 21,500	$ -	$ 23,650	$ 870	$ 41,057	$ 2,053
Urban Tree Planting	$ 3,000	$ 30,000	$ 150,000	$ 183,000	$ 1,210	$ 207,207	$ 10,360
Wet Ponds and Wetlands (New)	$ 5,565	$ 18,550	$ 2,000	$ 26,115	$ 763	$ 41,368	$ 2,068
Wet Ponds and Wetlands (Retrofit)	$ 21,333	$ 42,665	$ 2,000	$ 65,998	$ 763	$ 81,251	$ 4,063
Dry Detention Ponds (New)	$ 9,000	$ 30,000	$ 5,000	$ 44,000	$ 1,231	$ 68,620	$ 3,431
Hydrodynamic Structures (New)	$ 7,000	$ 35,000	$ -	$ 42,000	$ 3,531	$ 112,620	$ 5,631
Dry Extended Detention Ponds (New)	$ 9,000	$ 30,000	$ 5,000	$ 44,000	$ 1,231	$ 68,620	$ 3,431
Dry Extended Detention Ponds (Retrofit)	$ 22,500	$ 45,000	$ 5,000	$ 72,500	$ 1,231	$ 97,120	$ 4,856
Infiltration Practices w/o Sand, Veg. (New)	$ 16,700	$ 41,750	$ 5,000	$ 63,450	$ 866	$ 80,770	$ 4,039
Infiltration Practices w/ Sand, Veg. (New)	$ 17,500	$ 43,750	$ 5,000	$ 66,250	$ 906	$ 84,370	$ 4,219
Filtering Practices (Sand, above ground)	$ 14,000	$ 35,000	$ 5,000	$ 54,000	$ 1,431	$ 82,620	$ 4,131
Filtering Practices (Sand, below ground)	$ 16,000	$ 40,000	$ -	$ 56,000	$ 1,631	$ 88,620	$ 4,431
Erosion and Sediment Control	$ 6,000	$ 20,000	$ -	$ 26,000	$ 10	$ 26,207	$ 1,310
Urban Nutrient Management[5]	$ -	$ 61,000	$ -	$ 61,000	$ 31	$ 61,620	$ 3,081
Street Sweeping[6]	$ -	$ 6,049	$ -	$ 6,049	$ 451	$ 15,079	$ 754
Urban Stream Restoration	$ 21,500	$ 43,000	$ -	$ 64,500	$ 891	$ 82,320	$ 4,116
Bioretention (New - Suburban)	$ 9,375	$ 37,500	$ 3,000	$ 49,875	$ 1,531	$ 80,495	$ 4,025
Bioretention (Retrofit - Highly Urban)	$ 52,500	$ 131,250	$ 3,000	$ 186,750	$ 1,531	$ 217,370	$ 10,869
Vegetated Open Channels	$ 4,000	$ 20,000	$ 2,000	$ 26,000	$ 610	$ 38,207	$ 1,910
Bioswale (New)	$ 12,000	$ 30,000	$ 2,000	$ 44,000	$ 931	$ 62,620	$ 3,131
Permeable Pavement w/o Sand, Veg. (New)	$ 21,780	$ 217,800	$ -	$ 239,580	$ 2,188	$ 283,347	$ 14,167
Permeable Pavement w/ Sand, Veg. (New)	$ 30,492	$ 304,920	$ -	$ 335,412	$ 3,060	$ 396,603	$ 19,830

[1] Includes cost of site discovery, surveying, design, planning, permitting, etc. which, for various BMPs tend to range from 10% to 40% of BMP construction costs.

[2] Includes capital, labor, material and overhead costs, but not land costs, associated implementation; for street sweeping includes only capital cost of mechanical sweeper. Nutrient management construction costs refer to the cost of an outreach campaign, not to any construction costs.

[3] For all stormwater BMPs that require land it is assumed that: 1) the opportunity cost of developable land is $100,000 per acre and 2) 50% of projects that require land take place on developable land with the rest taking place on land that is not developable. This brings the opportunity cost of land for stormwater BMPs that require land to $50,000 per acre. Actual county-specific land cost and percent developable land values can be filled in.
NOTE: The area of some BMPs may be significantly less than the impervious area treated.

[4] Combined annual operating, implementation, and maintenance costs.

[5] Best available data indicate that "retail" (i.e., direct mail) public outreach campaigns cost about $15 per household contacted. For an illustrative county, we assumed that each household has 5,941 sq ft of turf and 2,406 sq ft of impervious cover (medium density development). This means that 7.33 households need to adopt this BMP to potentially result in an acre of turf being treated, at a cost $109.98 per turf acre. Based on a review of direct mail response rates, we assumed that 2% of households contacted will respond positively to this outreach effort, bringing the cost per turf acre treated to $5,497.50/acre. The equivalent on a per-impervious-acre was based on the MDE June 2011 stormwater guidance document, which provides an equivalent for this practice of .09 acres impervious area per one acre of this practice. This estimate does not include any additional costs for soil tests by the homeowner to determine the appropriate amount of fertilizer required.

[6] Capital acquisition cost per impervious acre treated.

3.2 Urban Land Use Change BMPs

Urban land use change BMPs that satisfy the criteria of being appropriate for use on private properties in Hampton Roads include:

- Impervious urban surface reduction; and
- Urban tree planting.

3.2.1 Impervious Urban Surface Reduction

According to *Best Management Practices for Sediment Control and Water Clarity Enhancement* (CBP, 2006), and other sources like the Scenario Builder documentation, impervious urban surface reduction reduces impervious surfaces to promote infiltration and percolation of stormwater runoff and can include the following:

- Natural area conservation to maintain areas such as forests, grasslands, and meadows that encourage stormwater infiltration;
- Replacement of existing impervious surfaces like patios, walkways, and driveways with pervious pavement, pavers, or landscaped planting beds;
- Disconnection of rooftop runoff, practices known as rooftop retrofits, rooftop disconnections, or downspout disconnects, that capture and control stormwater runoff from rooftops and direct the water into rain barrels, cisterns, and rain tanks or to a pervious area that allows the water to infiltrate into the ground;
- Disconnection of non-roof top impervious areas, practices that direct runoff as sheet flow from impervious paved surfaces (like driveways, patios, and walkways) onto pervious surfaces or forested areas allowing the water to infiltrate; and
- Green roofs.

All of these practices are modeled as a land use change from impervious to pervious urban lands or impervious to forest lands in the Chesapeake Bay Watershed Model. A summary of the pollutant reduction efficiencies associated with Impervious Urban Surface Reduction from *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Draft (MDE, 2011)* is provided in Figure 3-5. Virginia's runoff reduction rates are provided in Figure 3-2.

Typical BMPs that MS4 localities promote and incentivize on residential property include:

- Rain barrels,
- Downspout disconnections,
- Pervious pavers,
- Impervious surfaces draining to adjacent rain gardens or landscaped beds, and
- Replacement of impervious surfaces with landscaped beds.

Most stakeholders interviewed noted that while rain barrels may not the best BMPs, the rain barrels and rain barrel workshops offer citizen education and engagement opportunities and are often the first step towards increased environmental stewardship and the use of other BMPs. The rain barrels also serve as visual reminder and set an example of water-friendly behavior for other property owners within a neighborhood.

Figure 3-5: Pollutant Reduction Efficiencies Associated with Impervious Urban Surface Reduction (MDE, 2011)

	Land Use	TN (lbs/acre/yr)	TP (lbs/acre/yr)	TSS (tons/acre/yr)
Conversion from	Urban Impervious	10.85	2.04	0.44
Conversion to	Pervious	9.43	0.57	0.07
	Forest	3.16	0.13	0.03
Conversion Efficiency	Pervious	13%	72%	84%
	Forest	71%	94%	93%

(Adapted from CBP Model, Version 5.3.0, 2011)

3.2.1.1 Issues to Consider

Rain barrels, tanks, and cisterns generally cannot be used to achieve significant runoff reduction for a typical residential setting because of insufficient storage capacity and/or site constraints. Schueler notes the following example: In order to capture 40% of the runoff from a 1600 square foot roof resulting from a 1.2 inch rainfall event, a homeowner would need either 51 rain barrels (55 gallons/each), 3 rain tanks (1000 gallons/each), or 1 cistern (3000 gallons). Most urban properties don't have the space for large cisterns or rain tanks, and most homeowners who have rain barrels only install one. Schueler suggests that *downspout disconnects* may be the most cost-effective strategy as long as they actually reduce stormwater runoff from impervious surfaces and notes the following (Schueler, September 15, 2011 webcast):

- The best sites for *downspout disconnects* are in clusters within neighborhoods.
- *Downspout disconnects* to the *s*urface typically require more than "just installing flexible pipe, particularly at tight sites."
- "Subsurface disconnections are more expensive and are often combined with other projects (e.g., rain gardens)".
- Surface disconnections need the right grade, distance and filter path.
- *Downspout disconnects* tend to be harder to sell to homeowners.

Difficulties with homeowner installation of BMPs like incorrect *downspout disconnections* and overflowing or inactive rain barrels contributed to Washington, DC DOE decision to coordinate the design and installation of BMPs on private property (Guillaume, n.d.).

Most incentive programs that promote replacement of impervious surfaces with pervious pavement or landscaped beds have minimum area requirements. Arlington County requires that at least 150 square feet be replaced. Washington, DC only issues rebates for driveways or parking areas and not walkways or small patios. Anne Arundel County requires a minimum removal of 20% of the total impervious area on the site. The Montgomery County program has separate requirements for replacement of impervious surface with permeable pavers and turf or native plants. Most programs require pervious pavement to be installed by a professional contractor. All rebate programs require the property owner to sign a maintenance agreement because pervious pavement must be swept and kept free of debris to function properly.

Stakeholders have observed the following issues with rain barrels and downspout disconnections:

- Rain barrels require winter shutoff and dewatering.
- Outdoor water demand is lowest when rainfall is highest.
- Homeowners, while initially enthusiastic about rain barrels, may never install the barrels or eventually abandon them.
- Improper downspout disconnections can lead to erosion problems and/or basement flooding issues.

In addition to the limitations mentioned above, downspout disconnects, rain barrels/cisterns, green roofs, rain gardens, and permeable pavers have sizing and cost considerations. Green roofs and replacing impervious surfaces with pervious surfaces can be cost prohibitive for some private property owners. Some localities like Washington, DC have increased the rebate amount for driveway replacements with pervious surfaces. Costs can vary depending on the level of expertise and cost of services associated with design, installation, and maintenance. Figures 3-6, 3-7, and 3-8 identify several design considerations including drainage area/sizing, costs, and the amount of impervious surface within a watershed that impact the use of impervious urban surface reduction BMPs and on-site LID retrofits. The reader is referred to the Virginia BMP Clearinghouse for detailed guidance on rooftop and impervious surface disconnection.

Figure 3-6: Drainage –Surface Area Relationships Associated with BMP Retrofits (Schueler et al., 2007)

Other Retrofits	Sizing Considerations	Average Depth (ft)
Dry wells	Each dry well can treat 500 sf of roof	1
Rain barrel (50 gal)	Max area draining to rain barrel 500 sf	3-5
Cistern (500 gal)	Max area draining to cistern 1000 sf	5-10
Planter boxes	Max area draining to box 15,000 sf	1.0
Green roofs	1 to 1 ratio of impervious area treated	0.5
Permeable pavers	1 to 1 ratio of impervious area treated	0
Rain gardens	10% of rooftop area	1

3.2.1.2 Tracking

Most localities that incentivize impervious surface reduction for MS4 permit compliance track participants in the incentive programs through a database/GIS system. One primary concern is the long-term guarantee that impervious surface reduction BMPs are still there, functioning, and maintained. Program staff noted that some practices like rain barrels are abandoned over time. Others noted discontinuity in practices with a change in property ownership. Richmond requires recipients of utility credits to re-apply every three years. Additional recommendations on tracking and verification are provided in Section 3.5, Structural Stormwater Retrofit BMPs, of this document.

Figure 3-7: Retrofit Cost Estimates (Schueler et al., 2007)

Retrofit Technique	Median Cost	Range
Pond Retrofits	$ 3.00	$ 1.00 to 10.00
Rain Gardens	$ 4.00	$ 3.00 to 5.00
New Storage Retrofits	$ 5.00	$ 2.50 to 9.00
Larger Bioretention Retrofits	$ 10.50	$ 7.50 to 17.25
Water Quality Swale Retrofit	$ 12.50	$ 7.00 to 22.00
Cisterns	$ 15.00	$ 6.00 to 25.00
French Drain/Dry Well	$ 12.00	$ 10.50 to 13.50
Infiltration Retrofits	$ 15.00	$ 10.00 to 23.00
Rain Barrels	$ 25.00	$ 12.50 to 40.00
Structural Sand Filter	$ 20.00	$ 16.00 to 22.00
Impervious Cover Conversion	$ 20.00	$ 18.50 to 21.50
Stormwater Planter	$ 27.00	$ 18.00 to 36.00
Small Bioretention Retrofits	$ 30.00	$ 25.00 to 40.00
Underground Sand Filter	$ 65.00	$ 28.00 to 75.00
Stormwater Tree Pits	$ 70.00	$ 58.00 to 83.00
Permeable Pavers	$ 120.00	$ 96.00 to 144.00
Extensive Green Rooftops	$ 225.00	$ 144.00 to 300.00
Intensive Green Rooftops	$ 360.00	$ 300.00 to 420.00
Note: Costs shown are base construction costs and do not include additional D&E costs, which can range from 5 to 40%		

Figure 3-8: Suitability of BMPs Based on Contributing Drainage Area (VA DCR)

Practice	Spec No.	Micro Scale	Small Scale	Normal Scale	Moderate Scale	Large Scale
Rooftop Disconnection	1	250 to 1000 sf				
Sheet Flow to Veg. Filter or Conserved Open Space	2		1000 to 5000 sf	5000 to 25,000 sf		
Grass Channels	3			20,000 sf to 250,000 sf		
Soil Compost Amendments	4	250 sf to 2 acres				
Vegetated Roofs	5	Residential 250 to 2000 sf	Commercial 2,000 to 200,000 sf			
Rainwater Harvesting	6					
Permeable Pavement	7	250 to 1000 sf	1000 to 10,000 sf	10,000 to 200,000		
Infiltration	8	250 to 2500 sf	2500 to 20,000 sf	20,000 to 100,000 sf		
Bioretention	9	250 to 2500 sf	2500 to 20,000 sf	20,000 to 100,000 sf		
Urban Bioretention	9A	250 to 2500 sf	2500 to 20,000 sf			
Dry Swales	10			20,000 to 250,000 sf		
Wet Swales	11			20,000 to 250,000 sf		
Filtering Practices	12			20,000 to 250,000 sf		
Constructed Wetlands	13					10 + more acres, unless favorable water balance
Wet Ponds	14					
Ext. Detention Ponds	15					

3.2.2 Urban Tree Planting

Urban tree planting is treated as a land use change in the Chesapeake Bay Watershed Model. Urban forest buffers are treated as an efficiency reduction and are discussed in Section 3.4.2. The current Model documentation (5.3.0) states that urban trees should be planted with the intent to establish a forested condition in order to count as a BMP.

The Chesapeake Bay Program has established a Forestry Workgroup that is considering new types of Urban forest BMPs in 2012-2013 (see Appendix G). The Forestry Workgroup developed new working definitions and proposed efficiencies for tree planting on agriculture and urban lands in 2011. The interim efficiency for urban tree planting of 100 trees equals one acre of forest was incorporated into VAST and utilized by localities in their Phase II WIP strategies. During 2012, the Forestry Workgroup, in coordination with the Urban Stormwater Workgroup, will refine these recommendations and formalize new efficiencies that will be incorporated into the Bay Model.

The NPDES guidance document developed by Maryland, *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Draft* (MDE, June 2011) is consistent with the Forestry Workgroup's recommendation. Figure 3-9 summarizes the CBP Tree Planting and Reforestation pollutant load reduction efficiencies for these BMPs. In order to claim these credits, "a survival rate of 100 trees per acre or greater is necessary with at least 50% of the trees being 2 inches or greater in diameter at 4 ½ feet above ground level. Because contiguous parcels of one acre or greater may be difficult to locate for an urban tree planting program, an aggregate of smaller sites may be used."

In Technical Bulletin No 9, Schueler recommends that urban reforestation practices to "restore compacted soils and plant trees with the explicit goal of establishing a mature forest canopy that will intercept rainfall, increase evapotranspiration rates, and enhance soil infiltration rates" be categorized and modeled in five different ways including (Schueler, 2011):

1. Upland Reforestation: tree planting on a turf or open area that does not receive stormwater runoff.
2. Filter Strips: an engineered practice where trees are planted in a zone that is designed to accept runoff from adjacent impervious cover.
3. Urban Stream Buffers: planting trees within 100 feet of a stream or wetland to create a forest buffer and then installing controls at the boundary so that the buffer can treat sheet flow from adjacent pervious or impervious areas.
4. Urban Tree Canopy: planting trees in the street right of way in very urban areas to create a mature forest canopy over impervious areas. The canopy intercepts rainfall and acts as a vertical stormwater disconnection during the growing season (Cappiella et al, 2006).
5. Urban Tree Canopy with BMPs: urban tree canopy installations that also employ expanded tree pits to filter runoff from adjacent impervious areas.

The Forestry Workgroup will take these points into consideration when making its final BMP recommendations to the Chesapeake Bay Program. Multiple benefits are derived from tree planting, and increasing trees on private property is a strategy that satisfies the goals and objectives of many different stakeholders associated with urban forestry, community beautification, green building, Chesapeake Bay Act, green infrastructure, flood mitigation, and

habitat restoration programs. Many of the model programs identified in other jurisdictions within and outside the Chesapeake Bay watershed promote and incentivize tree planting as a BMP.

Figure 3-9: Recommended Tree Planting Efficiencies (MDE 2011)

	Land Use	TN (lbs/acre/yr)	TP (lbs/acre/yr)	TSS (tons/acre/yr)
Conversion from	Urban Pervious	9.43	0.57	0.07
	Urban Impervious	10.85	2.04	0.44
Conversion to	Forest	3.16	0.13	0.03
Conversion Efficiency	Urban Pervious	66%	77%	57%
	Urban Impervious	71%	94%	93%

(Adapted from CBP Model, Version 5.3.0, 2011)

3.2.2.1 Issues to Consider

Physical site constraints such as size, utilities, building locations, adequate room for root growth, and existing soils are some of the issues that must be considered in the use of this BMP. Maintenance and care of trees, particularly within the first two years of planting, are critical to ensure tree survival and health. Ann English, of the Montgomery County *RainScapes* program suggests that contracts with private contractors who install trees should include a guaranteed survival rate of two years.

In urban areas, there may be opportunities to convert land to forest when the property is no longer used as a playing field (for instance); however, local ordinances may need to be changed first. One stakeholder noted that existing land use ordinances for open space and recreational uses require a certain amount of land to remain as turf.

Within the Hampton Roads area, tree size is a significant consideration as large trees may be perceived as a hazard during coastal storms and many waterfront property owners don't want trees to block water views.

3.2.2.2 Tracking

Schueler makes the following recommendations to local government regarding tracking, reporting, and verification of tree planting as a BMP (Schueler, 2011):

- Tree survival rates depend on proper care and protection and it typically takes "at least 10 to 15 years for a tree planting to acquire a forest-like condition".
- Localities should wait 2 years after the initial tree planting before claiming credit in order to ensure adequate growth and survival.
- After the initial 2 years establishment, tree planting inspections and forest management activities should continue in two year intervals.

3.3 Load Reduction BMPs

Load reduction BMPs that satisfy the criteria of being appropriate for use on private properties in Hampton Roads are identified and described in Section 6 of the Chesapeake Bay Watershed Model 5.3.2 documentation and include:

- Urban stream restoration;
- Non-structural shoreline erosion control;
- Structural shoreline erosion control;
- Living shorelines and headland control; and
- SAV and Oyster Restoration

3.3.1 Urban Stream Restoration

The Chesapeake Bay Watershed Model 5.3 documentation defines stream restoration as a collection of site-specific engineering techniques used to stabilize an eroding streambank or channel. The objective is to prevent further erosion and improve downstream water quality by reducing nutrients and sediment entering the stream. The original load reduction rate for the urban stream restoration BMP is being considered for revision to a higher rate based on recent data for stream restoration projects. The CBP Urban Stormwater Committee is expected to recommend a higher rate in 2012 (Schueler, 2011).

3.3.1.1 Issues to Consider

Although Urban Stream Restoration projects are not typically installed or maintained by private property owners, they are often located within a residential setting on commonly owned community property or adjacent to private property. Public perception and property owner support are important considerations for project planners. While these projects require significant technical expertise and the proper supplies and equipment, installation costs may be reduced through the use of volunteer labor. These projects also provide an opportunity to educate and engage citizens and a variety of stakeholders. In Anne Arundel County, a Watershed Steward organized a Regenerative Stormwater Conveyance system project with design and installation guidance provided by the technical consortium and volunteer labor from the community. James City County's PRIDE program has conducted stream restoration projects and used citizens to provide volunteer labor.

3.3.1.2 Tracking

Schueler makes the following recommendations to local government regarding tracking, reporting, and verification of urban stream restoration projects (Schueler, 2011):

- Track the length of qualifying stream restoration projects installed each year,
- Establish post construction certification protocol to confirm stream restoration practices are installed and functioning as designed within the stream reach prior to inclusion in a local and/or state tracking database.
- Maintain stream restoration project files for each development site where the credit is claimed for the lifetime of the project (usually 20 to 25 years).

- BMP credit duration is five years, but credit can be renewed if field inspection indicates the stream restoration project is still meeting its design objectives.

3.3.2 Tidal Shoreline BMPs

Tidal shoreline BMPs including structural shoreline erosion control and living shoreline erosion control measures (non-structural shoreline erosion control, offshore breakwaters and headland controls) are being used in the Hampton Roads area. Non-structural shoreline erosion controls are defined as erosion control techniques that use native vegetation including tidal wetlands restoration and riparian buffers to reduce shoreline erosion. VIMS defines offshore breakwater as the use of native tidal marsh and/or beach vegetation supported by low-profile structures including marsh sills. Headland control is defined as shoreline stabilization with structures that support pocket beaches. All tidal shoreline BMPs are modeled as load reductions applied along a tidal boundary of the Chesapeake Bay model domain. These load reductions affect the nutrient and sediment load inputs to the Chesapeake Bay Water Quality and Sediment Transport Model.

While these shoreline practices are discussed as appropriate BMPs in many different documents, these BMPs are not included in Scenario Builder or VAST. Given these inconsistencies, many localities are not even aware that these are appropriate practices that should be promoted, tracked, and reported.

The multiple benefits derived from tidal wetlands are well documented, and wetlands are protected by State and Federal Regulations. Promoting the restoration of tidal wetlands is recognized as an effective erosion control strategy. Virginia recently enacted legislation that will make living shorelines the preferred shoreline erosion control technique, and VIMS and the Virginia Marine Resource Commission (VMRC) are working on permitting requirements and guidance to facilitate the installation and permitting of living shorelines. Encouraging the use of living shorelines as a BMP has multiple benefits. Tidal wetlands and living shorelines can also help address needs for coastal hazard mitigation and sea level rise adaptation.

3.3.2.1 Issues to Consider

Because most of the activities associated with tidal shoreline BMPs (site assessment, design, installation, inspection and permitting) require a higher degree of technical expertise and oversight, projects like living shorelines and tidal wetlands restoration can be somewhat costly. However, costs can be offset or reduced by utilizing grant funds and collaborating with research institutions, regulatory staff, and staff scientists of environmental NGOs. Citizens and trained environmental stewards can further reduce costs by providing volunteer labor.

For instance, a Chesapeake Bay Foundation VoiCeS graduate acquired grant funds and coordinated professional experts and volunteers to install a living shoreline project at the James City County 4-H Club property on the James River. When the James City County Parks and Recreation Department observed the success of the project in stopping shoreline erosion, they applied for and received a grant to install a living shoreline on the adjacent Jamestown Beach property. Volunteers from a local citizens group planted native grasses.

3.3.2.2 Tracking

In order to install a living shoreline project, a private property owner must apply to VMRC for a permit. VIMS is also involved in the permit review process. Local government, VMRC, and VIMS

should work together to identify existing living shoreline projects and establish protocol for tracking and reporting the actions to the State and EPA. Model documentation for the Watershed Model 5.3.2 indicates that model developers may have acquired existing shoreline information through GIS data.

Tracking and verification could follow a protocol similar to one suggested by Schueler for other BMPs (Schueler, 2011). Localities should maintain a project file for each project installed that includes the following: a site map of the project location(s); the contact information for the party responsible for maintenance; design information; maintenance and inspection reports; digital photos; and the nutrient and sediment reduction credits.

The file should be maintained for the life of nutrient reduction credits (approximately 25 years). In addition, pertinent information should be stored in a GIS-based BMP tracking system including the project/property location by GPS coordinates, the associated 12 digit watershed code, the length of shoreline in linear feet, the type of living shoreline, and the credits claimed. Once the vegetation is established and the inspector confirms the Living Shoreline is functioning as designed, the BMPs should be visually inspected at least once every 5 years.

3.3.3 Marine Sewage Disposal Facilities

Marine sewage disposal facilities are BMPs identified in the *Tracking Best Management Practice Nutrient Reductions in the Chesapeake Bay Program* (Chesapeake Bay Program Modeling Subcommittee, 1998). These facilities include "pumpout and portable toilet dump stations located shore side to allow boaters to properly dispose of sewage…and an education program to encourage use of the facilities."

3.3.3.1 Issues to Consider

In the Phase IV Chesapeake Bay Watershed Model, these reductions were "subtracted from the final simulation Watershed Model output values." The estimated nutrient and sediment removal rates for this BMP are 43% for total nitrogen, 53% for total phosphorus, and 53% for total sediment. Watershed Model 5.3.2 documentation does not include a discussion of this BMP. Additional information is needed to determine if this BMP was incorporated into the most recent model runs, and if there is a mechanism for localities to receive credit for these BMPs.

3.3.3.2 Tracking

If not already doing so, localities should track and report marine sewage disposal facilities so that nutrient reductions can be credited toward WIP and local TMDL efforts.

3.3.4 Submerged Aquatic Vegetation Plantings and Oyster Restoration

Submerged aquatic vegetation (SAV) restoration, oyster restoration, and oyster aquaculture were considered BMPs by the CBP Sediment Workgroup of the Nutrient Subcommittee in 2006 according to Best Management Practices for Sediment Control and Water Clarity Enhancement, which documents the findings from a February 2003 CBP Sediment BMP Workshop (CBP, October 2006). According to meeting minutes from the Workshop, meeting participants:

- Decided that SAV plantings and preservation would have a significant positive local impact on water clarity and that the practice will be pursued as a function of clarity improvements rather than load reduction; and
- Agreed that oysters can play an important role in water clarity and reducing nutrients, and that the group would pursue the practices of restoration and oyster aquaculture in tributary strategies.

3.3.4.1 Issues to Consider

As stated previously, SAV and oyster populations are modeled in the Chesapeake Bay Water Quality and Sediment Transport Model. Additional research is needed to clarify how localities can get credit for these BMPs.

3.3.4.2 Tracking

At a minimum, localities and NGOs should track and report SAV plantings and oyster restoration efforts to VIMS. VIMS monitors SAV distribution in the Chesapeake Bay and can report detailed changes to EPA. In addition, the VIMS Molluscan Ecology Program collects oyster population data in support of State management and restoration efforts.

3.4 Non Structural Stormwater Management BMPs

Most of the BMPs included in the Chesapeake Bay Watershed Model 5.3.2 and the Virginia Stormwater BMP Clearinghouse are structural and require compliance with specific design standards in order to meet the removal efficiencies listed in Table 3-1 and Figure 3-2. Those practices are discussed in detail in Section 3.5. This section focuses on non-structural BMPs that can be implemented on private property including:

- Urban nutrient management;
- Forest buffers; and
- Wetlands restoration.

3.4.1 Urban Nutrient Management

The current Chesapeake Bay Watershed Model documentation defines urban nutrient management as the reduction of fertilizer to grass lawns and other urban areas. The implementation of urban nutrient management is based on public education and awareness, targeting suburban residences and businesses, with emphasis on reducing excessive fertilizer use. The current reduction efficiency is 17 % for nitrogen and 22% for phosphorus.

The CBP has convened an urban nutrient management BMP expert panel to standardize the definition of this practice for model credit and calculate the phosphorus removal potential of new legislation, passed by the Virginia General Assembly, to restrict the use of phosphorus in turf fertilizers (Acts of Assembly chapter 341) (see http://lis.virginia.gov/cgi-bin/legp604.exe?111+ful+CHAP0341). The expert panel recommendations should be presented to the Urban Stormwater Workgroup for review in 2012.

A number of key Virginia WIP strategies fall under the urban nutrient management BMP category and are discussed in Virginia's Phase I and draft Phase II WIPs. The nutrient

management strategies will target nutrient management and nutrient reduction on both public and private properties, including golf courses and residential lawns. Many local watershed groups and localities, through outreach and education efforts associated with MS4 permits, promote environmentally friendly lawn care including nutrient management. Some efforts have also focused on reducing or eliminating lawns and replacing them with alternative ground-covers or landscaped beds of native plants.

The following is a list of State-run campaigns in Virginia that focus on watershed-friendly lawn care and landscaping practices:

- VA DCR "Plant More Plants" campaign (http://www.plantmoreplants.com/) is encouraging citizens in Hampton Roads and Richmond to adopt a series of watershed-friendly practices promoted by the Chesapeake Conservation Landscaping Council (CCLC).
- Virginia Coastal Zone Management (VA CZM) Eastern Shore Natives Campaign: http://www.deq.state.va.us/coastal/go-native.html.
- Virginia Department of Game and Inland Fisheries (DGIF) Habitat Partners Program: http://www.dgif.virginia.gov/habitat/.
- Urban Nutrient Management certification through Virginia DCR is available for citizens and Landscape Professionals. Nutrient Managers are required to report the location and total acres for nutrient management plans to DCR. DCR then compiles this by watershed and provides the information to EPA for modeling. See http://www.dcr.virginia.gov/stormwater_management/nutmgt.shtml.

3.4.1.1 Issues to Consider

Some watershed groups and nutrient managers have reported that soils test analyses performed by Virginia Tech recommend higher nutrient applications than is needed in the Hampton Roads Region. Lynnhaven River NOW and Elizabeth River Project have formed an arrangement with an independent soils testing company in Richmond to perform "reduced nutrient" analyses when requested by members of the two organizations. The Turf Love program in James City County has convinced several golf courses in the area to adopt nutrient management plans and may serve as a model for other localities.

Beyond these efforts, a reasonable focus may be to work with lawn care companies to modify their nutrient management plans; however, many of these maintenance companies benefit economically from the sale and application of fertilizers.

Because a great deal of time and money is spent in education and outreach as well as lawn care supplies, Schueler has recommended a program that would pay people to stop using fertilizers for three years and observe the results. He argues that localities and watershed groups could reduce the time and costs associated with the delivery of these lawn-care messages and ensure a quantifiable amount of nutrient reduction.

Several stakeholders would like to see an effort to replace lawns with alternative native ground covers or focus on replacing portions of lawn areas with native plants and composted soils. Both options would eliminate the need for fertilizers. One stakeholder noted that nitrogen is more of a concern than phosphorus in tidal waters and the use of nitrogen in fertilizers will still need to be addressed even after the phosphorus ban is in place. Another stakeholder from a more

rural/suburban county noted that few, if any, property owners fertilize their lawns in the first place.

Replacement of lawns with native plants points to a problem some of the proposed BMPs may have with local government codes and ordinances. Property owners in a Hampton Roads locality replaced their front lawn with a wild flower meadow/butterfly garden. After a neighbor complained about the "weeds", the City determined that the "weeds" were a nuisance. When, the property owners refused to cut the "weeds", the City brought in a maintenance crew to mow the property owner's front yard. A similar conflict can occur in neighborhoods with homeowners associations and yard care covenants.

Schueler has noted that one of the key technical issues associated with getting credit for urban nutrient management is getting an accurate count of the acres of pervious land under a plan resulting from an education campaign. In order to obtain detailed accounts of acres under nutrient management plan, someone would need to do a detailed survey of fertilizer behavior of the property owner. "In addition, changes in homeowner fertilization behavior may stall or even reverse unless outreach campaigns are repeated." (Schueler, 2011)

Coordination and collaboration to eliminate code/covenant conflicts, increase the number of certified nutrient managers, and convince property owners to adopt watershed-friendly turf and lawn-care practices are critical to the success of the Virginia WIP strategy.

3.4.1.2 Tracking

Urban nutrient managers certified by Virginia DCR report the number of urban nutrient management plans they generate to DCR on an annual basis. Localities and DCR should work together to develop a reporting protocol. In addition, NGO programs like the Elizabeth River Project *River Star Homes* or the Lynnhaven River NOW *Pearl Homes* programs promote urban nutrient management plans among participants and members. Localities might be able to coordinate with NGOs to track properties within the program that practice urban nutrient management.

3.4.2 Forest Buffers

According to the Chesapeake Bay Watershed Model 5.3.2 documentation, urban forest buffers (also known as riparian buffers and Chesapeake Bay Resource Protection Areas (RPAs) in Hampton Roads) is "an area of trees at least 35 feet wide on one side of a stream, usually accompanied by trees, shrubs and other vegetation adjacent to a body of water. The riparian area is managed to maintain the integrity of stream channels and shorelines, to reduce the impacts of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals."

Restoration of riparian buffers is a simple landscaping strategy to reduce flooding, enhance Chesapeake Bay RPAs, support green infrastructure plans, increase wildlife habitat, reduce erosion, and protect water quality. Planting native plants and increasing RPA buffers is encouraged by various state agencies (CZM, DGIF, DOF, and DCR), cooperative extension agents, Master Gardeners, Master Naturalists, SWCDs, local environmental divisions, local urban forestry programs, local Chesapeake Bay and Wetlands Boards, and all NGOs in Hampton Roads.

Private property owners adjacent to a body of water should be encouraged to plant urban riparian forest buffers of native plants where buffers do not currently exist or increase the size of existing buffers to at least 35 feet wide. Replacing lawn and turf with native plant riparian buffers has an approved nutrient and sediment reduction efficiency of 25% for Nitrogen, 50% for phosphorus, and 50% for sediment.

3.4.2.1 Issues to Consider

Detailed instructions for forest buffer establishment and expansion are provided in the *Riparian Buffer Modification and Mitigation Guidance Manual* (VA DCR, 2006). Other issues to consider were discussed in Section 3.2.2, Urban Tree Planting. Appendix E of HRPDC's "Vegetative Practices Guide for Nonpoint Source Pollution Management" provides lists of recommended plants for Coastal Virginia in the following categories: Erosion and Sediment Control, Hardy Plants to Reclaim Disturbed Areas, Plants for Use In and Around Infiltration Trenches and Detention Basins, Tidal Wetland Plants, and Wildflowers.

The Native Plants Marketing Group organized by CZM identified a need for a consistent list of native plants suitable for the coastal plain *and* readily available in local garden centers and nurseries. James City County worked with local VCE agents and the John Clayton Chapter of the Virginia Native Plant Society to develop a list of plants suitable for RPA buffer plantings. The list is provided in the Reference section of this document under James City County. In addition, ERP and LRN provide lists of native plants suitable for Hampton Roads and have identified sources for native plants. These resources are available on their websites. Sometimes native plants are available but not marked as native, so citizens are unable to distinguish native from non-native plants. There is a need to work with local nurseries, garden centers, and growers to increase the availability and labeling of native plants in Hampton Roads.

Other barriers include stakeholder perceptions of native plants as "weeds" and "messy," the desire of the property owner to avoid blocking water views, and the personal preference for manicured lawns and a cultivated "English Garden" look. As long as the planting requires minimal site disturbance, enhancing a buffer is permitted. However, if the existing buffer has invasive species that need to be removed or the action has a level of site disturbance that requires erosion and sediment control measures, permits may be required. Making the permitting process easier for individual homeowners seeking to restore their buffers may increase the adoption of these practices.

3.4.2.2 Tracking

See Section 3.2.2, Urban Tree Planting for additional information.

3.4.3 Wetlands Restoration

Section 6.8.3 of the Chesapeake Bay Watershed Model 5.3.2 documentation describes the wetlands restoration BMP as reestablishment of former wetlands by "manipulating the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a *former* wetland and resulting in a gain in wetland acres." Although the discussion identifies this BMP as an agricultural BMP, it is associated with high and low intensity pervious and impervious developed lands. According to Scenario Builder documentation, the removal rate for wetland restoration in the Coastal Plain is 25% for nitrogen, 50% for phosphorus, and 15% for sediment.

3.4.3.1 Issues to Consider

Additional clarification is needed from EPA regarding whether this BMP can be used in urban areas. This BMP was not included in the Virginia Assessment Scenario Tool (VAST) utilized by localities to calculate Phase II WIP reductions.

If wetlands restoration is available as a BMP in urban areas, there are some low cost behavior changes that localities and NGOs could encourage private property owners to adopt. Within the Commonwealth of Virginia, normal landscaping activities are allowed in wetlands without a permit, so many waterfront property owners (both private and public) mow the wetland plants on their property. Mowed wetlands may lose some of their nutrient removal function and be categorized as turf by aerial imagery. Restoring these wetlands to their natural state will result in greater nutrient attenuation. If tracked and reported, this behavior change may be able to be credited as a BMP in the Watershed model. The Elizabeth River Project, through the *River Star Homes* program has convinced at least one property owner to sign an agreement to stop mowing the tidal wetlands on his property.

More intensive wetlands restoration (removal of invasive species, etc.) and actual restoration of former wetlands is more difficult and expensive and will require wetlands permits. There are examples of this work being performed by NGOs in Hampton Roads in coordination with local government regulatory staff and wetlands professionals. The Lafayette Wetlands Partnership, CBF, and Lynnhaven River NOW have all conducted wetlands plantings/restoration projects.

3.4.3.2 Tracking

Most wetlands restoration requires a permit and should be tracked through the permitting process as acres or square feet restored. However, additional tracking is needed for private property owners who agree to stop mowing wetlands and allow those wetlands to re-establish. NGOs may have more success in convincing property owners to voluntarily adopt this action. Localities should consider working with NGOs to promote, track and report the reestablishment of former wetlands.

Currently, forested and non-tidal wetlands are identified in the Chesapeake Bay model as forest lands. HRPDC has suggested that these wetlands should be tracked, reported, and modeled as wetlands rather than being grouped under the Forest land use category. This report supports and reiterates the recommendation.

3.5 Structural Stormwater Retrofit BMPs

The Virginia stormwater design criteria are generally followed when constructing BMPs associated with new development. Construction of stormwater retrofits often requires design modifications because of unique site characteristics and conditions. Unless the retrofits meet standard design specifications, the estimated nutrient and sediment reduction rates provided in Table 3-1 and Figure 3-2 must be adjusted for stormwater retrofits.

According to Schueler, stormwater retrofits are a "diverse group of projects that provide nutrient and sediment reduction on existing development that is currently untreated by any BMP or is inadequately treated by an existing BMP" (CSN Technical Bulletin No. 9, 2011). These stormwater retrofits use EPA approved and Virginia accepted structural practices to control and treat stormwater on existing properties; however, unique site characteristics and constraints

often necessitate design modifications. As a result, the associated nutrient and sediment removal efficiency rates of the retrofits may be less than the EPA and Virginia approved BMPs.

The CBP Urban Stormwater Workgroup has convened an expert panel to review stormwater retrofit treatment rates and methods to estimate treatment rates for five different categories of urban stormwater retrofit BMPs including:

1. New retrofit facilities;
2. BMP conversions;
3. BMP enhancements;
4. Green street retrofits; and
5. On-site LID retrofits.

The panel has produced a draft report and anticipates that the review process and recommendations for urban stormwater retrofit BMPs will be completed and available in 2012 (Schueler, 2011 and personal communications with Tom Schueler). BMP descriptions, interim protocol recommendations to track BMPs, and methodologies for calculating nutrient and sediment reduction rates for the WIPs are summarized in Appendix H. In addition, recommended siting, design, installation, maintenance, and inspection protocol for urban stormwater retrofits can be found in *Urban Subwatershed Restoration Manual 3 – Urban Stormwater Retrofit Practices* (Schueler et al., 2007). Summary figures and tables for Green Street and on-site LID retrofits from that document are provided in Appendix E and Figures 3-10 through 3-13.

New retrofit facilities, BMP conversions, and BMP enhancements are more appropriate for larger properties, public right of ways, and upgrading existing stormwater management facilities owned and maintained by a community or commercial property owner. These retrofits will not be discussed further except to note localities and NGOs who intend to install these BMPs would benefit from stakeholder involvement and support because these types of BMPs are typically in highly visible locations and can require capital investments.

Most of the urban stormwater retrofits appropriate for retrofitting neighborhoods and individual residential, small commercial, and small institutionally-owned private properties are categorized as either On-site LID or green street retrofits. These practices reduce impervious surfaces and capture or infiltrate stormwater runoff from impervious surfaces like rooftops, driveways, and small parking lots. The on-site retrofits also include non-structural practices like sheet flow of stormwater runoff to wooded conservation areas or planting beds (vegetated filter strips). Because the on-site LID and green street retrofits are most appropriate for private property owners, this report will focus on these practices.

The amount of impervious surface within a watershed has a significant impact on the health of the watershed. Research shows deterioration in watersheds with increased impervious surfaces. In addition, the suitability and feasibility of BMPs in urban environments is dictated by the percentage of impervious surface within a subwatershed (Schueler, 2005). As the percent of impervious surface increases, the choice of BMPs becomes more limited (see Figure 3-10). Therefore, reducing impervious surfaces or treating stormwater runoff on-site with BMPs like On-Site LID and Green Street Retrofits is a primary strategy adopted by MS4 permitted localities and non-profit watershed groups.

Figure 3-10: Feasibility of Retrofits Based on Impervious Cover (Schueler, 2005).

Restoration Practice	Subwatershed Impervious Cover			
	10 to 25%	25 to 40%	40 to 60%	60 to 100%
Storm Water Retrofit Practices				
Storage Retrofit	●	⊙	○	×
On-site Non-Residential Retrofits	●	●	⊙	○
On-site Residential Retrofits	●	●	⊙	○
Stream Repair Practices				
Stream Clean-ups	●	●	⊙	×
Stream Repairs	●	⊙	⊙	○
Comprehensive Restoration	⊙	○	○	×
Riparian Management Practices				
Site Preparation	●	⊙	○	×
Active Reforestation	●	●	⊙	×
Park/Greenway Plantings	●	⊙	⊙	×
Natural Regeneration	●	⊙	⊙	×
Riparian Wetland Restoration	●	⊙	○	×
Discharge Prevention Practices				
Illicit Sewage Connections	●	●	●	●
Other Illicit Connections	⊙	●	●	●
Failing Sewage Lines	●	●	●	●
Industrial and Transport Spills	⊙	●	●	●
Watershed Forestry Practices				
Land Reclamation	●	●	⊙	○
Upland Revegetation	●	●	⊙	○
Natural Area Remnant	●	●	⊙	○
Pollution Source Control Practices				
Residential Source Controls	●	●	●	⊙
Hotspot Source Controls	⊙	●	●	●
Municipal Practices and Programs				
Street and Storm Drain Cleaning	⊙	⊙	⊙	●
Best Practices for Redevelopment	●	●	●	●
Stewardship of Public Land	●	●	⊙	○
Municipal Stewardship Programs	●	●	●	●
Education and Enforcement	●	●	●	●

KEY
● Technique is normally feasible and can be widely applied across subwatershed
⊙ Technique is often feasible, depending on subwatershed characteristics
○ Individual sites can be found, but widespread implementation across subwatershed is limited
× Technique is generally not feasible in the subwatershed

Figure 3-11: BMP Retrofit Design Issues (Schueler et al., 2007).

Subwatershed Location	Retrofit Design Issue			
	Easy to find from desktop?	Simple to design?	Easy to get permits?	Low treatment cost?
SR-1 Add Storage to Existing Ponds	●	○	⦿	●
SR-2 Storage Above Roadway Culverts	●	○	○	●
SR-3 New Storage Below Outfalls	⦿	○	⦿	⦿
SR-4 Storage In the Conveyance System	⦿	○	⦿	⦿
SR-5 Storage in Transport Right-of-ways	●	○	⦿	●
SR-6 Storage Near Large Parking Lots	●	○	⦿	⦿
OS-7 Hotspot Operations	○	⦿	●	○
OS-8 Small Parking Lots	⦿	⦿	●	⦿
OS-9 Individual Streets	○	⦿	●	○
OS-10 Individual Rooftops	○	R● N⦿	R● N⦿	R⦿ N○
OS-11 Little Retrofits	○	●	●	●
OS-12 Landscapes/Hardscapes	○	●	●	⦿
OS-13 Underground	○	○	⦿	○
Key: ● Yes ⦿ Moderate ○ No R = Residential N = Non-residential				

Figure 3-12: Common Locations for BMP Retrofits (Schueler et al., 2007).

Where	How
OS-7 **Hotspot Operations**	Install filtering or bioretention treatment to remove pollutants from confirmed or severe stormwater hotspots discovered during field investigation
OS-8 **Small Parking Lots**	Insert stormwater treatment within or on the margins of small parking lots (less than five acres). In many cases, the parking lot is delineated into a series of smaller on-site treatment units.
OS-9 **Individual Streets**	Look for opportunities with the street, its right of way, cul-de-sacs and traffic calming devices to treat stormwater runoff before it gets into the street storm drain network
OS-10 **Individual Rooftops**	Disconnect, store and treat stormwater runoff generated from residential and commercial rooftops close to the source.
OS-11 **Little Retrofits**	Convert or disconnect isolated areas of impervious cover and treat runoff in an adjacent pervious area using low tech approaches such as a filter strip
OS-12 **Hardscapes Landscapes**	Reconfigure the plumbing of high visibility urban landscapes, plazas and public spaces to treat stormwater runoff with landscaping and other urban design features.
OS-13 **Underground**	Provide stormwater treatment in an underground location when no surface land is available for surface treatment. Use this as a last resort at dense ultra-urban sites.

Figure 3-13: Other Site Characteristics That Impact Retrofit Feasibility (Schueler et al., 2007).

Screening Metric	What It Says About Retrofit Potential
Average Age of Development	The age of development helps to determine the potential for on-site retrofits, since the nature of rooftop connections is associated with the building codes and practices of different eras. (decades)
Publicly Owned Land	Subwatersheds with a high percentage of publicly owned land have greater retrofit potential because publicly owned lands are the preferred location for on-site retrofits. (% of subwatershed)
Medium and Large Lot Residential Land	Subwatersheds with a high proportion of residential land have greater on-site retrofit potential, although this frequently needs to be confirmed by field assessments. (% of subwatershed)
Stormwater Hotspot Density	Subwatersheds with a greater hotspot density are expected to generate higher stormwater pollution loads, and may be targeted for on-site retrofits and pollution prevention practices. (no. of hotspots / square mile)
Industrial Land	Subwatersheds with a high % of industrial land have high on-site retrofit potential, since many industrial operations are already regulated and may need to install on-site retrofits to comply with stormwater permits. (% of subwatershed)
Presence of Combined Sewers	Subwatersheds that are served by combined sewers have greater on-site retrofit potential, since local utilities have a strong interest in reducing the runoff volumes delivered to the system that cause overflows. (presence or absence)
Subwatershed Redevelopment Potential	Subwatersheds undergoing redevelopment present great opportunities to cost effectively incorporate stormwater retrofits as a component of the overall site design and construction. (% of subwatershed)
Active Homeowner Assocation or Watershed Group	Subwatersheds with active groups have an existing network to promote on-site retrofit delivery.

3.5.1 On-Site LID and Green Street Retrofits

On-site LID retrofits "includes the installation of a large number of small on-site retrofits, such as rain gardens, compost amendments, rain barrels, rooftop disconnections and tree planting, over the scale of a residential neighborhood. These retrofits are typically delivered by local governments or watershed groups, who provide incentives and subsidies to individual property owners to implement them. In many cases, dozens or even hundreds of these small retrofits might be installed in any given subwatershed" (CSN Technical Bulletin No. 9, 2011). On-site LID retrofits comprise the vast majority of BMPs that have been installed, tracked, and reported by local governments for MS4 permits and non-profit watershed groups for grant projects. Table 3-3 (see page 3-33) provides a list of the types of on-site LID retrofits commonly promoted, incentivized and tracked by local government/NGO/private partnerships.

Green street retrofits "utilize a combination of LID practices within the public street right of way, and are gaining popularity as an attractive option to treat stormwater runoff in highly urban watersheds…Green streets typically involve a combination of practices such as permeable pavers, street bioretention, expanded tree pits, individual street trees, impervious cover removal, curb extensions and filtering practices" (CSN Technical Bulletin No. 9, 2011). The green street BMP approach installs practices within the public right-of-way, but can be utilized in a residential setting to add community character, provide traffic calming measures, or incorporate pedestrian access.

Although projects are on public property, localities can often get support and buy-in of community members because of the community benefits associated with green street retrofits. In addition, engaged community members may be recruited to maintain plant material and/or bioretention features in front of their property or within their community. Green street retrofits may be an effective strategy particularly in ultra-urban areas.

3.5.1.1 Issues to Consider

CWP has identified the most common locations for on-site LID and green street retrofits (Figures 3-11 through 3-13). Table 3-4, adapted from a Mid-Atlantic Water Program webcast on LID maintenance, compares LID maintenance concerns versus conventional BMP maintenance.

One stakeholder interviewed noted that Fairfax County discovered that the County could not fund or install rain gardens on private property because the use of tax dollars to "improve" select properties was an inequitable use of tax dollars. To rectify this, the County turned the effort over to the Northern Virginia SWCD. Arlington County, aware of the Fairfax County experience, vetted their program through the legal department first and arranged for ACE (a non-profit) to distribute rebates. Additional research is warranted to determine if this issue would be a barrier in other localities.

Because there are typically such a large number of on-site LID retrofits installed within a subwatershed, Schueler has proposed a simplified method of analysis which uses the cumulative area of impervious cover treated by the BMPs and an average of the rainfall depth captured to estimate the total nutrient and sediment reduction for all on-site LID retrofits combined within a subwatershed (CSN Technical Bulletin No. 9, 2011). See Appendix H for a more detailed explanation of this method.

Table 3-4: Issues Associated with LID versus Conventional BMPs (Schueler and Scott 8/11/11).

The Changing Maintenance Paradigm		
	Conventional Practices	**LID Practice**
Example of Practice	Pond	Disconnects/rain garden
Number of practices?	A few at each site	Dozens
Size of practices?	Large drainage area	Micro-drainage area
When to construct?	During site construction	After site is stabilized
Who is responsible?	Homeowner association	Homeowner
Who does inspection?	Public sector engineer	Trained contractor
Who does maintenance	Specialized contractor	Landscape contractor
How long does it take?	Hour or more	10 minutes
What is the goal?	Prevent dam failure and and public nuisances	Maintain hydrologic function and landscaping
Sediment cleanouts?	On a 30 to 50 year cycle (if ever)	Annual cleanouts at pretreatment devices
Maintenance Triggers	After catastrophic failure	Visual inspection/appearance

3.5.1.2 Tracking

Schueler suggests that localities should maintain a project file for each LID project installed that includes the following (CSN Technical Bulletin No. 9, 2011):

- A site map with the LID location(s);
- Contact information for party responsible for maintenance;
- Design information for larger LID practices;
- Maintenance and inspection reports;
- Digital photos; and
- Record of nutrient and sediment reduction credits and method used to compute the credits.

The file should be maintained for the life of nutrient reduction credits (approximately 25 years). In addition, pertinent LID information should be stored in a GIS-based BMP tracking system including the LID/property location by GPS coordinates, the associated 12 digit watershed code, type of LID, the credits claimed, and method used to compute the credits. Once the vegetation is established and the inspector confirms the LID practice is functioning as designed, the BMPs should be visually inspected at least once every 5 years. Schueler suggests that maintenance agreements should (Schueler and Scott, webcast August 11, 2011):

- Identify specific parties responsible for maintenance;
- Identify landscape contractor or other party to perform maintenance;
- Require annual self-inspection;
- Reference the specific annual maintenance tasks that must be performed;
- Provide LID locator map to find practices; and
- Provide photos of the established LID practices

Existing model programs maintain databases to track BMP installation. A link to Anne Arundel County's GIS reporting system is provided in the Reference section under Anne Arundel County. Both Arlington County and Montgomery County staff use iPads to collect information during site visits and facilitate data entry into their database/GIS system. In addition, Montgomery County staff have begun to explore the use of stormwater smartphone/iPad applications to facilitate site analysis (personal communication with Christin Jolicoeur and Ann English, April 16, 2012). The City of Virginia Beach is currently working with Lynnhaven River Now to develop a tracking and reporting system that other Hampton Roads localities may use as a model. Stafford County Department of Code Administration also has a Stormwater BMP Master Database/GIS that other localities may be able to use as an example.

3.6 Onsite Sewage BMPs

Nitrogen delivered to the Chesapeake Bay watershed from onsite sewage systems, including septic systems, is attributed to the urban sector in the TMDL. If localities want to reduce nitrogen delivered by these private systems, then they can create programs and incentives in cooperation with the Health Department.

3.6.1 Septic Connections

Septic connections or hookups to existing sanitary sewer systems is a system change BMP. As many localities in Hampton Roads have become more urbanized, some residential property owners with septic systems have not and may not want to tie into the sanitary sewer system.

Cost to the property owner in the form of usage fees is one potential barrier to getting these property owners to go "on-line". However, as septic systems fail, if localities can provide the property owners with a life cycle cost-benefit analysis comparing the cost of installing a new system to the average long term cost of fees, some property owners may agree to hookup.

3.6.2 Septic Pumping

In localities that are still transitioning from rural to suburban and urban, there are still a number of private properties that are on septic systems. "Tidewater" localities within the Chesapeake Bay Resource Management Areas require private property owners to pump out their septic tanks every five years.

3.6.2.1 Issues to Consider

Several stakeholders interviewed noted that enforcement, tracking and reporting for the mandatory pump outs is sporadic and varies from locality to locality. Targeted outreach, communication, and engagement of private property owners with septic systems, including and ongoing reminders, may motivate citizens to pump-out their systems every five years. However, localities may have to enact penalties for citizens that do not comply in order to increase compliance. NGOs and trained environmental stewards may be valuable partners that can provide the targeted outreach, communication, and engagement functions for these efforts.

3.6.2.2 Tracking

As mentioned previously, some localities are notifying citizens of the need to pump out septic systems every five years and submit proof of the pump out, however, it is unclear whether or not these localities track or enforce the pump outs. If localities have not already done so, they should develop a tracking and reporting system for septic pump-outs and maintain pump-out certification records.

3.6.3 Septic Denitrification

This BMP requires private property owners to upgrade their existing septic systems to more efficient septic systems. One barrier to success for this BMP is the cost associated with system replacement when old systems are still functioning as designed. New Virginia Department of Health regulations require systems to achieve a 50% reduction in Total Nitrogen (compared to conventional gravity systems) from alternative on-site septic systems (AOSS) installed after

December 7, 2013 (12 VAC 5-613-90 D). If these systems replace existing septic systems, it may be possible for associated nutrient reductions to be credited toward local government targets.

Table 3-3: BMPs Used by Model Programs

BMP NAME	MONTGOMERY COUNTY RAINSCAPES	RICHMOND	ARLINGTON COUNTY	ANNE ARUNDEL COUNTY	WASHINGTON, DC RIVERHOMES	NORTH CAROLINA CCAP
Bioretention - facilities are similar to rain gardens, but they rely on structural components such as underdrains and connections to downstream stormdrain systems to drain the facility.				Bioretention		Bioretention Area
Rain gardens- are shallow gardens designed to capture and soak up stormwater	Rain Garden	Rain Garden	Rain Garden	Rain Garden	Rain Garden	Backyard rain garden
Conservation Landscaping - landscaping uses native plants that are adapted to local rainfall and soil conditions to replace part of your traditional lawn	Conservation Landscaping		Conservation Landscapes – conversion of lawns and non-native invasives to native plants, minimum of 150 sq. ft.		BayScaping; 120 square feet minimum of turf, grass, or lawn must be replaced with native plants	
Conservation landscape - could either be in the riparian buffer or outside and the land is perpetually dedicated for conservation purposes. Must specify if the planting is within the riparian buffer or whether it is inside or outside the critical area.				Conservation landscape		

Table 3-3: BMPs Used by Model Programs (continued)

BMP NAME	MONTGOMERY COUNTY RAINSCAPES	RICHMOND	ARLINGTON COUNTY	ANNE ARUNDEL COUNTY	WASHINGTON, DC RIVERHOMES	NORTH CAROLINA CCAP
Downspout Disconnection - direct water from your downspouts to an area on your property where the water can infiltrate		Downspout Disconnection (Reedy Creek Coalition)	Promoted but no rebate			
Vegetated Filter Strips – uniform strips of dense turf, meadow grasses, trees or other vegetation with a minimum slope and can treat runoff from roof downspouts		Vegetated Filter Strip				
Tree Canopy – created when trees planted near each other create an "umbrella" or canopy of leaf cover that shades the ground. Tree leaves intercept rainfall and their roots absorb it.	A tree canopy	Tree Planting - The minimum area for reforestation is 7500 square feet. (Reedy Creek Coalition)	Tree Canopy Fund – geared towards large plantings of trees in a community, also free native tree giveaway to individual homeowners.		Shade Tree Planting - specific trees	
Permeable Pavers - Replacing the hard, impermeable surfaces on your property with materials such as permeable pavers allows rainwater to soak into the ground. This reduces the amount of runoff that leaves the property	Permeable Pavers		Pervious Pavers or Concrete – can include removal of impervious surfaces Minimum of 150 sq. ft.		Pervious Pavers - Walkways and small patios are not eligible.	Impervious Surface Conversion to Permeable Pavement or Vegetation Establishment

Table 3-3: BMPs Used by Model Programs (continued)

BMP NAME	MONTGOMERY COUNTY RAINSCAPES	RICHMOND	ARLINGTON COUNTY	ANNE ARUNDEL COUNTY	WASHINGTON, DC RIVERHOMES	NORTH CAROLINA CCAP
Pervious Pavement - concrete blocks, grid pavers, or pervious concrete or asphalt with a stone reservoir underneath. The reservoir temporarily stores surface runoff before infiltrating it into the soil below		Pervious Pavement				Permeable Pavement - must be combined with impervious surface removal.
Permeable Surface - include description of type of permeable surface used, the location, and the coverage area				Permeable Surface		
Green Roof - are covered with a waterproof membrane and then planted with a special vegetation system to absorb rainfall.	Green roofs		Green roof	Green roofs		
Rain Barrels and Cisterns - collect and store rainwater from your roofs.	Rain barrels and cisterns	Onsite Stormwater Storage includes rain barrels, cisterns, or other stormwater storage devices approved by the Dept. of Public Utilities	Cisterns for rebate, rain barrels – build your own workshop for $55	Rain Barrels	Rain Barrels	Cistern

Table 3-3: BMPs Used by Model Programs (continued)

BMP NAME	MONTGOMERY COUNTY RAINSCAPES	RICHMOND	ARLINGTON COUNTY	ANNE ARUNDEL COUNTY	WASHINGTON, DC RIVERHOMES	NORTH CAROLINA CCAP
Dry Wells - well is an underground gravel-filled pit that collects stormwater from roof downspouts or hard surfaces, such as driveways and filters the water through the ground.	A dry well		Infiltration Trenches and Dry Wells			
Wetland Restoration - Include work to restore a historic wetlands or constructing a new wetland.				Wetland Restoration		Backyard Wetland or Stormwater Wetland?
Upland Tree Planting				Tree planting outside the Critical Area		
Critical Area Planting				Riparian Buffer Planting is planting within the 300 ft. stream buffer (Critical Area)		Establish a perennial vegetative cover on land that cannot be stabilized by ordinary conservation treatment.

Table 3-3: BMPs Used by Model Programs (continued)

BMP NAME	MONTGOMERY COUNTY RAINSCAPES	RICHMOND	ARLINGTON COUNTY	ANNE ARUNDEL COUNTY	WASHINGTON, DC RIVERHOMES	NORTH CAROLINA CCAP
Riparian Buffer Planting - are used to restore native plants along a stream. Tree and shrub species chosen will grow to various heights creating multiple layers of canopy at maturity. This is very effective at reducing runoff, protecting stream banks from erosion and will provide habitat for wildlife. Some maintenance is required during the first two years after planting		Riparian Forest Buffer Plantings (Reedy Creek Coalition)		Riparian Buffer Planting outside the Critical Area		Area adjacent to solid blue-line streams as shown on 7.5 minute USGS maps were a permanent, long-lived vegetative cover (shrubs, trees or combination of vegetation types) is established to improve water quality. Must be a minimum of 15 feet wide and native plants.
Living Shoreline				Include all soft/natural shoreline techniques		
Streambank and shoreline protection - Use of vegetation to stabilize and protect banks of streams, lakes, estuaries or excavated channels against scour and erosion.						Streambank and shoreline protection

Table 3-3: BMPs Used by Model Programs (continued)

BMP NAME	MONTGOMERY COUNTY RAINSCAPES	RICHMOND	ARLINGTON COUNTY	ANNE ARUNDEL COUNTY	WASHINGTON, DC RIVERHOMES	NORTH CAROLINA CCAP
Stream Restoration System - Use of bioengineering practices, native material revetments, channel stability structures and/or restoration or management of riparian corridors.						Stream Restoration System
Septic System Retrofits				number of septic systems retrofitted per address		
Oyster Planting - tracked entered per oyster planting location and includes location, type of planting location and shall include location information, size of planting bed, type of planting bed, number of spats, and other details				Oyster Planting		
Bay Grasses (SAV) - explanation of location, type and coverage area (sq. ft.) of grasses planted.				Bay Grasses (SAV)		
Stream Dumpsite Cleanup - extent of cleanup and tons of trash and types of trash removed				Stream Dumpsite Cleanup		

Table 3-3: BMPs Used by Model Programs (continued)

BMP NAME	MONTGOMERY COUNTY RAINSCAPES	RICHMOND	ARLINGTON COUNTY	ANNE ARUNDEL COUNTY	WASHINGTON, DC RIVERHOMES	NORTH CAROLINA CCAP
Upland Dumpsite Cleanup - extent of cleanup and tons of trash and types of trash removed				Upland Dumpsite Cleanup		
Pet Waste Receptacle				Pet Waste Receptacle		Pet Waste Receptacle
Education/Outreach				Education/Outreach		
Diversion - a channel constructed across a slope with a supporting ridge on the lower side to control drainage by diverting excess water from an area to improve water quality.						Diversion
Grassed Swale - natural or constructed channel that is shaped or graded to required dimensions and established in suitable vegetation for the stable conveyance of runoff to improve water quality						Grassed Swale

Table 3-3: BMPs Used by Model Programs (continued)

BMP NAME	MONTGOMERY COUNTY RAINSCAPES	RICHMOND	ARLINGTON COUNTY	ANNE ARUNDEL COUNTY	WASHINGTON, DC RIVERHOMES	NORTH CAROLINA CCAP
Stormwater Wetlands						Stormwater wetlands are constructed systems that mimic the functions of natural wetlands and are designed to mitigate the impacts of urbanization on stormwater quality and quantity. Designed to treat impervious surface area greater than 2500 sq. ft.
Backyard Wetland						Backyard wetlands are constructed systems that mimic the functions of natural wetlands A backyard wetland can temporarily store, filter and clean runoff from driveways, roofs and lawns and thereby improve water quality. The wetland remains saturated for two to three weeks.

4 ISSUES THAT IMPACT FEASIBILITY

An objective of this investigation was to interview stakeholders from agriculture, development, and local government sectors to identify advantages, disadvantages, obstacles, and unresolved issues that impact the feasibility of achieving nutrient reductions on private property. In order to accomplish this task, Wetlands Watch participated in webcasts, conducted a literature search, and interviewed program coordinators and other local stakeholders. The goal of this work was to identify challenges and barriers associated with local government's ability to increase the use of BMPs on private property as nutrient and sediment reduction strategies for MS4 and WIP programs.

Many of the challenges associated with individual BMPs are discussed in Section 3, Appropriate BMPs. However, additional challenges revolve around stakeholder and governmental planning, implementation, and coordination. Overall there are two sets of challenges to this strategy. One set of challenges resides with the private landowners (and organizations working with them) and one set resides with local, state, and federal governments.

The private landowner challenges include:

- Properly-targeted communication and outreach to private landowners;
- Availability of technical expertise and guidance;
- Availability of plants and other materials;
- Properly focused incentives and rewards;
- Personal preferences, knowledge, capabilities, and interest of targeted property owners;
- Covenants and restrictions within neighborhoods and communities;
- Cost and financial resources of targeted property owners; and
- Ease of implementation.

The local government challenges include:

- Conflicts and compliance with existing land-use policies, codes and ordinances, other departmental and regulatory programs, and standard practices;
- Efficacy - ensuring practices are properly designed and installed to achieve expected runoff and nutrient/sediment reductions;
- Accountability - ensuring practices installed are identified, tracked, and performing over time;
- Achieving credits - ensuring that practices are state-and EPA-approved practices so that they can be "counted" in MS4 and Chesapeake Bay TMDL-related programs; and
- Funding.

4.1 Planning

During the planning phase of a BMP project, the most significant challenges for private landowners are developing a project that meets technical requirements and personal preferences and navigating the permit and approval process. The most significant challenge for

local governments is how to make the project development and approval process easier for private landowners and still ensure compliance with all requirements. Based on existing programs, development of watershed restoration plans helps both the landowner and local governments with project planning. A program developed around a watershed restoration plan or other comprehensive planning tools like blue/green infrastructure plans provide localities and all stakeholders with a framework, guidance, and vision. Programs that were not developed around a local watershed restoration plan have often resulted in poorly designed and implemented BMP retrofit demonstration projects that do not provide long-term water quality benefits.

The following resources document methodologies for developing watershed restoration plans:

- *EPA's National Management Measures to Control Nonpoint Source Pollution from Urban Areas* (November 2005, EPA-841-B-05-004),
- CWP's *Urban Watershed Restoration Manual Series,*
- CWP's *Smart Watershed Benchmarking Tool* (Rowe and Schueler, 2008), and/or
- DCR's *Local Watershed Management Planning in Virginia, A Community Water Quality Approach*"

All of these documents recommend that planning organizations work together with interested stakeholders including government agencies, NGOs, private and public institutions, the development and real estate community (and other private sector entities), civic organizations, and community leaders to identify overlapping interests, develop implementation strategies that provide multiple benefits, build awareness of issues, and reflect community-specific ideas and needs. The plan should be promoted and readily accessible to all citizens and can be used to gain support for local government actions and policies.

Stakeholders interviewed for this report voiced concerns regarding the lack of communication and coordination with mandated programs at the Federal and State levels and a culture of "separation" at all levels of government. The feasibility of increasing BMPs on private property to achieve nutrient and sediment reduction credits can involve planning, capital improvements, code changes, permitting and coordination with multiple agencies. Inter-departmental communication and collaboration is needed, but is often missing. Complicated and costly permitting and approval processes can be a deterrent to private property owners who wish to adopt new practices on their property; whereas, access to technical expertise and guidance through the permitting and approval process can be an incentive.

4.2 Implementation

Programmatic issues that can impact the successful implementation of a BMP project on private property include:

- Organizational capacity (funding and staff);
- Management and coordination of partners;
- Partner skills and knowledge;
- Relationships and attitudes between stakeholders; and
- Attitudes, knowledge, and resources of targeted private property owners.

In the implementation phase, challenges for private property owners include:

- Need for information or technical assistance to build BMPs;
- Willingness to adopt and pay for these new practices,
- Willingness to assume responsibility for long and short-term maintenance; and
- Willingness to share information about the design and maintenance of the BMP with the local government.

In addition, some property owners may have to comply with neighborhood and community covenants and/or restrictions that conflict with water-friendly practices.

CSN's Technical Bulletin No. 9 (Schueler, 2011) identifies a number of implementation challenges from the local government perspective associated with efforts to increase BMPs on private property:

- Every retrofit project is unique to some degree, depending on the drainage area, the treatment mechanism(s) employed, the runoff volume captured, and the degree of prior stormwater treatment at the site, if any.
- Many retrofits are under-sized, due to site constraints, in comparison to new BMPs designed to new development standards. Some adjustment in pollutant removal capability is needed to account for situations where retrofits cannot meet the volume and treatment requirements of new standards.
- There is virtually no research available specifically for efficiencies of stormwater retrofits, so removal rates needs to be inferred from other known BMP and runoff reduction performance data.
- Many retrofits employ innovative combinations of runoff treatment mechanisms and may not be easily classified according to the existing CBP-approved BMP efficiencies.
- Localities often evaluate dozens or even hundreds of candidate projects during retrofit investigations to find the best ones. Therefore, localities will need fairly simple protocols to estimate pollutant reduction achieved by individual retrofits projects as part of their watershed assessment and retrofit investigation.

All of these factors cause concern with localities about their capacity to handle a program to increase the number of BMPs on private property. Local government concerns include:

- How will local government agencies accommodate and fund the new level of effort and costs associated with a program that promotes and tracks potentially "hundreds" of BMPs on private property?
- Who will do the work and what skills will be needed for the site assessment, design, installation, inspection, maintenance, and tracking of new BMPs?
- Who will provide education, engagement, and targeted recruitment of private property owners?
- What incentives should be offered, will they be effective, how should they be delivered, how should they be funded?
- What type of BMP data should be tracked and with what format?

Programs offered as model programs in this document have evolved and developed in an effort to overcome the obstacles encountered within their own programs and by others. NFWF grantees meet on an annual basis to review funded programs, identify obstacles and successes, and share information with other grant recipients. Tom Schueler of CSN attends these meetings and includes these "lessons learned" in technical bulletins, webcasts, and guidance documents, many of which have been referenced in this document.

4.2.1 Collaboration and Partnerships

Past experiences, personal attitudes, and trust influence citizens' willingness to use new water-friendly practices, participate in incentive programs, and allow access onto their property. Some property owners have declined to participate in incentive programs because they were unwilling to allow an inspection of the property. NGO stakeholders have noted that some property owners do not want regulatory staff in their backyard and may be unwilling to report voluntary practices installed on their property. NGOs have been able to ease homeowners concerns and help to build relationships with local environmental staff. NGOs spend a lot of time building a sense of trust among citizens and business owners, and they often rely on a community leader to gain that needed trust within a community. In addition, many of the BMPs suitable for private property tend to be landscaping-type actions. Since landscape and lawn-care professionals and suppliers (nurseries and garden centers) often are trusted advisors, theyhave a significant influence on private property owner decisions regarding BMP design, installation, and maintenance. Overcoming the challenges involved in gaining access to private property, building trust, and educating and convincing private property owners to adopt new water-friendly landscape-type practices is feasible through creative partnerships with NGOs and the private sector.

Programs that involve partnerships between NGOs, local governments, and private contractors seem to be the most effective. Local watershed group staff and trained environmental stewards who focus on promoting voluntary water-friendly practices are comprised of trusted community leaders that have established good relationships with local property owners, businesses, and community groups. Stormwater management and other regulatory staff may be technically proficient, but lack the outreach, education, communication, and engagement skills. The NGO entity can reach private landowners in ways that governmental entities cannot, while the governmental involvement adds elements of planning, technical expertise, and programmatic rigor needed to take full credit for these practices. NGOs, trained environmental stewards, and professional landscape contractors also enable local government to expand their program delivery without hiring more staff. For NGOs, partnerships with local government can be essential if there are conflicts with existing public policy, codes and ordinances.

Successful models typically involve local and state leaders who understand the value of integrating programs through a collaborative planning process. The Green Ribbon Committee and Water Quality Task Force in Virginia Beach and the Lafayette River Restoration effort in Norfolk are examples of collaborative planning efforts that include inter-departmental representatives of local governments as well as NGOs. The Native Plants Marketing Group, organized by the Virginia CZM, is an example of a state-level collaborative effort that includes multiple state agencies and NGOs.

Montgomery County *Rainscapes* is an example in which the County recognized the potential benefits of local watershed groups and helped develop them. A lack of qualified landscape professionals and insufficient capacity of local watershed groups to provide needed services

motivated the County to develop and offer professional training programs and partner with the NCR WSA. With these efforts, Montgomery County was able to:

- Expand their program without a significant increase in costs;
- Increase their outreach, education and engagement efforts to private citizens;
- Maintain some control over the quality of BMP design, installation, and maintenance;
- Assist with tracking and reporting; and
- Focus staff time on planning, regulatory compliance, inspections, and tracking and reporting.

Sometimes environmental advocates and local government staff have adversarial relationships associated with land-use decisions and regulatory enforcement that get in the way of a working partnership. In order to collaborate, watershed groups and local government staff must overcome any distrust from past experiences.

4.2.2 Funding and Incentives

Funding for the increasing costs of stormwater management continues to be an issue for all localities. Most Phase I MS4 permitted localities collect a stormwater utility fee or taxes that partially fund programs. Arlington County, Fairfax County, and the City of Alexandria (beginning in 2012) collect a stormwater tax to fund the stormwater management program. Prince William County, and the Cities of Manassas, Richmond, Chesapeake, Newport News, Norfolk, Hampton, Portsmouth, Suffolk, and Virginia Beach all collect a stormwater utility fee which is based on the amount of impervious surface area of a property (Berger, 2011). A discussion on the merits and governing statutes is provided in *The Chesapeake Bay TMDL: Managing Our Water Resources – Where Water Quality and Water Quantity Collide* (Bulova and Wortzel, 2011).

The majority of other Virginia localities tend to rely on "general fund appropriations (largely generated through real estate taxes) in combination with limited permit fees" for their stormwater management plans. These programs must compete with other capital improvement programs and, as a result, are typically underfunded (Bulova and Wortzel, 2011). All model programs identified have received grants, primarily from NFWF, EPA, the Virginia DCR Water Quality Implementation Fund (WQIF) and Virginia DEQ, to partially fund their programs.

The sustainability of all model programs is a critical challenge. In Virginia, from 2006 to 2012, the National Fish and Wildlife Fund (NFWF) granted almost $18 million dollars to NGO,Soil and Water Conservation District, andUniversity Research programs. The Chesapeake Bay Trust provided an additional $400,000 in grant money to NGOs and VIMS primarily for living shoreline projects. However, these grant funds were only available for a discrete period of time, typically not renewed, and therefore are not a sustainable funding source. NFWF funds oneto three year experimental or "ground-breaking" projects and programs. The Chesapeake Bay Funders Network in recent grant cycles has established an "organization building" grant for watershed groups that could be available to strengthen existing smaller watershed groups in the Hampton Roads region. Virginia DCR continues to provide funding to localities and NGOs through the WQIF grant fund.

Investigation efforts for this report identified several types of incentive programs designed to engage citizens and increase the number of BMPs on private property. The types of incentives offered to private property owners include financial incentives, assistance programs,

recognition/awards,and do-it-yourself workshops like "build your own rain barrel" or "how to design a rain garden." The financial incentives offered by the localities include cost-sharing/rebates, stormwater utility fee credits, and tax credits.

Financial incentive programs enable localities to educate private property owners, approve designs, conduct an inspection, obtain a written maintenance agreement, and track BMPs installed on private property. Some localities have noted that a cost-share requirement has resulted in better maintenance from the private property owner. Some localities require property owners to confirm that BMPs are still functioning after a certain period of time in order to continue to receive a stormwater utility credit. Both Arlington County and Montgomery County program managers noted that educated and engaged citizens who understand the importance of watershed restoration and stormwater management programs also provide political and fiscal program support.

Several localities have reported that rebate and tax credit application procedures and requirements are discouraging to private property owners who want to participate in these incentive programs. Complicated permitting processes and the need for professional certification of projects are perceived as barriers and raise the costs associated with BMP design and installation. Consequently, the tax credit or rebate is not worth the effort. In addition, managers of public utilities that fund tax credits and rebates may not fully promote and support these programs because credits and rebates are revenue losses.

Alternative incentives include free or subsidized technical assistance and services that facilitate or provide site analyses; recommend strategies and actions; negotiate permit processes; provide project oversight; and design or maintain BMPs. In Montgomery County, the *Rainscapes* program manager reported that the program has facilitated relationship building between staff and citizens and those citizens have voiced gratitude for the technical review provided by the manager. Montgomery County also noted that the County has trained and worked with NGOs, private landscaping contractors, suppliers, and trained environmental stewards to ensure that all are capable partners that can provide technical assistance and services to private property owners. After providing a local nursery with a list of approved trees and informing them about a tree planting incentive program, the nursery began informing citizens about the program. Subsequently, tree plantings increased significantly.

Several programs (*like Pearl Homes* and *River Star Homes*) have developed small signs or front yard flags that recognize the BMPs and the commitment of private property owners. Other localities and non-profits have recognition award ceremonies and promote the successes in the media and on websites. The Elizabeth River Project's River Star Businesses Program has an annual awards ceremony to recognize exemplary business participants. Many of these recognition programs promote (and some require) BMPs like Urban Nutrient Management on residential property. If localities could find a way to collaborate with NGOs and track willing participants of the program, these recognition programs represent a low cost strategy to increase BMPs on existing private property. Like the financial incentive programs, these recognition programs build support for watershed restoration and stormwater programs among the citizenry.

4.2.3 Tracking and Reporting

In Hampton Roads, most BMPs installed on private property were implemented because motivated local citizens responded to engagement efforts of local government, Master Gardeners

and Master Naturalists, and NGOs. Some BMPs were installed as demonstration projects to build awareness and increase stakeholder involvement using grant funds. Unless a BMP was installed through a rebate program or a grant project (after 2008), most BMPs have not been tracked and reported. If tracked and reported, the information available regarding the location and BMP characteristics are typically not sufficient to calculate nutrient or sediment reductions.

Private property owners may be willing to report BMP information, but the process must be straightforward and not time consuming. Ideally, local governments need reliable reporting data that satisfies MS4 permit audits. A tracking and reporting protocol is a critical element of a successful WIP strategy to increase BMPs on private property and allow localities to calculate and report nutrient and sediment reductions for those BMPs. At a minimum, all localities and the State should agree on a standard format, a standard list of BMP retrofits, and standard information (and units of measurement) to include in a GIS/database. Collaboration and coordination between the State, localities, and non-profit watershed groups would facilitate transfer of data and data analyses and reduce the financial burden associated with each locality developing and maintaining their own system.

Wetlands Watch conducted a survey of citizens in Hampton Roads to identify the types of BMPs private property owners have already installed (see Appendix I). Originally, the intent was to focus on a select population of members of local watershed groups and Master Gardeners and Naturalists; however, through word of mouth, a posting of the link on the a*skHRgreen.org* website and a local news story, a larger segment of the population participated in the survey. As of the March 30, 2012 survey end date, 266 Hampton Roads citizens completed the survey entitled *Watershed-Friendly Actions in Hampton Roads* to self-report BMPs installed on private property (see Appendix I). Given the willingness of citizens to participate in this survey, HRPDC might consider hosting a site through a*skHRgreen.org*, similar to the *Green Up DC* site (see section 2 for program discussion), as a voluntary reporting mechanism for citizens and local watershed groups. Such a site would also encourage and promote regional actions.

Anne Arundel County, MD and Washington, DC have both developed an on-line tracking and reporting system that private property owners can access and use to self-report BMPs. Montgomery County, MD has developed a tracking database that is linked to their GIS system and the City of Virginia Beach is in the process of working on a system similar to the Anne Arundel County system. HRPDC has an existing Permit Administration and Review System (PARS) database that some (but not all) localities use to track BMPs and other data for MS4 permits. This system could be revised to accommodate BMP retrofit data. DCR requires WQIF grant recipients to track and report BMPs installed with grant projects on a spreadsheet; however, the list and names of acceptable BMPs do not correspond completely with the Virginia-approved non-proprietary BMPs or the EPA approved BMPs. Virginia DCR hired a contractor to develop the e-Permitting system that will feed into the National Environmental Information Exchange Network (NEIEN) system used to track and transmit BMP data to the EPA for input into the Chesapeake TMDL models. CBP (Tom Schueler) also is in the process of developing a standard formatted tracking and reporting system. The Maryland DEP already developed a state BMP database system that tracks MS4 and TMDL related BMPs and is coordinated with local database systems. A review of Anne Arundel County's 2010 annual MS4 permit report, Phase II WIP report, and on-line "Restoration Activity" database indicates that the county is already reporting and getting credit for impervious surface, nutrient and sediment reduction credits for the retrofit BMPs installed by Watershed Stewards on private property.

Trust and control are large barriers to the success of effective regional or statewide systems. Some local officials voiced concern that the e-Permitting system will not meet their departmental needs. Others noted that the regional HRPDC database is not used by all localities and that some localities preferred to have their own system. Local government staff interviewed noted that Virginia may collect data from the localities, but does not provide data back to localities. Some citizens may prefer to fly below the radar and refuse to self-report or participate in a program that requires an agreement to let local officials inspect BMPs installed on their property.

4.3 Coordination of Services

This report identifies a number of environmental steward training programs hosted by organizations such as Master Gardeners, local watershed groups, and NGOs. Trained environmental stewards can provide property owners with training, coordination, and management services that include the following:

- Assess neighborhoods and individual properties;
- Develop site-specific plans;
- Educate and engage neighbors and community members;
- Reduce pollutants and stormwater runoff through with demonstration projects;
- Coordinate and report actions;
- Fund raise;
- Advocate & build advocacy;
- Collect water quality samples;
- Plant trees;
- Restore habitat;
- Develop nutrient management plans;
- Maintain BMPs; and
- Inspect BMPs.

The level of technical expertise and services provided by trained environmental stewards varies depending on individual steward interests and physical ability, professional credentials, and organizational leadership and oversight.

Trained environmental stewards have been valuable resources to local government and communities; however, these stewards would make stronger partners if all stakeholders had a clear understanding of the interests and capabilities of stewards and their associated organizations. By establishing regional training programs and a framework for credentialing, private property owners and local governments would have more certainty that projects guided by environmental stewards will be installed according to technical standards and will receive long-term maintenance. Since BMP installation and maintenance ranges from very simple to very complex, it would serve all stakeholders to have more information on which organizations have capabilities that match a project's complexity.

Also, centralizing information on stewards and organizations' capabilities may highlight gaps in community needs. For instance, the Virginia Zoo has noted that bioremediation projects like rain gardens are popular volunteer demonstration projects, but it is difficult to find volunteers to perform project maintenance.

A stronger communication network and consistent stewardship training could help minimize the number of mixed-messages being received by private property owners. For example, lawn-care companies and garden centers (and even the Virginia Tech soil analyses reports) promote excess fertilization of turf, while NGOs and local government are spreading the "less is better" message. *Be Water Smart* programs promote xeriscaping (low water needs landscaping techniques) that may include invasive species and non-native plants, while NGOs and other government programs promote the use of native plants. Another issue is the need for coordination with the private sector to address the market demand for specific materials and expertise. For example, programs to increase the use of BMPs on private property create a market for supplies (i.e. pervious pavers, native plants, rain barrels, and rain garden kits) and for trained and experienced landscape professionals and nutrient managers. These resources may not be available in the marketplace.

The Anne Arundel County WSA has developed an umbrella program that can serve as a model for programs in Hampton Roads, with modifications to better fit regional conditions. A Hampton Roads Strategic Summit is proposed to look at existing environmental stewardship programs and make recommendations on curriculum, program missions, steward roles, and organizational adjustments as they pertain to Virginia and specifically, Hampton Roads. Stakeholders have voiced concerns that the Strategic Summit should focus on refining and strengthening existing programs and networks that respond to local priorities rather than developing a new regional program.

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5 Existing BMPs

Another objective of this investigation was to conduct outreach to non-profit organizations to catalog existing undocumented BMPs that were implemented through grant-funded efforts, community-based programs, or other voluntary projects. In addition, Wetlands Watch was to attempt to quantify the nutrient removal achieved by these projects. Available information was collected through a review of grant reporting records, a survey, and interviews with project coordinators, participants, and funders. Specific tasks included:

- Identify grant-funded efforts, community-based programs, and other voluntary projects that have implemented BMPs on private residential and light commercial properties;
- Assess the quality of the data available on those BMPs;
- Given the quality of available data, assess the feasibility of using the BMP-related data to quantify the nutrient reduction achieved by the projects;
- Collect estimates of nutrient reduction achieved by the projects via project reports to funders and/or self-reporting of project coordinators and participants obtained through interviews or surveys;
- Identify sources and amount of funding used to fund the projects; and
- Summarize all information by locality.

In order to assess the value of available BMP data, Wetlands Watch identified whether NGOs:

- Tracked the number of BMPs installed per project;
- Can provide specifics regarding the location, design, installation, continued operation, and maintenance of BMPs installed; and
- Can provide individual or cumulative estimates of nutrient removal rates for BMPs installed.

Wetlands Watch determined that, although there are some data available regarding existing BMPs on private properties installed through grant-funded projects, the level of detail of most BMP data is insufficient to calculate nutrient or sediment reduction without additional investigation. Most grant-funded projects conducted by non-profit organizations in Hampton Roads focused on community outreach as a means to build advocacy, change behavior, and convince their members to use water-friendly practices on their property. Many of the BMPs were installed as demonstration projects on public property or institutional property with the objective to get people to start *practicing* rather than track BMPs installed.*;*.

The non-profit organization projects that have tracked BMP data have reported information in different formats as required by the funding source. The level of detail required by funders varies between sources and from year to year. For instance, information might be reported in number of plantings, type of BMP installed, total acres treated, orsquare feet of the project and may or may not include an estimate of nutrient and sediment reduction. Additional information is needed to even identify which type of BMP the "plants installed" might fall under. If the plants included trees and shrubs to replace turf or impervious surfaces, the "plants installed" could be defined as a land-use change reported in acres converted from Pervious or Impervious Urban lands to Forest lands.

Discussions with Lynnhaven River NOW and the Elizabeth River Project indicate that additional detailed BMP data can be compiled from files and/or through a comprehensive survey of members. However, this effort is time consuming and staff intensive. LRN is waiting for the City of Virginia Beach to finalize their tracking and reporting system. In addition, both the LRN *Pearl Homes* and ERP *River Star Homes* programs that focus on residential and small business owned private properties are relatively new. As a side note, the programs are popular with citizens. LRN and ERP have signed up 376 and 695 homes, respectively, and these programs will track the types of BMPs installed on private property and the addresses of participants.

Localities within the Elizabeth River Watershed should consider establishing a collaborative relationship with ERP like the LRN/City of Virginia Beach collaboration in order to ensure that data on BMPs installed through the *River Star Homes* program is captured and reported. At a minimum, every property owner that signs on to become a *River Star Home* will be practicing urban nutrient management because it is a condition of the agreement to become a *River Star Home*.

Nutrient management plans developed by *Turf Love* (and any other DCR certified nutrient manager) are tracked and reported to DCR annually and DCR in turn, reports the information to the EPA for input into the Watershed Model. This information was incorporated into the data provided to localities by DCR for Phase II WIP planning purposes.

The original intent of this study was to develop a simple database from existing spreadsheets and information collected during this investigation. However, the inconsistent reporting methods and lack of detailed data make it difficult to compile the information using the database format. The effort to collect more detailed data is beyond the scope of this project. Wetlands Watch compiled readily available BMP and grant-funded project information into a spreadsheet with several tabs (Final Existing BMPs.xls). The spreadsheet is organized by locality and is available from HRPDC electronically. For some projects listed, BMPs were installed on both public and private property and reported such that Wetlands Watch was unable to distinguish the BMPs on private property. The spreadsheet format is based on the format used by NFWF to compile and summarize grant information; however, Wetlands Watch added several new BMP columns to capture data collected during the investigation. Data provided regarding BMPs installed and nutrient and sediment reductions achieved are reported as totals for entire projects; Wetlands Watch was unable to discern individual BMP locations or quantify nutrient and sediment removal rates for each practice installed. Additional effort is needed to work with NGO grant project coordinators to ascertain if more detailed data is available, reliable, and quantifiable.

As discussed in Section 3, Appropriate BMPs, shoreline erosion control practices, oyster reefs, SAV plantings, and marine pump-out stations are all potential BMPs that should be further explored for clarification on whether or not they are included in the Chesapeake Bay Watershed Model 5.3.2 or the Water Quality and Sediment Transport Model. Because a majority of Hampton Roads Area is tidally influenced, these actions have been identified as effective pollutant and sediment reduction techniques. ERP, LRN, and CBF have implemented and promoted SAV plantings, oyster reefs/oyster gardening, and the use of marine pump-out stations. Some of the actions are tracked and reported for grant projects, but many oyster gardeners may not report their actions. These actions should be reported to VIMS for tracking and VIMS, if not already doing so, should provide the information to DCR and the EPA for inclusion in the Water Quality and Sediment Transport Model.

Non-structural shoreline erosion control BMPs include the installation of native plants and wetlands, and this type of action requires regulatory permits. Therefore, Wetlands Watch assumed that local government agencies track and report native plantings and tidal wetlands restoration actions. Localities may not be aware that these actions can be used as a BMP and may not have reported the actions during the Phase II WIP process. The same can be said for offshore breakwater (living shoreline) and headland control BMPs. Both of these types of BMPs require permits from VMRC, so there is already a mechanism to track these BMPs. Localities and Virginia may not be aware that these actions should be reported as BMPs. Wetlands Watch did not contact local and state regulatory agencies to obtain shoreline restoration or erosion control data. Wetlands restoration data from the Lafayette Wetlands Partnership actions are summarized in the existing BMP data spreadsheet (Final Existing BMPs.xls).

In an effort to identify the types of BMPs installed in Hampton Roads as a result of all the various outreach, education, and involvement programs, Wetlands Watch conducted an informal online survey of "Watershed Friendly Actions in Hampton Roads" (see Appendix I). The survey was originally intended to gather information from select NGO members and trained environmental stewards (Master Gardeners, VoiCeS, and Master Naturalists); however, a larger segment of the population participated in the survey, which ran from February 1, 2012 to March 30, 2012. A total of 266 citizens participated in the survey. The survey asked participants to identify different watershed-friendly practices that they are using on their property (or installed on someone else's private property), who did the design work, who installed the practice, do they use a lawn service or fertilize their lawn themselves, and do they have any concerns, advice, or experiences to share.

A summary of participation by locality is provided in Figure 5-1. The survey can also be queried by NGOs and environmental steward programs. The number of survey participants should not be considered an indicator of a lack of activity in a locality; it is more an indicator of participant access to the survey. For example, the Elizabeth River Project had just completed a survey of its members and felt that it was not a good time to ask members to participate in another survey. Lynnhaven River NOW included a request to members in a newsletter. The lack of survey participants in localities like Southampton, Franklin, and Surry reflects the fact that Wetlands Watch did not have a contact for an active NGO in those localities.

Figures 5-2 through 5-4 summarize the responses of survey participants. Figure 5-2 summarizes lawn/turf related practices of the survey participants. Some of these practices would fall under the urban nutrient management BMP and others might represent a land-use change from Urban Pervious to Forest land if the native plants include trees and shrubs.

Figure 5-3 summarizes impervious urban surface reduction, reforestation (tree planting and forest buffers) and on-site LID retrofit BMPs that survey participants are using on private property. Figure 5-4 summarizes the different types of BMPs that survey participants are using on waterfront/streamside private property including non-structural erosion control, living shorelines, wetlands restoration, and stream restoration as well as oyster gardening and SAV planting.

In conclusion, engagement of citizens through local, NGO, and trained environmental steward efforts have resulted in the voluntary installation of BMPs on private property. However, additional efforts are needed to align regulatory terminology and standards with the water-friendly or conservation landscaping-type terminology and practices used by NGOs, trained environmental stewards, landscape contractors, suppliers and private property owners. Once

this alignment occurs, in order to claim nutrient and sediment reduction credits, localities will need to coordinate with stakeholders to ensure that the practices are reported in a standard format, are installed and functioning as BMPs, and are maintained over time. Localities also will need to establish reporting protocols and decide whether or not they wish to allow self-reporting of practices similar to those employed by Anne Arundel County, MD and Washington, DC.

Figure 5-1: Localities in Which "Watershed-Friendly Behavior in Hampton Roads" Survey Participants Reside.

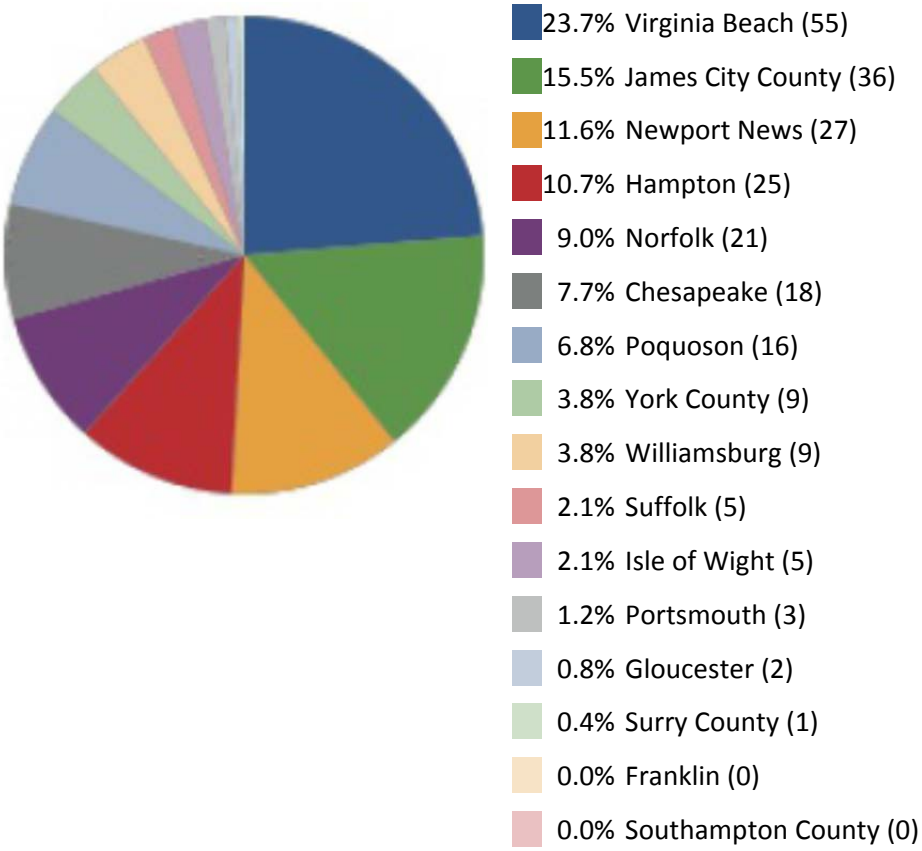
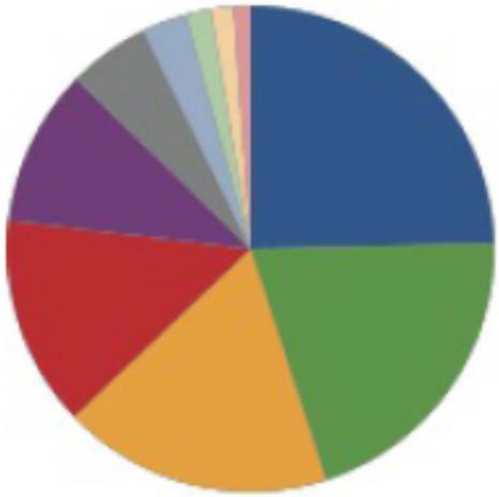
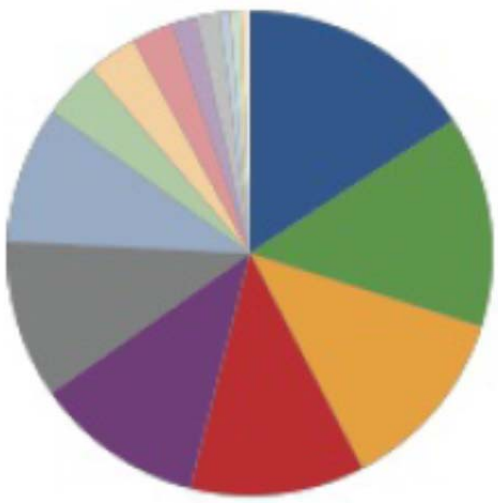


Figure 5-2: Summary of Lawn/Turf Related Practices from "Watershed-Friendly Behavior in Hampton Roads"



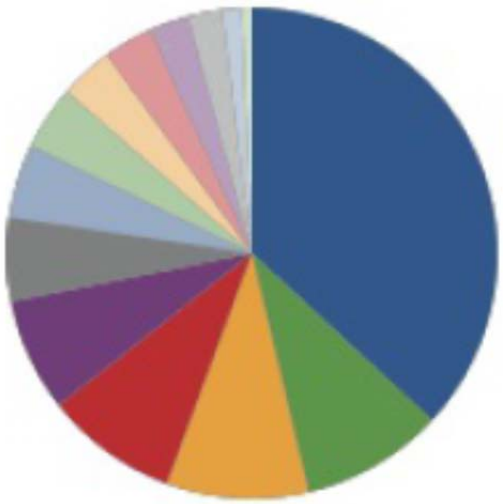
- 23.4% Lawn/turf is mowed at a height no less than 3 inches (147)
- 21.3% Stopped fertilizing lawn/turf (134)
- 18.6% Reduced lawn/turf area and replaced it with native plants (117)
- 14.0% Had soil analyzed (88)
- 9.4% Reduced fertilizer application to once in the fall (59)
- 6.8% View "Other" Answers
- 2.5% This property does not have a lawn (16)
- 1.4% Hired a water-friendly certified lawn care company to maintain my lawn/turf (9)
- 1.2% None of the Above (8)
- 0.9% Haven't done any of the above but would consider it in the future (6)

Figure 5-3: Summary of Impervious Surface Reduction, On-site LID, and other BMPs from "Watershed-Friendly Behavior in Hampton Roads"



- 15.7% Planted native plants and avoided invasive species (133)
- 14.1% I collect yard debris so it doesn't go down the storm drain (119)
- 12.4% Redirected downspouts and other stormwater runoff away from paved surfaces and into a planted bed or other permeable area (105)
- 11.6% Installed one or more rain barrels or cisterns (98)
- 11.2% Planted trees/participated in a tree planting project (95)
- 10.5% Scoop my dog's poop (89)
- 9.1% Installed a buffer garden of native trees, shrubs, perennials, and grasses between my lawn and waterway, wetlands, and/or the street (77)
- 3.7% Installed and maintain a rain garden (or bioretention area) to reduce and filter stormwater runoff (32)
- 3.3% Replaced paved surfaces with permeable pavement that allows water to soak into the ground (28)
- 2.7% Replaced impervious surfaces like concrete/asphalt driveways, walks and patios with permeable area that includes plants (23)
- 1.6% Created a wetland on the property with native wetland plants (14)
- 1.5% View "Other" Answers
- 0.7% None of the Above (6)
- 0.7% Haven't done any of the above but will consider it in the future (6)
- 0.5% Installed a green roof (5)

Figure 5-4: Summary of BMPs used by waterfront private property owners from "Watershed-Friendly Behavior in Hampton Roads"



- 36.8% This is not a waterfront property (114)
- 9.3% Expanded an existing or established a new buffer of native plants (29)
- 9.3% View "Other" Answers
- 8.7% None of the above (27)
- 7.4% Established a conservation area of native plants and/or wetlands (23)
- 5.5% Restored and protected wetlands (17)
- 4.8% Oyster gardening (15)
- 4.2% Installed a living shoreline to control erosion (13)
- 3.5% Participated in a streambank or stream restoration project (11)
- 3.2% Stopped mowing the wetland plants and now protect them (10)
- 2.5% Created a wetland on the property with native wetland plants (8)
- 2.2% None of the above, but would consider it in the future (7)
- 1.2% Replaced impervious surfaces like concrete/asphalt driveways, walks and patios with planted beds (4)
- 0.6% Planted underwater grasses (SAV) (2)

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6 Summary and Recommendations

The final objective of this investigation was to develop a planning framework to guide implementation of nutrient reductions on private property including two elements:

1. Strategies to work within the locality's authority and leverage existing tools to implement and maintain retrofits and BMPs on agricultural, conservation, and urban lands; and
2. A sample voluntary program that localities may use to incentivize implementation and maintenance of BMPs on residential private property.

At the beginning of this project, HRPDC and Wetlands Watch agreed that the findings of this investigation would be considered preliminary in nature, given the expedited project schedule. In addition, it was agreed that a more detailed assessment and recommendations will be formulated through a collaborative and inclusive regional Strategic Summit. In the interim, Wetlands Watch agreed to provide the following:

- Examples of local government collaboration with grant-funded, community-based, and other voluntary stormwater management/stewardship projects in the Hampton Roads area;
- A sample of several models programs and strategies to work within the locality's authority and leverage existing tools to implement and maintain retrofits and BMPs on private property;
- A summary of existing programs by locality including the number of potential existing BMPs on private property and the grant money received for the projects; and
- A summary table of all stakeholders contacted and programs/program details reviewed during the project.

Section 2, Existing Model Programs, provides a number of model programs that localities can emulate or modify based on their own needs in order to increase the number of BMPs on private property and use the nutrient and sediment reduction associated with those BMPs to meet the Chesapeake Bay TMDL. Seven of the programs highlighted are located in Virginia with three of the programs in Hampton Roads. Most of the programs highlighted, whether initiated by local government, NGOs, or SWCDs, include several key characteristics that localities in Hampton Roads should consider when designing their own program. The recommendations in this section are provided with a caveat: the time constraints and timing (during the Phase II WIP preparation effort) of this investigation made it difficult to speak directly with all stakeholders or identify all the programs within the area through a literature search. We suggest that readers consider this effort a preliminary investigation. Wetlands Watch welcomes the review and comments of interested parties and technical experts with more intimate knowledge of programs and issues.

6.1 Recommendation #1 – Engage in a Comprehensive Planning Effort

Organize programs around a comprehensive planning effort that includes watershed restoration at the subwatershed level. A comprehensive planning approach will allow localities to define the problems, compile a list of common goals and overlapping interests, identify barriers, identify opportunities for coordinated and collaborative solutions that focus on local priorities and areas of concern by neighborhood, identify budgetary needs, and provide all stakeholders with a

common vision and road map of implementation strategies. At a minimum, localities could utilize the HRPDC regional Green Infrastructure Plan (2010) as reference for watershed or stormwater management plans and look for opportunities to refine the Green Infrastructure Plan to the local level. The Green Infrastructure Plan identifies existing riparian buffers and corridors, priority habitat preservation areas, existing open spaces, etc. Reforestation BMPs (tree planting and forest buffers) are approved BMPs that can be used to connect and enhance riparian corridors, provide stormwater management, and improve habitat.

Stakeholders involved in plan development should include community leaders; local, state, and regional government agencies; private sector technical experts, service providers, and suppliers; trained environmental stewards; and local and regional watershed and civic groups. Some watershed groups (Elizabeth River Project and Lynnhaven River NOW) have developed watershed restoration priorities for their watersheds that may serve this need. Table 6-1 summarizes planning initiatives, active NGOs, steward programs, and SWCDs by locality.

Localities and project organizers can use documents like CWP's "Urban Watershed Restoration Manual Series, CWP's Smart Watershed Benchmarking Tool" (Rowe and Schueler, 2008), and/or Virginia DCR's "Local Watershed Management Planning in Virginia, A Community Water Quality Approach" (n.d.) for guidance to ensure that the planning effort is comprehensive and inclusive.

6.2 Recommendation #2 - Form Partnerships and Collaborate

Collaboration, partnerships, and protocols should be established to reduce costs, increase efficiency, solve multiple problems, and ensure that BMPs are properly designed, installed, inspected, maintained, and tracked. In addition, collaboration and partnerships should be formed to refine methods of outreach and communication and synchronize regional messages and efforts with local community-level efforts.

Several local efforts can serve as models for other localities and organizations including programs and planning efforts in Virginia Beach, in James City County, in Norfolk associated with the Lafayette River Restoration, in Portsmouth associated with Paradise Creek, in Hampton associated with the Hampton Comprehensive Waterways Management Plan and the multi-jurisdictional efforts associated with Elizabeth River Restoration plan.

6.3 Recommendation #3 - Apply Community-Based Social Marketing Techniques

Implementation strategies should *focus on community-based social marketing techniques.* Partnering with local NGOs, trained stewards, and community leaders to work within their own communities as trusted advisors will increase the likelihood of people adopting new watershed friendly behaviors and installing and maintaining BMPs on private property. Other localities and organizations will benefit from analyses, recommendations, and experiences gained by the ERP's collaboration with Dr. Doug McKenzie-Mohr on the *River Star Homes* program in the Lafayette River Restoration efforts. In addition, program organizers should look for and recruit community leaders from:

- Leadership institutes;
- Civic Leagues;
- HOAs;

- Faith-based organizations;
- Profession-based organizations; and
- Decision-makers like city council, county supervisors, board members, etc.

6.4 Recommendation #4 – Identify Funding Sources and Incentives

Localities (or other program organizers) should consider *utilizing a combination of funding mechanisms* including in-kind volunteer labor and partnerships with grant-funded NGOs. In addition, the program should *provide incentives and assistance* to help private property owners pay for the BMPs and to facilitate and promote the identification of site-specific areas of concern, recommend appropriate BMPs, and ensure that BMPs are dependably installed, maintained, and tracked. Within the Hampton Roads area, NFWF provided approximately $2.5 million in grant money to NGOs, SWCDs, and localities to conduct outreach, education, and deliver incentive-based programs that increase environmental stewardship and the number of BMPs on existing private property. NFWF grants require a 50% match, so the total economic value associated with these grants is at least $5 million. From the NFWF files provided to Wetlands Watch, it is estimated that NFWF provided almost $20 million in funding through a combination of Small and Targeted Watershed Grants in Virginia from 2006 to present.

Localities that have stormwater utility fees should consider establishing a stormwater rebate/credit/cost-share program similar to programs in the City of Richmond and Arlington County. These financial incentives could be used to match incentives (financial or assistance-type incentives) of grant-funded NGO programs like *River Star* and *Pearl Homes*. With rebate/credit/cost-share programs, localities can require property owners to sign maintenance and inspection agreements and the programs provide localities with a way to track and report BMPs on private property.

Many localities have other types of incentive programs that provide grants or rebates to private property owners and neighborhoods for tree planting, beautification, reduced water use, stormwater management, trash cleanup, etc. Localities should identify and coordinate all incentive programs and co-promote these programs.

6.5 Recommendation #5 – Define Appropriate BMPs

The program should *promote local-, state- and EPA-approved BMPs* that provide community- and locality-specific solutions for a range of issues and have readily available standards and protocols for site analysis, design modifications, installation, reporting, and maintenance for urban stormwater retrofits and other BMPs. The program should promote all types of appropriate BMPs, not just urban stormwater retrofits like on-site LID and green street retrofits. Program coordinators should select and encourage BMPs based on local needs, conditions, pollutants of concern, and unique site characteristics.

CSN Technical Bulletin No. 9 (Schueler, 2011) provides BMP and WIP guidance for localities. In a September 15, 2011 webcast by the Mid-Atlantic Water Program, "Increasing the Delivery of Residential Stewardship Practices in Urban Watersheds," CSN's Tom Schueler recommends that localities "focus on nutrient reduction and acres treated…and shift to stewardship practices" that include:

- Fertilizer reduction;
- Rooftop disconnection;
- Reforestation;
- Conservation landscaping;
- Rain gardens;
- Septic system upgrades;
- Stream restoration; and
- RPA buffer upgrades.

A review of practices being promoted and incentivized in Arlington County and the City of Richmond, indicate that these localities are applying this strategy. The following is a list of practices promoted by either Arlington County or Richmond:

- Rain gardens (bioretention with adjusted efficiency rates);
- Conservation landscapes – conversion of lawns and non-native invasive species to native plants (minimum of 150 square feet) (land-use change from Pervious Urban to Forest lands);
- Vegetated filter strips – uniform strips of dense turf, meadow grasses trees and other vegetation with a minimum slope and can treat runoff from roof downspouts (down spout disconnection – impervious urban surface reduction);
- Tree planting – target whole community, give away free native trees to individual property owners (reforestation – land-use change);
- RPA buffer plantings – increase from 0 to 35 feet or increase to 100 feet (reforestation and forest buffer);
- Replace existing impervious surface with pervious surfaces like pervious pavers, lawn, or planting beds (minimum of 150 square feet) (impervious urban surface reduction);
- Direct downspouts towards pervious pavement or other infiltration and bioretention areas – (impervious urban surface reduction with adjusted efficiency rates);
- Green roofs – (impervious urban surface reduction); and
- Cisterns – (impervious urban surface reduction), rebate and build-your-own rain barrels workshop (build advocacy).

In addition to the above practices, localities should considering including urban nutrient management strategies like the James City County *Turf Love* program, Lynnhaven River NOW's efforts, or the Elizabeth River Project's *River Star Homes*. All of these practices are Virginia and EPA approved practices. Granted, EPA and Virginia need to agree on common efficiency removal rates; however, most of the practices are modeled as land use changes or urban nutrient management. For rain gardens (and other on-site LID retrofits), Schueler's recommended methodology for calculating adjusted nutrient and sediment efficiency rates, as presented in CSN Technical Bulletin No. 9 (Schueler, 2011), is provided in Appendix H of this report.

Wetlands Watch recommends that, in addition to the above mentioned practices, localities should track and report tidal shoreline BMPs (using the load reduction rates provided within the

Chesapeake Bay Watershed Model 5.3.2) like tidal wetlands/buffer restoration and living shorelines. Additional clarification is needed from EPA regarding the wetlands restoration BMP, SAV plantings, oyster restoration, and marine sewage disposal facilities.

6.6 Recommendation #6 – Coordinate with Private Sector to Increase Available Materials and Services

The program organizers should *work with the private sector and support a growing market* for trained professionals and BMP supplies and suppliers. Some organizations already are working with the private sector; however, the efforts are localized and training opportunities are not comprehensive or ongoing. All Hampton Roads localities would benefit from a well-coordinated effort to develop and promote a larger network of trained professionals and to support a growing market for BMP supplies and suppliers. A regional, cooperative effort could be addressed at the proposed Strategic Summit.

6.7 Recommendation # 7 - Develop a Data Management Plan

The State, the region, localities, and NGOs must collaborate to develop a consistent *data management plan* to locate, track, analyze, and report select BMPs in order to demonstrate regulatory compliance, assess program impacts, or satisfy funders' reporting requirements. At a minimum, the Hampton Roads region should participate in the development of the Virginia e-Permitting system to facilitate a transfer of BMP information back and forth between the state and localities. All entities engaged in the design and development of a BMP database/GIS tracking system should agree on a common data reporting format, consistent terminology, minimum BMP data to track, and standard units of measurement. The BMP database/GIS tracking system should track all types of approved BMPs, not just urban stormwater retrofits, and should support other regulatory permit and grant-funded reporting requirements. The region would benefit from a collaborative effort to address BMP tracking and share existing data through a system like the one being developed by the City of Virginia Beach.

6.8 Recommendation #8 – Organize, Coordinate, and Refine Steward Programs

The region and localities should *sponsor hands-on workshops and comprehensive training programs* for local stormwater and landscape professionals, do-it-yourselfers, and environmental stewards. The region would benefit from collaborative, consistent training efforts particularly for local landscape professionals and environmental stewards. A review of existing environmental steward programs like the Master Gardeners, Master Naturalists, and VoiCeS, indicates that no one program offers all the services, technical support, organizational support, and tracking or reporting provided by the trained Watershed Stewards in Anne Arundel County and National Capital Region. The Watershed Steward Academies were designed to circumvent some of the problems encountered by other localities like Montgomery County and provide skilled services required to improve existing locality-designed and operated programs. Wetlands Watch continues to see a need for a facilitated Strategic Summit to identify ways to improve existing environmental steward programs, develop a network to strengthen existing organizations and relationships, share lessons learned and resources, and eliminate redundant efforts and conflicting messages.

6.9 Recommendation #9 – Convene a Regional Strategic Summit

This report initiated the process of reviewing existing model programs and NGO efforts in Hampton Roads to identify strategies that localities can use to increase, track, and receive credit for BMPs on private property for the Chesapeake Bay TMDL. Opportunities for collaboration have been identified, as well as opportunities to improve existing programs and to increase the likelihood of program success, but additional work is needed. A regional Strategic Summit would provide an opportunity for a more intensive look at existing programs and opportunities for collaboration, coordination, partnerships, and networking. Additional focused workshops could be run through the Hampton Roads Watershed Roundtable Workshops that HRPDC sponsors on a quarterly basis. Issues to address at the Strategic Summit and the quarterly workshops include the following:

- Highlight existing model programs in greater detail and identify best models for Hampton Roads localities.
- Share resources and lessons learned locally and in other areas of Virginia.
- Identify standard curriculum and qualified instructors that could be shared by all steward programs and landscape professionals regardless of locality. Identify creative, cost effective ways to deliver the training and make training more accessible.
- Identify locality-specific needs versus regional needs for training and services that can be provided by trained landscape professionals and trained stewards.
- Develop a technical consortium that would be available either regionally or locally for trained stewards.
- Develop a strategy to increase the availability of BMP-related products and services within the marketplace. Network with professional organizations and other private sector stakeholders to increase awareness and promote this new market.
- Identify a chain-of-command for each locality to ensure coordination of NGOs and trained stewards efforts with local government programs and projects.
- Develop protocol for design, installation, inspection, maintenance, tracking, and reporting of BMPs installed on private property.
- Coordinate local government BMP tracking programs with Virginia and EPA efforts to facilitate reporting for MS4 permits, local TMDLs, the Chesapeake Bay TMDL, and other regulatory programs.

Table 6-1: Summary of Collaborative Planning Efforts, NGOs, and SWCDs by Locality

	Details
City of Chesapeake	
Planning Initiatives	Forward Chesapeake 2026 Comprehensive Plan – Natural Resources, Green Infrastructure Plan, Watershed Management Plans, Sustainable Chesapeake Initiative - Sustainability Plan and Committee, Northwest River Watershed Protection District, Urban Forest Management Plan, HR Green, LEED Building policy for City facilities, Bicycle/Trails Advisory Committee, Annual Arbor Day Celebration, Open Space and Agricultural Preservation (OSAP) Program
Stormwater Utility Fee	Yes, credit for nonresidential stormwater management
Potential Incentive Partnerships	Environmental Improvement Council, Neighborhood Leadership Program, Neighborhood Matching Grants Program, River Star Homes, Schools, Businesses
Trained Stewards	Master Gardeners, Tidewater Master Naturalists, VoiCeS
SWCD	Virginia Dare
NGOs	Elizabeth River Project, Chesapeake Arboretum
Gloucester County	
Planning Initiatives	Flood Mitigation Plan, Comprehensive Plan
Potential Incentive Partnerships	The Clean Community Program, CBF – Grasses for the Masses, VIMS research projects
Trained Stewards	CBF Oyster gardeners, VoiCeS, VIMS workshops, Master Gardeners
SWCD	Tidewater
NGOs	Tidewater Oyster Gardeners Association
City of Hampton	
Planning Initiatives	Hampton Clean City Commission, Environmental Sustainability Coordinator, Hampton Comprehensive Waterways Management Plan Steering Committee, VIMS shoreline management study, Neighborhood Plans, Newmarket Creek Park and Trail System Master Plan, Beach Front and Storm Protection Plan, Newmarket and Back River Restoration Project
Stormwater Utility Fee	Yes, no rebate
Potential Incentive Partnerships	Keep Hampton Green, Clean City Commission Y.A.R.D.S and Environmental Stewards awards, Hampton Neighborhood Commission Neighborhood Grants, Hampton Housing Venture Curb Appeal Matching Grants
Trained Stewards	Peninsula Master Naturalists, Master Gardeners (Advanced Water Stewards), VoiCeS, Oyster Gardeners
VCE	Megan Tierney
University/Research	VIMS, Hampton University

Table 6-1: Summary of Collaborative Planning Efforts, NGOs, and SWCDs by Locality (continued)

	Details
Isle of Wight County	
Planning Initiative	Comprehensive Plan, Hazard Mitigation
Potential Incentive Partnerships	Septic Pump-out Grant Program
Trained Stewards	Historic Southside Master Naturalists, Western Tidewater Master Gardeners
VCE	Janet Spencer
SWCD	Peanut
James City County	
Planning Initiatives	Comprehensive Plan, Parks & Recreation, Green Building, Better Site Design, Community Character Corridors, Watershed Management Plans, Stormwater Management/Floodplain Management/Hazard Mitigation, Residential Cluster Development, Water Supply/Conservation
Potential Incentive Partnerships	JCSA Be Water Smart, PRIDE Mini-grants, Clean County Commission Good Neighbor Environment Grants, Turf Love - Garden Love Rain Garden Rebates, free pet waste stations for neighborhoods and community groups, Eco-park, Williamsburg Land Conservancy.
Trained Stewards	Historic Rivers Master Naturalists, VoiCeS, Water Quality Monitoring, Turf Love, Master Gardeners (Advanced Water Stewards and Tree Stewards), John Clayton Native Plant Society, Lafayette High School Oyster Gardeners
VCE	Bob Winters-not extension agent
SWCD	Colonial
NGOs	Williamsburg Land Conservancy, Friends of Powhatan Creek, J4Cs, CBF, Wetlands Watch
Universities/Research	W&M, VIMS
City of Newport News	
Planning Initiatives	City Sustainability Team and NNGreen, Newport News Waterworks Environmental Stewardship program, Environmental Management System and Environmental Policy, Newport News Redevelopment & Housing Authority (NNRHA) Community Development Department Plans, Reservoir Protection, Enhanced lake Program, Urban Tree Canopy
Potential Incentive Partnerships	Community Support Agency Grant, Residential Rehabilitation Property Tax Abatement Program, Adopt a Tree, Beach Erosion Technical Assistance,
Stormwater Utility Fee	Yes, rebate for participants in the City Household Hazardous Chemicals Collection get 15% stormwater rebate.
Trained Stewards	Peninsula Master Naturalists, Master Gardeners (Advanced Water Stewards), VoiCeS, Oyster Gardeners
VCE agent	Mary Wright
NGOs	Newport News Green Foundation, CBF, Wetlands Watch
University/Research	CNU, VIMS

Table 6-1: Summary of Collaborative Planning Efforts, NGOs, and SWCDs by Locality (continued)

City of Norfolk	
Planning Initiatives	Green Committee, Comprehensive Plan, Flood Mitigation Study, Norfolk Environmental Commission, Lafayette River Watershed Restoration Plan, Elizabeth River Watershed Restoration Plan, Environmental Outreach, Sustainability/Environmental
Stormwater Utility Fee	Yes, no rebate
Potential Incentive Partnerships	Celebrate Trees, Keep Norfolk Beautiful, EARNN, River Star Homes, Schools, Businesses
University Research Collaboration	VIMS, ODU,
Trained Stewards	Master Gardeners, Tidewater Master Naturalists, VoiCeS
NGOs	Elizabeth River Project, Chesapeake Bay Foundation, Wetlands Watch, Lafayette Wetlands Partnership,
City of Poquoson	
Planning Initiatives	Comprehensive Plan, Hazard Mitigation Plan
Stormwater Utility Fee	No
Trained Stewards	Master Gardeners, Peninsula Tree Stewards, Peninsula Master Naturalist, CBF VoiCeS, Oyster gardeners
NGOs	Poquoson Citizens for the Environment, Poquoson Lions Club Tree Planting Campaign
City of Portsmouth	
Planning	Comprehensive Plan, Flood protection/mitigation, Paradise Creek Greenway Plan, Greening Portsmouth, Parks, Recreation & Leisure Services Master Plan,
Potential Incentive Partnerships	River Star Homes, Schools, Businesses, Neighborhood Beautification Program,
Stormwater Utility Fee	Yes, non-residential credit for BMPs
Trained Stewards	Master Gardeners, Tidewater Master Naturalists, VoiCeS
NGOs	Elizabeth River Project, Chesapeake Bay Foundation, Wetlands Watch, Hoffler Creek Wildlife Foundation
NGO projects	Paradise Creek Park, ERP Paradise Creek brownfields redevelopment plan, River Star Businesses
Town of Smithfield	
Planning Initiatives	Comprehensive Plan, Entrance Corridor Overlay District Street Scape, Smithfield South Church Street Beautification Project
Stewards	Historic Southside Master Naturalists, Western Tidewater Master Gardeners
SWCD	Colonial

Table 6-1: Summary of Collaborative Planning Efforts, NGOs, and SWCDs by Locality (continued)

	Details
City of Suffolk	
Planning Initiatives	Comprehensive Plan – Focused Growth, Zoning around surface water supplies, Stormwater Management BMP tracking database, Unified Development Ordinance, established wetlands banks, Blue Water Trail map, Pro-rata stormwater assessment for new development and redevelopment
Potential Incentive Partnerships	
Stormwater Utility Fee	Yes, credit for nonresidential stormwater management
SWCD	Peanut
Trained Stewards	Tidewater Master Naturalists, Master Gardeners (Advanced Water Stewards), Oyster Gardeners, Water Quality Monitoring
VCE	No agent
NGO	Nansemond River Preservation Alliance, Oyster Reef Keepers of Virginia, Wetlands Watch, Lafayette Wetlands Partnership, ERP, CBF
NGO projects	NRPA – *Oyster Restoration Project, Corporate River Savers Program*, River Talks, Rain garden/rain barrel
Other	LJ Hansen on CBP Urban Stormwater Committee
Surry County	
Planning Incentives	Comprehensive Plan
Trained Stewards	Historic Southside Master Naturalists, Master Gardeners (Advanced Water Stewards)
SWCD	Peanut
City of Virginia Beach	
Planning Initiatives	Sustainability Plan, Green Ribbon Committee, Water Quality Task Force, Sea Level Rise Listening Sessions, Integrated Site Design, Coastal Primary Sand Dune ordinance, Urban Tree Canopy Study
Stormwater Utility Fee	Yes, no credit
Potential Incentive Partnerships	Virginia Beach Stewardship Awards Program, Friends of Live Oaks (giving away live oak trees), Pearl Homes, River Star Homes, Businesses, & Schools, Virginia Beach Beautification Commission, The Awards of Beautification and **C**onservation Program sponsored by the Council of Garden Clubs of Virginia Beach, Inc.
Trained Stewards	Tidewater Master Naturalists, Virginia Beach Master Gardeners (Advanced Water & Tree Stewards)
VCE	Laurie Fox (doesn't coordinate MG or MN)
SWCD	Virginia Dare
NGOs	Back Bay Restoration Foundation, Chesapeake Bay Foundation, Elizabeth River Project, Lynnhaven River NOW, North Landing Riverkeepers, Citizens for Stumpy Lake, The Crystal Club, Rudee Inlet Foundation, Wetlands Watch

Table 6-1: Summary of Collaborative Planning Efforts, NGOs, and SWCDs by Locality (continued)

	Details
City of Williamsburg	
Planning Initiatives	Green Williamsburg, City Open Space Preservation, County Resolution on Sustainability, Neighborhood Improvement Program
Potential Incentive Partnerships	Beautification Awards, Heritage Tree Program, Green Residential and Green Business Challenges
Master Naturalists	Historic Rivers Master Naturalists, W&M Water Quality Sampling, Master Gardeners
University/Research	W&M Committee on Sustainability, Greening WM, VIMs
NGOs	Williamsburg Land Conservancy, Colonial Williamsburg
SWCD	Colonial
Town of Windsor	
Planning Initiatives	Comprehensive Plan, Water Supply
York County	
Planning Incentives	Watershed management and protection area overlay district, York County Clean and Green, Parks and Recreation - York County Wetlands Interpretative Sanctuary for Education (WISE), Stormwater Advisory Committee
Potential Incentive Partnerships	Beautification Committee – Clean Business Awards, Tree giveaways & plantings
SWCD	Colonial
Master Naturalists	Historic Rivers Master Naturalist, York County Master Gardeners, Peninsula Tree Stewards, CBF Voices, Oyster Gardeners
VCE	Dan Nortman
NGOs	York County Waterways Alliance

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APPENDIX A

GENERAL ACTIVITY LOG AND CONTACTS

June to September 2011 – Conducted a series of informational interviews to identify existing Environmental stewardship programs and professional landscape training programs.

Attended the 2011 Chesapeake Watershed Forum in Shepherdstown, West Virginia (September 29 – October 1, 2011) including a 2-day Workshop on Community Based Social Marketing by Doug McKenzie-Mohr. http://www.chesapeakenetwork.org/library.htm?mode=view

Participated in the Chesapeake Bay Stormwater Training Partnership (CBSTP) MS4 Phase II Watershed Manager Training Series which can be viewed at http://www.mawaterquality.org/capacity_building/swmanagement.htm

Appointed to the CBP Master Watershed Stewards Action Team see http://www.chesapeakebay.net/groups/group/master_watershed_stewards_action_team and joined the Native Plants Marketing Group organized by the Virginia Coastal Zone Management Program.

Conducted informational interviews with

- local Virginia Cooperative Extension Agents (Laurie Fox and Susan French) and State Directors of the Virginia Master Naturalists (Michelle Prysby) and Virginia Master Gardeners (David Close) Programs,
- Local and regional non-profit groups engaged in promoting environmental stewardship and watershed friendly actions on private property including Joe Rieger of the Elizabeth River Project (ERP), Karen Forget of Lynnhaven River NOW (LRNOW), Craig Metcalfe and Ann Hewitt, Friends of Powhatan Creek, Christie Everett of Chesapeake Bay Foundation (CBF), and Chris French formerly of Alliance for the Chesapeake Bay (ABC).
- Directors of the CBNERRS (Sandra Erdle) and GBNERRS programs,
- Kate Venturini, University of Rhode Island Outreach Center and Landscape Restoration Program, who developed a Native Plants Systems Design Manual of Coastal Buffers for Rhode Island.
- Suzanne Etgen, Director of the Anne Arundel County Watershed Stewards Academy and Kit Gage co-director of the National Capital Area Watershed Stewards Academy.
- Carol Heiser, Education Program Section Manager and Habitat Education Coordinator for VA Dept. of Game and Inland Fisheries (VDGIF) and member of the Chesapeake Conservation Landscaping Council
- Julie Winters, Environmental Protection Agency (EPA) special assistant to Jeff Corbin, Chesapeake Bay Program (CBP) Master Watershed Stewards Action Team Co-Chair, Coordinator of the EPA NFWF funding, and Anne Arundel County Master Watershed Steward.
- Amy Handen of the National Park Service (NPS), CBP Master Watershed Steward Action Team Co-Chair, and Coordinates the NPS NFWF funding.
- Tom Schueler, the author of a number of documents by the Chesapeake Stormwater Network (CSN) and the Center for Watershed Protection (CWP) and a series of CBSTP

webcasts that provide guidance on watershed and habitat restoration, watershed and stormwater management, Watershed Implementation Plan (WIP) and Bay TMDL strategies for the Chesapeake Bay Region. Mr. Schueler is past director of the Center for Watershed (CWP), current director of the Chesapeake Stormwater Network (CSN), and of the EPA CBP Stormwater Coordinator.

- Lucinda Powers with the EPA CBP and assistant to Tom Schueler.

November – Early December 2011:

- Gave a Watershed Stewardship talk at the annual meeting of the James City County/Williamsburg Master Gardeners.
- Contacted Scott Thomas (Engineering and Natural Resources) and Fran Geissler (Stormwater Director) and PRIDE program coordinators in James City County, VA
- Met with Amanda Bassow and Brendan McIntyre of National Fish and Wildlife Foundation (NFWF) – requested and was provided with NFWF records of past and current grant projects in the Hampton Roads Region and any contact information and BMP data associated with the grant projects.
- Met with Julie Winters, Amy Handen, Tom Schueler, and Lucinda Powers
- Met with Verna Harrison, executive director, and Julie Hester, program officer, of the Keith Campbell Foundation and the Chesapeake Funders Network.
- Conducted outreach to non-profit organizations in an effort to catalog existing BMPs and further refine information provided by NFWF including Lynnhaven River NOW, Elizabeth River Project, PRIDE, Turf Love, and JCSA, Lafayette Wetlands Partnership, Colonial Soil and Water Conservation District.

December 2011 – February 2012

- Conducted informational interviews either in person, via phone or through email correspondence with Virginia DCR Staff; local stormwater, environmental, and/or sustainability staff from the Cities of Virginia Beach, Chesapeake, Norfolk, Suffolk, and Hampton, York and James City Counties; Lafayette Wetlands Partnership, ERP, LRNOW, CBF, Virginia Cooperative Extension Agents in James City County, Hampton, and Virginia Beach; Williamsburg Environmental Group, CWP, a local nursery, local landscape professionals, Colonial Soil and Water Conservation District.
- Attended and participated in the Lafayette River Steering Committee.
- Continued online research, reviewed documents, and interview program coordinators associated with voluntary and mandated private property stormwater management programs and practices, including financial incentive programs and utility credits.
- Prepared a presentation for and conducted a Hampton Roads Watershed Roundtable Workshop. The workshop included a tour of the Virginia Zoo, and facilitated discussions with attendees.
- Attended a Green Infrastructure Training Workshop by the CBNERRS program at VIMS.

APPENDIX B

MONTGOMERY COUNTY, MARYLAND RAINSCAPES PROGRAM OVERVIEW

RainScapes Program Overview **January 2011**

The Montgomery County RainScapes Program began as a grant-funded pilot program in 2004. The goal was to install environmentally friendly landscaping practices on public and institutional properties in the County and to demonstrate interest from the general public in using these techniques for their own yards. The emphasis was on multiple environmental benefits including water conservation, runoff management, and increasing habitat diversity. In 2006, environmental groups in the County lobbied successfully for the creation of a County-funded program to support installations on private properties. The funding comes from the Water Quality Protection Charge, an annual assessment on all residential and certain non-residential properties in the County to pay for watershed management required through the County's Municipal Separate Storm Sewer System (MS4) permit.

During late 2006, the Department of Environmental Protection (DEP) began a consultant study on key case studies on private property incentives for stormwater management from around the country. In 2007, the DEP held a community workshop to solicit input on how the County program should be structured. The final consultant report included summaries of the case studies and results from the community workshop. The DEP then established the RainScapes Rewards and RainScapes Neighborhoods Programs. These programs were established to reflect the desire by those at the community workshop that the program should promote stormwater runoff volume reduction solutions and from funding officials that the programs should result in measurable water quality benefits.

RainScapes Rewards

Description

The RainScapes Rewards Rebate Program offers financial incentives in the form of rebates to property owners who install RainScapes techniques. Eligible maximum rebates vary by project but each property has a rebate total cap. The first RainScapes Rewards were offered during fiscal year 2008 (July 1, 2007 through June 30, 2008).

Property Type	Maximum Rebate
Residential Property	$1,200
Commercial, multi-family, or institutional property	$5,000

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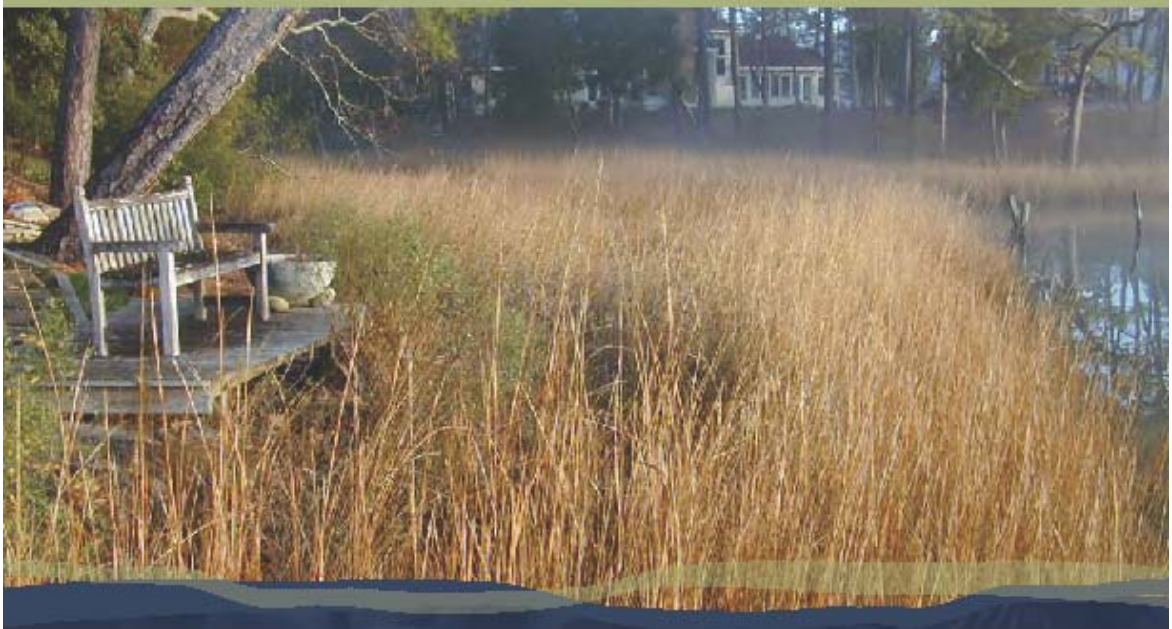
APPENDIX C

LYNNHAVEN RIVER NOW WATER-FRIENDLY RECOMMENDED PRACTICES



LYNNHAVEN RIVER NOw

PEARL HOME

So much of the progress that we have made in restoring the Lynnhaven River is a result of the great work that our residences are doing to change their practices and adopt more sustainable behaviors. Through our new PEARL HOMES program we want to thank you for all the good work you are doing and encourage others to join you.

Whether you have installed a rain garden or rain barrel, made a pledge to "scoop the poop" and encourage your neighbors to become poop scoopers too by placing a sticker on your black trash can, or planted trees to take up nutrients and reduce your runoff, you are helping to bring the Lynnhaven River back to life and we would like to recognize your efforts.

It takes a community to restore and protect a river. We know how fortunate we are to live in this beautiful place. The river is a large part of our daily enjoyment, our recreation, our local food and our livelihoods. We all want to do our part to restore the health of the Lynnhaven and protect it for future generations.

Fill in the attached application and become one our Inaugural group of PEARL HOMES and help us show the community the great work you are doing.

LYNNHAVEN River NOW

Restoring a legend.

WWW.LRNOW.ORG

SPRING 2011 INSERT

The Lynnhaven Friendly Home

PHOTO BY PETER FISHER

There are many choices we make in the care of our homes and lawns that can be beneficial to the Lynnhaven River. Before you fertilize your lawn, wash your car or choose plants for your gardens this spring, think about how your choices may affect the health of our waterways.

HERE ARE SOME TIPS:

- Do you have downspouts where the water flows directly onto impervious surface like a driveway or sidewalk? Think about installing a **rain barrel** on your downspout. A rain barrel will capture your roof runoff and make it available for you to use to irrigate your garden, wash your car or give your dog a bath. And you are keeping that water out of the storm drain. For more information: http://www.LRNow.org/rainbarrels.aspx
- Picking up after your pets regularly is one of the most important things you can do to help us reduce bacteria in the Lynnhaven River. Get a **"Scoop the Poop"** sticker for your trash can and be a responsible pet owner. For more information: www.LRNow.org.
- Occasionally, we all need to wash our car, but please do not let the soap run into the storm drain and into our river. If you take your car to a commercial car wash facility, the water will be captured and reused. If you wash your car at home, please pull it up on the grass where the water and soap will run off on the lawn and soak into the ground not into the river.
- Keeping the **gutter area** in front of your house free of debris (grass clippings, leaves, soil or sand, and trash) keeps these pollutants out of the storm drain and out of our river. And as a Virginia Beach homeowner, it is your responsibility.
- Raise your mower blade and keep it sharp, leave your grass clipping on the lawn and mow your lawn at a height of 3 inches or higher. Consistently **mowing your lawn** at a height of 3 inches or higher improves the health of your lawn and allows your lawn to capture more rain water. For more information: https://www.LRNow.org/files/pages/Lawn_Care_Publication.pdf.
- Do you have a low area where water collects? This may be the perfect location for a rain garden. A **rain garden** can be a beautiful way to reduce erosion and runoff from your yard. LRNow has a helpful publication on rain gardens that you can get from our office or from our website: https://www.LRNow.org/files/pages/RainGarden.pdf.
- A **buffer garden** between your lawn and the street or between your lawn and a waterway, can greatly reduce the runoff of sediments, nutrients and toxins from your property. For more information, refer to LRNow's buffer publication on our website: https://www.LRNOW.org/files/pages/Buffer_2010.pdf.
- Consider trying a year **without fertilizing your lawn** and see what happens. You may be surprised at how well your lawn does without fertilizer.
- Look for **natives** when you are selecting plants for your landscape. Native plants are perfectly suited for our climate and they also provide habitat and food for our native birds and butterflies that we all love.
- Watch for information fall, 2011 about LRNow's new **PEARL HOME PROGRAM**. You could be a Pearl Home.

LYNNHAVEN River NOW
Restoring a legend.

APPENDIX D

EXAMPLES OF LANDSCAPING WORKSHOPS

Virginia Chapter
ASLA

City of Virginia Beach

Online Registration
Virginia Chapter of ASLA
http://www.vaasla.org/

Watershed-Friendly Landscape Workshop

March 4 & 5, 2009

Advanced Technology Center

1800 College Crescent Virginia Beach, VA 23453

Two Day Registration Fee $35 (includes breakfast & lunch)

Workshop days will begin at 8:30 AM with a continental breakfast.
Presentations start at 9:00 AM. Workshops will adjourn at 4PM.
Continental breakfast and box lunch are included with registration costs for both days.
Continuing Education Credits available for ISA Certified Arborists &
Certified Stormwater Professionals

March 4, 2009

Welcome & Introductions::Clay Bernick, Administrator, Environmental Management, Department of Planning, City of Virginia Beach
Watersheds & Requirements ::Noah Hill, Regional Manager , Virginia Department of Conservation & Recreation
Riparian Buffers & Adjoining Wetlands::Mike McIntyre, CPESC, Permits & Inspections, Department of Planning, City of Virginia Beach
Riparian Buffers & Trophic Layers - Benefits, Design & Locations::Alli Baird, ASLA, Riparian Buffer Specialist, Virginia Department of Conservation and Recreation
Urban Forestry:: Kristina Villaire, City of Virginia Beach, City Arborist
Nutrient Management & Integrated Pest Management::Cutler Robinson, Bayville Golf Course

March 5, 2009

Plant Selections for Riparian Buffers & Rain Gardens::Laurie Fox, Horticultural Associate, The Hampton Roads Agricultural Research and Extension Center, Virginia Tech.
Soil Testing & Preparation, Nutrients & Plant Installation::Susan French, Environmental Horticulture Extension Agent ,Virginia Cooperative Extension.
Ecosystems Services of Buffers & Forest::Barbara White:: Virginia Department of Forestry
Watershed Practices:: Prince Georges County Maryland .
Low Impact Development::Charlie Heffington, NSPE, City of Virginia Beach, Planning Development Services Center
Sustainable Landscape Management Practices::Frank Fentress, ASLA, Landscape Management, City of Virginia Beach
Going Green & Saving Green:: Barry Frankenfield, FASLA, AICP, Department of

This workshop is presented by the City of Virginia Beach and
The Virginia Chapter of the American Society of Landscape Architects

For more information please contact:

Clay Bernick: 757 385 4621 cbernick@vbgov.com

Barry Frankenfield: 757 385 1104 bfranken@vbgov.com

Space Available for Non-Profit Displays and Information Exchange

Sustainable Landscaping Workshop Series

A series of classes to help landscaping professionals learn marketable, environmentally friendly practices

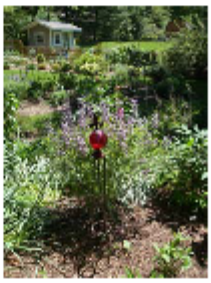
Looking for a place to learn *practical* sustainable landscaping? Attend this series of classes for landscaping professionals to learn practical information that helps our environment and gives you a marketing edge. Classes will include hands-on exercises to enable you to practice your new skills. All classes take place at Green Spring Gardens in Alexandria.

Sustainable Landscape Overview and Permeable Surfaces
Tuesday, June 22, 2010 10 AM – 3 PM

Raingarden Design and Construction
Wednesday, June 23, 2010 10 AM – 3 PM

Native Plant Alternatives & Controlling Invasive Plants
Tuesday, October 19, 2010 10 AM – 3 PM

Rainwater Harvesting & Water Efficient Landscaping
Tuesday, November 9, 2010 10 AM – 3 PM



- **Attendees who complete the entire series will be featured on a list of sustainable landscapers.**
- **Cost: $65 each or $200 for entire series.** Lunch available for $10 additional. Vegetarian lunch option available.
- **Prerequisites:** Basic landscape design experience and ability to read an engineering and architectural scale.
- **Association of Professional Landscape Designers offers 4 CEUS per class of 16 CEUs for the series.**
- **For more information, contact 703-642-5173. Registration form on reverse.**

Virginia Cooperative Extension

If accommodations or alternative formats are needed, please call 703-324-8563 at least 10 working days before event.
TTY 703-803-3354

APPENDIX E

ADDITIONAL GREEN STREET AND ON-SITE LID RETROFIT SUMMARY TABLES AND FIGURES

Note: The following are miscellaneous tables and figures from Urban Subwatershed Restoration Manual 3, Urban Stormwater Retrofit Practices, and Appendices (fromSchueler, Hirschman, Novotney, and Zielinski, 2007).

Minimum Distance... *	To Be Maintained From...
10 feet	Property Line
25 feet	Building Foundation
100 feet	Septic System Fields
100 feet	Private Well
1,200 feet	Public Water Supply Well
400 feet	Surface Drinking Water Source
100 feet	Surface Water
Do not submerge	Sewer Line
10 feet	Dry Utilities
15 feet	Overhead Wires
10 feet	Road (Seepage)
30 feet	Highway
*** Confirm that these common setbacks are consistent with local regulations**	

Table 2.2: Retrofit Options and Stormwater Treatment Provided

Subwatershed Location	Stormwater Treatment Provided			
	Water Quality	Runoff Reduction	Channel Protection	Flood Control
SR-1 Add Storage to Existing Ponds	●	○	●	○
SR-2 Storage Above Roadway Culverts	●	○	●	⦿
SR-3 New Storage Below Outfalls	●	⦿	⦿	⦿
SR-4 Storage In the Conveyance System	●	⦿	⦿	⦿
SR-5 Storage in Transport Rights-of-ways	●	⦿	●	⦿
SR-6 Storage Near Large Parking Lots	●	⦿	●	⦿
OS-7 Hotspot Operations	●	○	○	○
OS-8 Small Parking Lots	●	●	⦿	○
OS-9 Individual Streets	●	●	⦿	○
OS-10 Individual Rooftops	⦿	●	○	○
OS-11 Small Impervious Areas	●	●	○	○
OS-12 Landscapes/Hardscapes	●	⦿	○	○
OS-13 Underground	●	⦿	○	○
Key: ● Full ⦿ Partial ○ Rarely				

Table 1: Estimated Construction Costs for Small Parking Lot Retrofits (2006 $ per cubic foot treated)			
Stormwater Treatment Option	**Median Cost**	**Range**	**Design & Engineering (%)**
External Bioretention [1]	$ 10.50	$ 7.50 to $ 17.25	32
Internal Bioretention [2]	$ 30.00	$ 25.00 to $ 40.00	32
Surface Sand Filter [3]	$ 5.00	$ 3.00 to $ 8.00	32
Perimeter Sand Filter [4]	$ 20.00	$16.00 to $ 22.00	32
Filter Strip [5]	$ 5.00	$ 3.50 to $ 10.00	15
Parking Lot Swales [6]	$ 12.50	$ 7.00 to $ 22.00	15
Perimeter Infiltration [7]	$ 15.00	$ 10.00 to $ 23.00	32
Permeable Pavers [8]	$ 120.00	$ 96.00 to $ 144.00	15
IC Conversion [9]	$ 20.00	$ 18.50 to $ 21.50	15

[1] Located outside of the parking lot
[2] Bioretention installed within parking lot islands or elsewhere on the lot
[3] Non-structural surface sand filter located on the perimeter of parking lot
[4] Structural sand filter within the parking lot that bears load
[5] Grading, level spreader and re-vegetation at perimeter of parking lot
[6] Water quality swale draining a portion of the parking lot
[7] Infiltration with pretreatment at perimeter of parking lot
[8] Permeable paver blocks within lot, along with subgrade preparation
[9] Demolition and removal of IC with soil and grass replacement

Table 2: Factors that Influence Construction Cost of Small Parking Lot Retrofits	
Factors that Decrease Cost	**Factors that Increase Cost**
• Parking lot is under-capacity • High soil infiltration rates • Use of filter strips, swales or infiltration • Lot is scheduled for rehabilitation • Wide setbacks along lot perimeter	• Design to bear traffic loads • Additional landscaping and tree planting • Complicated construction sequence • Need to repave lot • Need for underdrains

Table 1: Estimated Construction Costs for Various Street Retrofits (2006 $ per cubic foot treated)			
Stormwater Treatment Option	**Median Cost**	**Range**	**Design & Engineering[7] (%)**
Water Quality Swale [1]	$ 12.50	$7.00 to $22.00	35
Dry Swale [2]	$ 23.00	$ 13.00 to 31.50	35
Bioretention Cells [3]	$ 30.00	$ 25.00 to $40.00	35
Street Bioretention [4]	$ 18.00	$15.00 to $24.00	35
Stormwater Tree Pits [5]	$ 70.00	$ 58.00 to $83.00	35
Daylight Enclosed Pipes [6]	$ 46.00	$ 26.00 to 63.00	40

[1] Conversion of existing grass channel into water quality swale
[2] Channel conversion, using urban bioswale costs reported by Hoyt (2007)
[3] Construction of new bioretention in street right of way
[4] Surface bioretention using curb extensions and other methods
[5] Expanded tree pits to treat stormwater on more urban streets
[6] Conversion of enclosed drainage to dry swale or bioretention. No cost data available; assumed to be twice the cost of dry swale
[7] Higher design & engineering for neighborhood consultation and utility negotiations

Table 2: Site-specific Factors that Reduce the Cost of Street Retrofit Projects	
Factors that Reduce Costs	**Factors that Increase Costs**
• Open section retrofits • No modification of road surface • Wide street right of way • Active civic or neighborhood group • Utilities located under pavement	• Closed section retrofits • Multiple driveways • Utility relocation • Legal resources to define right-of-way or easements • Additional landscaping

Table 1: Installation Costs for Other Stormwater Retrofits (per cubic foot treated)		
Retrofit Type	**Median Cost**	**Cost Range**
Residential Settings		
Rain Barrels	$ 25.00	$ 12.50 to $ 40.00
Rain Gardens:		
Volunteer Installation	$ 4.00	$ 3.00 to $ 5.00
Professional Installation	$ 7.00	$ 5.00 to $ 10.00
Professional Landscaping	$ 12.00	$ 10.00 to $ 15.00
French Drains/Drywells	$ 12.00	$ 10.50 to $ 13.50
Non-Residential Settings		
Cisterns	$ 15.00	$ 6.00 to $ 25.00
Intensive Green Rooftops	$ 360.00	$ 300.00 to $ 420.00
Extensive Green Rooftops	$ 225.00	$ 144.00 to $ 300.00
Permeable Pavers	$ 120.00	$ 96.00 to $ 144.00
Stormwater Planters	$ 27.00	$ 18.00 to $ 36.00
Rain Gardens	$ 12.00	$ 10.00 to $ 15.00
Note: See Appendix E for documentation and cost assumptions		

Table 1: Estimated Construction Costs for Scaping Retrofits (2006 $/cubic foot treated)			
Stormwater Treatment Option	**Median Cost**	**Range**	**Design & Engineering (%)**
Small Bioretention [1]	$ 30.00	$ 25.00 to $ 40.00	32
Permeable Pavers [2]	$ 120.00	$ 96.00 to $ 144.00	32
Stormwater Planters [3]	$ 27.00	$ 18.00 to $ 36.00	32
Water Quality Swale [4]	$ 12.50	$ 7.00 to $ 22.00	32
Stormwater Tree Pits [5]	$ 70.00	$ 58.00 to $ 73.00	32
IC Conversion [6]	$ 20.00	$ 18.50 to $ 21.50	15

[1] Designed bioretention cell in highly urban area serving less than 0.5 acre CDA with a landscape architect doing planting plan
[2] Replacement pavers for courtyard or plaza with some subgrade preparation
[3] Foundation planters capture rooftop runoff in an enclosed landscape box – see Appendix F
[4] Conversion of existing surface flow path to a more effective water quality swale
[5] Expanded tree pits with shared rooting space to treat stormwater in highly urban streets
[6] Breakup and removal of existing impervious area followed by revegetation with turf

Table 4.1: Purpose of the Eight Steps in the Stormwater Retrofitting Process	
Step and Purpose	**Key Tasks**
Step 1: Retrofit Scoping Refine the retrofit strategy to meet local restoration objectives	• Screen for subwatershed retrofit potential • Review past, current and future stormwater • Define core retrofitting objectives • Translate into minimum performance criteria • Define preferred retrofit treatment options • Scope out retrofit effort needed
Step 2: Desktop Retrofit Analysis Search for potential retrofit sites across the subwatershed	• Secure GIS and other mapping • Conduct desktop search for retrofit sites • Prepare base maps for RRI
Step 3 : Retrofit Reconnaissance Investigation Investigate feasibility of retrofit sites in the field	• Advanced preparation • Evaluate individual sites during RRI • Finalize RRI sheets back in office
Step 4: Compile Retrofit Inventory Develop initial concepts for best retrofit sites	• Complete storage retrofit concept designs • Finalize on-site retrofit delivery methods • Assemble retrofit inventory
Step 5: Retrofit Evaluation and Ranking Choose the most feasible and cost-effective sites	• Neighborhood consultation • Develop retrofit screening criteria • Create retrofit project priority list
Step 6: Subwatershed Treatment Analysis Determine if retrofits can achieve subwatershed restoration objective	• Compute pollutant removal by storage retrofits • Compute pollutant removal by on-site retrofits • Compare against restoration objective
Step 7: Final Design and Construction Assemble design package to lead to successful retrofit construction	• Secure environmental permits • Obtain landowner approval and easements • Perform special engineering studies • Put together final design package • Contract and project management
Step 8: Inspection, Maintenance & Evaluation Ensure retrofits are working properly and achieving subwatershed objectives	• Construction inspection • Retrofit maintenance • Project tracking and monitoring

Table 4.11: Desktop Search Criteria for Different Retrofits	
Retrofit Location	**What to Look For**
SR-1: Existing Pond	Evaluate stormwater layer to find existing stormwater ponds with a contributing drainage area greater than 5 acres *or* Superimpose topography, drainage layers and aerial photos to identify low points in the drainage network where dry ponds may exist.
SR-2: Roadway Culvert	Superimpose topography and headwater stream layers (zero, first and second order) over the local and state road network to identify road crossings.
SR-3: Below Outfall	Superimpose publicly-owned stream corridor land parcels at least two acres in area with storm drain outfalls with a diameter greater than 12 inches and less than 60 inches.
SR-4: Conveyance System	Superimpose ditch lines, zero-order streams, conveyance easements or open channels with open land adjacent to the drainage network
SR-5: Transport Right-of-Way	Compare local, state or federal highway right-of-way layers against the stream or drainage network to identify open spaces one acre or greater *or* review highway agency GIS for existing stormwater infrastructure or treatment practices suitable for retrofitting.
SR-6: Large Parking Lot	Match large contiguous parking areas/rooftops greater than 5 acres in size with adjacent open land in public or institutional ownership, or owned by the same landowner.
OS-7: Hotspot Operation	Review land use maps to identify commercial, industrial, or municipal land uses *or* search permit databases to identify industrial operations that hold stormwater permits.
OS-8: Small Parking Lot	Search for parking lots less than five acres in size that are municipally or institutionally owned.
OS-9: Individual Street	Screen for streets that meet street retrofit feasibility criteria, such as slope, right-of-way width, open section drainage, presence/absence of sidewalks and parking lanes.
OS-10: Individual Rooftop	Superimpose property ownership layers with aerial photos or planimetric data to locate large municipal, institutional, commercial or industrial buildings that may be assessed for demonstration rooftop retrofits *or* look for clusters of building permit data that indicates areas experiencing active redevelopment
OS-11: Little Retrofit	A desktop search is not helpful in finding specific locations for little retrofits, although a GIS can help find tax reverted vacant lots and publicly owned parcels, such as parks, schools, recreation centers to investigate in the field.
OS-12: Landscape/ Hardscapes	A desktop search is not helpful in finding specific locations for landscaping and hardscaping retrofits although it can find the general public spaces with high exposure and outdoor amenities, such as parks, schools, central business districts, spaces etc.
OS-13: Underground	A desktop search is not helpful in finding specific locations for underground retrofits, although storm sewer and utility maps are essential for field investigations.

APPENDIX F

CHESAPEAKE BAY PROGRAM WATER QUALITY GOAL IMPLEMENTATION TEAM PROTOCOL

Chesapeake Bay Program Water Quality Goal Implementation Team

Protocol for the Development, Review, and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model

March 15, 2010

Introduction

The Chesapeake Bay Program (CBP) uses loading estimates to quantify expected amounts of nutrients (nitrogen and phosphorus) or sediment loads to water from specific land uses or point sources. Changes in estimated loads from a particular piece of land can occur in four ways: 1) A change in the land use (e.g. forest instead of grassland), 2) an adjustment based on an estimate of effectiveness of a best management practice (BMP), 3) a measured reduction in direct load to the land use, and 4) a measured reduction from a treatment process. Effectiveness estimates and direct load reductions to land result in percentage adjustments on a per acre basis (as opposed to an adjustment in concentration or a load per farm operation) used by the CBP to modify the existing baseline loading for particular land uses and practices. Loads from point sources can be adjusted based on a new treatment process or practice.

The Water Quality Goal Implementation Team (WQGIT) is responsible for approving the loading rates, and percentage adjustments to these rates, used in the Chesapeake Bay Watershed Model (CBWM). The CBP Executive Council's 2009 commitment to meet two-year milestones that accelerate the pace of Chesapeake Bay restoration, and the need to quantify practices to be used in Watershed Implementation Plans (WIPs) that will achieve Total Maximum Daily Load (TMDL) allocations, will likely spur innovation and identification of new BMPs.

Direct load reductions and reductions from treatment process often can be estimated, or measured, with a relatively high degree of accuracy. However, due to the variability of available data, loading rates and effectiveness estimates for nonpoint sources are based largely on best professional judgment. Since the definitions and values used for both loading and effectiveness estimates have important implications for the CBP and the various partners, it is critical that they be developed in a process that is consistent, transparent, and scientifically defensible.

This document contains three sections addressing the following process steps:

I. Determine the need for a review process,
II. Review process:
    a. For new estimates
    b. For existing estimates or treatment processes
III. Chesapeake Bay Program review and approval

Chesapeake Bay Program Water Quality Goal Implementation Team

I. Determine the Need for a Review Process for:

A. New estimates
As the Executive Order and Bay TMDL processes unfold, the CBP expects to receive numerous requests to evaluate innovative technologies and practices. It will be necessary to review and prioritize these requests. Requests can be initiated by the following groups:

- A CBP source sector Workgroup
- A jurisdiction
- A different group/organization/agency *if* a CBP Workgroup agrees to sponsor the recommendation through the CBP review process

Requests should be submitted to the Chair of the WQGIT who will then route requests to the Watershed Technical Workgroup (WTWG) and to the relevant source sector Workgroup. These Workgroups will determine if sufficient credible data is available for a full review process. This determination will be made within 60 days from the date received by the WQGIT Chair. The decision to proceed will include a timeframe for completion of the review that will be based on the complexity of the review and workload issues. Proposed technologies and practices that have been identified by jurisdictions in their Watershed Implementation Plans (WIPs) will be given highest priority.

B. Existing estimates or treatment processes
The WQGIT will evaluate existing loading and effectiveness estimates on a three year schedule, or as appropriate, to determine if a review is warranted. Such reviews can be prompted by the availability of new information, such as a new treatment process. Reviews can also be initiated if current estimates produce illogical model outputs or if there is reason to believe that they were developed using inaccurate information.

IIA. Review Process for New Estimates

Convene a review panel
The source sector Workgroup, in consultation with the WTWG and WQGIT Chair, will identify and convene a panel of experts on the relevant topic. Each request for review should include suggestions for such panel members. The panel must include at least six individuals; three recognized topic experts and three individuals with expertise in environmental and water quality-related issues. It is also important that the review panel has appropriate geographic representation.

Expectations of the review panel
The review panel will develop definitions and loading or effectiveness estimates. The panel will work with the source Workgroup and WTWG to develop a report that addresses the following:

- Identity and expertise of panel members
- Land Use or practice name/title
- Detailed definition of the land use or practice
- Recommended nitrogen, phosphorus, and sediment loading or effectiveness estimates

  - Discussion may include alternative modeling approaches if appropriate
- Justification for the selected effectiveness estimates, including
  - List of references used (peer-reviewed, etc)
  - Detailed discussion of how each reference was considered.
- Land uses to which the BMP is applied
- Load sources that the BMP will address and potential interactions with other practices
- Description of pre-BMP and post-BMP circumstances, including the baseline conditions for individual practices
- Conditions under which the BMP works:
  - Should include conditions where the BMP will not work, or will be less effective. An example is large storms that overwhelm the design.
  - Any variations in BMP effectiveness across the watershed due to climate, hydrogeomorphic region, or other measureable factors.
- Temporal performance of the BMP including lag times between establishment and full functioning (if applicable)
- Unit of measure (e.g., feet, acres)
- Locations within the Chesapeake Bay watershed where this practice is applicable
- Useful life; effectiveness of practice over time
- Cumulative or annual practice
- Description of how the BMP will be tracked and reported:
  - Include a clear indication that this BMP will be used and reported by jurisdictions
- Identification of any ancillary benefits or unintended consequences beyond impacts on nitrogen, phosphorus and sediment loads. Examples include increased, or reduced, air emissions.
- Suggestion for a review timeline; when will additional information be available that may warrant a re-evaluation of the estimate
- Outstanding issues that need to be resolved in the future and a list of ongoing studies, if any
- Operation and Maintenance requirements and how neglect alters performance

Additional guidelines:

- Include negative results
  - Where studies with negative pollution reduction data are found (i.e. the BMP acted as a source of pollutants), they should be considered the same as all other data.
- Include results where the practice relocated pollutants to a different location. An example is where a practice eliminates a pollutant from surface transport but moves the pollutant into groundwater.

Data applicability

Determining which data should be used to develop loading and effectiveness estimates is a critical step. When considering sources of data, the panel must decide: 1) if the data is appropriate, and 2) how much influence each data source should have on the final estimate. Each of these decisions should be discussed explicitly in the final report for each data source.

Chesapeake Bay Program Water Quality Goal Implementation Team

Data sources should be characterized using Table 1 (below).

Table 1. Data source characterization matrix

	High confidence	**Medium confidence**	**Lowest confidence**
Applicability [a]	Definition matches technical specifications	Generally representative	Somewhat representative
Study location [b]	Very representative of soils and hydrology	Generally representative	Somewhat representative
Variability [c]	Relatively Low	Medium	Relatively High
Number of studies [d]	Many	Moderate	Few
Scientific support [e]	Operational scale research (peer reviewed)	Research scale (peer reviewed)	Not peer reviewed ("gray" literature)

a = How well does the practice match any established technical standards (according to participating professionals).
b = How well does the location of the reported practice match conditions in the Chesapeake Bay watershed (e.g. soil type, hydrologic flow paths, and species composition)?
c = How much variability is there in the reported results?
d = The number of studies included in the reference.
e = Has the source been peer reviewed in a scientific setting, and was the work done on an operational or a smaller (research/small plot) scale?

The panel should also consider the following:

- Was the data generated from a BMP design and implementation consistent with those found in the Chesapeake Bay watershed?
- How does is the duration of the experiment impact the operational effectiveness of the practice?
- Do results reflect changes in pollution reduction benefits over the lifetime of the practice?
- What parameters were sampled and monitored (paired watershed study, grab samples, etc.)?
- What, if any, assumptions were made during the experiment and conclusion?

Once the panel has characterized a data source, they must determine how much influence (i.e. 'weight') the data should have on resulting estimates. For example, peer-reviewed publications will usually have more weight than non-reviewed sources. However, the exact

influence of a particular data source will also consider other factors, such as those listed in the questions above, which the panel will consider.

IIB. Review Process for Existing Estimates or Treatment Processes

If approved by the WQGIT Chair, the review of existing estimates can be conducted within a source Workgroup in consultation with the WTWG. This approach should reduce the amount of time necessary to conduct the review because the definition(s) have already been developed, a background of available data already exists, and issues of how the practices or land use is incorporated into the CBWM have been addressed. Reviews of existing estimates should follow the guidelines listed in IIA above except that a separate review panel is not convened and the information generated is added to the existing support documentation for the estimate.

III. Chesapeake Bay Program Review and Approval

Review panel recommendations will follow a specific procedure through the CBP (listed below). Each recommendation must first receive approval from the indicated group before it can be reviewed by the next group listed in the process.

1. Review by the relevant source sector Workgroup. This group will be responsible for reviewing the technical components of the recommendation, ensuring that all of the pollutant(s) source loading(s) or BMP pollution reduction mechanisms have been included.

2. Review by the WTWG. This group will be responsible for analyzing the modeling components of the recommendation(s) and determining that the tracking and reporting data that is needed to receive credit is available in the appropriate Chesapeake Bay jurisdiction(s) thereby ensuring that no double counting is occurring.

3. Review by the WQGIT. This group will be responsible for reviewing the process used and the recommendation's consistency with other approved BMP effectiveness estimates.

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APPENDIX G

CBP URBAN TREE PLANTING EXPERT PANEL CONSIDERATIONS

Tree Planting in the Chesapeake Bay Model

FWG Briefing Paper, May 4, 2011

I. Tree Planting on Ag Lands

Current Definition: Tree planting includes any tree planting, except those used to establish riparian forest buffers, targeting lands that are highly erodible or identified as critical resource areas.

Proposed New Definition: Tree planting includes trees planted on any of the agricultural land uses, and not counted toward another BMP (e.g., riparian buffers) or not required by law.

- Reporting is done in acres, using a conversion rate of 100 trees= 1 acre.
- State must report as a net gain in #'s or acres of trees.
- Effectively reduces average edge of field loading from approximately 27 lb/acre of TN to 4 lb/acre.

II. Urban Tree Planting

Current Definition: Urban tree planting is planting trees on urban pervious areas at a rate that would produce a forest-like condition over time. The intent of the planting is to eventually convert the urban area to forest. If the trees are planted as part of the urban landscape, with no intention to convert the area to forest, then this would not count as urban tree planting.

Proposed New Definition: *Urban tree planting is planting trees in an urban or residential environment. The intent of the planting is to have a living tree in that site or nearby in perpetuity and to expand the tree canopy. Planting 100 trees is equivalent to converting one acre of "pervious urban" to forest.*

- Reporting is done in acres, using a conversion rate of 100 trees= 1 acre.
- If impervious surface is removed for a planting, this counts as a separate BMP (Impervious Surface Reduction credit reduces edge of stream loading from 13 lb/acre of TN to 12 lb/acre).
- Effectively reduces edge of stream loading from approximately 12 lb/acre (TN) to 4 lb/acre.
- State must report as a net gain in #'s or acres of trees.

FAQs:

Why is urban Tree Planting counted and not Urban Tree Canopy (UTC)? UTC expansion is a combination of conservation and restoration within the limits of a community. The act of conservation is not currently reflected as a benefit to water quality-- something must change on the ground to reflect a change in water quality. Since it is beneficial to both conserve and restore, we will continue to report both separately.

What about tree canopy over impervious surfaces? The model does not currently differentiate what land use the canopy will impact.

Tracking and crediting urban tree planting is still a relatively new arena. In December, FWG discussed what forestry BMP's had been reported. Several states were not reporting this practice.

5/2/11 1

Discussion Question: Do the descriptions of these two BMPs (for the model) work? How are tree planting practices tracked?

III. Tree Planting in TMDL Watershed Implementation Plans

	Tree Planting reported thru 2009 (acres)		2025 WIP Target for Tree Planting (new acres) *		Trees planted per year needed to meet WIP target (acre=100 trees)	
	Urban	**Ag**	**Urban**	**Ag**	**Urban**	**Ag**
DE	125	0	2	930	13	6,200
MD	0	15,318	800	3,345	5,333	22,300
PA	0	44,061	1444	0	9,627	0
NY	0	1772	no data	no data	no data	no data
VA	0	16,158	0	126,506	0	843,373
WV	143	4,452	0	0	0	0
DC	29	0	1,347	0	8,980	0

* Note: these WIP targets come from the state input decks submitted to the CB model estimating 2025 practice implementation; in some cases these numbers vary from what appears in the narrative WIP

Discussion Question:
How can the FWG encourage more tree planting in municipalities, for Phase II WIPs or otherwise?
What information, guidance, tools are needed? (E.g., fact sheets, webinars/trainings)
What key topics/issues most need to be addressed?

IV. Stormwater Permits and Urban Tree Planting

EPA has initiated a national rulemaking to establish a program to reduce stormwater discharges from new development and redevelopment and make other regulatory improvements to strengthen its stormwater program. EPA solicited input specifically on Chesapeake Bay-specific provisions of a new stormwater rulemaking (see Federal Register Notice PDF (5 pp, 68KB). Written comments and any supporting data were due by December 7, 2010. EPA held seven public "listening sessions" to request input from the public. As part of the listening sessions, EPA also addressed environmental justice considerations and potential impacts and benefits that may arise as a consequence of the rulemaking.

Can tree planting become an acceptable BMP in MS4 permits? EPA does not currently recognize tree planting as an Urban BMP in NPDES permits. But timing is good to incorporate considering onsite retention standards and using evapo-transpiration and other available water quality/quantity data. Some larger cities have language to facilitate tree planting but none have specifics (except DC). In Pennsylvania, DEP's Stormwater BMP manual recommends tree planting to meet MS4 permit requirements.

The following wording is part of DC's MS4 permit. While it is DC-specific, there's no reason something analogous couldn't be included in other permits. This permit also has a green landscaping provision, development performance standards that require green infrastructure measures to implement, and a number of other things.

"Tree Canopy
No later than one year following issuance of this permit, the permittee shall develop and public notice a strategy to reduce the discharge of stormwater pollutants by expanding tree canopy throughout the city. The permittee shall identify locations throughout the District where tree plantings and expanded tree boxes are technically feasible and commit to specific schedules for implementation at locations throughout the District, with highest priority given to projects that offer the greatest stormwater retention potential. This effort shall include, at a minimum:

1. Achieve a minimum annual tree planting rate of at least 4,150 plantings annually within the District MS4 area. This total shall be calculated as a net increase, such that annual mortality is also included in the estimate. Ensure that trees are planted and maintained, including requirements for adequately designed and sized tree boxes, to achieve optimal stormwater retention and tree survival rate within the District. Trees shall be planted in accordance with the Planting Specifications issued by the International Society of Arboriculture as appropriate to the site conditions.
2. Annually document the total trees planted and make an annual estimate of the volume of stormwater that is being removed from the MS4 (and combined system, as relevant) in a typical year of rainfall as a result of the maturing tree canopy over the life of the MS4 permit. Also report annually on the status of achieving 40% canopy District-wide."

Discussion Question:

Would the FWG want to recommend tree planting as an optional or required BMP element of MS4 stormwater permits?

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APPENDIX H

RETROFITS AND REFORESTATION GUIDANCE FROM CSN TECHNICAL BULLETIN NO. 9

All information provided in this Appendix is taken directly from *Schueler, Tom (2011) CSN Technical Bulletin No. 9 Nutrient Accounting Methods to Document Local Stormwater Load Reductions in the Chesapeake Bay Watershed Version 1.0 REVIEW DRAFT, August 15, 2011*.

5.3.1 STORMWATER RETROFITS

Status: This is a new urban BMP rate and will be the subject of a BMP Expert Panel that is scheduled to conclude in 2012. It is recommended that the proposed method be accepted on an interim basis during the WIP planning process, until such time as the Expert Panel makes its final recommendation.

Definition: Stormwater retrofits are a diverse group of projects that provide nutrient and sediment reduction on existing development that is currently untreated by any BMP or is inadequately treated by an existing BMP. Stormwater retrofits can be classified into five broad project categories, as shown below:

1. New retrofit facilities
2. BMP conversions
3. BMP enhancements
4. Green street retrofits
5. On-site LID retrofits

Technical Issues: Retrofits can be problematic when it comes to defining a nutrient removal rate. For example:

- Every retrofit project is unique to some degree, depending on the drainage area it treats, the treatment mechanism(s) it employs, the runoff volume it captures, and the degree of prior stormwater treatment at the site, if any.

- Many retrofits are under-sized in comparison to new BMPs designed to new development standards, due to site constraints. Some adjustment in pollutant removal capability is needed to account for situations where they cannot capture and treat the water quality volume.

- There is virtually no research available specifically for stormwater retrofits, so removal rates needs to be inferred from other known BMP and runoff reduction performance data.

- Many retrofits employ innovative combinations of runoff treatment mechanisms and may not be easily classified according to the existing CBP- approved BMP removal rates.

- Localities often evaluate dozens or even hundreds of candidate projects during retrofit investigations to find the best ones. Therefore, localities will need fairly simple protocols to estimate pollutant reduction achieved by individual retrofits projects as part of their watershed assessment and retrofit investigation.

Recommended Overall Protocol to Define Retrofit Removal Rate

The general protocol to define retrofit removal rates is as follows:

Step 1: Compute the baseline load for the drainage area to the proposed retrofit using the Simple Method (Schueler, 1987), the Virginia spreadsheet (CWP, 2009) or the unit nutrient load method (MDE, 2011). All three methods closely track the Bay Model projections for baseline nutrient loads for urban and suburban lands.

Step 2: Select the appropriate method to define a project-specific retrofit removal rate, based on its appropriate retrofit classification.

Step 3: Adjust removal rates using the runoff capture method if retrofit is under-sized

Step 4: Multiply the adjusted retrofit removal rate by the pre-retrofit baseline load to obtain the pounds of nutrients reduced by the project.

<u>New retrofit facilities:</u> This category includes new retrofit projects that create storage to reduce nutrients from existing developed land that is not currently receiving any stormwater treatment. Common examples of new retrofits include creating new storage upstream of roadway crossings, near existing stormwater outfalls, within the existing stormwater conveyance system or adjacent to large parking lots. Desktop and field methods for discovering opportunities for new retrofits are described in Schueler (2009).

There are two options to define removal rates for this class of retrofit projects:
CBP Rate Option: If the new retrofit project can be classified into one of the existing CBP urban BMP categories and has enough treatment volume to treat the runoff from at least one inch of rainfall, then the appropriate CBP approved rates should be used (i.e., Table 21).

Stormwater Retrofit Removal Rate Adjustor. If the retrofit is over or under-sized, or utilizes treatment mechanisms or design enhancements that cannot be classified under current CBP urban BMP categories, then designers should determine the actual rainfall depth controlled and degree of runoff reduction achieved by their retrofit project, and select the appropriate mass removal rate from Table 22. Some additional guidance for using Table 22 includes:

- Designers may interpolate between the rainfall depths if their new retrofit project has a non-standard rainfall depth controlled.
- High removal rates (HI) are assigned to new retrofit projects that achieve at least 50% reduction of the annual runoff volume through canopy interception, soil amendments,

evaporation, rainfall harvesting, engineered infiltration, extended filtration or evapotranspiration.

- The low removal rate (LO) should be used if the new retrofit employs a permanent pool, constructed wetlands or filtering as the primary runoff treatment mechanism.

BMP conversions are a fairly common and cost-effective retrofit approach where an existing BMP is converted into a different BMP that employs more effective treatment mechanism(s) to enhance nutrient reduction. Most BMP conversions involve retrofits of existing stormwater ponds, such as converting a dry detention pond into a constructed wetland (although many other types of BMP conversions are possible). Guidance on pond retrofits can be found in Profile Sheet SR-1 in Schueler (2009). There are three options to define removal rates for BMP conversion projects:

Incremental Improvement Method. Most older stormwater ponds can be classified according to CBP-approved urban BMP rates, so it is relatively straightforward to compute an incremental rate based on the difference between the old and new CBP BMP removal rate. For example, if a dry ED pond is converted into a wet pond, the phosphorus removal rate would increase from 20% to 45%, which would result in a net 25% removal due to the conversion retrofit.

Incremental Improvement for Maryland Design by Era Method. An incremental rate can also be derived based on the age of the BMP being converted. MDE (2011) assigns unique nutrient and sediment removal rates for each of the four design eras it has established (see Table 24 in Section 5.3.5). In this case, designers simply calculate the incremental difference in removal rates for the more recent design era compared to the earlier design era, and then multiply it by the baseline load delivered to the original BMP.

Incremental Rate Using Stormwater Retrofit Adjustor. The last method for BMP conversions is to use Table 22 to define a project specific mass removal rate for the original BMP and the proposed conversion based on the net change in rainfall depth controlled and degree of runoff reduction achieved. This method is recommended when the proposed BMP conversion utilizes LID practices; increases total treatment volume and/or involves major design enhancements.

Enhance Existing BMPs: This retrofit category applies to projects whereby the basic treatment mechanism of the existing BMP is not changed, but its nutrient reduction capability is enhanced by increasing its treatment volume and/or increasing the hydraulic retention time within the practice. BMP enhancements are a good strategy on older and larger ponds and wetlands built under less stringent sizing and design standards. BMP enhancement may also be a good strategy for the first generation of bioretention and filtering practices, whose original design lacked the features now known to enhance nutrient removal.

An example of a retrofit enhancement for an older wet pond might be to increase its treatment volume, re-align inlets to prevent short circuiting, add internal cells and

forebays to increase flow path, and add aquatic benches, wetland elements and possibly even floating islands to enhance overall nutrient reduction.

At first glance, it would seem to be difficult to assign removal rates for these BMP enhancements, although many Bay states now utilize a two level design system whereby nutrient removal rates are increased when certain treatment volume and design features are met or exceeded (Virginia DCR, 2011, CSN, 2011, and soon to be implemented in DC, DE, WV).

Therefore, the recommended option to estimate the nutrient reduction achieved by BMP enhancement retrofits is as follows:

Step 1: The base nutrient removal rate for the existing BMP (prior to enhancement) should be the conservative CBP-approved rate found in Table 20.

Step 2: The designer should then evaluate the range of BMP enhancements to see if they qualify for the higher Level 1 or Level 2 rates shown in Table 21.

Step 3: The nutrient removal rate for the retrofit is then computed as the difference from the Level 1 or 2 rates and the existing CBP-approved rate.

Green Street Retrofits: Green streets utilize a combination of LID practices within the public street right of way, and are gaining popularity as an attractive option to treat stormwater runoff in highly urban watersheds (CSN, 2011c). Green streets provide many urban design benefits and create a more attractive and functional urban streetscape. Green streets typically involve a combination of practices such as permeable pavers, street bioretention, expanded tree pits, individual street trees, impervious cover removal, curb extensions and filtering practices. The linear nature of green streets makes them a very efficient composite LID practice that can treat several acres of impervious cover in a single system.

Numerous green street demonstration projects have been installed in cities within the Bay watershed. At the current time, there is no standard design for green streets, since each project must deal with unique constraints present in each individual green street section (e.g. street width, right of way width, underground utilities, development intensity, parking needs, street lighting, and pedestrian/automotive safety).

Consequently, it is impossible to assign a generic nutrient and sediment removal rate for green streets at this time. As an alternative, the nutrient removal credit for green streets can be estimated in a simple two-step process:

Step 1: *Impervious Cover Reduction Credit.* The Simple Method can be used to compute the change in nutrient load that can be attributed the reduction in impervious cover associated with a narrower street. This is easily done by adjusting the site runoff coefficients to reflect the lower impervious cover associated with the green street.

Step 2: The green street project can then be analyzed as a whole to determine the actual rainfall depth it controls and degree of runoff reduction it achieves. Based on these factors, designers can select the appropriate mass removal rate from Table 22, and then multiply it by the adjusted baseline load computed in Step 1. The nutrient reduction calculated in this step can then be added to the impervious cover reduction credit computed in Step 1.

On-site LID Retrofits: This category includes the installation of a large number of small on-site retrofits, such as rain gardens, compost amendments, rain barrels, rooftop disconnections and tree planting, over the scale of a residential neighborhood. These retrofits are typically delivered by local governments or watershed groups, who provide incentives and subsidies to individual property owners to implement them. In many cases, dozens or even hundreds of these small retrofits might be installed in any given subwatershed.

To simplify analysis, it is recommended that localities record the cumulative area of impervious cover treated by on-site retrofits, and then enter the average rainfall depth controlled and runoff reduction achieved in Table 22 to find the appropriate mass removal rate for all of them.

Local Tracking, Reporting and Verification

Localities should maintain a project file for each retrofit project installed. The file should be maintained for the lifetime for which the retrofit nutrient removal credit will be claimed. The typical duration for the credit will be approximately 25 years, although the locality may be required to conduct a performance inspection at least once every five years to verify that the practice is being adequately maintained and operating as designed.

Localities should also submit some basic documentation to the state about each retrofit, including GPS coordinates for the project location, the 12 digit watershed in which it is located, the nutrient reduction credit claimed (and the method used to compute it), and a signed certification that the retrofit has inspected after construction and meets its performance criteria.

Localities are encouraged to develop a GIS-based BMP tracking system in order to schedule routine inspections and maintenance activities over time.

Table 19 Example of Two Level Design Approach for Bioretention	
LEVEL 1 DESIGN	**LEVEL 2 DESIGN**
RR = 40% TP = 55% TN = 64%	RR= 80% TP= 90% TN = 90%
Treats the 90% storm	Treats the 95% storm
HSG C and D soils and/or under drain	HSG A and B soils OR has 12 inch stone sump below under drain invert
Filter media at least 24" deep	Filter media at least 36" deep
One cell design	Two cell design
Both: Maximum organic material in media of 5% and hydraulic residence time of 1 inch per hour through media	

Table 20 Mass Nutrient Removal Rates for Stormwater Practices

Practice	Design Level[1]	TN Load Removal[4]	TP Load Removal[4]
Rooftop Disconnect [5]	1	25 to 50	25 to 50
	2 [6]	50	50
Filter Strips [5]	1	25 to 50	25 to 50
	2 [6]	50 to 75	50 to 75
Green Roof	1	45	45
	2	60	60
Rain Tanks & Cisterns [7]	1	15 to 60	15 to 60
	2	45 to 90	45 to 90
Permeable Pavers	1	59	59
	2	81	81
Infiltration Practices	1	57	63
	2	92	93
Bioretention Practices	1	64	55
	2	90	90
Dry Swales	1	55	52
	2	74	76
Wet Swales	1	25	20
	2	35	40
Filtering Practices	1	30	60
	2	45	65
Constructed Wetlands	1	25	50
	2	55	75
Wet Ponds [8]	1	30 (20)	50 (45)
	2	40 (30)	75 (65)
ED Ponds	1	10	15
	2	24	31

Notes

[1] See specific level 1 and 2 design requirements within each practice specification
[2] Annual runoff reduction rate (%) as defined in CWP and CSN (2008)
[3] Change in nutrient event mean concentration in and out of practice, as defined in CWP and CSN (2008)
[4] Load removed is the product of annual runoff reduction rate and change in nutrient EMC
[5] Lower rate is for HSG soils C and D, Higher rate is for HSG soils A and B
[6] Level 2 design involves soil compost amendments, may be higher if combined with secondary runoff reduction practices
[7] Range in RR depends on whether harvested rainwater is used for indoor, outdoor or discharged to secondary runoff reduction practice. Actual results will be based on spreadsheet
[8] lower nutrient removal parentheses apply to ponds in coastal plain terrain

Table 21
Current Urban BMP Efficiency Rates Approved by Chesapeake Bay Program as of 2/9/2011 [1, 2, 3]

URBAN BMP		Total Nitrogen	Total Phosphorus	TSS
		MASS LOAD REDUCTION (%)		
Wet Ponds and Constructed Wetlands		20	45	60
Dry Detention Ponds		5	10	10
Dry Extended Detention Ponds		20	20	60
Infiltration		80 (85) [4]	85	95
Filtering Practices (sand Filters)		40	60	80
Bioretention	C & D w/UD	25	45	55
	A & B w/ UD	70	75	80
	A & B w/o UD	80	85	90
Permeable Pavement	C & D w/UD	10 (20)	20	55
	A & B w/ UD	45 (50)	50	70
	A & B w/o UD	75 (80)	80	85
Grass Channels	C & D w/o UD	10	10	50
	A & B w/o UD	45	45	70
Bioswale	aka dry swale	70	75	80
Nutrient Management		17	22	NA
Street Sweeping	Bimonthly	3	3	9
Forest Buffers		25	50	50

[1] In many cases, removal rates have been discounted from published rates to account for poor design, maintenance and age, and apply to generally practices built prior to 2008
[2] Current Practices are designed to more stringent design and volumetric criteria, and may achieve higher rates –see Table 20
[3] Some practices, such as forest conservation, impervious cover reduction, tree planting are modeled as a land use change. Urban stream restoration is modeled based on a reduction per linear foot of qualifying stream restoration project
[4] Numbers in parentheses reflect design variation with a stone sump to improve long term infiltration rates

Table 22 Stormwater Retrofit Removal Rate Adjustor			
Volumetric Criteria		Mass Removal Rate %	
Rainfall depth controlled	Degree of runoff reduction	Total Phosphorus	Total Nitrogen
0.25	LO	20	20
	HI	30	30
0.50	LO	30	35
	HI	45	45
0.75	LO	40	40
	HI	55	60
1.0	LO	55	55
	HI	75	70
1.25	LO	65	65
	HI	85	75
1.50	LO	75	67
	HI	82	85
2.0	LO	80	77
	HI	90	92
2.5	LO	90	85
	HI	95	95
The technical derivation for the mass removal rates can be found in Appendix A.10			

URBAN REFORESTATION

Status: There is an existing CBP-approved BMP nutrient rate for reforestation in urban stream buffers. In addition, tree planting in urban areas is modeled as a land use change (i.e., shift from unit nutrient loading rate for turf cover to forest cover). Neither of these rates accounts for situations where stormwater runoff is directed to reforestation areas and/or when soil infiltration conditions are improved through soil restoration. In addition, there is no credit for urban tree planting techniques to increase forest canopy and improve stormwater treatment in highly urban watersheds. Interim methods for addressing these situations are proposed, and it is anticipated an Expert Panel and the Forestry Working Group will revisit the urban reforestation credits in late 2012 or early 2013.

Definition: Urban reforestation involves restoring compacted soils and planting trees explicit goal of establishing a mature forest canopy that will intercept rainfall, increase evapo-transpiration rates, and enhance soil infiltration rates. As a result, at least five kinds of reforestation are possible:

1. Upland Reforestation
2. Forest Filter Strip
3. Urban Stream Buffer
4. Urban Tree Canopy
5. Urban Tree Canopy w/ BMPs

Upland Reforestation is defined as tree planting on a turf or open area that does not receive stormwater runoff.

Filter Strips are an engineered practice where trees are planted in a zone that is designed to accept runoff from adjacent impervious cover.

Urban Stream Buffers involve planting trees within 100 feet of a stream or wetland to create a forest buffer and then installing controls at the boundary so that it can treat sheet flow from adjacent pervious or impervious areas.

Urban Tree Canopy involves planting trees in the street right of way in very urban areas to create a mature forest canopy over impervious areas. The canopy intercepts rainfall and acts as a ―vertical stormwater disconnection‖ during the growing season (Cappiella et al, 2006).

*Urban Tree Canopy w/ BM*Ps increase tree canopy but also employs expanded tree pits to filter runoff from adjacent impervious areas.

Technical Issues: Research is limited on the hydrologic function and potential nutrient removal associated with the five kinds of reforestation described above. In general, the CBP approved nutrient and sediment removal rates are higher for reforestation that occurs in agricultural watersheds than in urban applications. The primary reason is that agricultural buffers and forest filter strips treat nutrients in both groundwater and surface runoff, whereas their urban counterparts treat concentrated runoff that can often short-circuit the system. Lastly, the benefit of reforestation largely depends on where it is located in the urban landscape, what are the soil infiltration rates at the site and whether it can treat runoff from adjacent impervious areas. As an example, upland reforestation gets a nutrient credit that is much smaller than reforestation on permeable soils near a stream or a parking lot that is engineered to treat stormwater.

Recommended Rates for Reforestation.

Table 28 outlines the removal rates and reporting units for the five types of urban reforestation.

Table 28
Proposed Interim Rates for Reforestation, Based on Type and Location

Type and Location	Unit	Soil Type	TN	TP	TSS
Upland	Acres reforested	NA	10 [1]	10 [1]	20 [1]
Forest Filter Strip	Strip acreage + IC Acres treated	A & B	50	75	75
		C & D	25 [2]	50 [2]	60 [2]
Stream Buffer	Buffer acreage + IC Acres treated	A & B	50	50	75
		C & D	25 [2]	50 [2]	50 [2]
Urban Tree Canopy	Aggregate acres of forest canopy	In-situ	10	10	20
		Restored	15	15	25
Urban Tree Canopy BMPs	IC acres treated	NA	25 [3]	45 [3]	55 [3]

Note: The technical derivation of the rates in this table can be found in Appendix A-X
[1] These rates are derived based on converting the forest cover to an equivalent impervious acre and determining nutrient reduction using Simple Method approach
[2] Rates shown are current CBP approved rtes for urban filter strips and stream buffers, respectively
[3] Rates are assumed to be comparable to current CBP approved rate for bioretention on C?D soils with under drains

Qualifying Conditions

The qualifying conditions for upland reforestation are as follows:

- The minimum contiguous area of reforestation must be greater than 5,000 square feet.
- If soils are compacted, they will need to be deep tilled, graded and amended with compost to increase the porosity and water holding capacity of the pervious area, using the methods outlined in the Bay-wide soil restoration specification.
- The proposed reforestation must be for the purpose of reducing runoff. Compensatory reforestation required under local or state forest conservation laws is not eligible for the credit
- A long term vegetation management plan must be prepared and filed with the local review authority in order to maintain the reforestation area in a forest condition.
- The planting plan does not need to replicate a forest ecosystem or exclusively rely on native plant species, but it should be capable of achieving 75% forest canopy within ten years.
- The construction contract should contain a care and replacement warranty extending at least two growing seasons, to ensure adequate growth and survival of the plant community. Control of invasive tree species should be a major part of the initial maintenance plan.

- The reforestation area shall be shown on all construction drawings and erosion and sediment control plans during construction.

- The reforestation area should be protected by a stormwater easement, deed restriction or other legal instrument which stipulates that no future development or disturbance may occur within the reforested area, for a minimum of at least ten years. Any clearing or land disturbance after that point will negate the value of the nutrient credit.

The qualifying conditions for forested filter strips and urban stream buffers can be found in state design guidance such as MDE **(**2009), VADCR (2009) and CSN (2011). Qualifying conditions for urban tree canopy w/ or w/o BMPs have yet to be developed.

Local Tracking, Reporting and Verification

Tracking of reforestation projects is critical given that there is such a lag time between when the trees are planted and when the full runoff and nutrient reduction benefits of a forest are realized. In most cases, it takes at least 1o to 15 years for a tree planting to acquire the characteristics of a forest. During this time, there are a number of threats to successful forest establishment (deer browsing, drought, invasive species, etc.).

Therefore, the credit should not be reported until two growing seasons after the initial planting to ensure adequate growth and survival, followed by inspections and forest management activities every two years thereafter.

APPENDIX I

WETLANDS WATCH ONLINE SURVEY "WATERSHED FRIENDLY ACTIONS IN HAMPTON ROADS"

The following online survey was hosted on the Wetlands Watch, Inc. website and was open for responses from February 1 to March 30, 2012. A total of 266 citizens participated in the survey.

WATERSHED-FRIENDLY ACTIONS ON PRIVATE PROPERTY

WE ARE ASKING YOU TO TAKE THIS SURVEY BECAUSE OF YOUR INVOLVEMENT WITH AN ORGANIZATION THAT PROMOTES WATERSHED AND HABITAT-FRIENDLY ACTIONS IN HAMPTON ROADS.

Everyone in Hampton Roads lives in a watershed and our actions can have a negative or positive impact on the health of the Chesapeake Bay, our local waters, and other natural resources. Watershed stewardship actions, also known as best management practices (BMPs) *reduce and control* stormwater runoff along with associated water pollution, erosion, and flooding and *protect and restore* natural resources.

BMPs like rain gardens, rain barrels or cisterns, permeable pavement, living shorelines, water-friendly landscaping, native plants buffers,reduced fertilizer use and other water-friendly lawn care, planting trees and restoration of wetlands, streams, or stormwater ponds are examples of the types of actions that people can practice on private property.

This survey will be used to identify how many members of watershed groups are applying these BMPs on their private property and a general idea of the types of BMPs being used by the members.

PLEASE TAKE A MOMENT TO FILL OUT THIS SURVEY! If we can, through this survey, show government agencies that these efforts have taken place, they will start including them in watershed cleanup plans and your work will count toward your local governments cleanup goals! Also, more voluntary actions on the part of private property owners can lead to less regulatory requirements and reduce the need to collect additional stormwater fees to pay for costly upgrades to existing stormwater systems.

General Information

We are currently trying to collect information on watershed and habitat-friendly actions taken on existing PRIVATELY-OWNED residential, small commercial, and institutional properties. Please keep this in mind as you answer the following questions.

1. The watershed- and habitat-friendly actions described in this survey are on: *****

☐ single family residential property

- ☐ commercial property
- ☐ institutional property (museum, church, private school, private club, etc.)
- ☐ community-owned and maintained property
- ☐ multi-family residential property
- ☐ Other (please specify): _____

Provide additional comments or details below:

2. The watershed and habitat-friendly actions and property described in this survey are located in: *****

- ☐ Chesapeake
- ☐ Franklin
- ☐ Gloucester
- ☐ Hampton
- ☐ Isle of Wight
- ☐ James City County
- ☐ Newport News
- ☐ Norfolk
- ☐ Poquoson
- ☐ Portsmouth
- ☐ Southampton County
- ☐ Suffolk
- ☐ Surry County
- ☐ Virginia Beach
- ☐ Williamsburg
- ☐ York County

If you know the watershed that you are located in, please provide below:

3. Which best describes you? *****

- ☐ Member of the Elizabeth River Project
- ☐ Master Naturalist or Master Gardener
- ☐ Member of Lynnhaven River NOW
- ☐ Member of Chesapeake Bay Foundation (VOICES or other Watershed Stewardship Training)
- ☐ Member of the Friends of Powhatan Creek
- ☐ I am a residential property owner
- ☐ I am a commercial or mult-family property owner
- ☐ Member of a homeowners association
- ☐ Landscape Professional
- ☐ Associated with an institution (church, museum, private school, private club)
- ☐ A member of a native plant society
- ☐ A member of a garden club
- ☐ Member of Lafayette Wetlands Partnership
- ☐ Other (please specify):

Watershed and Habitat-Friendly Actions

4. Which of the following watershed-friendly lawn care actions have you practiced on this property? *****

- ☐ Stopped fertilizing lawn/turf
- ☐ Had soil analyzed
- ☐ Reduced fertilizer application to once in the fall
- ☐ Lawn/turf is mowed at a height no less than 3 inches
- ☐ Reduced lawn/turf area and replaced it with native plants

- ☐ This property does not have a lawn
- ☐ Hired a water-friendly certified lawn care company to maintain my lawn/turf
- ☐ None of the Above
- ☐ Haven't done any of the above but would consider it in the future
- ☐ Other (please specify): _____

5. Which of the following other watershed stewardship actions (BMPs) you have taken on this property? *****

- ☐ Installed and maintain a rain garden (or bioretention area) to reduce and filter stormwater runoff
- ☐ Installed one or more rain barrels or cisterns
- ☐ Installed a buffer garden of native trees, shrubs, perennials, and grasses between my lawn and waterway, wetlands, and/or the street
- ☐ Planted trees/participated in a tree planting project
- ☐ Planted native plants and avoided invasive species
- ☐ Scoop my dog's poop
- ☐ Redirected downspouts and other stormwater runoff away from paved surfaces and into a planted bed or other permeable area
- ☐ Replaced paved surfaces with permeable pavement that allows water to soak into the ground
- ☐ Created a wetland on the property with native wetland plants
- ☐ Replaced impervious surfaces like concrete/asphalt driveways, walks and patios with permeable area that includes plants
- ☐ Installed a green roof
- ☐ None of the Above
- ☐ Haven't done any of the above but will consider it in the future
- ☐ I collect yard debris so it doesn't go down the storm drain
- ☐ Other (please specify): _____

6. For waterfront properties (stream, river, lake, pond, bay, etc.) please indicate which actions have been installed next to or in the water body. *****

- ☐ Expanded an existing or established a new buffer of native plants
- ☐ Installed a living shoreline to control erosion
- ☐ Established a conservation area of native plants and/or wetlands
- ☐ Stopped mowing the wetland plants and now protect them
- ☐ Created a wetland on the property with native wetland plants
- ☐ Replaced impervious surfaces like concrete/asphalt driveways, walks and patios with planted beds
- ☐ Restored and protected wetlands
- ☐ Participated in a streambank or stream restoration project
- ☐ This is not a waterfront property
- ☐ Oyster gardening
- ☐ Planted underwater grasses (SAV)
- ☐ None of the above
- ☐ None of the above, but would consider it in the future
- ☐ Other (please specify): _____

7. If the property has a stormwater pond, please note any actions taken *****

- ☐ Performed the required maintenance on the pond
- ☐ Planted a buffer of native plants around the pond
- ☐ Added wetlands plants to the pond
- ☐ The property doesn't have a stormwater pond
- ☐ None of the above
- ☐ None of the above but will consider it in the future
- ☐ Other (please specify): _____

Additional Comments

This section is an opportunity for you provide additional details regarding your experiences with the design, installation, and maintenance of the actions noted in the previous section.

8. What types of resources would make it easier for you to increase the use of BMPs on your property? *****

- ☐ Ability to buy native plants at local nurseries
- ☐ Existing planting plans to take the guess work out of plant selection
- ☐ Professional guidance and oversight during the design, installation, and maintenance stages of the work
- ☐ Access to trained landscape professionals that I could hire to design, install, and/or maintain the project
- ☐ Project materials already assembled and readily available at local garden centers
- ☐ Financial assistance to help pay for the project
- ☐ A shorter plan approval process and facilitation by local government officials
- ☐ Guidance and assistance from a trained Watershed Steward
- ☐ Other (please specify): _____

Provide additional comments below:

9. If you have a lawn and you use fertilizer and weed control chemicals on you lawn, who does this?

- ○ I do
- ○ I have a lawn service
- ○ I don't have a lawn
- ○ I don't apply fertilizer or weed control on my lawn

10. Which of the following best describes who DESIGNED your BMPs? (select one or more answers)

- ☐ I did it myself using guidance from a workshop or literature
- ☐ A professional landscape designer, architect or landcaping company designed it for me
- ☐ A stormwater consultant
- ☐ A Master Gardener or Master Naturalist

- ☐ A non-profit group representative
- ☐ Other (please specify): _____

11. Do you have DESIGN "lessons learned" about BMP designs that you can share? Please note the type of BMP associated with the "lessons learned".

12. Which of the following best describes who INSTALLED your BMPs? (Select one or more answers)

- ☐ I did it myself
- ☐ A professional landscaping company or installation company
- ☐ A stormwater or environmental consultant
- ☐ A Master Gardener or Master Naturalist
- ☐ A non-profit organization
- ☐ Other (please specify): _____

13. Do you have INSTALLATION "lessons learned" about BMP installation that you can share? Please note the type of BMP associated with the "lessons learned".

14. Do you have MAINTENANCE "lessons learned" that you can share? Please note the type of BMP associated with the "lesson learned".

15. Would you like to recommend any professionals that you have worked with to realize these projects?

16. Do you have any additional comments or information that you wish to provide to us?

Contact Information

If you have more detailed information that you would like to share, you may call Wetlands Watch at 757-623-4835 or contact Shereen Hughes, Assistant Director of Wetlands Watch, via email at shereen.hughes@wetlandswatch.org. If you wish to participate in a more detailed accounting of existing BMPs on private property or wish to be contacted by us directly about your survey response, please provide us with your contact information.

First Name:

Last Name:

Email Address:

Thank you for participating in this survey!

You have now completed the survey. You may now close this window.